Working within environmental regulations - the carmaker's perspective

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VDA
Outline

1. Road Transport and Road Traffic in a global perspective
2. Global Challenges
3. Focus on Air Quality
4. Technical challenges for air quality
5. Principles of „better regulation“
1. Road Transport and Road Traffic in a global perspective

Motorization rate 2012 – WORLDWIDE

NAFTA: 647 +3%
C&S America: 160 +46%
EU 27/EFTA: 563 +6%
RU/TI/Other Europe: 254 +43%
J&SK: 539 +3%
AFRICA: 42 +25%
Asia (exc J&SK)/ Oceania/Middle east: 67 +90%

-versus 2005-

Average rate: 170 veh./1,000 inh.

Source: OICA
1. Road Transport and Road Traffic in a global perspective

Global Passenger Car Market growth

<table>
<thead>
<tr>
<th>Year</th>
<th>World Rest</th>
<th>Mercosur</th>
<th>Russia</th>
<th>India</th>
<th>China</th>
<th>Triade</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>57.9 Mio.</td>
<td></td>
<td></td>
<td></td>
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<td>2008</td>
</tr>
<tr>
<td>2011</td>
<td></td>
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<td>2011</td>
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<tr>
<td>2020</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>2020</td>
</tr>
</tbody>
</table>

Quelle: VDA
2. Global Challenges
Air Quality, CO2 and sustainable mobility
2. Global Challenges
International CO2-Regulations

- USA: 121g, 5.2l
- China: 117g, 5.0l
- Japan: 105g, 4.5l
- EU: 95g, 3.8l

X-Achse schneidet bei 50% Benzin/Diesel gemäß Marktanteil.
2. Global Challenges
alternative powertrains and regenerative energy sources contribute to a sustainable mobility

- Clean and efficient drivetrains and fuels
- Conventional and alternative drivetrains in parallel
2. Global Challenges
International Harmonization

Introduction of WLTP as example

- 27 EU-Memberstates, Japan and South Korea → WLTP
- China, India, Mexico, Australia, Russia, Argentina, Chile, South Africa and parts of the Middle East → WLTP introduction in view
- USA and Canada → different test procedure
3. Focus on Air Quality

Stringent legal emission limits lead to significant lower exhaust emissions

Diesel Passenger Car (UN/ECE R83)
3. Focus on Air Quality

Stringent legal emission limits lead to significant lower exhaust emissions.

Total Exhaust Emissions in Road Transport (Germany, TREMOD-Data)

PM-Emissions
HC-Emissions
NOx-Emissions
CO-Emissions
3. Focus on Air Quality

Stringent legal emission limits lead to significant lower exhaust emissions.

Immission situation

Focus on Urban Air Quality and Urban Emissions

Emission legislation must concentrate on urban traffic
3. Focus on Air Quality

Summary

- Stringent emission limits lead to significant lower emissions by road transport
- Air Quality has much improved by stepwise tightened UN/ECE-legislation
- Focus on Air Quality remains on densely populated regions (urban zones)
- Future emission legislation should reflect urban emissions/urban driving
- The new worldwide light duty test procedure and the world harmonised heavy duty test procedure are considered to represent global real world driving and should therefore be the basis for future emission legislation
4. Technical Challenges for Air Quality
There is no unique solution

• Clean Mobility can be achieved with a broad variety of technical solutions
• Legislation must be technological neutral
• Clean Vehicles must be affordable as quick market penetration is a key for better air quality
4. Technical Challenges for Air Quality
There is no unique solution

The VDA Fan Strategy as a pragmatic pathway to a sustainable mobility
4. Technical Challenges for Air Quality

balanced requirements

→ rising „Trade-off“ between Emissions, Fuel Consumption (CO2) and Noise Requirements
4. Technical Challenges for Air Quality

Clean Engine Concept’s must be fit for market

- Best engine technology
  - Direct Injection
  - EGR
  - Turbo-Charging
  - Downsizing

- Use of aftertreatment technologies
  - 3-Way-Catalyst
  - Particulate Trap
  - DeNox-Aftertreatment
  - AdBlue®-Infrastructure for Light Duty and Heavy Duty

- Alternative Powertrains
  - CNG, LNG
  - Fuel Cell
  - Hybrid Drivetrains, Electric Car
  - Available Infrastructure

Technologies must be:
- Available
- ready for market introduction
- Affordable by consumer
- Lifetime durability
4. Technical Challenges for Air Quality
Clean Engines require clean fuels

