Fuel consumption and CO₂ emissions

The largest share of primary energy consumption and CO₂ emissions over the life cycle of a vehicle is attributable to the usage phase. In the case of a passenger car with a combustion engine it is about 80 percent. The remaining 20 percent is consumed almost entirely during the manufacturing process. Vehicles with alternative drive systems have fewer CO₂ emissions during the usage phase. However, the primary energy consumption of these vehicles generally increases during production because of the energy needed to manufacture certain components such as batteries and electric motors.

Daimler is working intensively to further reduce emissions from all phases of the product life cycle. Through the optimization of our BlueEFFICIENCY measures and the market launch of the new models we were able to achieve another significant reduction in the CO₂ emissions of our new vehicle fleet in 2014.

In the reporting year, the average CO₂ emissions of the total fleet of Mercedes-Benz Cars in Europe were at 129 grams per kilometer. We have thus achieved a reduction by more than 19 percent in the last five years. In 2014, we achieved another improvement by an additional 4 percent. Our goal is to lower the CO₂ emissions of our new-vehicle fleet in Europe to 125 grams per kilometer by the year 2016. In the EU, M1 vehicles must meet a fleet target of 95 grams of CO₂ per kilometer beginning in 2020. In consideration of the expected average vehicle weight, this leads to a target of around 100 grams of CO₂ per kilometer for Daimler.

Development of average CO₂ emissions of Mercedes-Benz Cars vehicle fleet in Europe (EU 27)

---

1 1995 including vans registered as M1 vehicles. All other years without vans.
2 2014: M1 vehicles 131 g/km
**Data for all vehicle models**

Vehicle data for all models

Via the following links you can view the vehicle data for our passenger car and van models – including fuel consumption, CO\(_2\) emissions, exhaust emission standard, and energy label.

Select the desired model under “Modellansicht” in the upper bar then select “Technische Daten” in the navigation bar on the right-hand side.

(Tool only available in German)

- Cars
- Vans

**CO\(_2\) emissions of our vans.** An EU Directive on the CO\(_2\) emissions of vans with a total weight of up to 2,585 kilograms entered into force in 2011. According to the regulation, starting in 2014, the requirement is to comply with a level of 175 g CO\(_2\)/km which is applicable in stages and has to be met to a 100 percent by 2017. As of 2020 the level drops to 147 g CO\(_2\)/km. As in the case of passenger cars, the vehicle weight must also be taken into account: if the average weight of the fleet of a given manufacturer is above that of all vans sold in the market, the CO\(_2\) fleet level to be achieved is also increased accordingly. Accordingly, Mercedes-Benz vans must comply with a level of 210 g CO\(_2\)/km starting in 2014. At 199 g CO\(_2\)/km in 2014, the Mercedes-Benz vans fleet achieved an improvement by a good 3 percent compared with the previous year. This equals a more than 11 percent decrease compared with the reference year 2011; we have thus exceeded the goal we set for ourselves and fulfills the EU van fleet regulation already in the very first year to a 100 percent.

**Development of average CO\(_2\) emissions of Mercedes-Benz Cars van fleet in Europe (acc. to NEFZ)**

![Graph showing CO\(_2\) emissions over years]

<table>
<thead>
<tr>
<th>Year</th>
<th>CO(_2) Emissions (g/km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>223</td>
</tr>
<tr>
<td>2012</td>
<td>219</td>
</tr>
<tr>
<td>2013</td>
<td>206</td>
</tr>
<tr>
<td>2014</td>
<td>199</td>
</tr>
</tbody>
</table>
**Higher fuel efficiency for passenger cars and vans.** With the extremely economical BlueEFFICIENCY technology package we are reducing the consumption and CO₂ emissions of our Mercedes-Benz cars and vans by up to 32 percent in individual models compared with the predecessor vehicles. This is aided by optimization measures in the powertrain area, energy management, aerodynamics and weight reduction through lightweight construction and tires with optimized rolling resistance, as well as by driver information for adopting an energy-saving driving style.

