HDV CO2 standards

T&E's view on the regulation and zero-emission trucks

TRANSPORT & ENVIRONMENT

Why do we need strong CO2 standards?

- **Big and growing polluter**

Share of the fleet in 2019

Share of CO_2 emissions in 2019

Trucks and buses Cars and vans

A booming sector

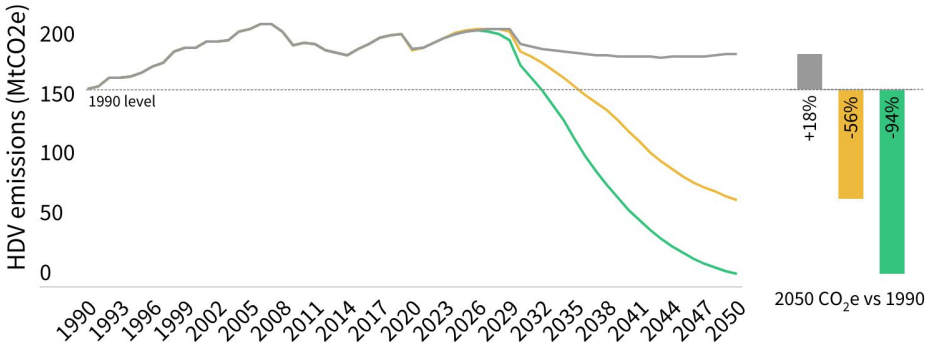
+40%
Increase in truck activity in 2019-2050

+10%
Increase in bus activity in 2019-2050

Trucks and buses will
eat up CO_2 savings
from electrifying cars and vans
until 2033

Why do we need strong CO2 standards?

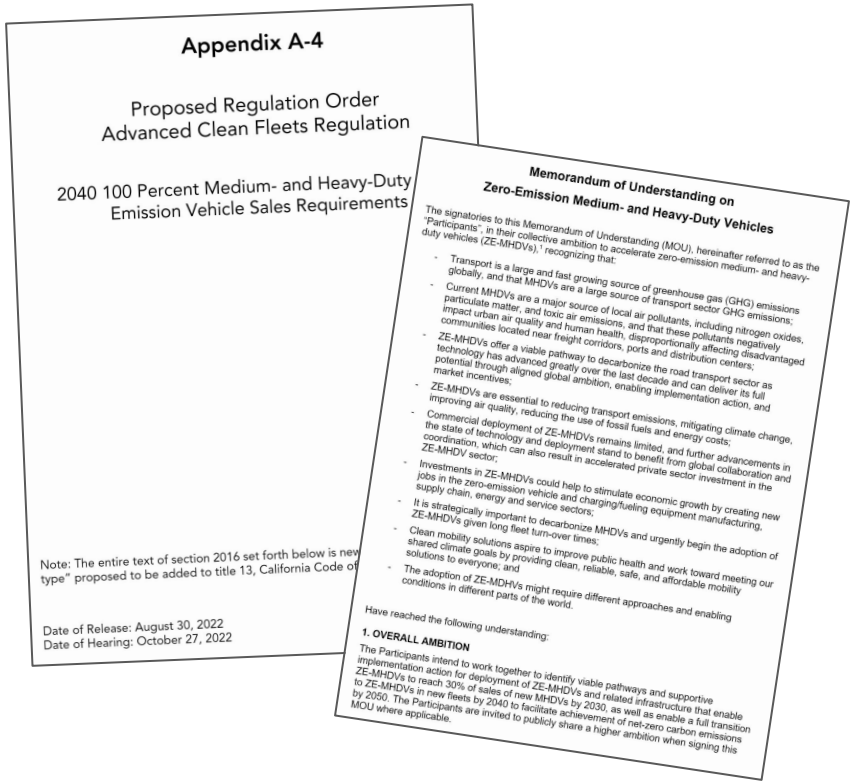
- Big and growing polluter
- Threat to EU climate targets



CO_2 targets	Current policies	Commission proposal	T&E recommendations
2030	-30%	-45%	-65%
2035		-65%	-100% (freight)
2040		-90%	-100% (all)

Why do we need strong CO2 standards?

