12th Diesel Engine-Efficiency and Emissions Research (DEER) Conference
August 20-24, 2006, Detroit, Michigan

Accelerating Light-Duty Diesel Sales in the U.S. Market

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Volkswagen AG, Wolfsburg, Germany
Content

- Situation in Europe
- Situation in U.S.
- Motivation for customers to purchase Diesel engine vehicles
- Accelerating Sales in U.S.
- Conclusions
Diesel Market in Western Europe
New Registrations in 2005

<table>
<thead>
<tr>
<th>Country</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>19%</td>
</tr>
<tr>
<td>France</td>
<td>20%</td>
</tr>
<tr>
<td>Italy</td>
<td>18%</td>
</tr>
<tr>
<td>Spain</td>
<td>15%</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>13%</td>
</tr>
<tr>
<td>Belgium/Lux</td>
<td>5%</td>
</tr>
<tr>
<td>Austria</td>
<td>3%</td>
</tr>
<tr>
<td>Portugal</td>
<td>2%</td>
</tr>
<tr>
<td>Netherlands</td>
<td>2%</td>
</tr>
<tr>
<td>Others</td>
<td>3%</td>
</tr>
</tbody>
</table>

Total Diesel Market: 7 Mio. vehicles

Source: ACEA

Accelerating LD Diesel Sales in U.S.
New Registrations of Diesel Passenger Cars
Western Europe: 2005

<table>
<thead>
<tr>
<th>Country</th>
<th>Diesel Share [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greece</td>
<td>1,6</td>
</tr>
<tr>
<td>Sweden</td>
<td>9,7</td>
</tr>
<tr>
<td>Finland</td>
<td>17,0</td>
</tr>
<tr>
<td>Iceland</td>
<td>19,6</td>
</tr>
<tr>
<td>Ireland</td>
<td>21,5</td>
</tr>
<tr>
<td>Denmark</td>
<td>23,8</td>
</tr>
<tr>
<td>Netherlands</td>
<td>26,8</td>
</tr>
<tr>
<td>Switzerland</td>
<td>28,3</td>
</tr>
<tr>
<td>U.K.</td>
<td>36,8</td>
</tr>
<tr>
<td>Norway</td>
<td>39,2</td>
</tr>
<tr>
<td>Germany</td>
<td>42,0</td>
</tr>
<tr>
<td>W. Europe</td>
<td>49,3</td>
</tr>
<tr>
<td>Italy</td>
<td>58,3</td>
</tr>
<tr>
<td>Portugal</td>
<td>63,3</td>
</tr>
<tr>
<td>Austria</td>
<td>64,7</td>
</tr>
<tr>
<td>Spain</td>
<td>67,8</td>
</tr>
<tr>
<td>France</td>
<td>69,1</td>
</tr>
<tr>
<td>Belgium</td>
<td>72,6</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>75,4</td>
</tr>
</tbody>
</table>

Accelerating LD Diesel Sales in U.S.
New Registrations of Passenger Cars (Germany)

- Million passenger cars:
  - Diesel: 5% in 1980, 27% in 1990, 43% in 2005
  - Gasoline: 95% in 1980, 73% in 1990, 57% in 2005

Source: Marketing Systems

Accelerating LD Diesel Sales in U.S.
New Registrations of Diesel Passenger cars
Germany: January – May 2006

<table>
<thead>
<tr>
<th>Segment</th>
<th>Sales per segment [thousand]</th>
<th>Share of the segment [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mini car</td>
<td>5,8</td>
<td>7,6</td>
</tr>
<tr>
<td>Small car</td>
<td>27,8</td>
<td>11,7</td>
</tr>
<tr>
<td>Compact car</td>
<td>147,3</td>
<td>41,5</td>
</tr>
<tr>
<td>Medium s. car</td>
<td>156,3</td>
<td>61,8</td>
</tr>
<tr>
<td>Full size car</td>
<td>60,7</td>
<td>76,7</td>
</tr>
<tr>
<td>Luxury car</td>
<td>5,8</td>
<td>31,0</td>
</tr>
<tr>
<td>Vans</td>
<td>60,3</td>
<td>69,9</td>
</tr>
<tr>
<td>SUVs</td>
<td>86,3</td>
<td>47,3</td>
</tr>
</tbody>
</table>

Accelerating LD Diesel Sales in U.S.
Diesel sales in Europe have always exceeded expectations.

