Antriebstechnologien zur Erreichung zukünftiger CO$_2$-Ziele

*Powertrain Technologies for Future CO$_2$-Emission Targets*

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Daimler AG
Challenges for Future Mobility

Abb. 1: Challenges for Future Mobility

Daimler’s Technology Portfolio for Future Mobility

Abb. 2: Daimler’s Technology Portfolio for Future Mobility
Diesel: higher Performance - lower Fuel Consumption

- Development over the years

<table>
<thead>
<tr>
<th>Year</th>
<th>Displacement</th>
<th>Torque</th>
<th>Output</th>
<th>Total weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>1936</td>
<td>2.600 cm³</td>
<td>45 PS</td>
<td>100 Nm</td>
<td></td>
</tr>
<tr>
<td>1983</td>
<td>2.500 cm³</td>
<td>90 PS</td>
<td>154 Nm</td>
<td></td>
</tr>
<tr>
<td>1997</td>
<td>2.200 cm³</td>
<td>125 PS</td>
<td>300 Nm</td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td>2.200 cm³</td>
<td>170 PS</td>
<td>400 Nm</td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>2.200 cm³</td>
<td>204 PS</td>
<td>500 Nm</td>
<td></td>
</tr>
</tbody>
</table>

Abb. 3: Diesel: higher Performance – lower Fuel Consumption

Diesel: OM 651 - Versatile 4-Cylinder Diesel Engine with new Dimensions in Output, Fuel consumption and Emissions

Displacement: 2.143 cm³
Torque: max. 500 Nm
Output: 70 - 150 kW
Total weight: 183 - 197 kg

Abb. 4: Diesel OM 651 – Versatile 4-Cylinder Diesel Engine with new Dimensions in Output, Fuel consumption and Emissions
Mercedes-Benz E 200/220/250 CDI BlueEFFICIENCY
Economic 4-Cylinder Diesel Engine for the New E-Class

- E 200 CDI BlueEFFICIENCY since September 2009

![Image of Mercedes-Benz E Class engine]

- Power output:
  - 100 / 125 / 150 kW
  - 136 / 170 / 204 HP
- Torque:
  - 360 / 400 / 500 Nm
- Fuel Consumption:
  - 5,2 / 5,3 / 5,3-5,5 l/100 km
  - 137 / 139 / 139-144 g/km CO₂

Displacement: 2143 cm³  6-gear manual transmission  Emission standard EU5

Abb. 5: Mercedes-Benz E 200/220/250 CDI BlueEFFICIENCY
Economic 4-Cylinder Diesel Engine for the New E-Class

Diesel: S250 CDI BlueEfficiency with OM 651 Diesel Engine
The world's first 5-litre car in the luxury segment

- First S-Class in the history with 4-Cylinder engine
- the most fuel-efficient luxury saloon...
  - Fuel consumption of just 5,7 l/100 km (NEDC);
  - CO₂-emission of only 149 g/km
- ... with top class performance:
  - Top speed: 240 km/h,
  - Acceleration 0-100 in 8.2s

Abb. 6: Diesel: S250 CDI BlueEfficiency with OM 651 Diesel Engine
The world's first 5-litre car in the luxury segment
Gasoline: Direct Injection

![Image of 1954: 300 SL and 2007: E 350 CGI]

**Engine Data:**
- 1954: 300 SL
  - Cylinders/Ventils: R6-2V
  - Bore: 85 mm
  - Stroke: 88 mm
  - Displacement: 2996 cm³
  - Compression Ratio: 8.5
  - Power: 215 PS (158 kW)
  - Torque: 28 mkg (ca. 275 Nm)

- 2007: E 350 CGI
  - Cylinders/Ventils: V6-4V
  - Bore: 92.9 mm
  - Stroke: 86 mm
  - Displacement: 3498 cm³
  - Compression Ratio: 12.2
  - Power: 215 kW
  - Torque: ca. 370 Nm

Abb. 7: Gasoline: Direct Injection

Gasoline: New Generation Engines with BlueDIRECT technology

**V6-Engine with Direct Injection**
- 24 % more economical and 50 % more efficient compared to its predecessor

![Image of 200 kW / 272 hp and 225 kW / 306 hp]

- 200 kW / 272 hp
- 225 kW / 306 hp

- 10.0 l/100 km
- 7.6 l/100 km

Abb. 8: Gasoline: New Generation Engines with BlueDIRECT technology

**V6-Engine with Direct Injection**
Gasoline: New Generation Engines with BlueDIRECT technology
V8-Engine with Direct Injection