- **Big and growing polluter**
- **Threat to EU climate targets**
- **Industrial leadership at stake**
  - U.S. (+25 countries) pledge 100% ZE-HDVs by 2040
  - California proposes 2040 100% ZE-HDV target
  - Inflation Reduction Act



Appendix A-4

Proposed Regulation Order
Advanced Clean Fleets Regulation

2040 100 Percent Medium- and Heavy-Duty
Emission Vehicle Sales Requirements

Note: The entire text of section 2016 set forth below is new
type" proposed to be added to title 13, California Code of

Date of Release: August 30, 2022
Date of Hearing: October 27, 2022

Memorandum of Understanding on
Zero-Emission Medium- and Heavy-Duty Vehicles

The signatories to this Memorandum of Understanding (MOU), hereinafter referred to as the "Participants", in their collective ambition to accelerate zero-emission medium- and heavy-duty vehicles (ZE-MHDVs),' recognizing that:

- Transport is a large and fast growing source of greenhouse gas (GHG) emissions globally, and that MHDVs are a large source of transport sector GHG emissions;
- Current MHDVs are a major source of local air pollutants, including nitrogen oxides, particulate matter, and toxic air emissions, and that these pollutants negatively impact urban air quality and human health, disproportionally affecting disadvantaged communities located near freight corridors, ports and distribution centers;
- ZE-MHDVs offer a viable pathway to decarbonize the road transport sector as technology has advanced greatly over the last decade and can deliver its full potential through aligned global ambition, enabling implementation action, and market incentives;
- ZE-MHDVs are essential to reducing transport emissions, mitigating climate change, improving air quality, reducing the use of fossil fuels and energy costs;
- Commercial deployment of ZE-MHDVs remains limited, and further advancements in the state of technology and deployment stand to benefit from global collaboration and coordination, which can also result in accelerated private sector investment in the ZE-MHDV sector;
- Investments in ZE-MHDVs could help to stimulate economic growth by creating new jobs in the zero-emission vehicle and charging/fueling equipment manufacturing, supply chain, energy and service sectors;
- It is strategically important to decarbonize MHDVs and urgently begin the adoption of ZE-MHDVs given long fleet turn-over times;
- Clean mobility solutions aspire to improve public health and work toward meeting our shared climate goals by providing clean, reliable, safe, and affordable mobility solutions to everyone; and
- The adoption of ZE-MDHVs might require different approaches and enabling conditions in different parts of the world.

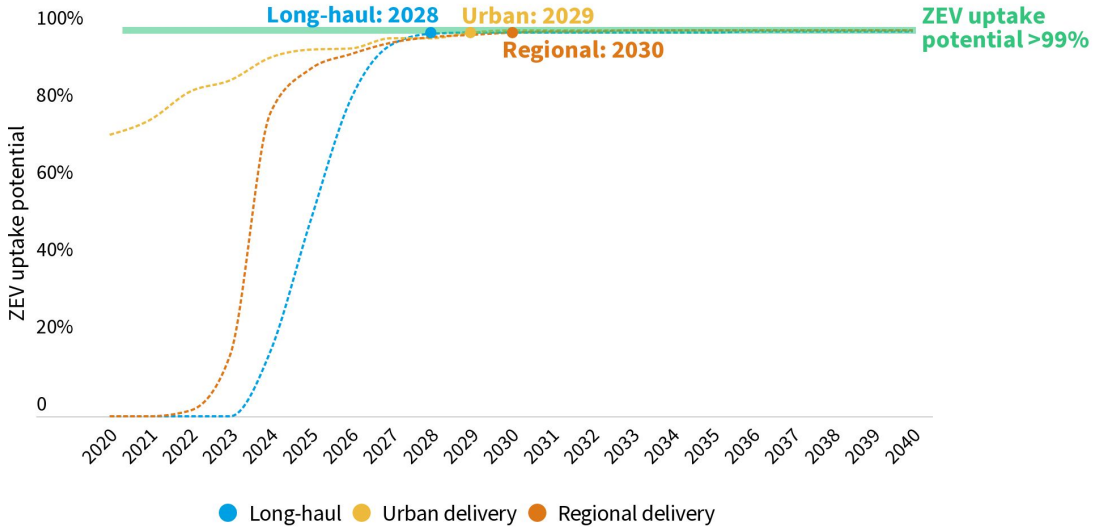
Have reached the following understanding:

1. OVERALL AMBITION

The Participants intend to work together to identify viable pathways and supportive implementation action for deployment of ZE-MHDVs and related infrastructure that enable ZE-MHDVs to reach 30% of sales of new MHDVs by 2030, as well as enable a full transition to ZE-MHDVs in new fleets by 2040 to facilitate achievement of net-zero carbon emissions by 2050. The Participants are invited to publicly share a higher ambition when signing this MOU where applicable.

