

Life  
cycle **COMPACT**  
360° ENVIRONMENTAL CHECK



# Environmental Certificate Mercedes-Benz E-Class

Mercedes-Benz  
The best or nothing.





Mercedes-Benz has long recognised the importance of vehicle interiors optimised for allergy sufferers. Interior emissions have been measured since 1992. Today, designers and developers can make their choice from a database of several thousand interior materials that have been approved by the material department.

The laboratory test of the complete vehicle in a special test chamber takes one week. Like all new model series, the E-Class bears the ECARF (European Centre for Allergy Research Foundation) seal of quality.

Editorial

## “We improve the environmental performance over the entire life cycle of a car”

One of our six environmental and energy guidelines states: “We strive to develop products that are highly responsible to the environment in their respective market segments.” To achieve this goal we have to incorporate environmental protection into products from the very start to a certain extent. The earlier this “Design for Environment” approach is integrated into the development process, the greater the benefits in terms of minimised environmental impact and cost.



It is likewise crucial to reduce the environmental impact caused by emissions and consumption of resources during the entire life cycle. This comprehensive and exhaustive Life Cycle Assessment (LCA) we call ‘360° environmental check’. It scrutinises 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 life cycle, we have the results checked and confirmed by independent assessors from the TÜV Süd inspection authority. Only then does a car receive its Environmental Certificate.

This brochure briefly summarises the results of the LCA for you. Incidentally, the new E-Class is a good example of why a comprehensive assessment is necessary to gauge the overall environmental impact. Because whilst the extensive lightweight construction measures do necessitate higher energy consumption in production, this is however more than compensated for by the clearly improved efficiency of the car during operation.

If this compact brochure has aroused your interest in the subject, I would recommend you to take a look at the detailed documentation of the life cycle assessment for the E-Class. The “Life Cycle OVERALL” brochure is available for download at <http://www.mercedes-benz.com>.

Kind regards  
Yours,

Anke Kleinschmit  
Chief Environmental Officer of the Daimler Group

Mercedes-Benz E 220 d<sup>[1]</sup>

# Intelligent technology, masterpiece of efficiency

Mercedes-Benz unlocks new efficiency dimensions in the E 220 d. One factor in this is a new four-cylinder diesel engine, which despite having a smaller displacement than its predecessor has a significantly higher output and nonetheless a considerably lower NEDC combined average fuel consumption.

But there are also other factors that play a major role in the exemplary efficiency of the E 220 d – among them intelligent lightweight construction, aerodynamics benchmarks and a host of detail optimisations.

The new four-cylinder diesel engine is shorter, more compact and lighter than its predecessor while producing an output of 143 kW/195 hp from a displacement reduced to just under two litres. In the E 220 d, this engine makes do on a NEDC combined average fuel consumption of 3.9 litres per 100 kilometres, which equates to CO<sub>2</sub> emissions of 102 grams per kilometre –

a figure that until now only significantly smaller vehicles have been able to deliver. Furthermore, the four-cylinder with single-stage turbocharger and variable turbine geometry is distinguished by a high level of refinement.

The model variants of the new E-Class also include the E 350 e<sup>[2]</sup> with hybrid technology. The PLUG-IN HYBRID impresses with its dynamics and efficiency, allowing around 30 kilometres of all-electric and therefore locally emission-free driving. In concert with a powerful electric motor, its four-cylinder petrol engine delivers a system output of 210 kW (286 hp) and a system

torque of 550 Nm. With this set-up, the E 350 e achieves the performance of a sports car yet consumes less fuel than a sub-compact car.

All engines for the new E-Class are equipped with the ECO start/stop function and meet the requirements of the EU 6 emissions standard. The new OM 654 four-cylinder diesel engine is already designed with future RDE limits in mind.

