



# Fully charged for 2030

Enough infrastructure for more electric trucks in 2030

April 2023

## Summary

Charging and refuelling infrastructure is often cited as the main obstacle for an obligation on truck manufacturers to ramp-up zero-emissions truck and bus sales more quickly. T&E has analysed the public charging infrastructure targets recently agreed under the new EU Alternative Fuel Infrastructure Regulation (AFIR), as well as the additional deployment plans in Germany, and compared public charging availability with the projected energy demand of the zero-emission heavy-duty vehicle (HDV) fleet in 2030. We found that AFIR will provide sufficient public charging infrastructure EU-wide to reduce the CO2 emissions from new HDVs by -65%, and will be more than enough for the -45% target proposed under the HDV CO2 standards by the European Commission.



**HDV-energy demand in 2030**

(T&E recommendations)



**Available charging energy in 2030**

**Notes:** Projected gross energy demand from HDVs in EU-27 (TTW) in 2030 that needs to be provided by public charging, based on T&E recommendations and available public charging energy.

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

AFIR obliges each EU member state to install a minimum of one charging hub exclusively for HDVs every 60 km (TEN-T core) to 100 km (TEN-T network) in each direction of travel by 2030. It represents the world's first law of its kind. Some member states have already announced they will go beyond AFIR. Based on AFIR and the infrastructure plans in the central truck transit country Germany, we project that an annual charging energy of 13.79 TWh will be available in 2030. This is under conservative assumptions such as a utilisation of high power chargers of only 4 hours per day.

To estimate the demand, we looked at the zero-emission sales targets of the HDV CO2 standards. The Commission has recently

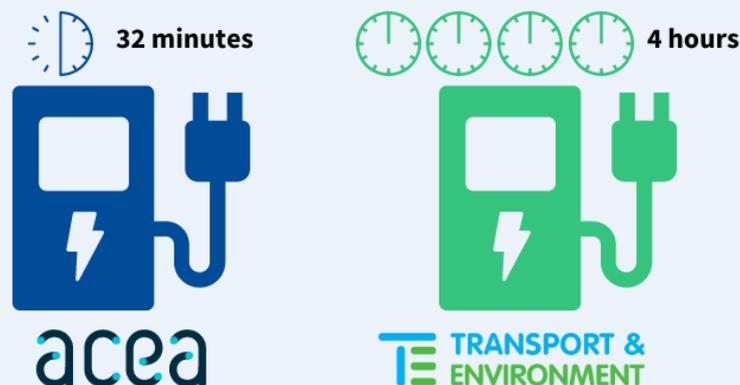
proposed a new 2030 target of -45% in 2030. This would lead to a public energy demand from the battery electric truck and coach fleet of 8.13 TWh, or 41% below the charging available under the new AFIR. This risks leaving a large proportion of the planned infrastructure unused, potentially undermining the business case of companies such as Milence. On the other hand, if EU lawmakers were to increase the CO2 target for 2030 to -65%, the HDV fleet would have a charging energy need of 14.25 TWh, much closer to what the AFI will provide. The projected infrastructure would then be capable of supplying 97% of the required public charging demand.

AFIR will also lead to the deployment of sufficient hydrogen refuelling infrastructure. Under the assumption of a -65% target in 2030, the hydrogen powered HDV-fleet is expected to require 344,000 tonnes of hydrogen annually by 2030. The mandated targets in AFIR alone will provide 337,000 tonnes per year, covering 98% of the needs.

Beyond Germany, this analysis does not take into account the plans of other member states - such as the Netherlands and Austria - whose charging plans also go beyond their respective obligations under the AFIR. In addition, a number of private Charging Point Operators (CPOs) are ready to deploy truck charging infrastructure on a large scale in the next couple of years. It is therefore very likely that this analysis is on the conservative side of what charging infrastructure will be available in 2030.

