Low Carbon Technologies for Heavy Duty Vehicles

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Innovation in Road Transport
Opportunities for Improving Efficiency

Delivering Value Through Innovation & Technology
Road Transport accounted for 23.5% of man-made CO₂ emissions in 2007 & has been increasing since 1990 – Electrification not a solution for Heavy Goods Vehicles

Commercial Vehicle Technology Assessment followed 3 stage process and applied to both Medium & Heavy Duty applications

3 Stage Assessment Process:
1. Technology Identification (Initial Screening)
2. Feasibility Analysis (limitations, CO₂ benefits & Costs)
3. Technology Summary (Comparative Assessment)

2 Applications:
- Medium Duty (7.5t)
- Heavy Duty (>32.5t)

Technology Areas Assessed

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<thead>
<tr>
<th>Vehicle</th>
<th>Powertrain</th>
<th>Fuel</th>
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<tbody>
<tr>
<td>Rolling Resistance: Low Res. Tyres, Single Wide Tyres, Auto Tyre Pressures</td>
<td>Alternatives: Fuel cells, Battery Electric, ICE/Elec Hybrids</td>
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<td>Driver/Control: Predictive Cruise, Platooning, Driver Behaviour</td>
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Typical energy flow losses for a Heavy Duty vehicle at 100 km/h show opportunities to improve engine efficiency, ancillaries, transmission, aerodynamics and rolling resistance.

From the total amount of fuel used (at 100km/h), the energy flows are as follows:

- **Combustion**: 65%
- **Ancillaries**: 5%
- **Transmission Loss**: 5%
- **Roll Resistance**: 10%
- **Aero Drag**: 15%

(Underbody accounts for around 1/3)

Source: Ricardo analysis
Hybrid technology can be applied to commercial vehicle applications – Benefits depend on drive cycle as for passenger vehicles

A subjective summary of hybrid vehicle potential based on a typical 8 hour drive cycle

- Key issue for Hybrid Commercial vehicles remains difficulty in business case:
  - Savings in fuel costs must be greater than extra purchase/lease and maintenance of Hybrid compared with conventionally fuelled vehicles

Source: Ricardo analysis
Comparison of CO$_2$ benefit v costs reveal complex application specific interactions – Trials are required to prove benefits.
Electric/Alternative fuel bodies, Platooning & Driver Training all show attractive cost/benefit but with varying maturity and risks

**Electric/Alternative Fuel Bodies**
- **Concept:** Replacement of existing power sources for vehicle bodies which use diesel for power
- **CO₂ Benefit:** Varies between 10% and 20% depending on the body power system being replaced
- **Costs:** Up to 15% vehicle on cost but depends on technology

**Vehicle Platooning**
- **Concept:** Vehicle driving in close proximity to each other to create a train
- **CO₂ Benefit:** In the region of 20% for motorway speeds
- **Costs:** Anticipated costs of around £305 – £1,600 for additional sensors and active safety features required

**Driver Behaviour**
- **Concept:** Driver training for improved fuel economy and safety
- **CO₂ Benefit:** Varies with driver but averages at circa 10%. Effectiveness reduces after initial training
- **Costs:** UK SAFED training varies from £150 to £300 per session