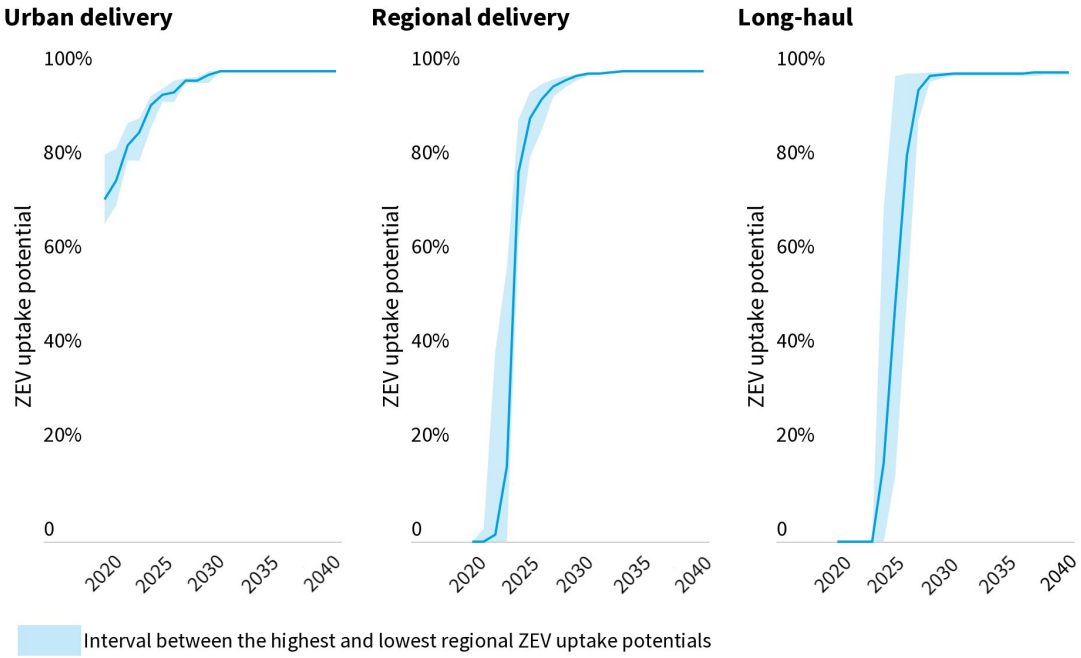
> 99 % of ZE freight trucks beat diesel by 2035

- **Cheaper** to run
- Driving **as far**
- Carrying **as much**



Scope of the analysis: 'Freight trucks' i.e. vehicles used for goods delivery (78% of HDV sales)
Out of scope: Vocational trucks, buses and coaches (22% of HDV sales)

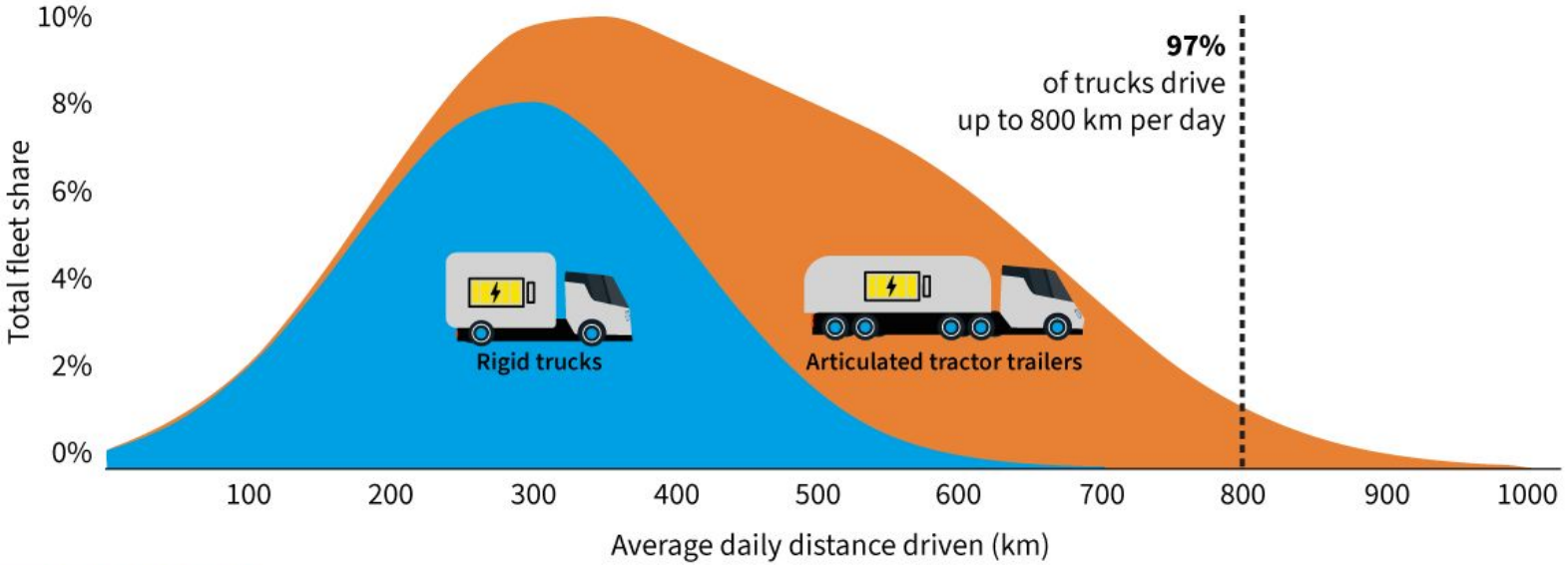
Similar ZEV uptake potential across European regions



