

The road to cleaner trucking

T&E position paper on HDV standards proposal

Summary

On 18 May the European Commission proposed the first ever European truck CO₂ standards.ⁱ The EU will now follow other countries such as the US, Canada, China, India and Japan which have already successfully introduced truck fuel efficiency standards.

The Commission's impact assessment clearly shows that 20% emissions reductions in 2025 and 35% in 2030 are the most cost-effective targets and would bring the highest return on investment during the first ownership periods.^{ii iii} Therefore the upcoming 2025 targets should go beyond the 15% proposed by the European Commission and get the maximum cost-effective potential out of trucks which is -20% effective reductions on diesel trucks by 2025.

At the same time things are moving fast in the field of zero emission trucking. Nearly all major European truckmakers (DAF, Mercedes, MAN, Volvo and Renault) have announced series production and/or sales of electric trucks in the next years.

The upcoming HDV standards raise important issues of industrial policy for the EU. Demand for zero emission trucks is increasing and there is growing impatience because of the limited supply. Big retailers and transport companies throughout Europe are publicly asking the European Commission to introduce an ambitious zero emission vehicle mandate for trucks. Zero emission trucks are crucial for EU and Member States to hit their 2030 targets and meet the Paris Climate Agreement goals.

The goal of the upcoming HDV proposal should therefore be twofold: dramatically improve fuel efficiency with ambitious truck standards while at the same time kick-start zero emission trucking in Europe. Below we discuss in two separate briefings why and how Europe should do this.

Briefing 1: Truck CO₂ standards

1. Getting strong fuel efficiency standards - five reasons why

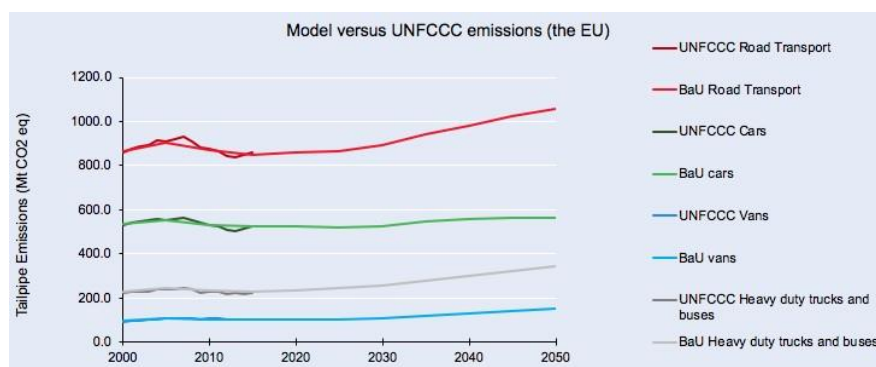
1. Vital to meet our climate goals

Transport is currently Europe's biggest climate problem accounting for most of the greenhouse gas (GHG) emissions. At the same time, transport GHG emissions rose for the third year running according to EEA data.^{iv} The European Union and Member States have the legal obligation to reduce GHG emissions from the so-called non-ETS sectors (mainly transport, buildings and agriculture) with 30% by 2030. Transport is currently the biggest non-ETS sector accounting for

35% of the total emission share and this share is expected to increase over the coming decades (see the red line).

Heavy duty vehicles (HDVs), i.e. trucks and buses, only make up 5% of the vehicles on the road, but already account for more than one quarter of road CO₂ emissions in Europe.

These emissions will only go up (see the grey line) as the demand for road freight continues to increase. At the same time, emissions of cars and vans continue to go down due to CO₂ standards making truck emissions an even bigger challenge. In other words, without strong EU truck standards, enforced in real driving conditions, the EU and Member States will never meet their 2030 climate targets or otherwise have to implement very drastic domestic measures to tackle truck emissions.



2. Business and transport sector call for 2025 fuel efficiency standards of -21%

Truck standards will not only curb transport emissions but also help businesses in Europe to save fuel and costs. In April this year 37 companies called the European Commission in an open letter to introduce 2025 standards of -24%. Converted to a 2019 baseline this means -21%.