**Legendary power, increased efficiency.** In our semi-trailer tractors (class 8) we are using highly efficient powertrain components and sophisticated aerodynamics in order to reduce fuel consumption and CO₂ emissions. We have also done this in our new Western Star 5700XE truck. The hood and chassis and cabin paneling of the truck have a new aerodynamic design which significantly reduces drag. This alone reduces fuel consumption by more than 7 percent. In addition, the truck comes with a new integrated Detroit Diesel powertrain with a slow-speed DD15 engine, and the Detroit DT12 direct transmission and a particularly fuel-saving final drive ratio. The individual measures and, most of all, the fine-tuned overall package, yield a bottom-line decrease in consumption of nearly 15 percent compared with the reference vehicle (Western Star 4900SB with fuel efficiency package).

**Economical SuperTruck.** With further advanced technologies Daimler has successfully implemented the goals of a research project of the US Department of Energy. In 2014, our experimental vehicle achieved the required efficiency increase for both the entire semitrailer rig and the engine efficiency. The stationary testing indicated an engine efficiency of 50.2 percent, and the semitrailer rig demonstrated a 61 percent efficiency increase compared with the 2009 reference vehicle in two on-road highway tests.

---

**More on the SuperTruck**

**Economical SuperTruck.** In the USA, long-distance heavy-duty trucks make up 2 percent of the overall fleet, but account for 6 percent of all miles driven and for 20 percent of fuel consumption. According to the forecasts of the American Trucking Association, the freight volume in the USA will rise by 23.5 percent between 2013 and 2015.

That is why the U.S. Department of Energy (DOE) is funding a five-year research project with the goal of reducing fuel consumption and emissions of greenhouse gases of long-distance semi-trailer trucks (Class 8). The project focuses on the development and testing of especially promising fuel-saving technologies.

The project examines fully loaded long-distance semi-trailer trucks with a total weight of 29.5 tons. The goal is to increase the overall efficiency of semi-truck and trailer by 50 percent, measured in miles per ton (freight) and gallons of fuel (diesel). In addition, the efficiency of the engine is to be increased by 20 percent.

In 2014, one year before the end of the project, the engine of our test truck already achieved a thermal efficiency of 50 percent on the test rig; and in two highway road tests efficiency increases of 50.2 and 61 percent,
respectively, were documented compared with the 2009 reference vehicle. This success was possible primarily as a result of optimized aerodynamics, lightweight construction measures, an intelligent engine management system, improvements in the powertrain and in energy management, and the detailed fine-tuning of individual components. In addition, the engine was downsized, the engine speed reduced, and the drive system hybridized. At the same time it was even possible to increase the payload by about 680 kg (5 percent of the weight of the tractor-trailer combination).

Distribution of energy consumption of a loaded U.S. long-distance truck (vehicle energy balance in highway driving)

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerodynamics</td>
<td>16%</td>
</tr>
<tr>
<td>Rolling resistance</td>
<td>16%</td>
</tr>
<tr>
<td>Engine</td>
<td>56%</td>
</tr>
<tr>
<td>Idling</td>
<td>5%</td>
</tr>
<tr>
<td>Driveline</td>
<td>3%</td>
</tr>
<tr>
<td>Braking</td>
<td>3%</td>
</tr>
<tr>
<td>Auxiliaries</td>
<td>1%</td>
</tr>
</tbody>
</table>

More efficient with high-tech steel pistons. Since the autumn of 2014, we have been using the new high-tech pistons made of steel in the V6 diesel engine of the Mercedes-Benz E 350 BlueTEC — a world premiere in a production passenger car. Because steel conducts less heat than aluminum, higher temperatures are generated in the combustion chamber cavity of the steel piston, which leads to a shorter combustion time and improved combustion, and additionally enables reducing the piston friction. As a result, the engine uses about 3 percent less fuel. In addition, the greater strength of steel allows a particularly compact design. In this way, despite the significantly higher material density, the steel piston weighs about as much as an aluminum piston. The lower piston height additionally yields potential for new engine concepts with an even lower weight and installation space.