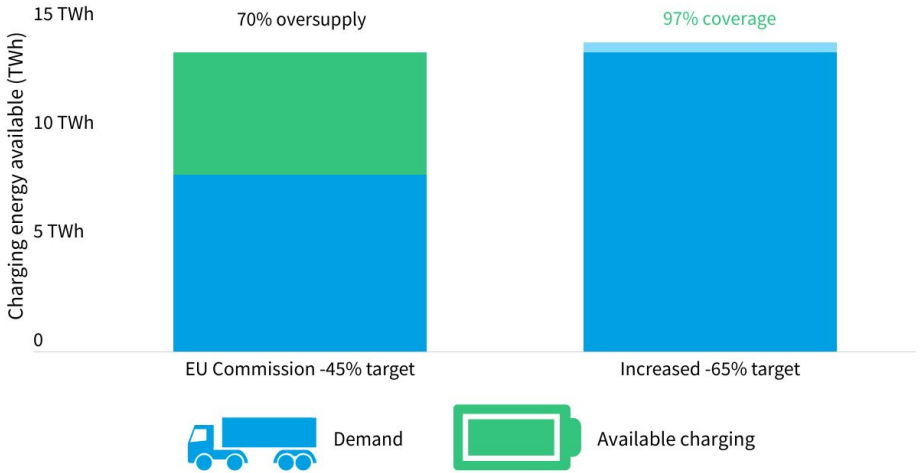
Unlike for cars where one could expect (small) regional differences in ZEV uptake, trucking is primarily driven by costs in a European single road freight market

Electric trucks can go the distance

» 97% of trucks in Europe drive less than 800 km a day «



AFIR mandates enough public charging to increase the 2030 CO2 target

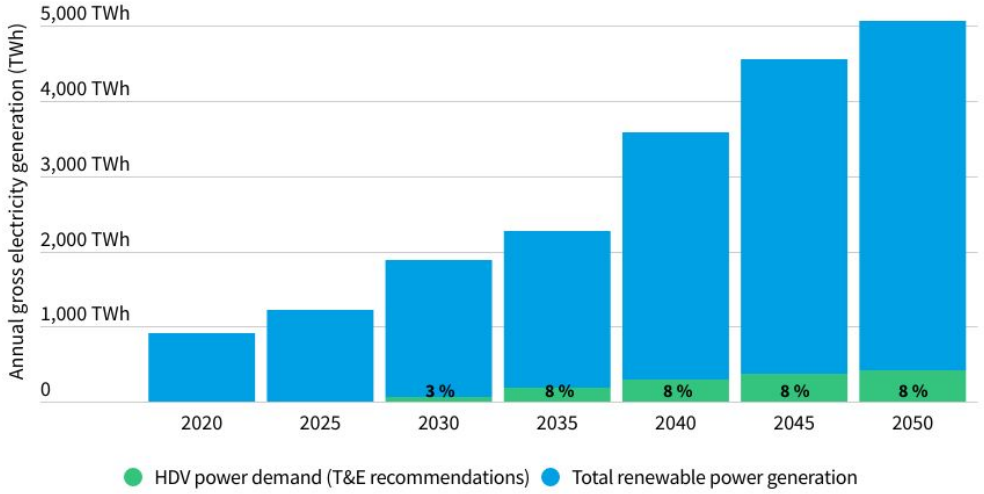


Notes: Projected gross energy demand from HDVs in EU-27 (TTW) in 2030 that needs to be provided by public charging and available charging energy.

Sources: T&E calculations based on T&E (2022), EU (2023).