Amongst the signatories are big retailers such (IKEA, Nestlé, Unilever etc.) logistics operators (DB Schenker and Geodis) but also transport fleets (Vos Logistics, Meyer & Meyer) and the Spanish, Portuguese, Belgian, Dutch and Hungarian national road transport associations representing thousands of SMEs. ^v This shows that ambitious standards that harvest the full cost-effective potential are supported by all different stakeholders involved.



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Dear Mr. Jean Claude Juncker, President of the European Commission

CC:

First Vice-President of the European Commission, Frans Timmermans

Vice-Presidents Maroš Šefčovič, Jyrki Katainen

Commissioners Miguel Arias Cañete, Violeta Bulc, Elżbieta Bieńkowska, Karmenu Vella, Carlos Moedas, Margrethe Vestager

17 April 2018

During your State of the Union in September last year, you stated that Europe shall 'remain the global leader in the fight against climate change'. Meeting the goals and promises of the 2015 Paris Climate Agreement of limiting global warming to well below 2 degrees will be essential in this regard. Therefore the EU has set itself a target of reducing its greenhouse gas emissions by 40% by 2030.

Europe's climate emissions cannot be tackled without addressing transport. The latest data from the European Environment Agency reconfirms that transport is Europe's biggest climate problem. Transport emissions now represent 27% of the EU's total and they have risen for the third year running. Within transport, road freight emissions are on the rise. Heavy duty vehicles already account for one quarter of road transport CO₂ emissions and this is expected to increase by 14% by 2030 in a business as usual scenario². In other words, if Europe wants to deliver on its Paris Commitments, and own 2030 targets, transport and truck emissions need to be curbed urgently.

As a sector we already take many valuable initia-

3. There is plenty cost-effective potential

The Commission impact assessment clearly shows that fuel efficiency of tractor trailers can be radically improved by 2030 in a cost-effective way. ^{vi} ^{vii} As the table shows, the net savings during the first five years for all scenarios by far outweigh the increase vehicle costs (capital costs). Technologies include improved aerodynamics, better tyres and engine and powertrain efficiency improvements. ^{viii} It is worth noting that vehicles are used for seven years on average before being sold. ^{ix}

10.4 TCO-first use (5 years)

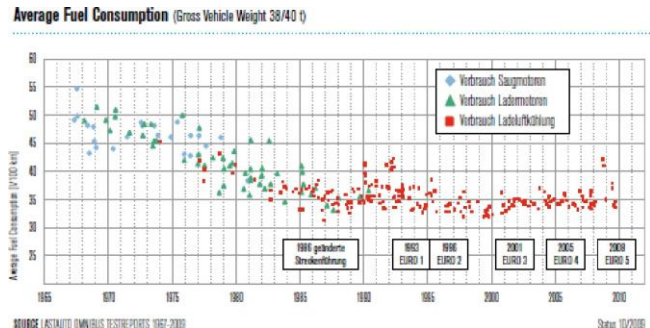
Table 15: Net economic savings from a first use (5 years) perspective in 2025 and 2030 (EUR/lorry)

2025 (EUR/lorry)	Cost assumptions	TL20 (10%)	TL30N L (12.5%)	TL30 (15%)	TL32 (17.5%)	TL35 (20%)
Capital cost [1]	Base	481	991	1,729	2,516	4,110
	High	1,723	3,553	6,048	9,923	15,566
Fuel Savings [2]	Base	7,804	15,655	25,167	32,175	41,699
	High	14,480	24,424	32,385	40,920	48,568
Net Savings [2] - [1]	Base	7,323	14,664	23,438	29,659	37,589
	High	12,757	20,871	26,337	30,997	33,002
2030 (EUR/lorry)	Cost assumptions	TL20 (20%)	TL30 * (30%)		TL32 (32%)	TL35 (35%)
Capital cost [1]	Base	2,608	10,803		14,881	18,584
	High	7,684	26,666		29,161	32,906
Fuel Savings [2]	Base	32,947	68,809		75,652	90,704
	High	40,812	81,437		95,014	115,334

Different studies such as the ICCT 2017 study and more recent work for the Dutch Ministry of Infrastructure and the Environment confirm the Commission findings, all concluding that by 2030 truck fuel efficiency can be improved by 40% and more while bringing gains to society, truck operators and end-users.

