

# VIA VISION

VOLKSWAGEN GROUP

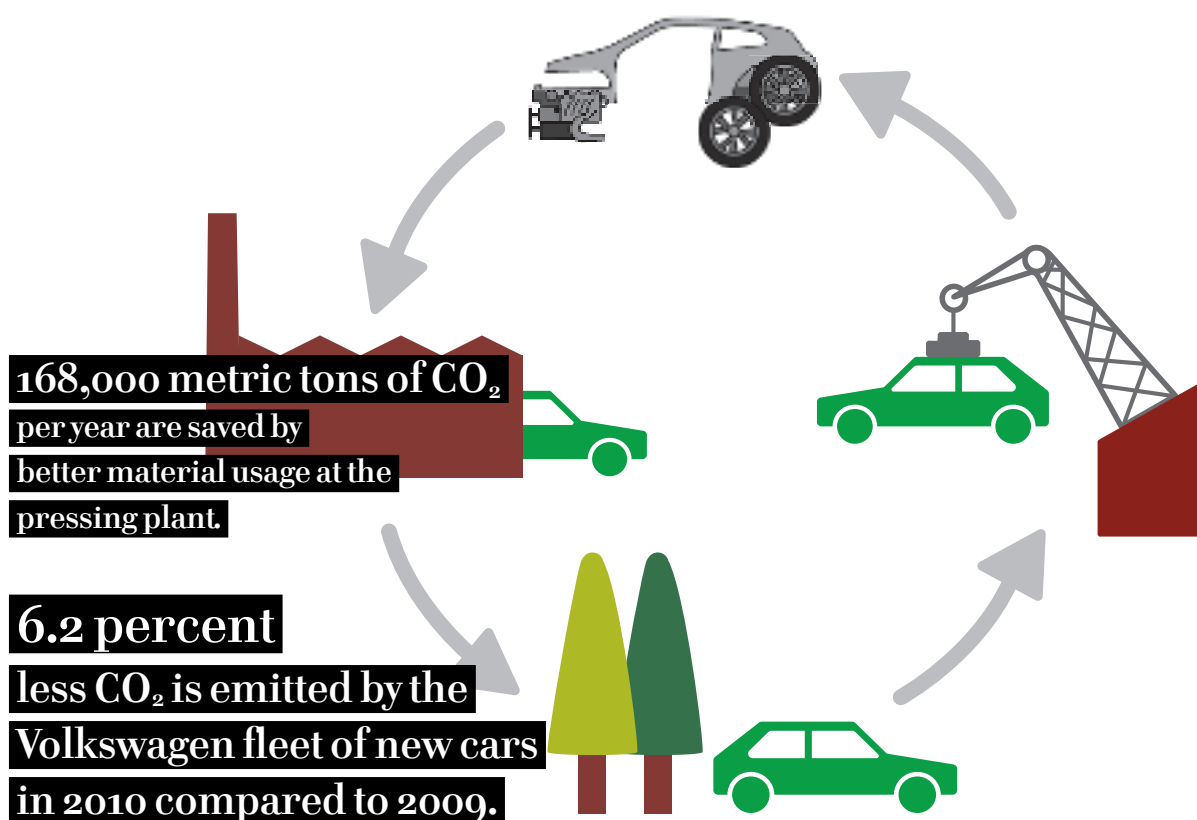
• SHAPING THE FUTURE OF MOBILITY

## NO 07

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Editorial – Dr. Ulrich Hackenberg	2
Clean Process – Climate Protection Starts at the Factory	2
Decreasing Values – Cars Emit Less and Less CO <sub>2</sub>	4
Efficiency Measures – Technologies for Lower Consumption	6
New for Old – How Car Parts Are Recycled	8
Imprint	8

## Climate Protection From Factory to Shredder



**Editorial**



*Dr. Ulrich Hackenberg, Member of the Board of Management of Volkswagen Brand with responsibility for Research and Development.*

A car manufacturer carries a special social responsibility. Its activities, from the acquisition of materials to production to recycling, as well as its products have an effect on the environment. On the following pages you can read about the steps Volkswagen is taking to minimize this effect.

