



European
Automobile
Manufacturers
Association

ACEA Position Paper Charging and re-fuelling infrastructure required for heavy-duty vehicles



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KEY MESSAGES

- a. The rapid deployment of a sufficiently dense network of charging points and re-fuelling stations for alternatively-powered heavy-duty vehicles is one of the key prerequisites for a successful transition to carbon-neutral road transport.
- b. The technical specifications of the charging and re-fuelling infrastructure needed for commercial vehicles, especially heavy-duty trucks, differ significantly from those for passenger cars.
- c. In light of the recent political developments driving the shift to alternative fuels and carbon neutrality, as well as the ambitious CO₂ reduction targets set for 2025 and 2030, ACEA is revising its previous estimates of the minimum infrastructure requirements for commercial vehicles.
- d. Specific, binding targets for the deployment of infrastructure suitable for heavy-duty vehicles, buses and coaches must be included in the EU's Alternative Fuels Infrastructure Directive (AFID).
- e. It is essential that sufficient truck- and bus-specific electric charging points, hydrogen (LH₂/CH₂) and gas (CNG/LNG) stations are available across the EU at the latest by 2025, and that their number increases significantly by 2030.
- f. Missing technical standards have to be defined urgently and the necessary standardisation processes need to start immediately.
- g. If meaningful supportive policy measures are put in place and the necessary charging and re-fuelling infrastructure is deployed, a total fleet of approximately 200,000 battery-electric trucks (>3.5t GVW) will be in operation in the EU by 2030.
- h. All of these will require, mostly private, depot charging stations as well as – depending on their mission profiles – public and/or semi-public charging points.
- i. High-power charging of commercial vehicles (HPCCV) is an important enabler and a standard must be developed, and the first chargers built, well before 2025.
- j. Already by 2025, approximately 24,000 charging points with DC<100 kW capacity (4,000 publicly-accessible ones plus 20,000 depot stations), 11,000 stations with DC350 kW and 2,000 charging points with DC>500 kW will be required.
- k. By 2030, these figures will have to increase significantly to roughly 250,000 DC<100 kW charging points (of which 200,000 depot), 20,000 publicly-accessible points (DC 350 kW) and 20,000 public fast-charging points (DC> 500 kW).
- l. These infrastructure investments will require significant financial support. Transport operators in particular should be incentivised to invest early in private and semi-publicly accessible depot charging stations.

INTRODUCTION

The rapid deployment of a sufficiently dense network of charging points and re-fuelling stations for alternatively-powered heavy-duty vehicles is one of the key prerequisites for a successful transition to carbon-neutral road transport in Europe. However, the technical specifications of the infrastructure needed for commercial vehicles, especially heavy-duty trucks, differ significantly from those for passenger cars. Because of their significantly higher power and energy demand, as well as greater space and access requirements, heavy-duty trucks simply cannot use the infrastructure available for cars.

The European Automobile Manufacturers' Association (ACEA) published its first estimates of the minimum number of charging points and re-fuelling stations needed for heavy-duty vehicles in January 2019. These were based on the 2025 and 2030 targets proposed by the European Commission in its draft regulation for CO₂ emissions standards. According to the final Regulation (EU) 2019/1242, which entered into force on 14 August 2019, a significant number of low- and zero-emission vehicles will be required to meet the targets in 2025 and 2030.¹ Hence, this paper revises ACEA's initial estimates of the infrastructure requirements for heavy-duty vehicles.

Driven by the current regulatory framework, the electric motor will have to become a cornerstone of future drivetrain technology for commercial vehicles. However, the storage and supply of electricity to the electric motor will differ depending on the application, market and mission profile of a vehicle.

- Batteries that are charged when the vehicle is stationary are sufficient to accommodate a major portion of today's transport patterns. With a combination of private charging infrastructure (eg at depots), semi-public charging infrastructure (eg at logistics hubs, used by different operators) and public charging points, including fast-charging possibilities, the charging of stationary vehicles can fulfil the needs and market requirements for most applications, including long-haul transportation.
- In the longer term, in order to cover even more vehicle applications and use-cases, several other options for the on-board generation and transfer of electricity could be considered:
 - Range extenders for the internal combustion engine (ICE) powered by low-carbon or carbon-neutral fuels;
 - Hydrogen-powered fuel cells;
 - Electric road systems (ie roads supplying electricity to vehicles travelling on them).
- Specifications for battery size, stationary charging capacity and/or on-board power generation will have to be adapted to the specific vehicle application concerned and the

¹ Even higher, additional ambition levels have recently been announced as part of the European Green Deal. It is yet unclear, however, if and how these would affect the CO₂ targets set for heavy-duty vehicles. They have therefore not been considered in this estimation.

available infrastructure.