4. Stagnating fuel efficiency and the cartel scandal

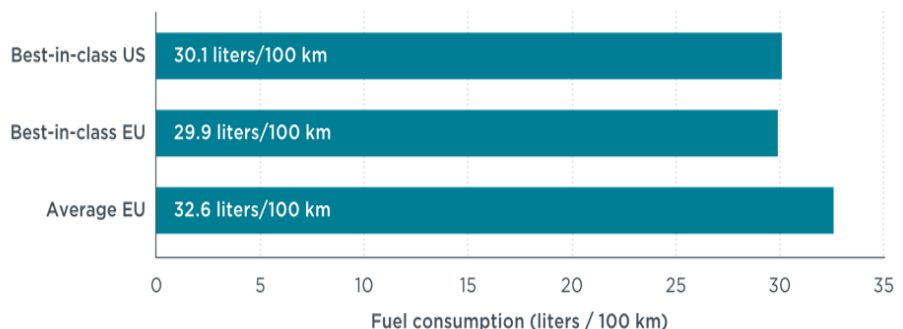
Truck manufacturers have always claimed that the market alone will do the job and that fuel efficiency standards are therefore not needed.^x This is however not true. Lastauto omnibus data - testing a wide range of trucks from different OEMs - show that over the past two decades the average fuel consumption of tractors has hardly improved.^{xi} These findings are actually confirmed by earlier data *provided by the truckmakers themselves* (see the red dots in the infographic).^{xii}



On top of this there is also an urgent need to create more competition between truck OEMs. All big European truckmakers have recently been fined for colluding in a cartel for over 14 years, delaying innovation and rigging prices. The total fine (almost 4 billion euros) is the biggest cartel fine in EU history.^{xiii}

5. Protect competitiveness of EU industry

Standards are also urgently needed to protect the competitiveness of EU industry. Without strong EU truck standards, US trucks are projected to overtake European lorries in 2020 as the most fuel efficient in the world.^{xiv} European truckmakers have always claimed that US trucks are way behind but new



research shows this is not true. Independent on road tests prove that the fuel consumption of US trucks today is comparable to EU trucks (see image).^{xv} On top of this the US has introduced a 2027 standards that will make class 8 trucks (comparable to VECTO categories 5 and 10) 27% more fuel efficient compared to 2017 models.^{xvi}

This is a huge threat for EU HDV manufacturers who currently account for 40% of global production.^{xvii} The EU could lose its dominant position without strong standards. Also, emerging markets such as India, China and Brazil will increasingly look to the US, copying its truck standards and test procedures, and - unless the EU acts quickly - buying and importing more US-made trucks. EU fuel efficiency standards are the perfect policy tool to kick-start fuel efficiency improvements in Europe, as they are currently doing in the US, and make sure Europe keeps leading on innovation and efficiency - and we keep manufacturing jobs in Europe

2. How the proposal should be improved – 2025 CO2 target of at least 20%

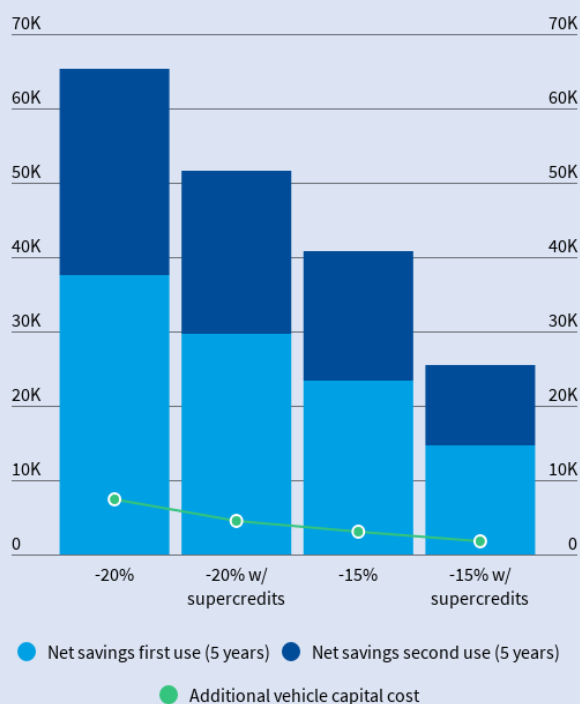
The European Commission impact assessment accompanying the proposal clearly shows that -20% by 2025 would bring much higher fuel savings for transport operators during the first five years than -15% as proposed.