At the time of its market launch, the E 220 d comes with the new 9G-TRONIC nine-speed automatic transmission as standard. Its broad spread (9.15) of



At the time of its market launch, the E 220 d comes with the new 9G-TRONIC nine-speed automatic transmission and like all models of the new E-Class with the ECO start/stop system as standard. The new four-cylinder diesel engine already complies with future RDE limits.



gears one to nine allows an overall reduction in engine speed a key factor behind the high energy efficiency and ride quality. Shortened shift and response times ensure optimum spontaneity combined with outstandingly smooth gear changes. This is combined with the transmission's high efficiency, which is a noticeable advantage in terms of fuel consumption.

Thanks to intelligent lightweight construction, the body shell weighs about 70 kilograms less than that of its predecessor. To achieve this, the engineers opted for a body shell with a far higher percentage of aluminium and ultra-high-strength steel components than in the previous E-Class. The front wings, bonnet, boot lid and large sections of the front and rear ends are made of sheet or cast aluminium. This lightweight design reduces fuel consumption and makes for noticeably sporty and agile vehicle handling.

Mercedes-Benz is setting the pace in the field of aerodynamics and offers the most streamlined cars with the best drag coefficients in almost all vehicle categories. The new E-Class also follows this tradition: The saloon model achieves a drag coefficient of as low as Cd = 0.23 and is thus the benchmark in the business class. To accomplish this, the AIRPANEL radiator shutter system is available for the first time, for example. It opens and closes the

radiator grille depending on the cooling capacity requirements by means of adjustable louvres and further enhances the overall performance of the system with a second shutter in the air intake below the number plate. The sophisticated aerodynamics additionally minimise wind noise and ensure that the new E-Class is even quieter than some luxury-class models.

This new E-Class also marks the world première of numerous technical innovations. They enable comfortable, safe driving on an unprecedented level plus a new dimension in driver assistance –

among other things. The vehicle comes complete with infotainment and control systems offering an all-new experience.

An optional new multi-chamber air suspension system additionally ensures outstanding ride comfort quality with first-class driving dynamics. The sum total of its innovations, including Active Lane Change Assist, which allows the driver to effortlessly steer into the selected lane, makes the E-Class the most intelligent saloon car in the business class.



The best drag coefficient in the segment plays a major role in the high efficiency of the E-Class in daily operations. To achieve it, the aerodynamics experts of Mercedes-Benz have optimised many details. This especially pays dividends when driving on motorways – both in terms of the environment and costs.

[1] Fuel consumption E 220 d Saloon with automatic transmission (combined): 4.3-3.9 l/100km; CO<sub>2</sub>-emissions (combined): 112-102 g/km.

[2] Fuel consumption E 350 e Saloon with automatic transmission (combined): 2.5-2.1 l/100km, 14-11.5 kWh/100km; CO<sub>2</sub>-emissions (combined): 57-49 g/km.

The facts

# The Mercedes-Benz E-Class in the 360° environmental check

Early in the development stage of a new model, Mercedes-Benz starts looking at environmental performance over the car's entire life cycle. On the following pages you can read about how the new E-Class fares in the key areas of the comprehensive Life Cycle Assessment (LCA): consumption of resources and emissions.

- **Climate-friendly:**  
up to 29 percent lower CO<sub>2</sub> emissions
- **Economical:**  
NEDC fuel consumption of just 3.9 litres/100 km for the E 220 d
- **Resource-efficient:**  
72 components made from high-quality recycled plastics and  
90 components made from natural materials