Diesel share of the total market [%]

Source: DRI, ACEA

Accelerating LD Diesel Sales in U.S.
Content

- Situation in Europe
- Situation in U.S.

Accelerating LD Diesel Sales in U.S.
Sales of Volkswagen diesel vehicles in U.S.
VW has continuously sold diesels in U.S. for over 25 years

Accelerating LD Diesel Sales in U.S.
1975-1984 U.S. Gas Prices vs. Diesel Vehicle Sales

Gas Prices [$]

Diesel Vehicle Sales

Accelerating LD Diesel Sales in U.S.
Percentage of TDI of 2005 Jetta Sales vs. Average Gasoline Prices in U.S.

Jetta Diesel Vehicle Sales [%] Gas Prices [$]

January | February | March | April | May | June | July | August | September

% TDI of Jetta Sales

Avg. Gasoline Price

Accelerating LD Diesel Sales in U.S.
Diesel Market Potential in U.S.

- Current U.S. diesel sales at about 15% at Volkswagen
- Diesel sales depends on fuel price
- Fuel price related surge in diesel demand (25% of Jetta orders)
- Fuel Price projections?

Accelerating LD Diesel Sales in U.S.
Content

- Situation in Europe
- Situation in U.S.
- Motivation for customers to purchase Diesel engine vehicles
Why do customers in Europe purchase Diesel engine vehicles?

The modern TDI engine is ....

- powerful
- economical
- ecological
- future-oriented

Accelerating LD Diesel Sales in U.S.
The modern TDI engine is powerful because it is a mature high-tech product with high traction power and high elasticity, and impressing with its speed, acceleration, handling, and comfort.
The TDI is powerful …

![Graph showing torque and power of Touareg V10 5.0L TDI and Touareg V8 4.2L engines.]

Accelerating LD Diesel Sales in U.S.
The modern TDI engine is ... economical because of

- low fuel consumption
- extreme durability
The TDI is economical …

… highest advantage of fuel consumption in cities

Accelerating LD Diesel Sales in U.S.
The modern TDI engine is ecological because:
- it saves the resources worldwide due to its outstanding fuel economy
- it enables low environmental pollution
- it contributes very little to greenhouse relevant gases
- the particulate emissions have been reduced by over 90% since 1988
The modern TDI engine is...

**future oriented**

because

• it will comply with future emission legislations
• the problems of the diesel (PM, NOx)
  - are (DPF) or
  - will be (deNOx)
  solved
Future development potential for passenger cars

Particulates [g/mi]

- Limit at 120,000 miles

<table>
<thead>
<tr>
<th>BIN 9</th>
<th>BIN 8</th>
<th>BIN 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basis</td>
<td>DPF</td>
<td>NOx-Cat</td>
</tr>
</tbody>
</table>

NOx emission [g/mi]

- TIER 2 /BIN 10
- opt. injection
- opt. comb. process
- opt. air management
- opt. oxi-cat
- opt. fuel
- New combustion process

Accelerating LD Diesel Sales in U.S.
Accelerating LD Diesel Sales in U.S.
Cost efficiency – example Golf

CO₂-Emissions NEDC [g/km]

Gasoline FSI

Gasoline TSI

150

130

Diesel Potential incl. DPF + DeNOₓ

Diesel today

Diesel Potential

NEDC = New European Driving Cycle

Additional Costs [%]

0 500

Accelerating LD Diesel Sales in U.S.
Why do customers purchase Diesel vehicles?

