



European
Automobile
Manufacturers
Association



Reducing CO₂ emissions from heavy-duty vehicles



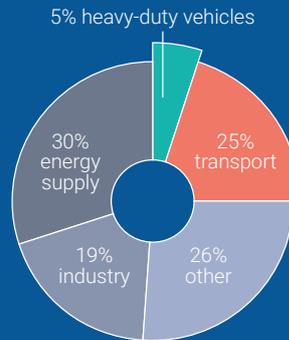
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AN INTEGRATED APPROACH
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1. WHAT PROGRESS HAS BEEN MADE?

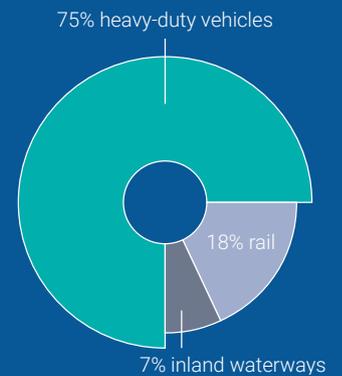
Transport is currently responsible for around a quarter of total greenhouse gas emissions, with road transport representing 17.8% of total emissions, arising from the use of vehicles. Of this, all heavy-duty vehicles in Europe combined account for 5% of Europe's greenhouse gas emissions, while they are responsible for carrying 75% of all land-based freight. As a comparison, energy supply is responsible for 30% of emissions and industry for 19%.

The truck industry remains committed to continuing to lower greenhouse gas emissions through more fuel-efficient technology (such as common rail injection, GPS-based automated gearboxes, highly-efficient exhaust after-treatment systems). This comes in addition to further improvements of combustion and air handling, aerodynamics, low rolling resistance tyres and advanced control systems.

Sources of greenhouse gas emissions in Europe



Transport of freight over land in Europe

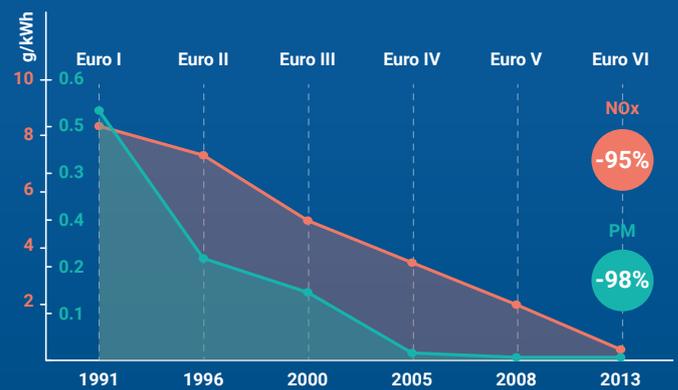


Pollutant emissions have been slashed to near-zero levels

Between the early nineties and 2013, the main focus of policy makers and the industry was on achieving dramatic decreases in pollutant emissions, such as NOx and PM. To that end, six sets of 'Euro' standards were introduced in just over 20 years.

As a result, pollutant emissions from the latest Euro VI heavy-duty vehicles have been slashed to near-zero levels.

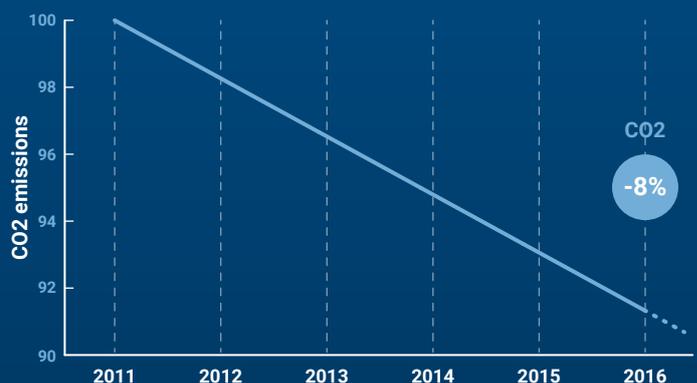
However, it should be understood that reducing pollutant emissions requires conflicting measures to reducing CO2 emissions. This 'technological trade-off' made it extremely difficult to decrease CO2 emissions simultaneously.



Further reducing CO2 emissions from heavy-duty vehicles

With the major investments in reducing pollutant emissions behind it, the industry then shifted focus to reducing CO2 emissions and succeeded in reducing fuel consumption by about 8% over the last five years.

Per tonne transported, this innovation has resulted in a fuel consumption of as little as nearly one litre of fuel per 100 tonne-km, delivering a significant reduction of CO2 emissions.