Compared to the 15% reduction proposed by the Commission, and accounting for the weakening effect of supercredits, an effective emission reduction of 20% would save truck drivers an additional €22 900 during the first five-year ownership period (i.e. the difference between €37 600 and €14 664). For the second user there will be a further, additional, saving of €16 900 (this is over the second five-year ownership period).

Improving the ambition level of -15% (which in reality falls to 12.4% with supercredit weakening) proposed to effective emissions reductions of -20% only raises vehicle capital for the first user by about €3 000, meaning the extra investment is recovered within months. It is also striking that the European impact assessment explicitly acknowledges this: 'with the base and the high cost assumptions, net benefits are highest under the most ambitious option TL35 [-20% (2025)] in both 2025 and 2030.'^{xxvi}

In short, the higher ambition (effective -20% reduction) brings average annual net savings per truck to €7 500 in each of the first 5 years.

Considerable net savings from higher ambition (€/truck)



Net savings: difference between fuel savings and technology costs. Taxes are included (except VAT in view of the commercial use of the vehicles), discount rate of 9.5%.

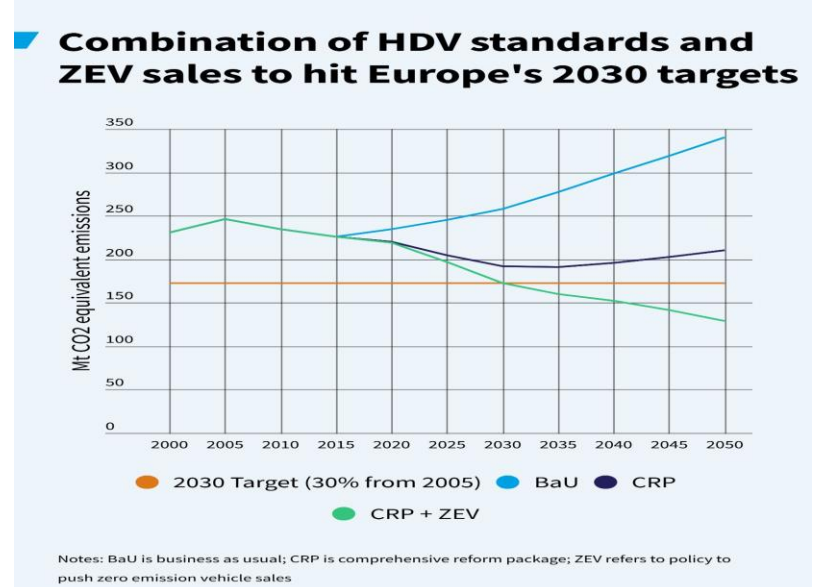
Source: Impact Assessment of Proposal for a Regulation of the European Parliament and of the Council setting CO2 emission performance standards for new heavy duty vehicles

Briefing 2: How to kick-start zero emission trucking

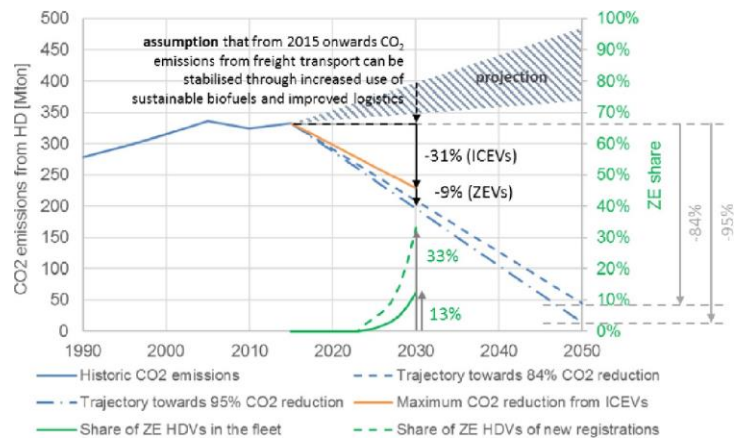
1. Three reasons why Europe needs to introduce a 2025 zero emission vehicle mandate

