Heavy duty trucks – optimisation of the vehicle in total

Dr Nils-Gunnar Vågstedt
Research & Development
Scania
Motives for improved energy efficiency

- **CO₂**
- **Peak Oil**
  - Energy as commodity in short supply
- **New ‘Hard’ requirements**
  - Laws & Markets

Carbon dioxide emissions per tonne-km

1. Logistics
2. Driver
3. Vehicle technology
4. Biofuel

Potential – 50%

Data from TREMOVE
## Main components

<table>
<thead>
<tr>
<th>Vehicle</th>
<th>Driver training</th>
<th>Driver follow-up</th>
<th>Maintenance+</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO₂ and energy optimised specification</td>
<td>Customised energy efficient driving</td>
<td>Coaching and continuous improvements</td>
<td>Extra attention to fuel economy</td>
</tr>
</tbody>
</table>

**Consulting**
## Packaging by application – trucks

<table>
<thead>
<tr>
<th>Trucks</th>
<th>Refuse collection</th>
<th>Distribution</th>
<th>Construction</th>
<th>Long-haulage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>![Truck Image]</td>
<td>![Truck Image]</td>
<td>![Truck Image]</td>
<td>![Truck Image]</td>
</tr>
<tr>
<td>Fuel</td>
<td>Biodiesel</td>
<td>Biodiesel</td>
<td>Biodiesel</td>
<td>Biodiesel</td>
</tr>
<tr>
<td></td>
<td>Ethanol Biogas</td>
<td>Ethanol Biogas</td>
<td></td>
<td>Diesel</td>
</tr>
<tr>
<td>Vehicle</td>
<td></td>
<td>Optimised specification</td>
<td>C200 analysis package</td>
<td></td>
</tr>
<tr>
<td>Driver support</td>
<td>Driver training</td>
<td>Driver follow-up</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repair &amp; Maintenance</td>
<td>R&amp;M contract</td>
<td>Maintenance+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Follow-up</td>
<td>Fuel follow-up</td>
<td>Target consumption</td>
<td>Environmental reporting</td>
<td></td>
</tr>
</tbody>
</table>
## CO₂ reduction examples – trucks

CO₂ savings vs. regular truck running on diesel

<table>
<thead>
<tr>
<th>Application</th>
<th>Regular diesel</th>
<th>Ecolution</th>
<th>Annual saving</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Long-haulage</strong></td>
<td>30 litres diesel/100km</td>
<td>122 tonnes CO₂</td>
<td>Diesel: –15% fuel</td>
</tr>
<tr>
<td>150,000 km/year</td>
<td></td>
<td></td>
<td>Biodiesel: –15% fuel, –35% CO₂</td>
</tr>
<tr>
<td></td>
<td><strong>18 tonnes CO₂</strong></td>
<td><strong>55 tonnes CO₂</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Construction</strong></td>
<td>40 litres diesel/100km</td>
<td>76 tonnes CO₂</td>
<td>Biodiesel: –10% fuel, –35% CO₂</td>
</tr>
<tr>
<td>70,000 km/year</td>
<td></td>
<td></td>
<td><strong>32 tonnes CO₂</strong></td>
</tr>
<tr>
<td><strong>Distribution</strong></td>
<td>30 litres diesel/100km</td>
<td>49 tonnes CO₂</td>
<td>Biodiesel: –10% fuel, –35% CO₂</td>
</tr>
<tr>
<td>60,000 km/year</td>
<td></td>
<td></td>
<td>Ethanol: –10% fuel, –70% CO₂</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Biogas: –10% fuel, –70% CO₂</td>
</tr>
<tr>
<td></td>
<td><strong>20 tonnes CO₂</strong></td>
<td><strong>36 tonnes CO₂</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Refuse collection</strong></td>
<td>50 litres diesel/100km</td>
<td>40 tonnes CO₂</td>
<td>Biodiesel: –10% fuel, –35% CO₂</td>
</tr>
<tr>
<td>30,000 km/year</td>
<td></td>
<td></td>
<td>Ethanol: –10% fuel, –70% CO₂</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Biogas: –10% fuel, –70% CO₂</td>
</tr>
<tr>
<td></td>
<td><strong>17 tonnes CO₂</strong></td>
<td><strong>29 tonnes CO₂</strong></td>
<td></td>
</tr>
</tbody>
</table>
Optimisation potential

Vehicle population
On average 15% reduction possible!

Driver population
On average 25% reduction possible!

Consumption (CO₂)
Current status: 40-tonne truck in operation
Example: Scania Transport Laboratory AB

- 14 trucks in operation, 50 drivers
- Transportation including load handling
- GTW 34 tonnes on average, 200,000 km per year
  - -> 26.6 l/100 km on average
- Strict semitrailer traffic (switching semitrailers and drivers)
  - 24/7, 44 weeks per year, 360,000 km per year
  - -> 26.1 l/100 km on average
- Best ¼ drivers: based on 14 weeks’ operation, 367,500 km
  - -> 24.9 l/100 km
- Best ¼ drivers, best ¼ trucks
  - -> 23.6 l/100 km
- Individual 34-tonne trips
  - -> 19.9 l/100 km
- Target: 22 l/100 km for the fleet as a whole

“There is still a lot to do regarding fuel optimisation”

Anders Gustavsson, MD, Transport Laboratory

Trip data
2,550 km round trip
Södertälje-Zwolle. Each truck 3.25 trips/week

SCANIA
Next step – what's around the corner?

- Drive-cycle preview: hills and slopes
- Air drag reduction – trailer boat-tail
- Advanced driver follow up – the truck as your mentor
- Learn from the best, European truck driver competitions
- Energy recovery, hybrids and waste heat recovery
- ...

- Potential?

GTW 34 tonnes at 15 l/100 km
Hybrid saving potential

- 25%
- 15%
- 5%

Fuel consumption 5 l/h

Fuel consumption 25 l/h

3,000-6,000 litres saved per year
Is hybridisation the answer?

- Efficiency increase will probably lead to increased transportation need
- We will be much more efficient, but we still produce CO$_2$ at the same level or higher
- Clean energy – fuel without any CO$_2$ footprint?
Is there an ultimately sustainable road transport solution?

- Electric trucks with road feed power source
- Clean production and distribution of electricity – nuclear, solar, wind, water
- Potential for a fossil free transport system
- Energy efficiency increase, the next 50% improvement

Is it a dream or is it realistic?

Carbon dioxide emissions per tonne-km

- 2040: Potential – 50%
Thank you for your attention!
Comments, please.

nils-gunnar.vagstedt@scania.com