Data: Lastauto Omnibus, Trucker Magazine & Green Truck Award

2. WHY IS THE TRUCK MARKET SO COMPLEX?

The end-use or 'mission' of trucks varies widely – they may for instance be used for long-haul or regional delivery, for construction or for municipality use.

Depending on their mission, most trucks are custom-built on an individual basis in order to meet specific requirements, from the number of axles to the size of the engine and fuel tank, to the size of the cab or the height of the chassis.

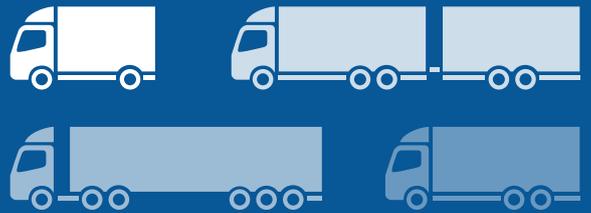
Furthermore, when we take the complete vehicle into account – the rigid body or a tractor plus trailer – the heavy-duty vehicle market becomes even more complex. There are literally thousands of shapes and sizes of trucks.

There simply is no 'one-size-fits-all' approach for heavy-duty vehicles



Any strategy to reduce CO2 emissions from heavy-duty vehicles has to take account of the key features of trucks:

- The shape of the vehicles, which depends on their daily 'mission'.
- The same tractor or engine may end up pulling very different trailers and combinations, affecting the CO2 emissions of the complete vehicle.



- The usage pattern of the vehicles and their cargo, in other words, 'the work they do'.



Is the payload heavy or light, large or small?



Is the road flat or hilly?



Will the vehicle travel over a long distance in one go, or is the journey short with many starts and stops?

- All these variables result in different CO2 emissions.

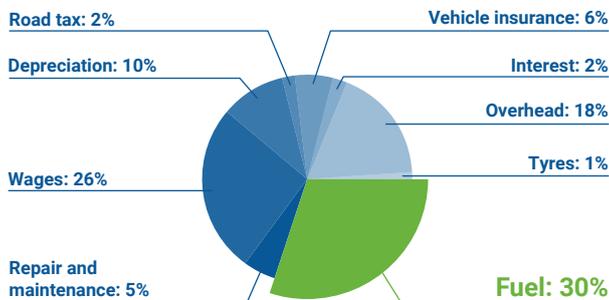
Considering the complexity of the truck market with several thousand shapes and sizes, introducing legislation suitable for all variations is extremely challenging. There simply is no 'one-size-fits-all' approach for heavy-duty vehicles.

Trucks are not 'big cars'. CO2 reduction policy for heavy-duty vehicles should therefore not follow the same approach as that for passenger cars.

3. BRINGING THE MOST FUEL-EFFICIENT VEHICLES TO THE MARKET

Why is fuel efficiency so important to the truck customers?

Operating costs of a truck



Trucks and buses are economic goods, which makes fuel efficiency a key element in the purchase decision.

Fuel represents around 30% of the running costs in the transport sector. Given the competition between transport service providers for goods and people, strong economic incentives exist for fuel efficiency improvement.

How will customer information be improved with VECTO?

Giving customers transparent and reliable fuel consumption information based on a common testing method will allow them to select the most CO2-efficient vehicle.

Since 2010, the European Commission has been working closely with the industry on a computer simulation tool (VECTO), which will model CO2 emissions from a wide variety of complete truck and trailer configurations. This means that VECTO will be able to reflect the complexity of the heavy-duty vehicle market, as it takes the variables into account that affect the CO2 emissions of complete vehicles.

The upcoming EU legislation on the certification of CO2 from heavy-duty vehicles will require a mandatory declaration of CO2 values for each truck produced for the

EU market, using this VECTO tool.

This CO2 certification has a lot of potential to significantly reduce CO2 emissions from trucks, as it provides a credible, standardised way of comparing fuel efficiency. It will lead to increased transparency and competition among manufacturers, driving the market uptake of the cleanest vehicles.

Before setting the direction for future CO2 reduction policy, we first need to have a clear understanding of the baseline – reflecting today's level of truck CO2 emissions.

VECTO is a necessary tool to close this knowledge gap. It is essential that policy makers give time to analyse the impact of this data collection and certification procedure before considering setting CO2 limits for heavy-duty vehicles.



CUSTOMER BENEFITS

- 1 VECTO gives customers **transparent and reliable fuel consumption information**.
- 2 VECTO allows customers to **compare the CO2 and fuel efficiency performance** of vehicles from different manufacturers.