Happy reading.

# Clean Process

## Climate Protection Starts at the Factory

It is not all about emissions: To determine a car's impact on the environment one has to look at its whole lifespan. It ranges from the production process to the use of the vehicle to its recycling. Therefore environmentally friendly thinking already begins during production. It is essential to save energy, water, waste and emissions at this stage. This is a perpetual process of improvement. A lot has already been done but there is always room for improvement.

**40** percent less greenhouse gas emissions, compared to 2010 levels, resulting from the energy used in production at Volkswagen Group is the target for the year 2020.  
Source: Volkswagen Sustainability Report 2010

**311,350,000** euros of operating expenses in 2010 were spent by Volkswagen Group on environment protection. The bulk of this is spent on water conservation, waste management and the prevention of air pollution.  
Source: Volkswagen Sustainability Report 2010

### CO<sub>2</sub> Emissions

Greenhouse gases are produced in a factory whenever something is burned, for example in boiler plants or furnaces. Indirect emissions, created by the factory's respective energy suppliers, add to the CO<sub>2</sub> emissions total.

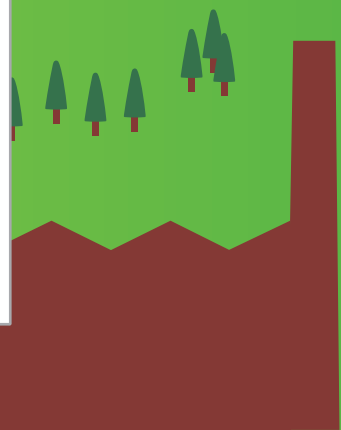
#### CO<sub>2</sub> Emissions per year:

(in metric tons)  
**2009:** 6,450,000  
**2010:** 7,700,000

#### CO<sub>2</sub> Emissions per vehicle:

(in kilograms)  
**2009:** 1,064.7  
**2010:** 1,047.1

*Because Volkswagen produced more cars in 2010 than in 2009 the amount of CO<sub>2</sub> emitted directly by the Group, as well as that caused as a result of energy consumption, has increased. In proportion to the cars produced, however, it decreased.*





**Energy**

The consumption of electricity, district heating and fuels like coal and natural gas for production processes accounts for the Group's energy demand. The CO<sub>2</sub> emissions are reduced mainly by the purchase of green electricity or through the use of in-house hydroelectric and solar power plants. The improved control of robots and lighting systems also reduces energy consumption.

<b>Energy consumption per year:</b> (in megawatt hours)	<b>Energy consumption per vehicle:</b> (in megawatt hours)
<b>2009:</b> 16,980,000	<b>2009:</b> 2.8
<b>2010:</b> 18,830,000	<b>2010:</b> 2.6

*Due to the increased output figures, energy consumption increased from 2009 to 2010. However, it decreased per vehicle.*

**61,500** metric tons of CO<sub>2</sub>\* are saved by the use of green electricity every year at the VW plant in Navarra, Spain. There 125,000 megawatt hours of electricity come from renewable sources.

**3,292** metric tons less of CO<sub>2</sub>\* are emitted per year by means of the improved control of robots during Volkswagen's car body manufacturing process.



**Waste**

At the plant various forms of waste accumulate, the largest proportion of which are metals. They belong to the group of recyclable waste products into which plastics also fall.

<b>Waste per year:</b> (in metric tons)	<b>Waste per vehicle:</b> (in kilograms)
<b>2009:</b> 1,805,107	<b>2009:</b> 298.1
<b>2010:</b> 2,198,447	<b>2010:</b> 298.8

*While the total amount of waste increased, less metal was wasted; thanks to better material utilization.*

**168,000** metric tons of CO<sub>2</sub>\* per year are saved by better material utilization at the pressing plant – for example by cutting out car body parts more efficiently.