Finally, we looked into recommendations made by truck makers for the deployment of public charging infrastructure. Their demands would lead to a total installed charging power of 30.25 GW in 2030, meaning the infrastructure would be able to power a fleet of electric trucks almost 4.2 times the projected size in 2030. This recommendation entirely disregards the fact that many electric trucks will charge at private locations. If the ACEA recommendation were to materialise, it could potentially have adverse effects on charging businesses who invest in heavy-duty vehicle charging infrastructure. This is mainly due to the expected low utilisation of the charging equipment (just 32 minutes each day). As a result, there may be a considerable risk of financial loss, which may prompt the need for costly public subsidies funded by taxpayers.

Daily utilisation of public high power chargers



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

MEPs and EU-governments can ramp up CO2 reduction targets for trucks in 2030 as high as -65% with confidence that there will be enough charging available. In fact, clean truck targets adequate to the expected availability of charging infrastructure are key for efficient utilisation and subsequently the business case for CPOs.

# Table of Contents

<b>1. How much charging infrastructure will be available?.....</b>	<b>5</b>
1.1 AFIR: What's in it?.....	5
1.2 Additional roll-out plans.....	6
<b>2. Available charging energy.....</b>	<b>7</b>
2.1 Split between high power chargers and overnight chargers.....	8
2.2 Assumed utilisation rates.....	8
<b>3. How much energy will the HDV-fleet need in 2030?.....</b>	<b>9</b>
3.1 Scenarios and energy consumption.....	9
3.2 Public energy demand.....	11
<b>4. Sufficiency of available infrastructure in 2030.....</b>	<b>12</b>
4.1 Excess infrastructure calls for higher 2030 HDV CO2 target.....	12
4.3 Truck makers' claims threaten to thwart CPOs' business case.....	14
<b>4. Recommendations.....</b>	<b>16</b>
<b>Annex - EUTRM.....</b>	<b>17</b>

# 1. How much charging infrastructure will be available?

On March 28th, 2023, the European Parliament and EU governments came to an agreement on the Alternative Fuels Infrastructure Regulation (AFIR)<sup>1</sup>. This landmark legislation establishes compulsory minimums for the installation of truck-charging infrastructure across Europe and represents the world's first of its kind.

## 1.1 AFIR: What's in it?

The truck charging infrastructure will be situated alongside the Trans-European Transport Network (TEN-T)<sup>2</sup>, which spans over 108,000 km of roads across the EU. As per the AFIR, member states are required to install a minimum of one charging hub exclusively for HDVs every 60 km (TEN-T core) to 100 km (TEN-T network) in each direction of travel by 2030.



Figure 1<sup>3</sup>: TEN-T core and comprehensive network (bold red: core, yellow: urban nodes)

Each charging hub needs to have a certain minimum power output that increases over time, meaning they will be able to serve a growing number of trucks at higher charging speed. In addition, the

<sup>1</sup> European Council (2023). Alternative fuel infrastructure: Provisional agreement for more recharging and refuelling stations across Europe. Retrieved from: <https://www.consilium.europa.eu/en/press/press-releases/2023/03/28/alternative-fuel-infrastructure-provisional-agreement-for-more-recharging-and-refuelling-stations-across-europe/>

<sup>2</sup> European Union (2021). TEN-T regulation. Retrieved from: <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=COM%3A2021%3A812%3AFIN>

<sup>3</sup> European Commission (2023). TEN-T interactive map viewer. Retrieved from: <https://ec.europa.eu/transport/infrastructure/tentec/tentec-portal/map/maps.html>

agreement reached will mean that every major city<sup>4</sup> in the EU needs to install a certain number of charging stations for HDVs. Finally the so-called *Safe and Secure Truck Parking Areas*<sup>5</sup> along the TEN-T roads will also need to be equipped with a certain number of charging stations. In total, AFIR could lead to HDV charging opportunities at almost 4,000 different locations across the whole continent. (Figure 3 summarises the targets for the years 2025 - 2030).