Enough green power for electric trucks and buses

HDVs will consume 8 % of the EU's growing renewable electricity generation

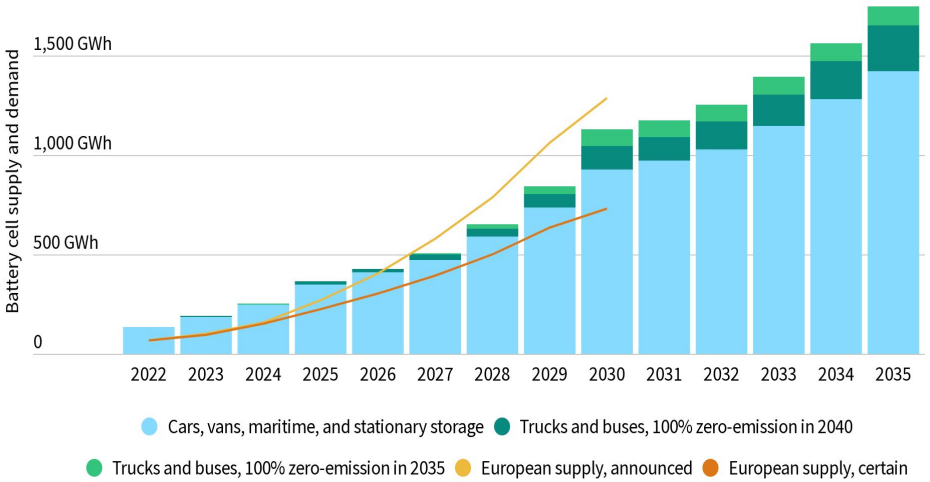


Notes: Projected annual gross electricity demand from HDVs in the EU 27 based on T&E recommendations for the HDV CO2 standards (CO2 targets of -65% in 2030 and -100% in 2035). Includes grid transmission and distribution losses. Compared to the gross renewable electricity generation according to Ember's 'Stated Policy' scenario. Assuming 100% BEVs for small and medium trucks and urban buses, 90% BEVs / 10% FCEVs for heavy trucks, 80% BEVs / 20% FCEVs for vocational vehicles, and 50% BEVs / 50% FCEVs for coaches.

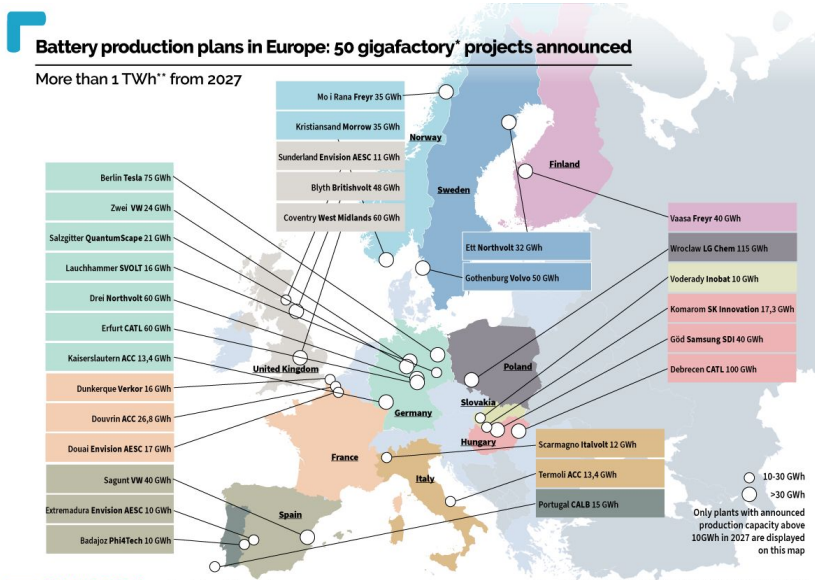
Sources: T&E calculations based on EUTRM (2023), EU (2021), Ember (2023).

Enough EU battery production for electric trucks and buses

But strong CO_2 standards needed for investment certainty



Note: European battery cell production is forecasted based on capacity from planned gigafactories and accounts for scrap. Vocational trucks reach 100% zero-emission sales in 2040 in both scenarios.



Electric (long-haul) trucks are coming to market

Scania: series production of 40-tonne battery-powered trucks with **560 km** from **2024**

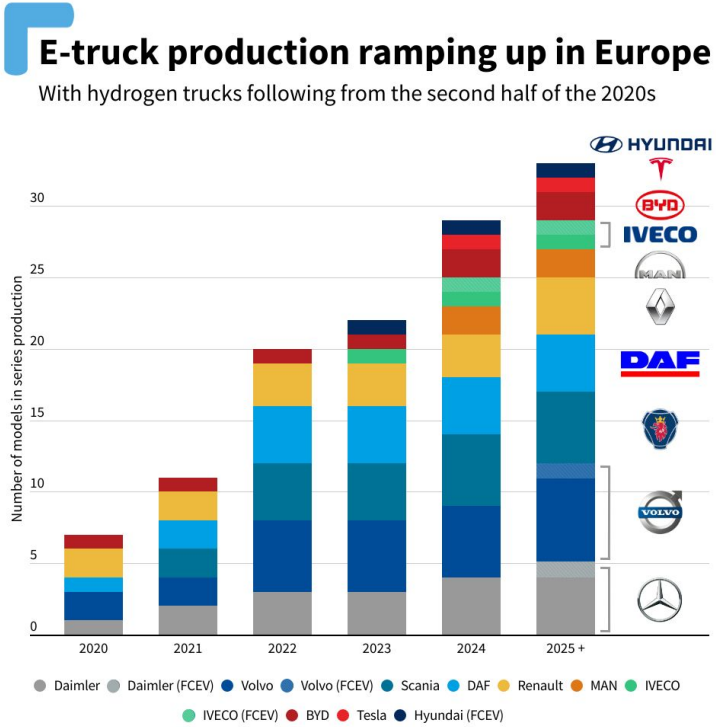
MAN: series production of the *eTruck* with **450 km** from **2024**