**3,000** metric tons of CO<sub>2</sub>\* per year are saved by the reconditioning of old transmission components.



**Water**

Whilst a car consumes almost no water when it is being driven, water is required during the production process. Volkswagen uses water sparingly as well as also collecting rainwater and deriving water from wells.

<b>Water consumption per year:</b> (in cubic meters)	<b>Water consumption per vehicle:</b> (in cubic meters)
<b>2009:</b> 32,690,000	<b>2009:</b> 5.4
<b>2010:</b> 36,850,000	<b>2010:</b> 5

*Total freshwater consumption has increased but has been reduced in proportion to the number of cars produced.*

**1,600,000** cubic meters of rainwater per year are collected through reforestation at the Volkswagen brand production site in Puebla, Mexico and fed into the ground water.

**6** is the number of times every drop of water is utilized, statistically speaking, at the Wolfsburg plant.

\* Values correspond to CO<sub>2</sub> equivalents, meaning the total of CO<sub>2</sub> and other greenhouse substances.

Sources: Volkswagen Sustainability Report 2010; Volkswagen Brand Production (as of 2011); Joint Environmental Declaration 2010 Volkswagen and Volkswagen Commercial Vehicles

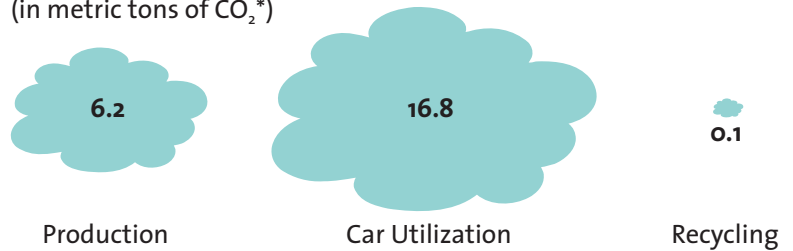
# Decreasing Values

## Cars Emit Less and Less CO<sub>2</sub>

A car's impact on the environment is greatest when it is driven. A mid range car emits three times the amount of CO<sub>2</sub> during the utilization phase compared to during production. This is why there is ongoing work to reduce consumption and thus pollutant emissions. There are several parameters: Optimized combustion engines, alternative drives and fuels but also lighter cars and low friction tires contribute to decreased fuel consumption.

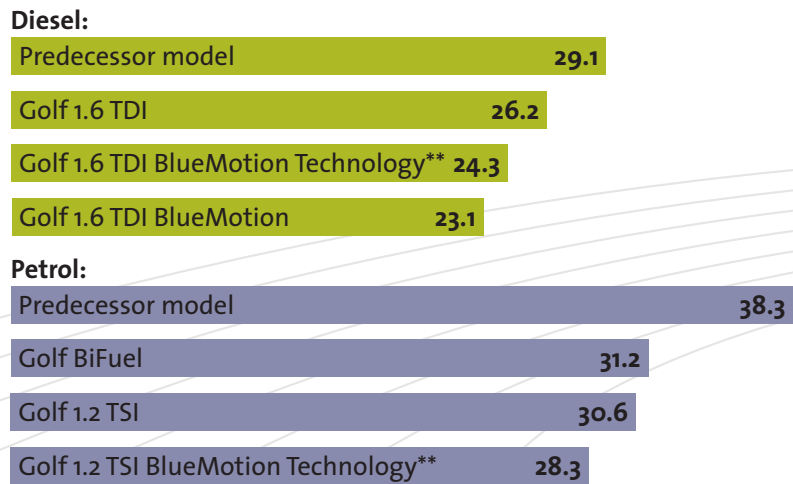
### Environmental impact of a Golf BlueMotion: (in metric tons of CO<sub>2</sub>\*)