Excellent engine compartment encapsulation. Insulating partition walls in the engine compartment and a radiator shutter that is closed when the vehicle is not moving ensure that the heat in the Mercedes-Benz S 300 BlueTEC HYBRID is retained where it is generated: in the engine compartment. The “ECO Thermo Cover” ensures that the vehicle does not cool off when it sits for a longer time. The higher temperatures reduce engine friction when the vehicle is restarted. This leads to a minimization of cold-start losses and lower CO$_2$ emissions. According to our research, this makes annual average fuel savings of up to 1.5 liters per tank filling possible.
The European Commission has recognized the innovative engine encapsulation as an ecological innovation. It awards this label to technologies which lead to lower consumption in daily operations but show no or only minor effects in the standardized testing cycles of the EU (NEDC). With this, the EU Commission also reaffirms our “Real Life Efficiency” strategy.

**Lower fuel consumption of the new C-Class.** In the new C-Class we have realized fuel savings of up to 32 percent with the help of numerous coordinated measures to the vehicle body, engines, and ancillaries.

### Optimizations in the new C-Class

Optimization measures for the vehicle body, engines, and ancillaries of the new C-Class have made higher fuel efficiency and reduced consumption by as much as 32 percent possible. The most important innovations at a glance:

- All gasoline and diesel engines with optimized friction-reduced engines with turbocharging, direct injection and thermal management
- Start-stop system as standard on all vehicles
- Fuel and oil pump with closed-loop control which adjust their output in line with the required load
- Electric water pump with demand-controlled operation
- Tires with optimized rolling resistance
- Friction-optimized 6-speed manual transmission and 7G-TRONIC PLUS 7-speed automatic transmission
- Fuel-economy rear differential with tapered roller bearings for reduced power loss and low-friction oil
- Aerodynamic improvements to the underbody paneling concept, radiator shutters, and wheels
- Wheel bearings with significantly reduced friction
- Weight optimization through the use of lightweight materials
- Intelligent alternator management and efficient alternator, which ensure that the consumers are supplied from the battery during acceleration; some of the energy is recovered during braking and fed back into the battery
- High-efficiency air conditioning compressor with magnetic clutch
- Optimized belt drive with decoupler

Environmental certificate of the new C-Class: [PDF file (10.9 MB)]

**Fleet values in the US.** In the US, fleet values are regulated by two co-regulating standards for reduction of greenhouse gases in vehicle fleets: the Greenhouse Gas Standards (GHG) and the Corporate Average Fuel Economy Standards (CAFE). The CAFE fleet value for each model year is determined on the basis of the number of vehicles sold and their respective fuel economy figures. For every 0.1 mile per gallon below the specified limit, the manufacturer is required to pay a fine to the government of US$5.50 per vehicle sold. In the 2014 model year the introduction of vehicles like the CLA 250 contributed to the increase of our CAFE fleet figure.
Daimler CAFE* values for passenger and light commercial vehicles in the U.S.

In 2010, the Environmental Protection Agency (EPA) and the National Highway Traffic Safety Administration (NHTSA) published concerted regulations on fuel efficiency (Corporate Average Fuel Economy Standards) and reduction of CO$_2$ emissions (greenhouse gas standards, GHG) for the model years 2012 through 2016. Although separate, the two standards are closely coordinated and apply in all U.S. states. Separate target values specific to each manufacturer are set for cars and light trucks, which are based on the vehicles’ “footprint” – wheelbase times the track width.

If a manufacturer does not meet the GHG standards, the EPA identifies the vehicles from the manufacturer’s fleet to which the overrun of the limit is attributable. Starting with the models that have the highest CO$_2$ figure, the EPA keeps removing vehicles from the fleet calculation until the specified fleet limit is reached. All affected models are considered improperly certified and are subject to penalties that can total up to USD 37,500 per vehicle.

Fleet value in China. In China, there are different fuel economy requirements for domestically produced and imported passenger cars. At the same time a differentiation between sixteen weight
classes is also made. The fleet fuel economy target relative to the weight of Daimler’s “domestic” fleet was 9.3 liters/100 km, and the actual value achieved in 2014 was 8.4 liters/100 km. The target for the import fleet was 9.6 liters/100 km, and 8.3 liters/100 km was achieved.