The resources: what is needed to produce a car

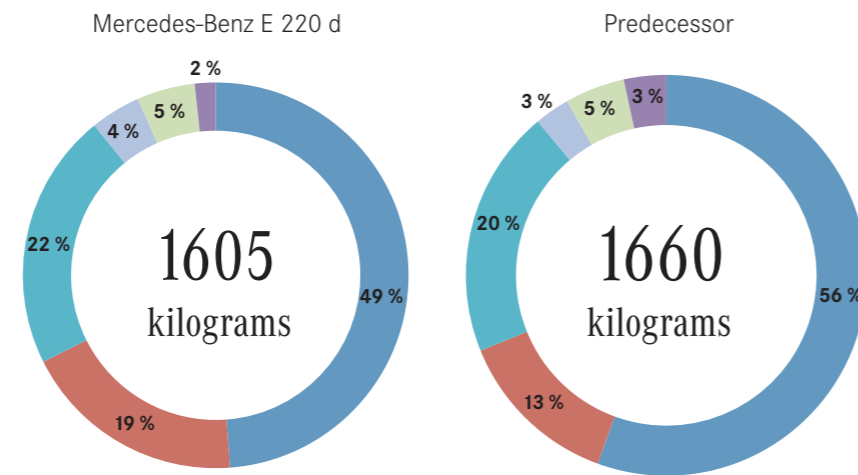
# Achieve more with less

The E 220 d is distinguished by low use of resources, low energy consumption and good recycling properties. A comparison with the predecessor E 220 CDI from 2009 illustrates the achieved improvements.

## Material resources

- Steel/ferrous materials
- Light alloys
- Polymer materials
- Other metals
- Fuels and lubricants
- Other materials

The increased use of lightweight materials made a reduction in the use of material resources compared with the predecessor possible. The new E 220 d exhibits a number of differences in the material mix from the previous model. Due to the numerous lightweight construction measures in the area of the body shell and the chassis, the share of steel in the new E 220 d is about

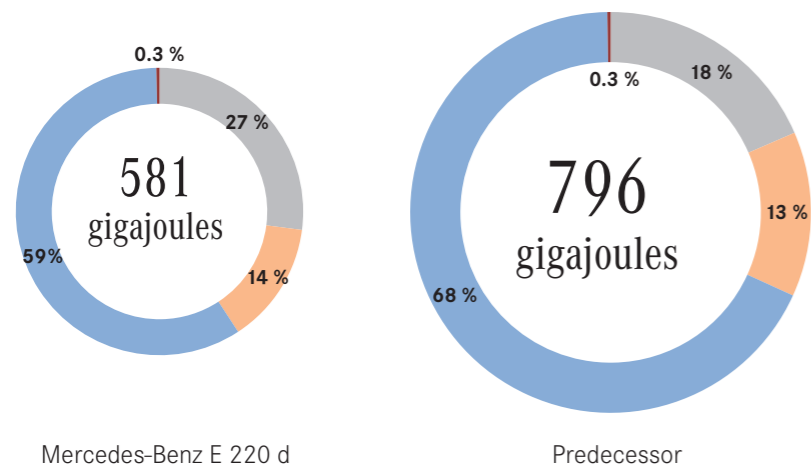


7 percent lower while the percentage of alloys increased by about the same magnitude.

## Energy resources

- Car production
- Fuel production
- Vehicle operation
- End of Life

When the individual life cycle phases are considered in detail, the energy required to produce the new E-Class is slightly higher initially. In the operating phase, however, energy requirements are reduced significantly thanks to its high efficiency.



The comparative analysis of the energy and material resources used for the E 220 d and its predecessor shows that a realistic picture only emerges when the entire life cycle (material manufacturing, production, operation for 250,000 kilometres and recycling) is examined.

The bottom line is that consumption of energy resources is far lower in the E 220 d than in the previous model. Over the entire life cycle, this can translate into primary energy savings of 27 percent. This is equivalent to the energy content of around 6000 litres of diesel fuel.

Moreover, the high-quality material resources used in the new E-Class do not go to waste. The analysis demonstrated that 85 percent of the materials overall can be recycled, with a recycling rate of 95% as part of the vehicle type approval.