- The main parameters here are the relation between the needs and demands of the customer (regarding range, payload and vehicle utilisation) versus the availability of charging and re-fuelling infrastructure.
- Heavy-payload transport and long-haul operations require significantly more energy than, for example, regional distribution missions, thereby also increasing the need for the deployment of additional charging points that allow customers to charge their vehicles along the route.

The market uptake of electric and alternatively-powered vehicles will depend highly on the availability of energy infrastructure as well as supply and energy costs, ie the deployment of energy supply systems will massively influence the development of the market for these vehicles.

In addition to deploying public infrastructure, it is equally important to support the deployment of private (eg at depots) and semi-public (eg at logistics hubs) infrastructure, given the nature of heavy-duty vehicles (ie their mission profiles and use cases) and how this would affect operators of battery electric vehicles (BEVs).

ACEA believes that all energy-supply infrastructure systems currently considered will be required to reach the goal of carbon-neutral road freight transport by 2050. In that respect, also gas-powered trucks, and especially vehicles running on renewable fuels, will have to play an important role in this transition.

A broad and rapid shift from conventional diesel-powered vehicles to sustainable alternatives will only happen if these alternatives are competitive in terms of the customer's total cost of ownership (TCO) and lead to significantly better business cases for vehicle operators.

ESTIMATING INFRASTRUCTURE DEMAND

In order to estimate minimum infrastructure demand, assumptions had to be made with regard to the market uptake of low- and zero-emission vehicles (especially the number of battery electric and fuel-cell electric vehicles in operation by 2025 and 2030) and their usage patterns. However, in light of the strict competition law requirements that ACEA and vehicle manufacturers adhere to, specific strategies and/or technological pathways could not be considered nor discussed.

The ACEA position laid down here, should therefore be seen as a joint understanding among manufacturers of the minimum infrastructure requirements necessary to enable and facilitate the transition to carbon-neutral road transport.

Plug-in hybrids and buses and coaches have not (yet) been included in the scope of this paper. However, it is clear that city buses have distinct infrastructure requirements (depot, opportunity charging, etc), especially with regard to their location. Alternatively-powered coaches will also have specific needs when it comes to charging locations (to some extent), but have not been looked at in more detail at this stage.

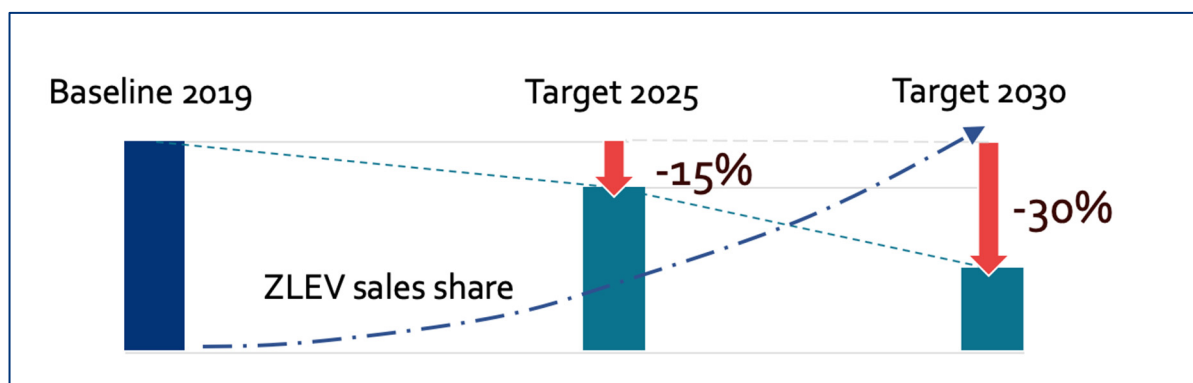
It is important to note that all assumptions made in this paper are conservative and would not lead to 'overcapacity' in charging points and/or re-fuelling stations, ie double counting is excluded. Although some uncertainties remain, the figures presented here should be seen as the minimum requirements. ACEA already has a high level of confidence in the minimum requirements and the number of required charging points for battery electric trucks as outlined in this paper. The estimates for fuel-cell electric trucks, on the other hand, are made with a different level of confidence. ACEA tries to closely monitor all relevant developments and will revise its estimates in the future as soon as new information becomes available.