1. Vital to meet our 2030 targets and the Paris Climate Agreement (2050)

Heavy Duty Vehicles (HDV) emissions are expected to grow very fast over the next decades (see light blue line). This is mainly because of two reasons: the expected GDP and population growth in Europe and the lack of fuel efficiency improvements by truck manufacturers (without standards). This means that even with very ambitious measures to reduce land freight greenhouse gas (GHG) emissions (see CRP on the right) ^{xxxiv} - including very demanding truck standards, modal shift and pricing - EU countries will not be able to cut CO₂ of land transport by 30% as required under the proposed 2030 targets. This means we need a significant share of zero emission trucks in 2025 (5-10%) and 2030 (20-30%) to hit such target.



If we look beyond 2030, we need even more radical reductions in transport for Europe to meet the Paris Climate goals. As shown by a recent [study](#) by the Öko Institut, land transport CO₂ needs to be zero by 2050 to be in line with the Paris Agreement. This because there are certain non-ETS sectors, like agriculture, that cannot be entirely decarbonised (including all GHG emissions). ^{xxxv} The only way we can get to zero is by moving away from fossil fueled trucks and buses (incl. gas) and move to zero emission technologies such as electricity and green hydrogen. Recent research published by the Dutch



Ministry of Infrastructure and the Environment shows that if Europe wants to be in line to meet the 1.5 degrees target, transport needs to reduce its GHG emissions by 95% by 2050. To meet this 1.5 degrees target, 33% of all new HDV sales in 2030 need to be zero emission. Even a less ambitious 2°C target would still require significant shares of zero emission trucks by 2030. Hence already in 2025 between 5-10% of new trucks need to be zero emission to meet a 25-35% sales share five years later. These assumptions already take into account that all new diesel trucks in 2030 would be 40% more fuel efficient. ^{xxxvi}

2. Zero emission technology for heavy duty vehicles is already there

44% of trucks drive daily distances of no more than 300km^{xxxvii} and a large part of these trucks can be electrified. With falling battery prices this is likely to become cost effective in the next decade. It is therefore reasonable to demand that 25-35% of new trucks sold in 2030 should be zero emissions. Basically all major European truckmakers will bring electric trucks to the market over the next years. Daimler Mercedes and MAN are currently testing fully electric trucks that go up to 26 tons and they will both start series

production in 2021.^{xxxviii xxxix} Meanwhile Volvo and Renault have announced they will both start selling electric trucks as from 2019 while also DAF and bus OEMs such as BYD and VDL are planning to sell battery electric trucks in Europe up to 37 tons.^{xl xli} All these trucks are mainly for urban (and regional) distribution.^{xlii}



But also in the long haul segment things are moving fast. Recently Tesla presented their fully electric tractor trailer truck and is also planning to enter the European market.^{xliii} It would have a range of 800 km which makes it fit for long haul transport.^{xliv} Siemens is already testing its eHighway trucks in Sweden where trucks are charged with overhead powerlines. These lorries will also be able to cover long-distance freight transport. Early 2019 the catenary concept will also be tested on the public road on three different locations in Germany.^{xlv}

3. Business and transport sector want an ambitious mandate

Major companies (37 in total) asked the European Commission in [a joint letter](#) to introduce an 'ambitious mandatory sales target for zero emission trucks'.

In the meantime cities clearly want to move away from diesel and clean up their air for citizens.^{xlvi xlvii}

Transport operators also want to make a shift and are looking for solutions to continue operating in cities in a sustainable way. The Dutch national transport association (TLN), for example, announced recently that they want to move to zero emission for urban transport by 2025. One condition however is that there is supply from the OEMs.^{xlvi} DB Schenker, one of the biggest logistics players in Europe, is building its own electric trucks mainly because of the lack of supply from traditional European truckmakers.^{xlix} Instruments such as a zero emission vehicle mandate will help to overcome these barriers and oblige truckmakers to sell more zero emission vehicles at competitive prices.