The emissions: the carbon footprint over the life cycle

# High efficiency in the powertrain

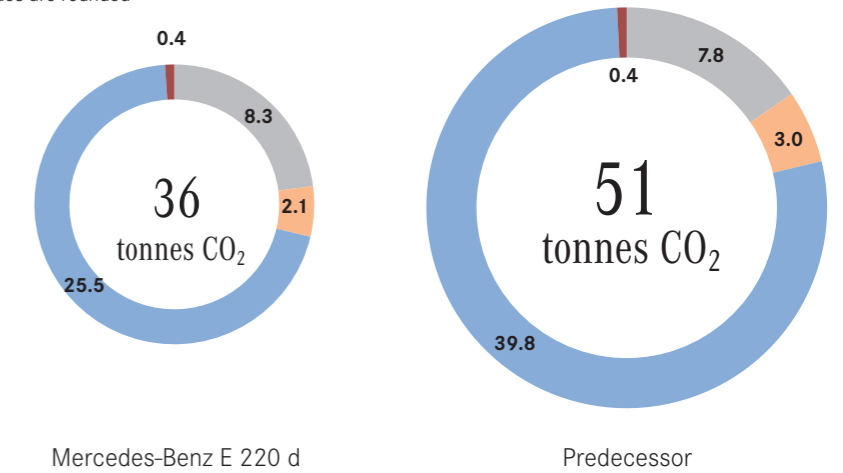
The E 220 d sets new benchmarks for emissions. Apart from the CO<sub>2</sub> emissions from vehicle operation, the comprehensive assessment also requires the production and recycling phases to be taken into account.

## CO<sub>2</sub> emissions

- Car production
- Fuel production
- Vehicle operation
- End of Life

When the CO<sub>2</sub> footprint of the E 220 d is compared with that of its predecessor, it is plain to see that the slightly higher emissions in the production of the E 220 d are ultimately more than compensated for.

Values are rounded



Analysis of the emissions during the individual phases of the life cycle makes it very clear: it is still the actual process of car operation that offers the greatest potential to reduce CO<sub>2</sub> emissions in particular. Incidentally, this is also an incentive for the driver to drive as efficiently as possible.

cent (15 tonnes) less CO<sub>2</sub> emissions than its predecessor.

E 220 d represents a major improvement in environmental compatibility.

The E 220 d also offers clear advantages with regard to other environmental effects such as summer smog, acidification and eutrophication potential over the entire life cycle. Overall, the

Significantly lower CO<sub>2</sub> emissions than the previous model: modern engine technology is a factor in considerably lowering CO<sub>2</sub> emissions on the road.

The production of the new E-Class generates 8.3 tonnes of CO<sub>2</sub>, slightly more at the start of the life cycle than the previous model. In the subsequent operating phase, the new E 220 d emits 27.6 tonnes of CO<sub>2</sub>; resulting in total emissions during production, use for 250,000 km and recycling of 36.3 tonnes of CO<sub>2</sub>.

Production of the previous model generated 7.8 tonnes of CO<sub>2</sub>. It emits 42.7 tonnes of CO<sub>2</sub> during its use and 0.4 tonnes of CO<sub>2</sub> are produced during recycling. Overall, CO<sub>2</sub> emissions thus total 51 tonnes.

Taking the entire life cycle into consideration, namely production, operation for 250,000 kilometres and recycling, the new E-Class produces about 29 per-



# Fuel-saving measures

Friction-optimised engines

Friction-optimised transmissions

Alternator management

ECO start/stop system

Optimised belt drive with decoupler\*

Mercedes-Benz hybrid technology\*

Air conditioning compressor with solenoid clutch

ECO display in the instrument cluster

Regulated fuel pump and oil pump

Electric water pump\*

Radiator shutter\*

Friction-reduced wheel bearings

**Optimised aerodynamics:**

e.g. through extended sealing around radiator and headlamps, radiator shutter, wheel spoilers front and back, optimised underbody panelling

Weight optimisation through the use of lightweight materials

Tyres with low rolling resistance

\*model-/equipment-dependent

# Innovative technology for low emissions

With the new four-cylinder diesel engine, Mercedes-Benz is not only unlocking new efficiency dimensions. The new diesel engine also already accounts for the future “RDE”\* emissions legislation today. In future, exhaust-gas aftertreatment systems will not only have to meet the prescribed emission limits on the test stand, but also under a wide range of real-life conditions.

Both the cylinder head and the crankcase are made of aluminium. NANO-SLIDE® cylinder liner coating developed by Mercedes-Benz efficiently reduces the friction between cylinder liner and piston.

The combustion process of the engine has been completely redesigned. Its key feature is an innovative shape of the piston bowl that is completely new for passenger car engines: the stepped bowl. The special tuning of the bowl shape, airflow and injection nozzle is distinguished by very efficient utilisation of air and tolerance for low air-to-fuel ratios. The result is high combustion speeds and, as a consequence, increased combustion efficiency in conjunction with low particulate matter emissions.