Daimler fleet fuel consumption in China

Driver training. Fuel consumption can be reduced by as much as 10 percent through an economical and anticipatory driving style. Our Mercedes-Benz Eco-Training programs for drivers of passenger cars and commercial vehicles show how this can be done.

More on our Eco-Training programs

Eco driver training at Mercedes-Benz

In the Mercedes-Benz Eco Training courses, which we offer for drivers of cars and commercial vehicles, we demonstrate how fuel consumption can be cut by as much as ten percent. The electronic shift recommendation and the current consumption display in the instrument cluster of our vehicles additionally support the driver’s efforts.

Economical driving has to be learned. Those who master it conserve valuable resources and save money. This applies equally to drivers of cars, buses, and trucks. Our Eco driver training courses teach our customers how to strategically reduce their fuel consumption without loss of time.

- Eco Training for car drivers
- Eco Training for truck drivers*
- Eco Training for fleet managers and business owners*
- Omniplus – Eco Training for bus customers

* Site only available in German
Fuel-saving tips

Tips for saving fuel
How much fuel your vehicle consumes and how much wear and tear your engine, transmission, brakes, and tires are subject to depends above all on the following factors: first, on the conditions under which your vehicle operates, and secondly, on your personal driving style. You can influence both factors by following these tips:

Operating conditions
- Avoid short trips – they increase fuel consumption.
- Make sure your tire pressure is correct.
- Don't carry unnecessary ballast.
- Remove the roof rack when you don't need it.
- A regularly serviced vehicle is environment-friendly. Observe the service intervals.
- Always have service work performed in a qualified specialist workshop.

Personal driving style
- Don't press the accelerator when you start the engine.
- Don't idle your engine to let it warm up before driving.
- Drive with anticipation and maintain an adequate distance from the vehicle ahead.
- Avoid frequent and heavy acceleration and braking.
- Shift in good time and utilize only two-thirds of the redline speed in each gear.
- Turn off the engine when waiting in traffic.

Driving and saving with electric vehicles

Those who want to drive economically with an electric vehicle should pay attention to a number of special aspects. Because not everything that applies to vehicles with combustion engines is also helpful here.

Driving style
- **Quick acceleration** affects energy consumption to a lesser extent in an electric car than in a gasoline-powered car. Nevertheless, it is recommended to accelerate softly because this protects the battery.
- **High speeds** of more than 100 km/h lead to a significantly higher energy consumption in an electric vehicle. This increases disproportionately compared with a vehicle powered by a combustion engine.
- **An anticipatory driving style** and techniques such as coasting also pay off in an electric car. That is because uniform braking allows most of the energy to be recovered and fed back into the battery.
- **Very heavy braking** should be avoided since part of the kinetic energy is converted into heat and cannot therefore not be recovered.

Usage behavior
- **The heating and air conditioning unit** use additional energy from the traction battery. Here it can be beneficial to preheat or precool the vehicle before the trip while it is still charging (pre-entry climate control) to ensure that the operating range is reduced to a much lesser extent.
- **Short trips** in an electric vehicle hardly increase consumption or wear and tear. That is why electric vehicles are especially well suited for use in cities and urban areas.

Battery care
• **Charging capacity.** Electric vehicles can be “filled up” at household power outlets or at wall boxes and other charging stations. The charging time depends mainly on the charge remaining in the battery and the charge rate of the power supply. Low-current charging has a positive effect on the life of the battery.

• **State of charge.** Frequent recharging while the battery still has a high state of charge should be avoided since this weakens its performance.

• **Memory effect.** The lithium-ion batteries used in Mercedes-Benz and smart electric vehicles are not affected by the so-called memory effect, known mainly from earlier nickel-cadmium batteries, which seem to remember the usual energy need after frequent partial charging and over time no longer make the full energy charge available.

• **Parking in winter.** It is recommended to park an electric vehicle in a garage protected from the cold. This also increases the life of the battery.