Fuel and technology alternatives for commercial vehicles

European Biofuels Technology Platform
6th Stakeholder Plenary Meeting
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Outline

- Energy use in transport
- Vehicle categories
- Current state of the art (heavy-duty diesel)
- Evaluation of alternatives
- Finland goes drop-in!
- Alternative technology vehicles
- Summary
Transport energy

- Transport is some 25% of total final energy consumption
- Road is some 75% of total transport
- Trucks and buses are some 30% within road transport

Source: WEF Repowering Transport 2011

Commercial vehicle categories

- Light commercial vehicles (vans)
- Heavy-duty vehicles
New HD vehicles (Euro VI) are extremely clean

The argument that one fuel is cleaner (for regulated emissions) than another is fading away.

Ultimately the solution providing lowest CO2 emissions will win!

Low emissions require high-quality fuels (zero sulphur, zero contaminants...)

Euro VI technology (example from MAN)

A lot of sensors missing in the picture!
Estimated schedules for standardisation in Europe

Note! Schedules based on estimations or planned CEN schedules and FQD review

<table>
<thead>
<tr>
<th>Fuel Type</th>
<th>Schedules</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gasoline (otto engines incl. FFV)</td>
<td>E5 (EN 228), in Finland decision; E10 (EN 228), at least till 2018; E85 (TS 1520), B85 (EN 12565) for large fleets; small-engine gasoline (CWA xxxx) discussed but not decided</td>
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<tr>
<td>Diesel (diesel engines incl. E95-modifications)</td>
<td>B7 (EN 590), at least till 2020; B10 (EN 590, 10% FAME) for dedicated fleets; B20 (EN yyyy, 15-20% FAME) for dedicated fleets; B30 (EN yyyy, 25-30% FAME) for dedicated fleets; ED95 (CWA xxxx) for dedicated fleets proposed but not proceeding</td>
</tr>
<tr>
<td>LPG</td>
<td>LPG (EN 589) automotive use</td>
</tr>
</tbody>
</table>


Source: Seppo Mikkonen /Neste Oil 2014

Reducing CO₂ remains a challenge

To reach the climate goals of 2050, the fuel consumption of a semi-trailer truck should be clearly less than 10 l/100 km, an annual improvement of some 3 %!
As for technology options:
Remember: In reality, one size doesn’t fit all!
Electric timber truck

Substitution of fossil diesel oil is crucial!

**Threats**
- Already shortage of Diesel oil in Europe
- Higher share of diesel cars due to regulations of fuel consumption.
- Aviation fuels and diesel oil are competitors
- Environmental marine regulations will raise demand for diesel oil?

**Solutions**
- Biofuels ought to be used in heavy vehicles
- Biomethane
- Synthetic diesel oil
- Dimethyleter (DME)

Source: Olof Hådell 2012
Liquid hydrocarbons

- The superiority of liquid hydrocarbons is due to:
  - excellent energy density
  - easy handling
  - easy production
  - a 100 year plus tradition

- Comparison to electricity:
  - diesel refuelling >10 MW
  - superfast charging 300 kW
  - slow charging 3.5 kW
  - 10 kWh = 1 l of diesel fuel
    - cost of a 10 kWh battery 5000 – 10000 €
    - weight 100 kg
Evaluation of alternative fuels/energies

- Costs
  - Cost of fuel
  - Cost of new vehicles
  - Cost of new infrastructure

- Vehicle performance
  - Range
  - Weight of energy storage
  - Volume of energy storage
  - Safety
  - Energy efficiency
  - (Exhaust emissions, must meet Euro VI = close to zero!)

Evaluation of alternative fuels/energies, cont.

- How is the vehicle operated?
  - Urban service
  - Long-haul
  - Scheduled operation
  - Random operation
Diesel prevails in heavy services

Number of technology alternatives

Coaches
Long-haul trucks
Urban vehicles:
  • vans
  • trucks (delivery, refuse..)
  • city buses

Source: GM
No fuss alternative for diesel vehicles: Paraffinic diesel

- Many alternative feedstocks
- Alternative processing routes
- A true drop-in alternative, up to 100 %
- No modifications to infrastructure or vehicles
- No storage issues

Automotive fuels — Paraffinic diesel fuel from synthesis or hydrotreatment — Requirements and test methods (CEN/TS 15940:2012)
Alternatives for light commercial vehicles

Nissan e-NV200

Mercedes Sprinter NGT (CNG)

Alternatives for single-unit trucks

Dual-fuel CNG

Parallel hybrid

Ethanol

Spark-Ignition CNG
Final report now available

Some 400 pages including a 20-page Executive Summary

- 21 buses
- Combinations of vehicle, fuel & driving cycle: 180!

http://www.iea-amf.vtt.fi/8annexreports.html

Energy consumption of European vehicles
Braunschweig cycle

![Energy Consumption - Braunschweig chart]
Volvo flags for electrification of buses

Volvo Buses
A complete new range

City buses
- Diesel buses
  - Volvo 7900
  - Volvo 7900 Retractable

Regional buses
- Volvo 8700

Line-haul routes
- Volvo 7700

Gas buses
- Volvo 7900 Gas

Hybrid
- Volvo 7900 Hybrid
  - Articulated

Electric
- Volvo 7900 Electric

Electric Hybrid
- Volvo 7900 Plug-in
  - Articulated

Electric
- Volvo 7900 Electric
  - Articulated

Source: Edward Jobson/Volvo 2014

Alternatives for long-haul trucks

- Spark-ignited CNG/LNG
- Dual-fuel LNG
- DME
Alternative fuels infrastructure decided upon

Clean fuels for transport: Member States now obliged to ensure minimum coverage of refuelling points for EU-wide mobility

New EU rules have been adopted today to ensure the build-up of alternative fuelling points across Europe with common standards for their design and use including a common plug for recharging electric vehicles. Member States must also make public their targets and present their national policy frameworks by end-2015.

"Alternative fuels are key to improving the security of energy supply, reducing the impact of transport on the environment and boosting EU competitiveness," said Commission Vice-President Siim Kallas, commissioner for transport. "With these new rules, the EU provides foreseen legal certainty for companies to start investing, and the possibility for economic offtakes. EU Member States are requested flexibility in deploying the infrastructure.

It is now up to them to develop the right national policy frameworks. Up to now, clean fuels have been held back by three main barriers: the high cost of vehicles, a low level of customer acceptance, and the lack of recharging and refuelling stations. This is a vicious circle. With the new requirements for the deployment of the alternative fuels infrastructure, Member States will have to provide a minimum coverage for alternative fuels such as electricity, hydrogen and natural gas as well as common technical and other information standards for liquefied natural gas (LNG) for inland barges and marine ships and provide a realistic option to meet challenges on lower emissions, in particular stricter sulphur emission limits to enter into force.

Summary

- The current HD diesel (Euro VI) is extremely clean for regulated emissions
- Reducing CO₂ remains a challenge
- One size doesn’t fit all, meaning that one single alternative technology will not cater for the needs of all vehicle categories
- When calculating costs, take into account need for new infrastructure, new vehicles, fuel price and vehicle efficiency
- "Drop-in" type renewable diesel is really a good option
- Number of available options vary by vehicle category (long-haul highway vs. urban services)
- With the directive on infrastructure, the Commission has focused on electricity and natural gas, not really on biofuels!
TECHNOLOGY FOR BUSINESS