*During utilization, a Golf BlueMotion uses almost three times as many metric tons of CO<sub>2</sub> compared to during its production. Recycling has by far the least impact on the climate.*  
Source: Volkswagen Group (as of 2011)



### Environmental impact of a Golf: (in metric tons of CO<sub>2</sub>\*)

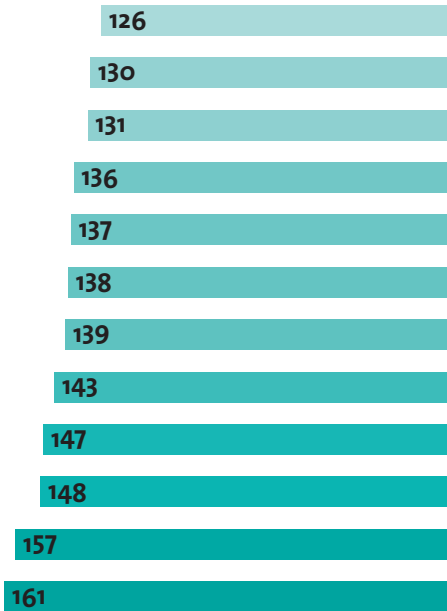
*The environmental balance of the Golf shows that it has become more and more climate friendly. Here, the current diesel and petrol vehicles are compared to a similarly engined predecessor model. The numbers apply to the whole life cycle of the cars; from the production to the utilization to recycling.*  
Source: Volkswagen Environmental Rating Golf 2010



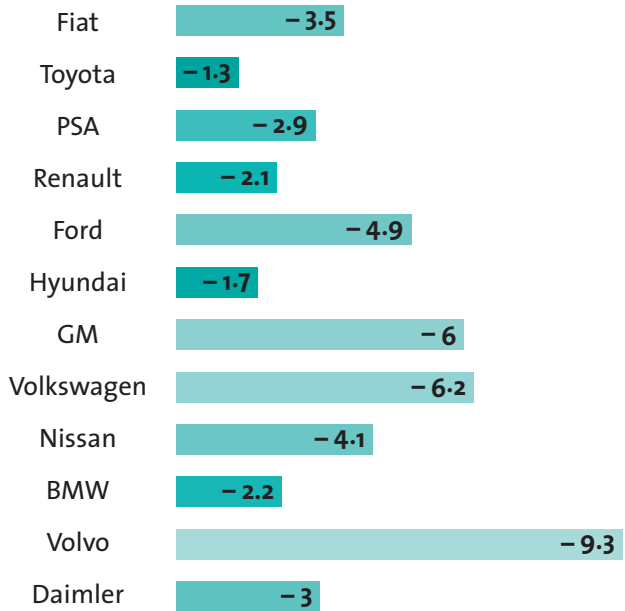
\*Values correspond to CO<sub>2</sub> equivalents, meaning the sum of CO<sub>2</sub> and other greenhouse substances such as methane or nitrous oxide.

\*\*While the Golf BlueMotion is equipped with all the technologies of the BlueMotion series (among others, recuperation, start-stop system, light-weight construction), only selected efficiency technologies are available for the Golf BlueMotion Technology.

**Average CO<sub>2</sub> emissions of new cars sold in Europe by the twelve highest volume selling producers 2010:**  
(in grams per kilometer)



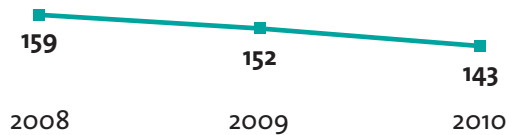
**Reduction of CO<sub>2</sub> emissions of new cars sold in Europe by the twelve highest volume selling producers from 2009 to 2010:**  
(in percent)



