Cost-effective potential for reducing freight fuel consumption in Europe

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Truck fuel: less is more
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Where are we now? The CO$_2$ emissions of heavy-duty vehicles are a big and growing problem
EU’s transport emissions, in particular from HDVs, keep growing.

Tractor-trailers account for the majority of HDV CO$_2$ emissions

Vehicle groups 5 and 10 (i.e., tractor-trailers) account for over 70% on the CO$_2$ emissions of on-road HDVs

There is no certified fuel consumption data available. Unofficial data (Lastauto Omnibus) suggests limited improvements in the past.


* The testing route used by Lastauto Omnibus changed in the year 2010. However, the ICCT has not been able to estimate the impact of the new testing route on fuel consumption due to a lack of information on the speed and elevation profiles of each testing route.
New study: The fuel consumption difference between a typical and a best-in-class tractor-trailer is 9%

The ICCT commissioned TU Graz to conduct track and chassis dyno testing of a typical tractor-trailer, representative of the EU fleet, and a best-in-class (BIC) vehicle.

Over the Long Haul cycle, the typical truck consumed 9% more fuel than the BIC truck.

While the BIC vehicle required 3% more energy at the wheel, it had a powertrain 11% more efficient than the typical truck.

Four key barriers delay technology uptake

**Uncertain return on investment**
Will the technologies perform as expected?
What will fuel prices be in the future?

**Capital cost constraints**
Can the fleet get access to additional capital?

**Split incentives**
Are the equipment owner and operator different entities with different motivations?
Who makes the technology purchase vs. who pays for fuel?

**Lack of technology availability**
Are the technologies available in the market?
Are they available from a preferred supplier?

What can be done in the future?

Tractor-trailers have a significant cost-effective potential to reduce the CO$_2$ emissions of on-road freight.
Reference 2015 tractor-trailer used for our analysis

<table>
<thead>
<tr>
<th>Baseline specifications</th>
<th>Tractor-trailer</th>
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<tbody>
<tr>
<td>Gross vehicle weight (t)</td>
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<tr>
<td>Vehicle curb weight (t)</td>
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<tr>
<td>Axle configuration</td>
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<td>Aerodynamic drag area (m²)</td>
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<tr>
<td>Tire rolling resistance (N/kN)</td>
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<td>Engine emissions</td>
<td>Euro VI</td>
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<tr>
<td>Engine displacement (L)</td>
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<tr>
<td>Engine power (kW)</td>
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<td>Engine peak BTE (%)</td>
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<td>Rear axle ratio</td>
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<tr>
<td>Accessory power (kW)</td>
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</tbody>
</table>

Vehicle Simulation

Twelve technology packages and their costs were analyzed in the cost-effective potential analysis. A reduction of 43% is possible.


The payback for the 43% reduction package can be achieved with a payback between 1.4 to 2.7 years in 2030

Main study assumptions:

- Fuel price: 0.7 to 1.4 €/L
- Discount rates: 4% to 10%
- Evaluation year: 2030
- Trailers per tractor: 1.4
- Vehicle lifetime: ~1 M km
- First owner annual use: ~110k km


43% $\text{CO}_2$ reduction possible for long-haul tractor-trailers by 2030

How efficient can diesel long-haul tractor trailers be in the future?

- Engine: 55% peak efficiency
- Aerodynamic drag: 0.35
- Rolling resistance: 4 N / kN
- Lightweighting: -2300 kg
- Hybrid powertrain

http://www.theicct.org/EU-HDV-fuel-efficiency-tech-2020-2030
The technologies for 43% reduction increase the tractor-trailer cost by approximately 20%


Policy recommendations

A well-designed technology forcing standard brings benefits to all stakeholders
The EU will be the last major economy to introduce HDV efficiency standards

As a comparison, the US Phase 2 standards for long-haul tractor-trucks* was introduced in late 2016 with the following targets with respect to a 2017 baseline:

- 14% by 2021 (3.6% p.a.)
- 19% by 2024 (3.0% p.a.)
- 27% by 2027 (3.1% p.a.)

* Tractors with a sleeper cab and high roof. The reduction targets are for the tractor only. Separate standards exist for trailers.
There are 2 key technologies that may require a longer lead time for market introduction: 55% peak efficiency engine, and hybrid powertrain.
1. Long-haul tractor-trailers can become 43% more efficient in the 2030 timeframe (vs. 2015 baseline). **Using tractor-only technologies, a 35% reduction in CO\textsubscript{2} is possible by 2030.**

2. A well-designed **technology forcing standard** can be beneficial for all stakeholders, ensuring CO\textsubscript{2} reductions, while at the same time reducing the total cost of ownership for transport operators and ensuring that EU manufacturers remain competitive in international markets.

3. Complementary efficiency standards for trailers and engines would lead to additional CO\textsubscript{2} savings
Technology forcing HDV CO\textsubscript{2} standards could reduce on-road freight emissions by approximately 18% below 2005 levels.

The ICCT Roadmap Model was used to estimate the impact of HDV CO\textsubscript{2} standards.

A moderate stringency could reduce fleet emissions by ~9% below 2005. More stringent standards, that take advantage of the complete cost-effective potential, could reduce fleet emissions by ~18% below 2005 levels.

Need at least 60% CO2 reduction for new vehicles by 2030 to be in line with EU climate targets

Fleet renewal slows down the benefits of CO2 targets

Setting ambitious LDV and HDV CO2 standards for 2021–2030 would increase the likelihood of meeting the long-term climate target.

Figure source: Mock (2018). Blog post. https://www.theicct.org/blog/staff/no-regrets-eu-co2-std-2025-2030-20180404