	2025	2027	2030	Number of Charging hubs
<b>TEN-T core</b>	At least every 120 km: 15% of the network with 1,400 kW/hub	At least every 120 km: 50% of the network with 2,800 kW/hub	At least every 60 km: whole network with 3,600 kW/hub	1565
<b>TEN-T non-core</b>	At least every 120 km: 15% of the network with 1,400 kW/hub	At least every 120 km: 50% of the network with 1,400 kW/hub	At least every 100 km: whole network with 1,500 kW/hub	1239
<b>Urban nodes</b>		900 kW	1,800 kW	424
<b>SSTPA</b>		200 kW	400 kW	726

Figure 2: HDV-charging infrastructure AFIR

The AFIR establishes targets for hydrogen refuelling stations (HRS) as well. According to the new regulation, member states must ensure that at least one HRS every 200 km along the TEN-T core network is ready for use by 2030. Additionally, each urban node must be equipped with one HRS. In total, this will likely result in 659 publicly accessible HRS. Assuming that these refuelling stations have a capacity of 2 tonnes per day, we estimate a theoretical daily capacity of 1317 tonnes of hydrogen in total.

## 1.2 Additional roll-out plans

The AFIR is not the sole effort driving progress in the deployment of truck charging infrastructure. Some member states<sup>6</sup>, particularly Germany, have taken the lead by developing additional national deployment plans. The 'Nationale Leitstelle Ladeinfrastruktur' (NLL), operating under the purview of the Federal Ministry for Digital and Transport and in alignment with the Charging Masterplan II<sup>7</sup>, is spearheading an ambitious plan to establish a robust network of public charging infrastructure for HDVs<sup>8</sup> with the aim of putting it out for tendering this year<sup>9</sup>. What sets the German plan apart is its substantial expansion beyond the AFIR-targets Germany is already obligated to meet. The NLL has based its objectives on a thorough analysis of projected demand from the expected fleet of zero-emission HDVs<sup>10</sup>, as well as actual

<sup>4</sup> AFIR sets requirements for each so-called 'urban nodes'. The TEN-T regulation has a list of 424 urban nodes across the EU.

<sup>5</sup> European Union (2022). EU standards for safe and secure parking areas for trucks. Retrieved from: ([https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13257-Road-transport-EU-standards-for-safe-and-secure-parking-areas-for-trucks\\_en](https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13257-Road-transport-EU-standards-for-safe-and-secure-parking-areas-for-trucks_en))

<sup>6</sup> Other member states such as the Netherlands and Austria are also set to come up with deployment plans.

<sup>7</sup> The Federal Government (2023). Charging Masterplan II. Retrieved from: ([https://nationale-leitstelle.de/wp-content/uploads/2023/01/Masterplan-Ladeinfrastruktur-II-der-Bundesregierung\\_Englisch\\_DIN\\_A4\\_barrierefrei.pdf](https://nationale-leitstelle.de/wp-content/uploads/2023/01/Masterplan-Ladeinfrastruktur-II-der-Bundesregierung_Englisch_DIN_A4_barrierefrei.pdf))

<sup>8</sup> NOW GmbH (2022). Aktivitäten zur Nutzfahrzeugladeinfrastruktur. Retrieved from: ([https://www.now-gmbh.de/wp-content/uploads/2022/11/NFZ22\\_Aktivitaeten-zur-Nutzfahrzeug-Ladeinfrastruktur\\_Lahmann.pdf](https://www.now-gmbh.de/wp-content/uploads/2022/11/NFZ22_Aktivitaeten-zur-Nutzfahrzeug-Ladeinfrastruktur_Lahmann.pdf))

<sup>9</sup> The Federal Government (2023). Charging Masterplan II.