This means that transport operators can **choose the most fuel-efficient vehicle** more easily, helping them to lower the cost of running a fleet.

- 3 The customer receives certified CO2 values for each truck purchased.



SOCIETAL BENEFITS

When it comes to society at large:

- 1 VECTO **stimulates innovation and competition** among manufacturers to develop the most fuel-efficient vehicles. After all, **end-users will be able to compare the offerings** of different manufacturers by using VECTO results.
- 2 VECTO provides a credible, **standardised way of comparing fuel efficiency**. It will also give a clear picture of progress in reducing CO2 emissions from trucks.

Hence, VECTO ensures that the most fuel-efficient vehicle combinations are brought onto the market, thereby **significantly reducing CO2 emissions** from trucks.

4. HOW CAN MORE SIGNIFICANT CO2 REDUCTIONS BE MADE IN THE FUTURE?

In 2008, the commercial vehicle industry made a commitment to reduce fuel consumption from new vehicles by 20% by 2020, compared to 2005. A recent study by Transport & Mobility Leuven (TML)¹, confirmed that the industry is on track with reaching this target.

However, the technology of new vehicles is just part of a bigger picture. Firstly, because new vehicles represent such a small fraction of the fleet, it is important to look at the entire vehicle fleet rather than just new vehicles. Secondly, there are many more factors than just the vehicle alone that determine CO2 emissions – such as permitted vehicle length and weight, trailer designs, alternative fuels, driver behaviour, transport operations, infrastructure, or a better utilisation of the vehicle (for example load optimisation), to name a few. A truly

integrated approach would draw on this full spectrum of solutions to reduce CO2 emissions more effectively.

The TML study quantifies for the first time the reduction potential of this integrated approach, and estimates the potential gains to be more than double the CO2 reduction rate from a 'vehicle only' approach. The overall results of the study were validated by a consortium of 15 stakeholders who, together with truck manufacturers represent the different components of the integrated approach.

A truly integrated approach would draw on the full spectrum of solutions to reduce CO2 emissions more effectively

PILOT PROJECTS

The integrated approach is not just a theoretical concept, truck manufacturers have demonstrated the potential of these measures in real-life conditions.

Transport Lab

For five years, Transport Lab ran a fleet of some 25 vehicles from Sweden to Holland, implementing all measures that can help to reduce emissions – from vehicles and logistics, to driver training and alternative fuels. This test fleet achieved **fuel consumption reductions of a full 50% between 2008 and 2013.**

-50%



Aerodynamics



Telematics



Logistics planning



Maintenance



Driver training



Biofuels

Efficiency Run

By looking at all parts of a vehicle and trailer rather than focusing on a single component, the Efficiency Run tests found that each truck **consumed around 12% to 14% less fuel than standard vehicles** in each fleet.

The tests also investigated the **potential of long combination vehicles**, and found that fuel consumption was reduced by around 17% compared with standard semi-trailer combinations.



Tyres



Predictive Powertrain Control



Aero-dynamics

-12% to 14%



Long combination vehicles

-17%

¹ Greenhouse gas reduction measures for the road freight transport sector, Transport & Mobility Leuven, July 2015

5. MEASURES TO COMBAT CO2 MORE EFFECTIVELY



Vehicle-related



Improving the aerodynamic characteristics, for example, can effectively contribute to bringing CO2 emissions down by 3% to 4% by 2020 when compared to 2014 – of which 1.5% to 2% can come from the trailer.



Low rolling resistance tyres can be retrofitted to any vehicle at little cost and provide fuel efficiency improvements up to 4%.

-4.8%



Operations



One of the most prominent candidates for a 'quick win' is driver training. At a minimal cost, the potential reduction can be as high as 7%.



Revising maximum weights and dimensions to allow for the cross-border, EU-wide use of high-capacity vehicles, such as the European Modular System (EMS).



Better road infrastructure management and maintenance (think for example of improving the rolling resistance of roads or optimising traffic flows) can reduce CO2 emissions by 4%.



Smart and connected transport networks using intelligent transport systems hold great potential, for instance truck platooning.

-16%



Alternative fuels



For instance, second-generation biodiesel is twice as efficient as common diesel.



The additional reduction potential of biofuels by 2020 (compared to 2014) is estimated to be 0.5% to 1.4%. In the long term, biofuels have the potential to realise a much higher reduction, but there is great uncertainty about how fast technology will advance and to which extent their increased usage will reduce (well-to-wheel) CO2 emissions.