Daimler: series production of the *eActros LongHaul* with **500 km** from **2024**

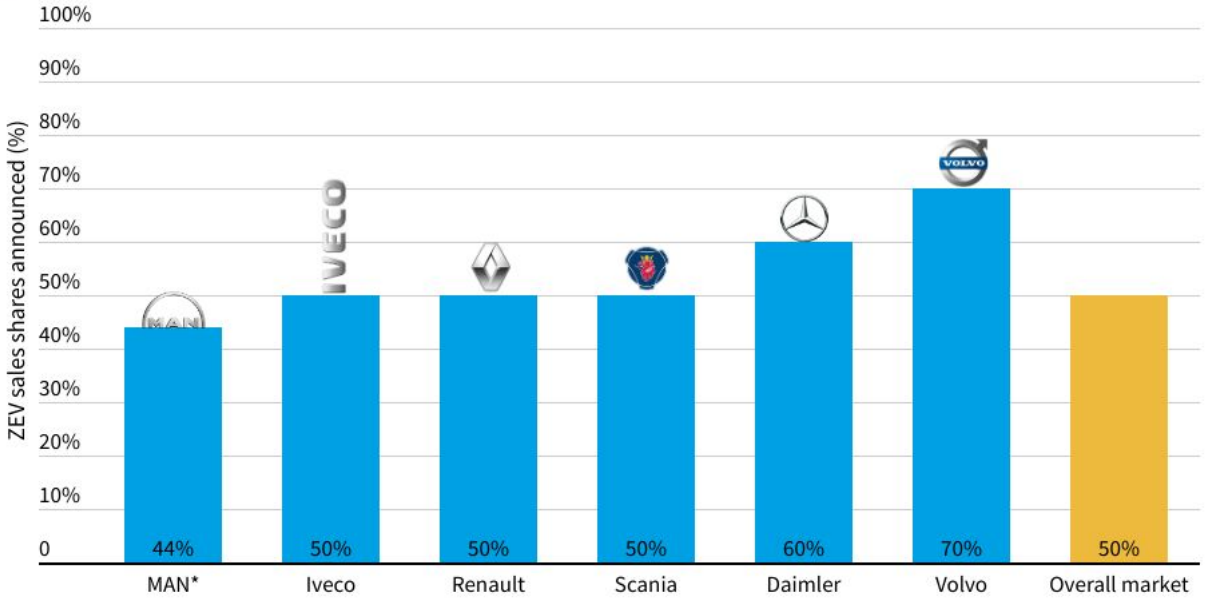
Volvo: series production of the *FH Electric* which can drive up to **500 km** (incl. one charging stop) since **2022**

DAF: series production of the *XD Electric* and *XF Electric* with up to **500 km** from **2023**