<sup>10</sup> NOW GmbH (2023). New NOW publication: Market development of climate-friendly technologies in heavy road freight transport. Retrieved from: (<https://www.now-gmbh.de/en/news/pressreleases/new-now-publication-market-development-of-climate-friendly-technologies-in-heavy-road-freight-transport/>)

traffic data gleaned from the German truck-tolling system. Building on the distance-based targets prescribed by AFIR, the plan aims to construct charging hubs with varying power outputs to match the local charging demand with the necessary charging infrastructure.

Other member states, such as the Netherlands<sup>11</sup> and Austria<sup>12</sup> are working on national deployment plans that go beyond AFIR. More member states are expected to develop this in the coming years. Besides countries, private actors are making roll-out plans. The Charge Point Operator (CPO) and truck-OEM joint venture Milence<sup>13</sup> for instance plans to deploy 1,700 HDV chargers by 2027 alone. This means that the actual installed public charging power in 2030 will be significantly higher than what AFIR has set into law.

The AFIR targets<sup>14</sup> will result in a total installed charging power<sup>15</sup> of 8.55 GW by 2030. On top of that the German truck-charging infrastructure roll-out plans are likely to deliver another 1.83 GW resulting in a total available installed power of 10.37 GW across Europe by 2030 and could amount to more than 48,000<sup>16</sup> chargers by 2030.

## 2. Available charging energy

To estimate the available charging energy the installed charging infrastructure is likely to deliver, assumptions about the utilisation have to be made. Various factors can greatly impact the actual amount of energy available. To address this, T&E has adopted a cautious approach in its assumptions for these variables. The assumptions taken align with the more conservative estimates held among the majority of stakeholders. These assumptions are also consistent with those used in T&E's previous reports on truck charging.<sup>17</sup> The analysis takes only the actual AFIR-targets and the German deployment plans into account. Germany is by far the biggest transport market<sup>18</sup> and its location in the centre of the European Union makes it the number one transit country for a large portion of the overall road transport activity in Europe.

---

<sup>11</sup> LOLA (2023). Boosting a nationwide publicly accessible fast charging network for freight transport. Retrieved from: <https://logistiekladen.nl/en/locations/>

<sup>12</sup> BMK (2023). Masterplan Güterverkehr. Retrieved from:

<https://www.bmk.gv.at/themen/mobilitaet/transport/gueterverkehr/masterplan.html> The masterplan mentioned that Austria is likely to mandate more truck charging infrastructure than what it is obliged to deploy because of AFIR.

<sup>13</sup> Milence (2022). Milence charging network accelerates Europe's shift to fossil-free road transport. Retrieved from: <https://milence.com/news/milence-accelerates-europes-shift/> Milence is a joint venture by the TRATON Group, the Volvo Group and Daimler Truck and plans to roll out 1,700 HDV-chargers across Europe by 2027 alone.

<sup>14</sup> In this analysis we assume that targets apply without the exemptions that are possible albeit optional under the AFIR-agreement.

<sup>15</sup> Total power that is theoretically available at the same time

<sup>16</sup> Assuming that 2/3 of the installed chargers will be high power chargers, with an average nominal power output of 500 kW and 1/3 overnight chargers, with an average nominal power output of 100 kW.

<sup>17</sup> Transport & Environment (2021). Unlocking electric truck charging along highways. Retrieved from: <https://www.transportenvironment.org/discover/unlocking-electric-trucking-eu-recharging-along-highways/>

<sup>18</sup> Eurostat (2022). Road freight transport statistics Retrieved from:

[https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Road freight transport statistics#In 2021.2C Germany.2C France.2C Spain.2C Poland and Italy accounted for almost two thirds of the total tonnage transported in the EU](https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Road_freight_transport_statistics#In_2021.2C_Germany.2C_France.2C_Spain.2C_Poland_and_Italy_accounted_for_almost_two_thirds_of_the_total_tonnage_transported_in_the_EU)

## Installed power (GW) and available energy (TWh)

Installed charging power refers to the total amount of power that can be delivered by the charging infrastructure at any given time, while available energy in TWh (1,000 GWh) refers to the amount of energy that is supplied by the charging infrastructure (to the battery electric truck fleet) over a certain period of time (here annually).