Gaseous fuels hold significant potential to cut CO2 emissions. Engines running on compressed natural gas, for example, can reduce CO2 by 10-15% on a per-vehicle basis. However, the market share of gas vehicles remains low for the moment, given the current lack of refuelling infrastructure.

-0.5%



Fleet renewal

The automobile industry has succeeded in transforming both engines and many other components to increase fuel efficiency and reduce emissions from new vehicles.

But the impact on total emissions from road transport is only felt when someone replaces an old vehicle with a new one (fleet renewal).

Besides the fact that fleet renewal is the most cost-efficient and, in practice, the quickest way to reduce emissions, it also stimulates consumption in Europe, which is one of the key drivers of GDP growth.



IN FOCUS

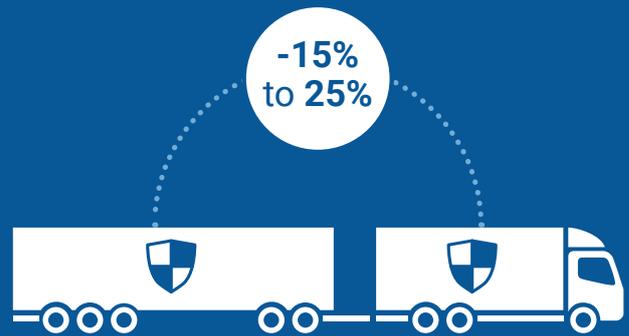
The European Modular System (EMS)

Revising maximum weights and dimensions of heavy-duty vehicles has great potential. For instance, the EMS has proven to be successful in all countries where it has been implemented: Denmark, Finland, the Netherlands and Sweden – with successful tests underway in Belgium, Germany and Spain.

Using existing technology, EMS combinations can replace three trucks with two, resulting in a reduction in fuel consumption of about 15-25% (without safety being compromised or any damage to infrastructure). In some cases, safety was improved with EMS.

Efficiency is currently constrained by the legal boundary conditions on maximum permitted weight,

dimensions and speed. Therefore, changes to these legal boundary conditions would bring significant efficiency improvements. For instance, by further promoting a wider cross-border use of longer vehicle combinations in Europe.



IN FOCUS

Truck platooning

Platooning is the linking of two or three self-driving trucks in convoy.

The trucks closely follow each other at a set distance, using state-of-the-art connectivity technology and driving support systems. The trucks in the platoon communicate with each other, using for example Wi-Fi technology, enabling them to travel in sync.

The vehicle at the head of the convoy acts as the

leader. If it brakes, all the other trucks in the platoon also brake. Reaction time is virtually one-on-one for all trucks.

Platooning results in a lower fuel consumption and increased safety, as the trucks drive closer together at a constant speed, with less braking and accelerating.

Truck platooning has the potential to reduce CO2 emissions by around 10%.



6. HOW DOES THE EU COMPARE TO THE US?

As European manufacturers are global players, they also produce trucks for the American, Chinese and Japanese markets. EU truck manufacturers implement the latest and best technology, wherever customers are asking for it.

However, it is difficult to compare the CO2 emissions of EU and US trucks. This is because trucks are designed for their market-specific use, and freight efficiency is mostly determined by legal boundary conditions, which differ between the EU and US.

FOR INSTANCE:

- Maximum speed limits are higher in the US
- Payload and trailer cargo volume differ significantly between both markets
- In terms of CO2/g/m³km (volume), EU trucks perform less well simply because US trucks can legally transport 21% more volume

In the EU, efficiency is currently constrained by the legal conditions on maximum permitted weight, dimensions and speed. Hence, road freight efficiency in Europe could be greatly improved by changing vehicle legislation.

For instance, by allowing the cross-border use of longer combination vehicles in Europe, which is already common practice in the US, truck manufacturers would achieve a 14% higher fuel efficiency.

Moreover, the lack of tractor length restrictions in the US results in an air drag benefit for American vehicles.

Nonetheless, when using the weight metric, ie fuel consumption per tonne-kilometre (CO2 g/tkm), EU trucks emit 16% less CO2 emissions than US trucks. This metric is also known as the 'work-done principle', and shows the true transport efficiency.

Volume comparison



Interior length	13.62m	16.00m
Interior width	2.47m	2.50m
Interior height	2.75m	2.80m
Interior volume	92.5m³	112.0m³

“ When looking at the fuel consumption per tonne-kilometre (CO2 g/tkm), EU trucks emit 16% less CO2 emissions than US trucks ”

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