*On average, the twelve highest volume selling producers in Europe have decreased the CO<sub>2</sub> emissions of their cars sold in 2010 by four percent, compared to the year before. The reduction in CO<sub>2</sub> emissions by Volvo, Volkswagen and GM are significantly above average. As far as mean emissions of carbon dioxide are concerned, the new car fleets of Fiat, Toyota and PSA are especially economical.*

Source: European Federation for Transport and Environment AISBL

**CO<sub>2</sub> emissions of new cars sold by Volkswagen in Europe:**  
(in grams per kilometer)



*The average CO<sub>2</sub> emissions of new cars sold by Volkswagen Group brands in Europe are continuously decreasing. They fell by a good 6.2 percent from 2009 to 2010.*

Source: European Federation for Transport and Environment AISBL

**“We can see that Volkswagen has made great progress in the past two years. They came from far behind but have advanced to the top of German manufacturers in terms of CO<sub>2</sub> reduction.”**

Dietmar Oeliger,  
expert for transportation at the Nature and Biodiversity Conservation Union Germany (NABU)

# Efficiency Measures

## Technologies for Lower Consumption

Passenger car traffic is responsible for more than a tenth of CO<sub>2</sub> emissions in Germany. In order to lower this share, cars are equipped with new technologies which lower fuel consumption without affecting their drivability. In addition, every driver can reduce his individual fuel consumption through his driving behavior, thus reducing carbon dioxide emissions.

### Cylinder deactivation

At low speeds several cylinders in the motor are temporarily cut off. This lowers neither speed nor ride comfort but does save fuel. The cylinders are deactivated by shutting the in- and outlet valves so that the fuel supply is interrupted. As soon as the car is driven faster, the cylinders re-engage.

**800** grams of CO<sub>2</sub> or 0.4 liters of fuel are saved by cylinder deactivation per 100 kilometers.\*

### Sailing mode

As soon as the driver steps off the gas, the gear is changed into neutral. The engine then runs at only idle speed, the car thus rolls much further and better utilizes its momentum. At steep declivities, however, the sailing mode is deactivated to avoid excessive acceleration.

**1,800** grams of CO<sub>2</sub> per 100 kilometers can be saved using the sailing function – according to driving behavior and fuel demand. This equates to 0.7 liters of fuel per 100 kilometers.\*\*

### Downsizing

Downsizing means building fewer or smaller cylinders in the engine in order to lower consumption. To prevent a decrease in performance more air, and consequently more oxygen, is pumped into the cylinders, making the combustion more efficient.

**3,000** grams of CO<sub>2</sub> per 100 kilometers are saved thanks to downsizing – this equates to 1.2 liters of fuel.\*\*\*

\* Values refer to the 1.4 TSI engine by Volkswagen.

\*\* Values refer to a VW Passat, 1.8 liters, 118 kilowatts, TSI.

\*\*\* Values refer to a Polo 1.2 TSI compared to its predecessor.

Source: Volkswagen Group (as of 2011)

## Economical Models from the Volkswagen Group

**79** grams of CO<sub>2</sub> per kilometer: This is made possible by a combination of BlueMotion technologies and the Eco Up!'s natural gas engine. Because natural gas contains less carbon than petrol it burns more cleanly.



**87** grams of CO<sub>2</sub> per kilometer are emitted by the Polo BlueMotion. It consumes 3.3 liters of fuel per 100 kilometers – thanks to the whole range of BlueMotion technologies, such as start-stop system and low friction tires, for example.

**89** grams of CO<sub>2</sub> per kilometer make the Škoda Fabia GreenLine the car with the lowest emissions in the Škoda fleet, thanks to improved aerodynamics and start-stop system, amongst others.



**89** grams of CO<sub>2</sub> per kilometer put the Seat Ibiza E-Comotive first amongst the cleanest Seat models. Above all the start-stop system and recuperation, meaning regenerative braking, are utilized to achieve this.

Source: Volkswagen Group (as of 2011)

## Drive Intelligently – Save Fuel

Efficiency measures concerning consumption are not only a matter of technology. The driver too affects how much fuel he consumes. The Volkswagen initiative “Think Blue.” compiles tips concerning this.