Recommendations of fuel quality in RE3 & SR1: “minimum” parameters

<table>
<thead>
<tr>
<th>Diesel parameter</th>
<th>Emission control system</th>
<th>Toxic</th>
<th>Environmental</th>
<th>Performance/Durability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulphur</td>
<td>✔</td>
<td></td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Cetane number</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Cetane index</td>
<td></td>
<td></td>
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<tr>
<td>Density [TBD]</td>
<td>✔</td>
<td>✔</td>
<td></td>
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<tr>
<td>Viscosity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T95</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>PAH</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flash point</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>CCR &amp; CFPP</td>
<td></td>
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<tr>
<td>Cloud point</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Water, ash, lubricity, total contamination</td>
<td></td>
<td></td>
<td>✔</td>
<td></td>
</tr>
</tbody>
</table>

**TBD:** T50, T85

<table>
<thead>
<tr>
<th>Gasoline parameter</th>
<th>Emission control system</th>
<th>Toxic</th>
<th>Environmental</th>
<th>Performance/Durability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead</td>
<td>✔</td>
<td>✔</td>
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<tr>
<td>Sulphur</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metallic additives</td>
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<td></td>
<td></td>
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<tr>
<td>RON</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>MON</td>
<td></td>
<td></td>
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<td>✔</td>
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<tr>
<td>Benzene</td>
<td></td>
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<td>✔</td>
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<tr>
<td>Oxygen, Oxygenates</td>
<td>✔</td>
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<td></td>
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<tr>
<td>VLI</td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
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<tr>
<td>Density</td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
</tr>
</tbody>
</table>

**TBD:** Aromatics, Olefins, FBP, E70, E100, E150, E180, Residue.

✔ = agreed.
GRPE / FQ-03-02, dated 13 January 2009
4. Technical Challenges for Air Quality

A broad infrastructure is a prerequisite for mandating alternative fuels/reagents

If emission legislation might require new infrastructural measures:

• CNG
• LNG
• Biofuels (Ethanol)
• AdBlue
• Electric Mobility
• Hydrogen
• …
5. Principles of better regulation

- Technical neutrality
- Cost-benefit and impact assessment as a basis for decision
- Setting clear targets with sufficient lead time taking into account the development-process and life-cycle of vehicles
- Stakeholder participation
- Worldwide harmonization
  - 58-Agreement
  - 98-Agreement
1. Road Transport and Road Traffic in a global perspective

Trend of Urbanisation

1950
2,53 bil people
countryside 71 % cities 29 %

2000
6,12 bil people
countryside 53 % cities 47 %

2050
9,15 bil people
cities 70 %
countryside 30 %

Quelle: Vereinte Nationen, VDA
Mit Innovationen den Herausforderungen begegnen

Zahlen 2011

F&E-Investitionen der deutschen Industrie

- 31 % ANDERE BRANCHEN
- 27 % Automobilindustrie
- 16 % Elektroindustrie
- 10 % Pharmazie
- 10 % Chemie
- 8 % Maschinenbau
- 7 % Elektroindustrie

Knapp 90.000 Beschäftigte der AI in Forschung und Entwicklung

10 Patente pro Tag

Quelle: Stifterverband für die Deutsche Wissenschaft 2012, VDA
NEFZ vs. WLTC – Einfluss auf den Flottenverbrauch

Verbrennungsmotor dominiert weiterhin und wird elektrifiziert

Bruttoinlandsprodukt Deutschland

Antriebskonzepte

PKW Produktion

Quelle: Universität Duisburg-Essen, 2012
Quelle: destatis 2013
CO₂-Emissionen stagnieren bei steigender Verkehrsleistung in der EU

Quellen: EU, UNFCCC
Neuzulassungen für E-Fahrzeuge

Werte kumuliert in tausend
- USA: 32.765
- Japan: 24.898
- China: 9.153
- Deutschland: 5.494
- Schweden: 4.858
- Spanien: 4.151
- Frankreich: 3.301
- Großbritannien: 2.322
- Spanien: 1.067

USA gesamt: 14,4 Mio.
The Clean Diesel
The Diesel-Engine is still a core part of our Drivetrain Strategy to comply with legislative targets

- Gas
- Biofuels 1st Generation
- Gas-Toluene
- Biomass-To-Liquid
- Hydrogen-direct
- Synthetic fuels
- Full-Hybrids
- Electric drive
- Hydrogen-fuel cells

Substitute

![Graph showing efficiency improvements](image)

- Standard motor technology in the mid 200s
- Latest motor innovations
- Currently developing...
- Additional efficiency potential of motor and hybrid

-15%  -26%  -40%
Einführung WLTC

- Der WLTC (Worldwide Harmonized Light Duty Test Cycle) wurde anhand weltweit gesammelter Fahrdaten entwickelt und deckt ein breites Spektrum an Fahrsituationen ab.
- Im Gegensatz zum NEFZ ist der Zyklus dynamischer (mehr Beschleunigungs- und Bremsvorgänge).
- Ein Fahrzeug desselben Typs muss auch beim WLTC zu jedem Zeitpunkt ein identisches Testergebnis erbringen.
- Automobilindustrie arbeitet eng mit Regulierungsbehörden der verantwortlichen Mitgliedsstaaten zusammen.