Today, the vast majority of heavy-duty vehicles in operation across Europe run on diesel (98.3%), as it is the most convenient and affordable energy carrier for customers. So far, only a negligible number of alternatively-powered trucks are part of the current vehicle fleet – see table below.

European truck fleet, by fuel type						
	Petrol	Diesel	Hybrid electric	Battery electric (incl plug-in hybrid)	Natural gas	Other
Medium-duty and heavy-duty vehicles	1.0%	98.3%	0.02%	0.01%	0.4%	0.2%

Source: ACEA, Vehicles in Use - Europe 2019 (note: due to rounding errors the total is not 100%)

The regulation setting CO₂ standards for heavy-duty vehicles introduced important milestones for the pathway towards carbon-neutral road transport. Manufacturers are committed and obliged to increasingly put more low- and zero-emission vehicles on the market. However, almost none of the required charging points and re-fuelling stations are available today. Indeed, the widespread availability of dedicated infrastructure for trucks is one of the basic prerequisites for achieving the necessary market uptake of low- and zero-emission trucks required by this regulation.



INFRASTRUCTURE REQUIREMENTS

It is important to reiterate that the technical specifications of charging and re-fuelling infrastructure suitable for heavy-duty vehicles differ significantly from those for passenger cars. Because of their significantly higher power and energy demand, as well as the many parking spots required along all major routes in Europe, heavy-duty trucks cannot use infrastructure for passenger cars.

Battery electric truck infrastructure

In the truck segment, battery electric vehicles (BEVs) will be essential for the transition to carbon neutrality. Already by 2025 several thousand battery electric trucks will have to be put on the European market. By 2030, approximately 200,000 BEVs (>3.5t GVW) are estimated to be in operation in the European truck fleet. All of these vehicles will require (mostly private) depot charging stations and in addition to that – depending on their mission profiles – also public and/or semi-public charging points.

Semi-public chargers would be located in places that are not accessible to the general public, but which are used by a multitude of different transport operators. Think for example of logistics hubs, areas designated for truck charging, drop-off/pick-up locations, etc. To ensure the best possible utilisation of these charging points, ACEA members are ready to provide information on suitable locations for the installation of chargers based on expected movement patterns of electric trucks.

Publicly-accessible charging points			
	Currently available	Needed by 2025	Needed by 2030
DC <100 kW	<10*	4,000 (+20,000**)	50,000 (+200,000**)
DC 350 kW	0	11,000	20,000
DC >500 kW	0	2,000	20,000

* No detailed information available

** Depot charging, not publicly accessible

The following assumptions have been made with regard to the public charging requirements:

- Medium-duty vehicles will have to use public charging stations every fifth day of operation during daytime;
- Heavy-duty vehicles (for regional delivery) will have to use public charging points every second day during daytime;
- Heavy-duty vehicles (for long-haul) will charge daily (daytime) and every fifth day (during the night) at public charging stations.

Here the availability of infrastructure in general, and different power/capacity levels in particular, will result in various technical solutions. The current 'break points' are (roughly) 100kW (200A), 350kW (500A) and 750kW (1,000A). While some of the technical details are not known yet, it is clear though that under the current regulations and the existing business model (especially in long-haul transport) recharging for a four-and-a-half-hour drive may take no longer than 45 minutes. This (roughly) translates into a charging capacity of around 600 - 800kW.

Long-haul trucks in particular will require high-power charging stations of DC >500 kW. Hence, the fast implementation of standards for the high-power charging of commercial vehicles (HPCCV) with 1 - 3MW (currently developed as part of the CharIN initiative) is key to meeting plans for the electrification of long-haul transport.