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Europe's climate emissions cannot be tackled without addressing transport. The latest data from the European Environment Agency reconfirms that transport is Europe's biggest climate problem. Transport emissions now represent 27% of the EU's total and they have risen for the third year running. Within transport, road freight emissions are on the rise. Heavy duty vehicles already account for one quarter of road transport CO₂ emissions and this is expected to increase by 14% by 2030 in a business as usual scenario². In other words, if Europe wants to deliver on its Paris Commitments, and own 2030 targets, transport and truck emissions need to be curbed urgently.

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2. How to improve the supercredit system – A 2025 mandate of 10%

Instead of the supercredit system that would undermine the target and not lead to a meaningful uptake of ZEVs, Europe should introduce a zero emission trucking mandate of 10% by 2025 or a well-designed benchmark with a malus. Both systems will increase the offer of zero emission trucks, reduce prices and protect the CO2 target.

This binding mandate is a separate mechanism that doesn't interact with the truck CO2 standard and will help to overcome the market barriers that were described earlier. Such a mandate will oblige OEMs to sell a certain share of zero emission vehicles as part of their total sales in 2025 and 2030. If a manufacturer doesn't meet the target, it will have to pay a fine or could buy credits for OEMs that are overachieving the target. In California such a system is already in place for cars.^{lxiv}

This system will protect the CO2 target because it is a separate system. Safeguarding the CO2 target is very important given that diesel powered trucks will still be a big part of the total truck fleet in 2025 and 2030.

Is a 10% mandate achievable?

The TNO analysis clearly shows that already in 2025 at least 5% to 10% of new trucks need to be zero emission if Europe wants to be in line with meeting the COP21 targets of limiting global warming to 1.5 degrees.

But also recent research by Frost & Sullivan shows that by 2025, even 55% of new trucks in Europe will be electric with plug-in hybrid accounting for another 37.4%.^{lxv} Moreover the 2017 McKinsey research shows that already a wide range of electric trucks will be cost-effective well before 2025.^{lxv}

Conclusion - what Europe should do

The European Commission now made a proposal for truck standards that will set the scene for cleaner trucking for the next decade and more. Truck standards need to be more ambitious than the proposed 15% as they are good for the climate, the transport sector, and competitiveness of European truckmakers.

These trucks standards should also be the start of a shift away from fossil fueled trucks towards a zero emission future. Zero emission trucks are becoming more and more cost-effective, will help cities clean up their air and are crucial to hit our climate targets. A binding mandate or a well- designed rising benchmark are the only effective ways to create a market, reduce prices and get the infrastructure we need. Again, this is about future-proofing EU truck production. European bus manufacturers are already far behind in the race on clean buses, the same should be avoided for trucks.

It's time for Europe to lead again on innovation in the field of fuel efficiency and zero emission trucking. There is no better occasion than the upcoming HDV standards to do this.