Unusual for an engine with aluminium case, the pistons of the OM 654 are made of steel. The lesser expansion of steel as operating temperatures rise ensures increasing clearance between piston and aluminium case, thereby reducing friction by 40 to 50 percent. At the same time, the fact that steel is stronger than aluminium allows very compact, lightweight pistons that offer additional structural safety margins. Finally, the lower heat conductivity of steel leads to higher component temperatures, thereby improving thermodynamic efficiency, increasing ignitability and reducing combustion duration.

The use of steel pistons in conjunction with lightweight aluminium cases with NANOSLIDE® cylinder liner coating results in fuel consumption and CO<sub>2</sub> emissions advantages of two to four percent. At lower and medium engine speeds, which play an important part in everyday motoring, the reduction in fuel consumption is even more pronounced.

### Highlight: fully close-coupled exhaust system

The close-coupled exhaust system as a complete assembly comprises an oxidation catalytic converter (DOC), the metering and mixing unit for AdBlue and a combined diesel particulate filter with SCR coating. There is no longer any structural separation of the diesel particulate filter (DPF) and the SCR unit. Apart from the resulting lower weight, this compact design of the exhaust system not only means that the engine takes up less space, but also plays its part in heating up the diesel particulate filter more quickly and in speedy activation of the oxidation catalytic converter. These factors, coupled with a reduced requirement for additional heating energy, have a positive impact on fuel consumption and emissions.

Along with the combined high and low-pressure exhaust-gas recirculation system, in-engine emission control measures include an optimised combustion chamber geometry and an intake port shut-off to control swirl as a means of lowering untreated emissions. The same applies to the controlled electric water pump in the engine’s low-temperature circuit, which works in conjunction with a conventional thermostat to regulate the coolant temperature. From inside the car, the new compression-ignition engine feels powerfully dynamic and is barely perceptible as a diesel engine, with a characteristic sound that is much easier on the ear than is commonly experienced with diesel engines.



The crankshaft has a low-friction design, the steel pistons feature an innovative stepped bowl, which contributes to low particulate matter emissions.

\* Real Driving Emissions

# Responsible resource utilisation

Closed-loop material cycles and the usage of renewable raw materials are the key levers for responsible resource utilisation.

72 components in the new E-Class are made of high-quality recycled plastics



Some 72 components in the new E-Class with a total weight of 54.4 kilograms are made of high-quality recycled plastics. The objective is to obtain secondary raw materials wherever possible from vehicle-related waste flows, so as to achieve closed loops. To this end, established processes are applied in the E-Class: a recycled material composed of reprocessed starter batteries and bumper panelling is used for the wheel arch linings, for example.

The new E-Class now also uses Dinamica®, a high-quality recycled material, in the interior. Dinamica® is a micro-fibre material made of recycled polyester and water-based polyurethane.

The recycled polyester in Dinamica® comes from fabrics and PET bottles, for example. Dinamica® has the appearance and touch and feel of velour leather. It is used in the vehicle interior as seat covers, roof liners and pillar panelling, for example.

Furthermore, 90 components in the new E-Class with a total weight of 33.1 kilograms are made using natural materials. This represents an increase of 59 percent compared with its predecessor.