Hydrogen truck infrastructure

Several truck manufacturers have announced the development of hydrogen fuel-cell electric trucks, especially with a view to medium- and long-haul missions. It is therefore equally important to begin the ramp up of hydrogen re-fuelling stations.

The estimates presented here are based on the current status of technology readiness and market development. At this stage a distinction between compressed and liquefied hydrogen is not being made. However, if hydrogen will be delivered in liquefied form to stations, both could technically be offered to customers. Also in this case, ACEA tries to closely monitor all relevant developments and will update its estimates as soon as new information becomes available in the future.

It is important to note that hydrogen (H₂) infrastructure for passenger cars cannot be used by trucks, given that the storage pressure is too low to meet the requirements of trucks. Long-haul trucks will require high pressure H₂ (700 bar) or liquified H₂ for those distances covered by conventional trucks today.

Publicly-accessible hydrogen stations			
	Currently available	Needed by 2025	Needed by 2030
H ₂ stations (compressed, liquified)	16 (350 bar, for buses)	50 at least	500 at least

Gas truck infrastructure

Thousands of natural gas-powered trucks are already part of the European fleet today, making a contribution to lowering CO₂ emissions from road freight transport. These vehicles will play an important role in the transition to carbon neutrality, especially considering the CO₂ reduction potential of renewable, low-carbon fuels like biogas.

Policy measures at member state level, growing confidence among transport operators and an

increasing number of filling stations have led to a significant market uptake of trucks powered by liquefied natural gas (LNG) in a number of EU member states.

However, truck-specific public fuelling stations for compressed natural gas (CNG) and LNG are currently available in some member states, but overall their distribution is still very patchy across the European Union. Today's LNG infrastructure mainly supports regional-haul operations in countries with filling stations. To support efficient long-haul and interregional transport a more comprehensive network of LNG filling stations is needed.

Publicly-accessible gas stations			
	Currently available	Needed by 2025	Needed by 2030
CNG stations	300	400	500
LNG stations	252	750 at least	1,500 at least

LNG filling stations should be suitable for both bio-LNG and LNG, thus able to handle renewable, low-carbon fuels. Filling stations should also support both spark ignition (SI) and compression ignition (CI) by providing both cold LNG (3-4 bar) and saturated LNG (7-9 bar), as well as supporting different vent-to-station procedures. Work is currently ongoing to further simplify the refuelling process (CEN326, together with NVGA Europe).

POLICY RECOMMENDATIONS

- ACEA believes that specific, binding targets for the deployment of charging and re-fuelling infrastructure suitable for heavy-duty vehicles, buses and coaches must be included in the EU's Alternative Fuels Infrastructure Directive (AFID).
- It is essential that sufficient truck- and bus-specific electric charging points, hydrogen (LH₂/CH₂) and gas (CNG/LNG) stations are available across the EU at the latest by 2025, and that their number increases significantly by 2030.
- Missing technical standards have to be defined urgently and the necessary standardisation processes need to start immediately.
- These infrastructure investments will require significant financial support. Transport operators in particular should be incentivised to invest early in private and semi-publicly accessible depot charging stations.
- A broad and rapid shift from conventional diesel-powered vehicles to sustainable alternatives will only happen if these alternatives are competitive in terms of the customer's total cost of ownership (TCO) and lead to significantly better business cases for vehicle operators.
- ACEA therefore calls for a comprehensive and consistent policy framework, including the revision of the Eurovignette Directive.
- Likewise, a fully supportive fuel taxation framework is much needed, guaranteeing predictability and stability (at least in the medium term) and setting the right price signals.



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ABOUT THE EU AUTOMOBILE INDUSTRY

- 13.8 million Europeans work in the auto industry (directly and indirectly), accounting for 6.1% of all EU jobs.
- 11.4% of EU manufacturing jobs – some 3.5 million – are in the automotive sector.
- Motor vehicles account for €428 billion in taxes in the EU15 countries alone.
- The automobile industry generates a trade surplus of €84.4 billion for the EU.
- The turnover generated by the auto industry represents over 7% of EU GDP.
- Investing €57.4 billion in R&D annually, the automotive sector is Europe's largest private contributor to innovation, accounting for 28% of total EU spending.

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