Endnotes

- ⁱ <http://www.europarl.europa.eu/committees/de/envi/home.html>
- ⁱⁱ https://www.theicct.org/sites/default/files/publications/ICCT_EU-HDV-tech-2025-30_20180116.pdf
- ⁱⁱⁱ https://www.theicct.org/sites/default/files/publications/HDV-Technology-Potential-and-Cost-Study_Ricardo_Consultant-Report_26052017_vF.pdf
- ^{iv} <https://www.transportenvironment.org/newsroom/blog/reconfirmed-transport-europe%E2%80%99s-biggest-climate-problem>
- ^v <https://www.transportenvironment.org/publications/letter-its-time-fuel-economy-standards-trucks>
- ^{vi} https://www.theicct.org/sites/default/files/publications/HDV-Technology-Potential-and-Cost-Study_Ricardo_Consultant-Report_26052017_vF.pdf
- ^{vii} http://europa.eu/rapid/press-release_IP-14-576_en.htm
- ^{viii} <https://www.theicct.org/publications/fuel-efficiency-technology-european-heavy-duty-vehicles-baseline-and-potential-2020>
- ^{ix} <https://www.iru.org/sites/default/files/2017-07/iru-report-commercial-vehicle-of-the-future-en%20V2.pdf> p. 24
- ^x http://www.acea.be/uploads/publications/20101013_Commercial_Vehicles_CO2.pdf
- ^{xi} <https://www.theicct.org/blogs/staff/debating-EU-HDV-real-world-fuel-consumption-trends>
- ^{xii} http://www.acea.be/uploads/publications/20101013_Commercial_Vehicles_CO2.pdf
- ^{xiii} http://ec.europa.eu/competition/elojade/iseef/case_details.cfm?proc_code=1_39824
- ^{xiv} <https://www.euractiv.com/section/transport/opinion/america-s-challenge-to-european-truck-supremacy/>
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- ^{xvi} <https://www.gpo.gov/fdsys/pkg/FR-2016-10-25/pdf/2016-21203.pdf>
- ^{xvii} https://ec.europa.eu/clima/sites/clima/files/transport/vehicles/docs/ec_hdv_ghg_strategy_en.pdf
- ^{xviii} <https://www.transportenvironment.org/press/truck-fuel-bills-can-be-cut-%E2%82%AC5700-if-new-technology-deployed-report-finds>
- ^{xix} http://eur-lex.europa.eu/resource.html?uri=cellar:0c10fd76-59db-11e8-ab41-01aa75ed71a1.0001.02/DOC_1&format=PDF p. 10
- ^{xx} https://www.google.com/url?q=http://theicct.org/barriers-to-fuel-saving-technologies-trucking-sector&sa=D&ust=1532531207125000&usq=AFQjCNHDvXzL0n_xjrs_qSvCb2HUXcMZBq
- ^{xxi} <https://www.transportenvironment.org/publications/us-truck-fuel-efficiency-standards-costs-and-benefits>
- ^{xxii} <https://www.trucks.com/2018/01/10/truck-orders-surge-2017/>
- ^{xxiii} https://www.theicct.org/sites/default/files/publications/EU-HDV-Tech-Potential_ICCT-white-paper_14072017_vF.pdf, p. 10
- ^{xxiv} Notes on modelling. According to the ICCT, the yet to be regulated categories of trucks are responsible for 76% of the emissions. Thus, a 10% improvement on fuel efficiency is equivalent to a 7.6% reduction for the new fleet; similarly a 30% target is equivalent to a 23% improvement to the fleet.
- ^{xxv} https://ec.europa.eu/clima/sites/clima/files/transport/vehicles/docs/swd_2017_650_p1_en.pdf p. 156-157
- ^{xxvi} TL35 scenario corresponds to 20% emission reduction in 2025 and 35% in 2030: http://eur-lex.europa.eu/resource.html?uri=cellar:0c10fd76-59db-11e8-ab41-01aa75ed71a1.0001.02/DOC_1&format=PDF p. 39
- ^{xxvii} <https://www.theicct.org/news/comments-ec-hdv-co2-stds-20180119>
- ^{xxviii} <https://nepis.epa.gov/Exe/ZyPDF.cgi/P100P8IS.PDF?Dockey=P100P8IS.PDF> p. 199
- ^{xxix} https://www.theicct.org/sites/default/files/publications/HDV_engine-efficiency-eval_WVU-rpt_oct2014.pdf
- ^{xxx} <https://www.theicct.org/publications/roadmap-heavy-duty-engine-co2-standards-within-european-union-framework>
- ^{xxxi} <http://www.dft.gov.uk/vca/conformity-of-production/conformity-of-production.asp>
- ^{xxxii} <https://www.ft.com/content/19494a7e-8f47-11e8-b639-7680cedcc421>
- ^{xxxiii} <https://www.theicct.org/publications/eu-proposal-hdv-co2-position-brief-20180725>
- ^{xxxiv} CRP means comprehensive reform package. This package includes: increasing share of rail freight from 18 to 23%, improving fuel efficiency of all truck by 40%, 43% of all new sales of buses will be electric and 5% CO2 reduction due to logistics efficiency.
- ^{xxxv} <https://www.transportenvironment.org/publications/europe-needs-slash-its-transport-emissions-94-2050-effort-sharing-regulation>
- ^{xxxvi} *Assessments with respect to the EU HDV CO2 legislation*, TNO 2018 P10214, March 15, 2018
- ^{xxxvii} http://ec.europa.eu/eurostat/statistics-explained/index.php/Road_freight_transport_by_journey_characteristics
- ^{xxxviii} <https://www.reuters.com/article/us-daimler-electric/daimler-to-start-serial-production-of-eactros-truck-in-2021-idUSKCN1G516F>