**25** percent of fuel can be saved with the right driving style.

Source: Deutsche Automobil Treuhand (as of 2011)

- **Avoid short journeys:** Engines that have reached operating temperature work more efficiently. Over the first four to ten kilometers, fuel consumption of up to 30 liters per 100 kilometers is possible. Warming up when stationary is not helpful.
- **Check tire pressure:** Tires with too low pressure have a larger rolling friction which increases fuel consumption. Therefore always fill the tires according to the manufacturer's specifications.
- **Avoid ballast:** 100 kilograms of weight added to a vehicle increase consumption up to 0.3 liters per 100 kilometers.
- **Reduce air resistance:** Roof racks impair a car's aerodynamics. At a speed of 160 kilometers per hour the fuel consumption rises by up to two liters per 100 kilometers.

- **Shift early:** Shifting up gears early can save ten to 20 percent of fuel.
- **Drive steadily:** On the motorway for example, one should drive at a constant speed of 130, rather than one half of the distance at 100 and the other half at 160. On a distance of 130 kilometers this saves 0.4 liters of fuel and takes no longer.
- **Save electricity:** Additional consumers cost fuel. Air conditioning, for example, consumes up to two liters per 100 kilometers.

Source: Volkswagen Think Blue



**Recycling at Volkswagen**

Together with the SiCon company, Volkswagen has developed a patented process that allows the remains of old cars, that have accumulated after the disassembly and shredding of the car body, to be salvaged. By means of blowers, magnets and sieves, the shredded material is sorted by properties such as size, density or conductivity. Metals for the most part go straight back into the resources cycle. The remaining material can be used differently: Shredded fluffs from fibrous materials, for example, are used as filters for the drainage of sewage sludge.

Source: Volkswagen Eco Balance Sheet Old Car Recycling (as of 2005)

**95** percent of a car can be recycled using the VW SiCon process.

Source: Volkswagen Sustainability Report 2010

**30** percent of CO<sub>2</sub> emissions can be saved by the VW SiCon process, compared to the manual disassembly of an old car.

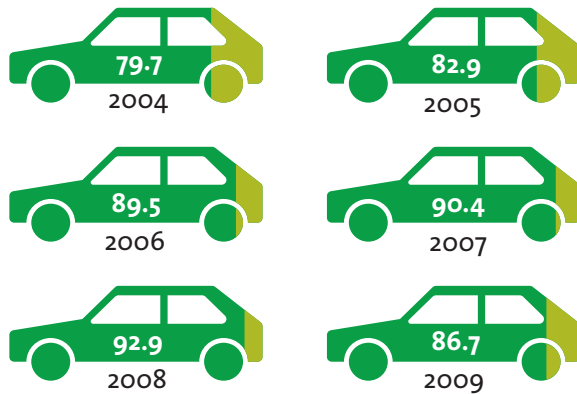
Source: Volkswagen Eco Balance Sheet Old Car Recycling (as of 2005)

# New for Old

## How Car Parts Are Recycled

A car consists of 6,000 to 10,000 individual parts. In order to reuse the resources contained they have to be homogenous, meaning free of different materials. In an ideal scenario, recycling forms an almost closed cycle: A resource is built into a car, processed after disassembly and finally reused in the production of a new car. This saves the initial resource and lowers the total CO<sub>2</sub> balance of cars.

### Old car recycling rate in Germany: (in percent of the weight of all old cars)



*Recycling of old cars has continuously increased over the past years. In the '90s the ratio estimated by experts, which was not an official figure back then, was 75 percent. It only decreased in 2009 because of the scrappage premium; there were so many old cars that recycling extended into the year 2010.*

Sources: Federal Environment Agency of Germany; The Parliament of the Federal Republic of Germany, End of Life Vehicle Directive

## Imprint

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