• 22 % lower fuel consumption and 12 % higher power output

Abb. 9: Gasoline: New Generation Engines with BlueDIRECT technology
V8-Engine with Direct Injection

50 Years of Experience in Developing and Producing Automatic Transmissions

Abb. 10: 50 Years of Experience in Developing and Producing Automatic Transmissions
Fuel Economy Potentials of New Automatic Transmission Concepts (Rear-Wheel-Drive)

Abb. 11: Fuel Economy Potentials of New Automatic Transmission Concepts (Rear-Wheel-Drive)

Hybrid Powertrains during History

Abb. 12: Hybrid Powertrains during History
Abb. 13: Mercedes-Benz S 400 HYBRID - the world's first series production car to feature a hybrid drive system with a lithium-ion battery

<table>
<thead>
<tr>
<th>Power ICE:</th>
<th>205 kW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power E-Motor:</td>
<td>15 kW</td>
</tr>
<tr>
<td>Nominal Torque ICE:</td>
<td>350 Nm</td>
</tr>
<tr>
<td>Nominal Torque E-Motor: combined:</td>
<td>160 Nm</td>
</tr>
<tr>
<td></td>
<td>385 Nm</td>
</tr>
<tr>
<td>0 – 100 km/h:</td>
<td>7,2 s</td>
</tr>
<tr>
<td>Fuel Consumption (NEDC):</td>
<td>7,9 l/100km</td>
</tr>
<tr>
<td>CO₂-Emissions:</td>
<td>186 g/km</td>
</tr>
</tbody>
</table>

Abb. 14: Hybrid: ML 450 HYBRID

Functionalities
- Silent start
- Start/stop
- Regenerative brake system
- Boost
- electric drive
- CVT Modus

M 272 KE 35 (6-cyl. gasoline engine)
- Power: 205 kW / 350 Nm

2 E-motors with 62 kW and 60 kW
- 288 Volt NiMH-battery
- max. system power: 250 kW
- max. system torque: 517 Nm
- 0-60 mph: 7,8 s
- Fuel efficiency up to ca. 30%
Near future: E 300 BlueTEC HYBRID

- Sophisticated operation strategy with start/stop and "sail" functions
- Fuel consumption of 4.1 l/100km; CO₂-emissions at just 109g/km

Abb. 15: Near future: E 300 BlueTEC HYBRID

Outlook: F 800 Style - Cultivated Sportiness with Plug-in-Hybrid

Abb. 16: Outlook: F 800 Style - Cultivated Sportiness with Plug-in-Hybrid
BlueZERO: Modular Concept for E-Mobility

Abb. 17: BlueZERO: Modular Concept for E-Mobility

F-CELL: B-Class F-CELL (2009)

<table>
<thead>
<tr>
<th>Drive system</th>
<th>Electric motor with fuel cell</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated output (kW/ hp)</td>
<td>100/136</td>
</tr>
<tr>
<td>Rated torque (Nm)</td>
<td>290</td>
</tr>
<tr>
<td>Maximum speed (km/h)</td>
<td>170</td>
</tr>
<tr>
<td>NEDC fuel consumption (diesel equivalent in l/100km)</td>
<td>3.3</td>
</tr>
<tr>
<td>CO₂ comb. (g/km min.—max.)</td>
<td>0.0</td>
</tr>
<tr>
<td>Range (km) NEDC</td>
<td>385</td>
</tr>
<tr>
<td>Capacity / output of lithium-ion battery (kWh/kW)</td>
<td>1.4 / 35</td>
</tr>
<tr>
<td>Cold-start capability</td>
<td>Down to -25 °C</td>
</tr>
</tbody>
</table>

Abb. 18: Fuel Cell: B-Class F-CELL (2009)

- Permanent-field synchronous unit:
  - continuous power rating 50kW (68 hp)
  - peak output 70 kW (95 hp)
  - high maximum torque of 290 Nm

- Two high-efficiency lithium-ion batteries providing a range of over 200 km (NEDC)

- Dynamic performance:
  - Maximum speed 150 km/h
  - 0 - 60kph in 5.5s

- Production of small series started at Rastatt Plant. Vehicles will be leased to selected customers in several European countries including Germany


Thank you for your attention!