- xxxix <https://www.truck.man.eu/de/de/ma> n-welt/man-in-deutschland/presse-und-medien/MAN-und-CNL-bringen-eTrucks-auf-die-Strasse-279872.html
- xl <https://www.electrive.com/2017/11/28/first-electric-truck-vgd/>
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- xlii <http://www.volvogroup.com/en-en/news/2018/jan/news-2796722.html>
- xliii <https://electrek.co/2017/12/20/tesla-opens-electric-semi-truck-reservations-europe/>
- xliv <https://www.electrive.com/2017/11/17/tesla-semi-electric-truck-800-km-range/>
- xlv <http://www.hessenschau.de/wirtschaft/a5-wird-zum-elektro-highway-fuer-lastwagen-umgebaut,oberleitung-lkw-104.html>
- xlvi <https://www.zeit.de/mobilitaet/2018-05/diesel-fahrverbote-hamburg-autoindustrie-abgase>
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- xlviii https://www.tln.nl/actueel/nieuws/Documents/Position%20paper%20Duurzaamheid_TLN.pdf
- lix <https://www.transportjournal.com/fr/home/news/artikeldetail/fleet-of-electric-trucks-on-trial-at-db-schenker.html>
- i <https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/whats-sparking-electric-vehicle-adoption-in-the-truck-industry>
- ii <https://www.bloomberg.com/news/articles/2017-12-05/latest-bull-case-for-electric-cars-the-cheapest-batteries-ever>
- iii <https://www.transportenvironment.org/publications/roadmap-climate-friendly-land-freight-and-buses-europe>
- iiii https://ec.europa.eu/clima/sites/clima/files/transport/vehicles/docs/swd_2017_650_p1_en.pdf p. 28
- lv <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1497446257859&uri=CELEX:52017PC0275>
- lv <http://www.sueddeutsche.de/wirtschaft/verkehrsministerium-e-lastwagen-sollen-von-lkw-maut-befreit-werden-1.3939944>
- lvi <https://www.pv-magazine.com/press-releases/byd-wins-order-for-largest-fleet-of-articulated-ebuses-in-europe-for-oslo/>
- lvii <https://cleantechnica.com/2017/10/03/deutsche-post-dhl-building-2nd-streetscooter-electric-van-factory-doubling-production-volume/>
- lviii <http://freightinthecity.com/2015/08/heineken-netherlands-finding-success-with-large-electric-hgvs-for-city-centre-distribution-in-rotterdam-and-amsterdam/>
- lix 10 year lifetime for regulated trucks, 250,000 regulated trucks sold per year (EC IA, 2018), Total about 5 million tonnes CO₂.
- lx Net savings is the total of fuel savings during the first 5 years minus the increased vehicle costs.
- lxi <http://zeeus.eu/uploads/publications/documents/zeeus-ebus-report-2.pdf>
- lxii *"Cities all over Europe will only buy electric buses from 2025 onwards – and I am very sure of this. Urban transport will be electric - we are on the brink of radical change".*
- lxiii Share of bus and coaches (total 2017 HDV sales in Europe, ACEA): Renault 1%, DAF 3%, Volvo 3%, Scania 4%
- lxiv <http://www.element-energy.co.uk/wordpress/wp-content/uploads/2017/03/20161024---Towards-a-European-Market-for-Electro-Mobility-FINAL.pdf> p. 3-4
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