Aktueller Status

- Testprozedur befindet sich derzeit in der Fertigstellung.

Bewertung des aktuellen Status

- WLTC alleine hat im Flottenmittel keinen signifikanten Einfluss auf den Verbrauch, jedoch durchaus Auswirkungen im Einzelfahrzeug (z.B. Handschalter-/Automatikfahrzeuge, Motor-Stopp-Start).
- Testprozedur WLTP kann die CO₂-Emission im Flottenmittel um ca. 15% oder mehr gegenüber NEFZ erhöhen (Einschränkung des heute bestehenden Rechtsrahmens und Verschärfung der Randbedingungen).
Purpose of these recommendations

• The objective is to provide recommendations for the minimum quality of market fuels (i.e. gasoline and diesel) that should be ensured in order to complement the level of UN-ECE vehicle emission standards that a country or region (outside the 3 major regions) may be considering to introduce.
Background

• There are **three major players** which define the content of vehicle emissions legislation worldwide → these being the **European Union, Japan and the United States of America**.

• There are **countries with well established vehicle emission legislation** based on those of the “Triad“ described above. Examples of such countries are Australia, Canada and South Korea.

• Next come a number of **countries who are starting on or climbing up the ladder of emissions legislation**.

• It is this **third group of countries that are the exclusive focus** of this recommendation.
Background – need for improvement

- Of course not all of these countries which are introducing or tightening their emissions legislation are members of the UN-ECE WP29, but documents generated by WP29 are recognised and respected worldwide.
- The basis of vehicle emission legislation within WP29 has historically been the European legislation.
- Regulations 49, 83 and 96 (non-road machinery) of the 1958 Agreement have been selected *only as references* for the recommendations on vehicle emission control performance that are included in this document.
Reasoning

• The complementary role of high quality fuels in the reduction of vehicle pollutant emissions and CO2 is well documented and generally understood by the world’s legislators.

• The proposal (GRPE-68-16-Rev.1) aims to give guidance to those legislators planning or enforcing new measures, particularly in developing countries, to make the connection between necessary fuel quality and intended vehicle emission targets.

• With this in mind, there are three reasons for selecting the fuel parameters and their criteria:

A. Fuel parameters that are known to have a negative effect on engine controls, the combustion process and emission control equipment.

B. Fuel parameters that are known to have a negative influence on ambient air quality.

C. To match with the significant fuel parameters that were in place in Europe at the time of application of the relevant UN-ECE emission stages.
Summary

• The link between fuel quality and achieving and maintaining pollutant emission performance is unquestionable.

• Independent organisations & many countries share and promote these objectives, e.g:
  ▪ Partnership for Cleaner Fuels & Vehicles (PCFV) – assisting developing countries to reduce vehicle emissions by promoting lead-free, low sulphur fuels and cleaner vehicle standards and technologies.
  ▪ Climate & Clean Air Coalition (CCAC) – to reduce short-lived climate change pollutants (i.e. BC, CH4, O3, HFCs).

• The list of parameters and criteria proposed by the auto-industry should not be taken as the minimum necessary to achieve low vehicle emissions.

• Our support of the parameters and limits in the Worldwide Fuel Charter is not affected by this proposal - which has different global intentions.

• These recommendations are not necessarily applicable to regions that already have state of the art vehicle emission legislation.
So far – result of discussions OICA-IPIECA

First set of parameters:
Gasoline: lead, sulphur, metallic additives, oxygen/oxygenates, vapour pressure (all with the indication of limit values or a range of validity), density and RON/MON (with specifications for publication, definitions and test methods only).

Diesel: sulphur, ash and total contamination (all with the indication of limit values or a range of validity) as well as the cetane number/index, density, viscosity and flash point (with specifications for publication, definitions and test methods only).

Second set of parameters:
Gasoline: benzene, aromatics, olefins, VLI, FBP, E70, E100, E150, E180 and residue.

Diesel: T50, T85, T95, PAH, CCR, CFPP, cloud point, water and lubricity.

16/1/08: FQ-01
GRPE endorses mandate to FQ group

04/06/08: FQ-02
asks OICA & IPIECA to prepare proposal

12/01/10: FQ-05:
no agreement. IPIECA only accepts S, Pb etc

13/01/09: FQ-03
agrees 2-step approach & fuel parameter rankings

09/06/10: FQ-06:
OICA-IPIECA (min) proposal

09/06/09: FQ-04:
OICA tables parameters for step-one

01/11: GRPE-61
endorses (min) proposal

09/06/10: FQ-06:
OICA-IPIECA (min) proposal

01/11: GRPE-61
endorses (min) proposal

RE3 & SR1 “minimum” parameters

Little progress