- the TDI technology closed the gap to the gasoline engine on
  - performance
  - noise
  - emissions
- the TDI has increased fuel economy / reduced CO$_2$ emissions dramatically
- the TDI provides lower operating costs
Content

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- Accelerating Sales in U.S.

Accelerating LD Diesel Sales in U.S.
Volkswagen ...

- … is ranked 4th in total vehicle production worldwide (12% of global market share)
- … is a worldwide leader in diesel technology and diesel passenger car production with a current Diesel sales in
  - Western Europe: ~50%
  - Canada: ~50%
  - US: ~15%

Accelerating LD Diesel Sales in U.S.
Volkswagen ...

- ... is strongly committed to the marketing of diesel powered cars in the future, including in the United States
- ... believes Diesel will succeed by delivering
  - Increased energy efficiency;
  - Reduced CO2 emissions;
  - High levels of performance, convenience;
  - The best platform for renewable fuels including Biodiesel, Sunfuel, SunDiesel

But there are some challenges which must be addressed .....
Obstacles Facing LD Diesel Development

- Image deficit – customer acceptance
- Emissions Controls
- Competition from other technologies with potential to reduce CO2 emissions
- Fuel Issues
- Cost (break-even)

Accelerating LD Diesel Sales in U.S.
Addressing Diesel‘s Image Deficit

- Ongoing campaign to educate opinion makers and policymakers about the advances in diesel technology and the benefits that advanced diesels can provide for the economy, the environment, and for consumers.

- High visibility events that demonstrate technical advances to the public incl. motorsports campaigns (e.g. Audi R10 first diesel vehicle wins Le Mans and Sebring).

- Marketing: Promoting diesel sales through advertising and through promotion of alternative fuel strategies that relate to diesels (biodiesel, BTL/GTL projects to address customer interest in renewable fuel capability).

- Customer experience: The biggest gains in diesel acceptance will come through successful customer experience as more diesel vehicles appear in the US.
Addressing Diesel‘s Image Deficit

If customers drive the vehicles they will want them!
Addressing the Diesel Emissions Challenge

- The threshold for success is to meet EPA’s Tier 2 Bin 5 emissions levels in MY 2007 – 50 state strategy
- Volkswagen and other manufacturers have confidence this can and will be achieved
- Multiple technological solutions under current development, evaluation and comparison
- Diesel Particulate Filter in serial production
- NO\textsubscript{X} is the toughest challenge: Solutions include Selective Catalytic Reduction (Urea Injection) and NO\textsubscript{X} storage with regeneration

Accelerating LD Diesel Sales in U.S.
Addressing the Competition

- Advanced Diesels will compete against and coexist with other technologies including
  - Advances in Gasoline Technology
  - “Success” of Hybrids
  - Public Focus on Long Term Solutions (Hydrogen)
- Government should promote innovation and assure fair competition by establishing technology neutral regulations and incentive programs
- Industry must invest in development and production of clean diesel technology
  → Volkswagen is committed to play a leading role

Accelerating LD Diesel Sales in U.S.
Addressing Fuel Issues

- **Fuel quality**
  - ultra low sulfur content important for new aftertreatment devices
  - strict standards must be applied to alternative fuels/blends (biodiesel, synthetic diesel)

- **Fuel Availability**
  - 35 – 40 % of U.S. filling stations sell diesel fuel
  - fuel distributors plan to increase availability in line with market demand

- **Fuel Prices**
  - new level of consumer interest in fuel economy, $3.00/gallon as “tipping point”
  - Fuel prices are not expected to decline
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Conclusion

- Modern TDI Diesel technology has come a long way since the old diesel engines of the past

- The modern TDI Diesel engine is not only powerful but also very economical

- A major progress in lowering the exhaust gas emissions has taken place

We are convinced that

✓ the TDI is a solution for future powertrains for light duty vehicles

✓ there is a further potential in the U.S. which will be realized
Thank for your attention!

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