IVECO: series production of the *Nikola Tre BEV* with **500 km** from **2023**



Truck makers aim for 50% zero-emission sales by 2030



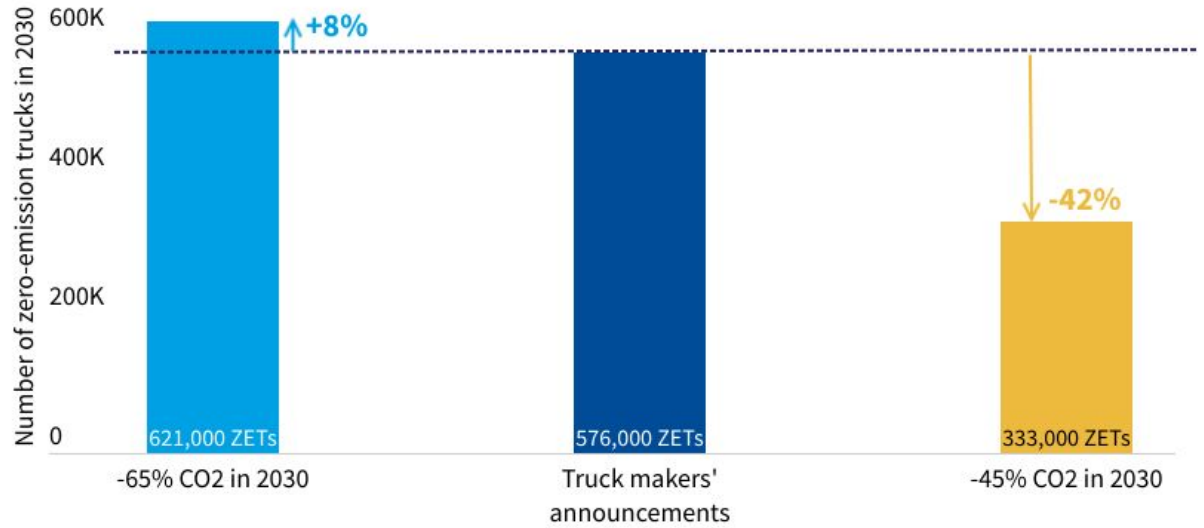
Notes: The overall market averages have been estimated based on the 2019 sales share of each OEM in Europe. OEMs which have not made public announcements are assumed to only deliver enough ZEVs to comply with the current HDV CO_2 standards.

*Based on MAN's announcement of 60% ZEV sales shares in the urban and regional delivery and 40% in the long-haul segment and a 20%/80% split based on the manufacturer's vehicle registrations during the reference period 2019/2020.

Source: T&E analysis, data from public OEM announcements and ACEA sales shares (2019).

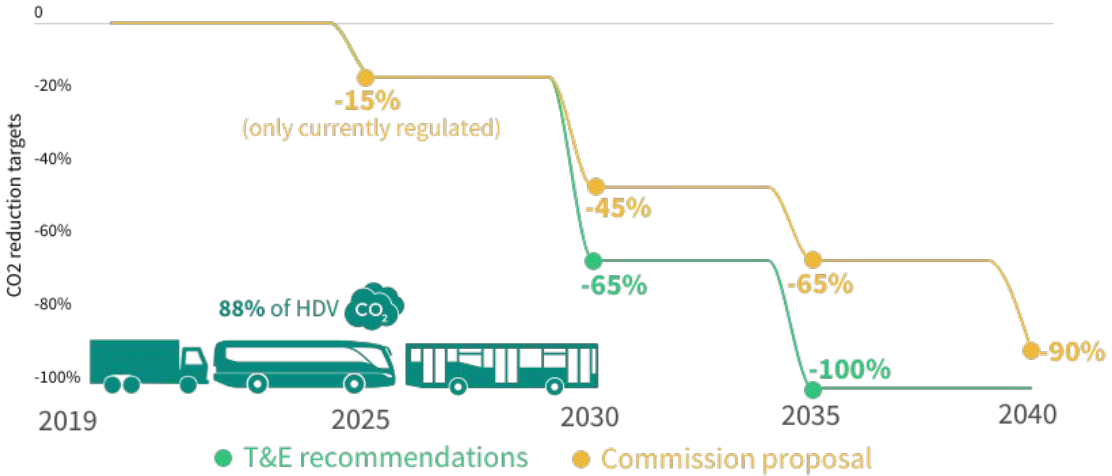
OEM announcements result in a -65% CO2 target in 2030

Sweet spot between climate needs and industry announcements



Scope: EU+UK (in line with the scope of truck makers' announcements)