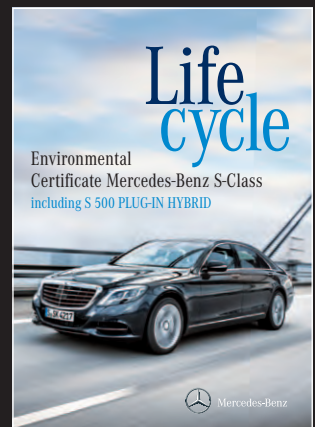
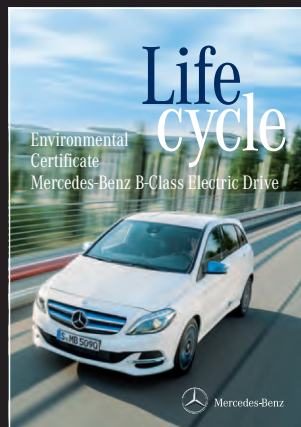
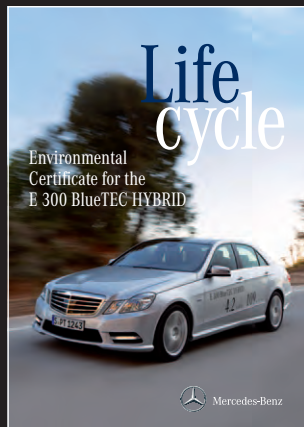
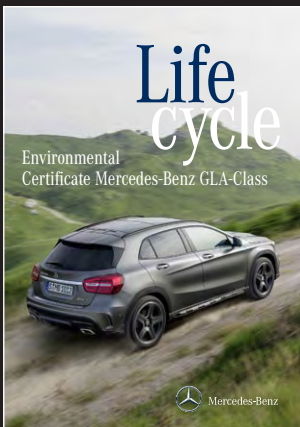
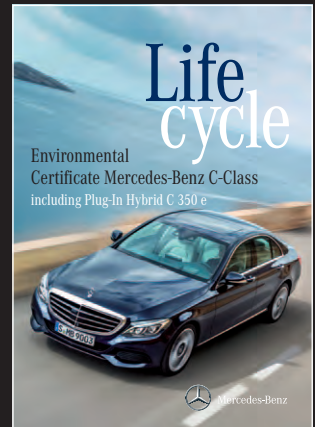
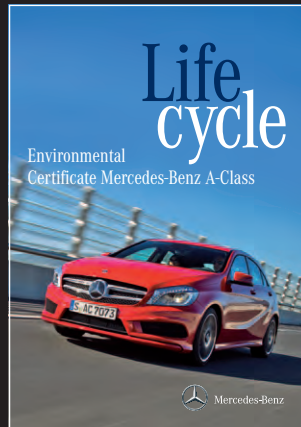
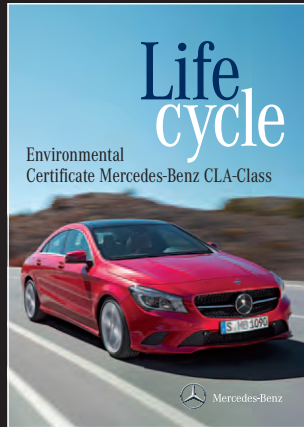
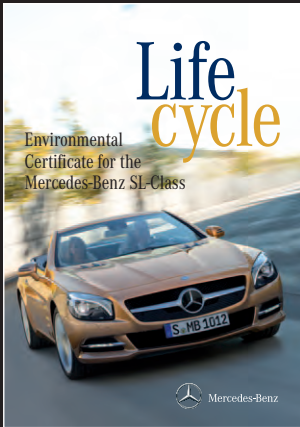


90 components in the new E-Class are made using natural materials



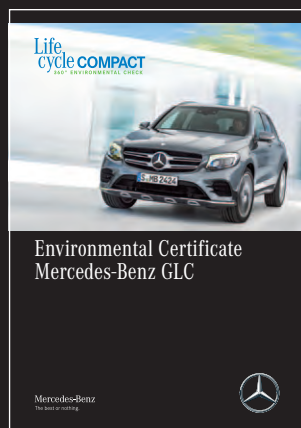


As early as 2005, the Mercedes-Benz S-Class was the first-ever vehicle to be awarded the Environmental Certificate from TÜV Süd. Life Cycle has been presenting and documenting the Environmental Certificates for Mercedes-Benz vehicles since 2009. If you're looking for detailed information about the complex matter of vehicles and the environment, you've come to the right place. The brochures can be downloaded from [www.mercedes-benz.com](http://www.mercedes-benz.com).



“Life Cycle COMPACT”, the compact edition with the key data from the Environmental Certificate, has been published since early 2015.

Detailed information on the complex issue of cars and the environment is now published in the “Life Cycle OVERALL” brochure, the successor to “Life Cycle”.



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