Global Challenges and Demands on Vehicles
Reduction of Emissions (incl. CO₂-Emission) and Fuel Consumption

**Global challenges**

- **World Population**
  - 1950: 3 bn
  - 2000: 6 bn
  - 2050: 9 bn
  - Source: Prognosis UNO

- **Limited Resources of Crude Oil**
  - 1950: 10 Gb/a
  - 2050: 30 Gb/a
  - Source: ASPO 2004

- **World Mobility**
  - 1950: 2.3 bn vehicles
  - 2050: 3.1 bn vehicles
  - Source: Downs 2002

**Demands on new vehicles**

**Regulations**
- Safety
- Consumption
- Emissions
- Noise

**Environment**
- Clean Air
- Pollution
- Resources
- Recycling

**Customer**
- Performance
- Price
- Costs
- Reliability

Source: Prognosis UNO, ASPO 2004, Downs 2002
Introduction

• About 110 years ago Rudolf Diesel invented the self-ignition engine which was named DIESEL engine since then.
• The diesel engine was for a long time known as robust and efficient, but for some attributes like power, driveability, sportiness the gasoline engine was often favoured.
• Due to a lot of technical improvements within the last 15 years, e.g. turbo charging, 4-valve technology, common rail direct injection, particular trap and BlueTEC, the DIESEL engine has become a competitive power train with outstanding torque and driveability properties.
• Today about 50 % of the customers make their choice for a diesel car and accordingly the diesel share has grown significantly in Europe.
• Looking on the global energy demand, the DIESEL engine has a big potential to save the crude oil reserves and to reduce the total CO₂ emissions, due to economical benefits in terms of fuel economy.
• The technology evolution of today's high performance DIESEL engines was extensively driven by Mercedes-Benz.
Diesel History and Success

The evolution of the Diesel is closely linked to innovative Mercedes-Benz developments.

More than 70 Years of Diesel Competence: Mercedes-Benz 260 D - First Diesel Passenger Car

Mercedes-Benz 260 D

Rudolf Diesel

1936
More than 70 Years of Diesel Competence
Mercedes-Benz E 320 BlueTEC – World’s Cleanest Diesel Car

Mercedes-Benz E 320 BlueTEC
Rudolf Diesel

2006

Mercedes-Benz E-Class 320 CDI: World Record in Laredo/USA (2005)
Low Fuel Consumption and High Mileage

Four Times around the World
160,934 Kilometer, Ø-Velocity 224.823 km/h

1672 km without Fueling
4.75 l/100 km

450 000 Kilometers in 26 Days (2006)
Perspective of Diesel Market Share

The demand for diesel cars in the USA is rising strongly

Source: USA: Automobilwoche 06/2006, S.3
WEU: MAPIS and Global Insight 4/06
J. MAPIS

Western Europe

USA

2005 history
3.4% 1.2%
17 Mio.
2010 forecast
4.6%
17 Mio.

China

2005 history
0.2%
14.5 Mio.
2010 forecast
5.1%
14.5 Mio.

Japan

2005 history
0.1%
5 Mio.
2010 forecast
2.2%
5 Mio.

The diesel share in Europe is still increasing

Development of EU Emission Standards

Since the introduction of first emission standards the emissions have been reduced extensively.
In Three Steps – Towards the Cleanest Diesel of the World

- **internal measures, clean fuels**
  - **efficient and clean combustion process**

- **oxidizing catalytic converter, particulate filter**
  - **lower emissions incl. particulate emissions**

- **BlueTEC technology**
  - **reduces emissions of nitrogen oxides by 80 percent**

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BlueTEC: The Key Elements of Clean Diesel Technology

**Diesel Engines as Clean as Gasoline Engines**

- **Control of emission components**
- **Particulate filter and oxidation catalyst**
- **Reduction of engine out emissions**
- **NOx aftertreatment**

**Goal:** Diesel engines as clean as gasoline engines thanks to **BlueTEC**

Showing the way to the most stringent emission standards **EU5 and EU6**
Modular BlueTEC Technology
BlueTEC1: Advanced DeNOx-Catalyst

- BlueTEC 1 market launch in passenger car on US market in October 2006 in E 320 sedan
- BlueTEC 1 in passenger cars in Europe since end of 2007

First BlueTEC in the US

20 % to 40 % fuel consumption advantage for BlueTEC compared to gasoline vehicles
Diesel market share of about 11 % in US E-Class sales
Modular BlueTEC Technology
BlueTEC2: AdBlue-Injection

- BlueTEC is highly efficient and economical
- BlueTEC is applicable worldwide
- BlueTEC in commercial vehicles since 2005
- GL 320 BlueTEC with SCR-AdBlue-aftertreatment is dedicated to comply with US federal BIN 5 and California LEV2.

Next Steps ...

... Mercedes-Benz GL-, R and ML 320 BlueTEC

with ULEV / BIN5 certification for MY2009 in all 50 states of the US
Success Story of BlueTEC Technology

The new four-cylinder Diesel generation from Mercedes-Benz ...
Key Data

<table>
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<tr>
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<th>250 CDI</th>
<th>220 CDI</th>
<th>200 CDI</th>
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<tr>
<td>Number of cylinders</td>
<td>4</td>
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<tr>
<td>Valves per cylinder</td>
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<td>Displacement, cc</td>
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<tr>
<td>Bore/stroke, mm</td>
<td>83.0/99.0</td>
<td>83.0/99.0</td>
<td>83.0/99.0</td>
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<td>Compression ratio</td>
<td>16.2:1</td>
<td>16.2:1</td>
<td>16.2:1</td>
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<tr>
<td>Output, kW/hp</td>
<td>150/204 at 4200 rpm</td>
<td>125/170 at 3200 - 4800 rpm</td>
<td>100/136 at 3000 - 4600 rpm</td>
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<tr>
<td>Torque, Nm</td>
<td>500 at 1600 - 1800 rpm</td>
<td>400 at 1400 - 2800 rpm</td>
<td>330 *) at 1600 - 2800 rpm</td>
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</tbody>
</table>

*) with automatic transmission

The engine will be introduced in the Mercedes-Benz C-Class in autumn 2008

... taking performance, consumption and emissions into a new dimension.

- 20 per cent more power
- 25 per cent more torque
- 13 per cent less CO₂ emissions
- EU5 emissions standard
- Two-stage turbo charging system
- Fourth-generation common-rail technology 2000 bar with a new piezoelectric injector concept featuring direct injector needle control
- Ignition pressure of 200 bar and such a high power-to-displacement ratio
- Both the oil-spray nozzles and the water pump are activated in accordance
- Camshaft drive is positioned at the rear
- Engine block is made from cast iron, the cylinder head from aluminum.
- High vibrational comfort:
  - Forged crankshaft with eight counterweights
  - Two Lanchester balancer shafts in low-friction roller bearings
  - Two-mass flywheel
Summary

• The diesel engine's success story is closely coupled to the technologies developed by Mercedes-Benz.

• BlueTEC technology has the potential of fulfilling the stringiest emission standards all over the world, making the Diesel engine as clean as the gasoline engine.

• With the well known torque and efficiency of the diesel engines BlueTEC is clean, efficient and powerful like no other diesel engine before.

• Mercedes-Benz will continue to offer its customers diesel engines with BlueTEC technology. This comprises advanced internal engine measures and highly sophisticated exhaust gas after treatment.

• The brand new generation of four-cylinder diesel engines from Mercedes-Benz will outstrip all previous benchmarks for performance, torque, emission properties and fuel economy in their segment.