100% zero-emission targets are needed

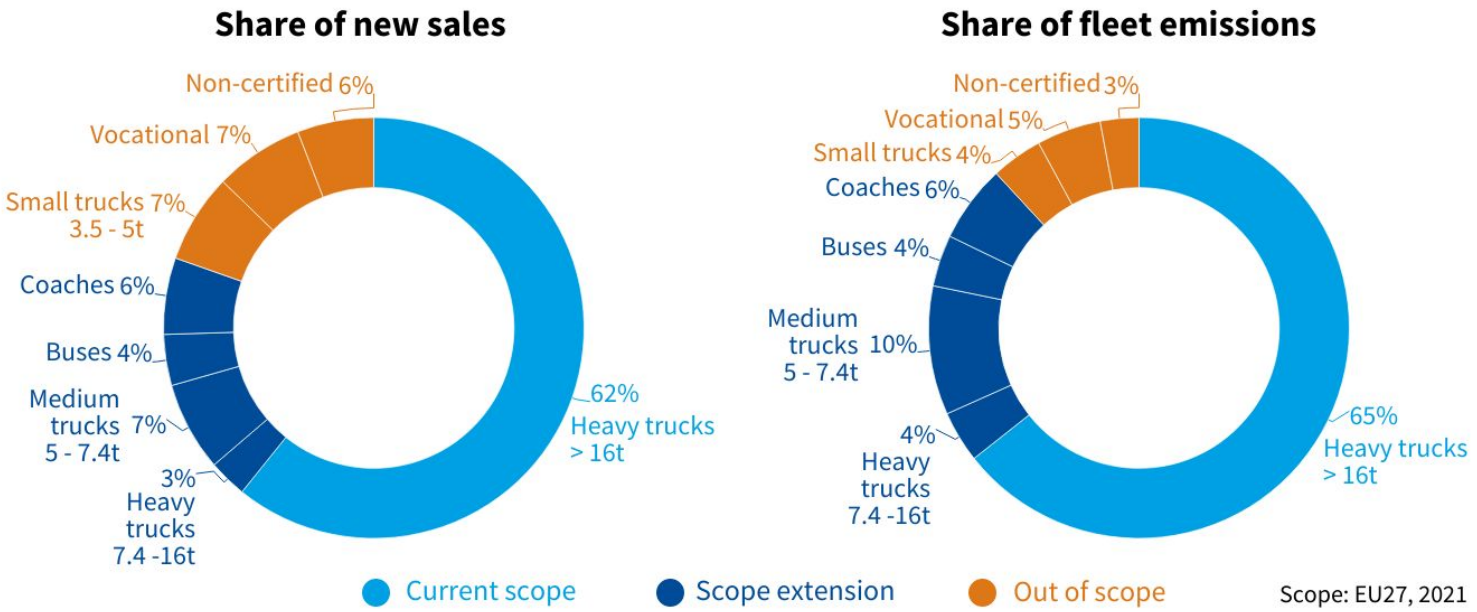


100% target in 2027
Urban buses

100% target in 2035
Freight trucks
Coaches

100% target in 2040
Vocational trucks
Non-certified trucks

Extend the scope of the HDV CO2 standards

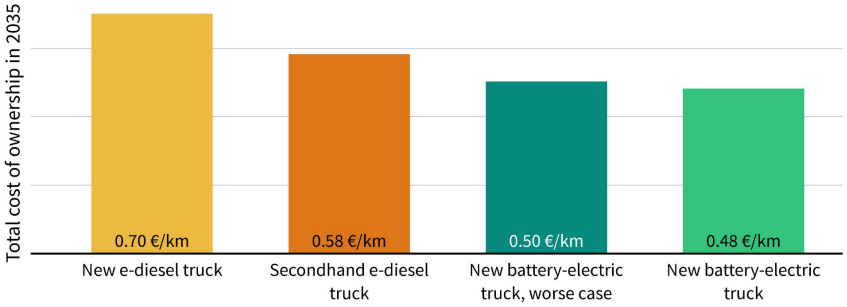


+ CO_2 targets for trailers

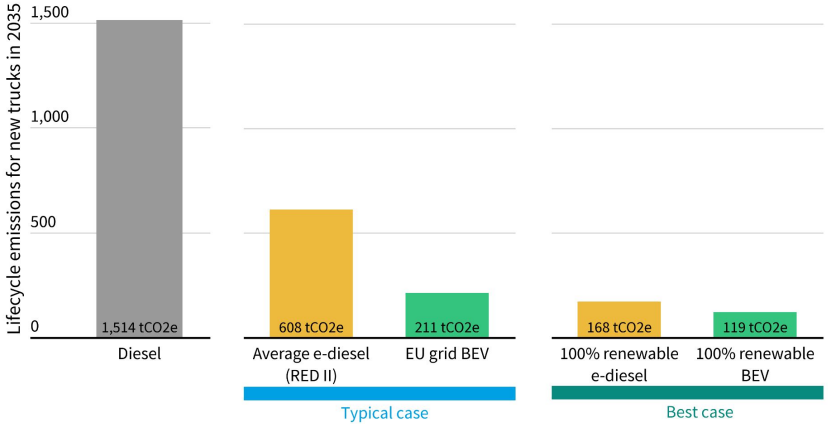
E-fuels? Expensive, scarce, and less green than batteries

» Energy consumption dominates costs and emissions «

Total cost of ownership
47% more expensive



Lifecycle emissions
3x more emissions



→ Prioritise e-fuels for aviation, shipping and industry

Recommendations ✅

100% ZE-HDVs in 2035

Set 100% ZE target for all new freight trucks and buses in 2035 (2040 at the latest)

2030 target increase

Increase the CO2 target in 2030 to -65%

Scope extension

Extend the regulation also to vocational and non-certified trucks

Do not include fuels

Do not introduce a fuel crediting system or carbon correction factor for (e-)fuels