### 2.1 Split between high power chargers and overnight chargers

Truck drivers have to stop for 45 minutes every 4.5 hours because of the EU's driving and rest time regulation<sup>19</sup>. After a maximum daily driving period of 9 hours, an 11 hours rest period is required. These breaks and rest periods provide the ideal opportunity to charge the trucks, either fast during the day (opportunity charging) or longer overnight.

We assume that 2/3th of the power that needs to be deployed by 2030 will be high power chargers (HPC<sup>20</sup>) for opportunity charging. This means individual charging points of 350 kW and more (and once they become available in 2024: Megawatt Charging System (MCS) chargers of 700 kW and more<sup>21</sup>). The remaining 1/3th of the installed power on the other hand will be deployed for overnight use, where vehicles charge at slower speed and we assume an average power output of only 100 kW per charging point. These power need assumptions are largely in line with a recent publication by Fraunhofer ISI<sup>22</sup> and corresponds to the truck-charging deployment plans in Germany<sup>23</sup>.

### 2.2 Assumed utilisation rates

For the high power opportunity chargers we assume that each charger serves 5 - 6 trucks per day for 45 min<sup>24</sup>. This results in an average utilisation of 4 hours per charging point per day. This utilisation is likely to be higher in the future due to an increased fleet size and activity. Furthermore, CPOs will try to maximise utilisation rates in order to improve the profitability of their charging network. For overnight chargers we assume that those HDVs that do not return to the depot will use their mandatory daily rest period of 11 hours to recharge their battery in this time window. On average we assume that each of these overnight charging points is used for 7 hours per day.

<sup>19</sup> EU (2020). Regulation (EC) No 561/2006. Retrieved from: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32006R0561>

<sup>20</sup> CCS chargers of 350 kW + MCS chargers

<sup>21</sup> Inside EVs (2022). CharIN Officially Launches The Megawatt Charging System (MCS). Retrieved from: <https://insideevs.com/news/592360/megawatt-charging-system-mcs-launch/>

<sup>22</sup> Shoman, Yeh, Sprei et.al (2023). Public charging requirements for battery electric long-haul trucks in Europe: a trip chain approach. Retrieved from: <https://publica-rest.fraunhofer.de/server/api/core/bitstreams/bd314b3f-f21a-4e73-bd32-48ff6a8d022a/content>

<sup>23</sup> NOW GmbH (2022).

<sup>24</sup> The mandatory break time after 4.5 h of driving in the European Union in line with the driving and rest time rules

For all charging points it is assumed that they operate with an efficiency (difference between the theoretical power output of the charger and the average energy that is delivered) of 85%<sup>25</sup>. The uptime is set to be at 6 days per week. The rest of the time the chargers are assumed to be either out of service, or under maintenance. It has to be noted, that an uptime of 86% is considered to be quite low to maximise the efficiency of the charging network. Higher uptimes are desirable and achievable.

Assumptions		
	HPC	Overnight chargers
Share of installed capacity	2/3	1/3
Charging efficiency	85%	85%
Utilization (h/day)	4 h	7 h
Uptime (h/year)	7509 h	7509 h
Share of public charging		30%

Figure 3: Assumptions on the infrastructure utilisation

Based on ICCT’s assumptions, our analysis assumes that on average the installed HRS are used at 70%<sup>26</sup> of their theoretical capacity which results in an adjusted output of 922 tonnes per day and 337,000 tonnes annually across all mandated HRS.

### 3. How much energy will the HDV-fleet need in 2030?

To estimate how many zero-emission HDVs the installed infrastructure can serve, we used T&E's EU Transport Roadmap Model (EUTRM)<sup>27</sup>. It models the composition of Europe's HDV fleet to assess the impact of the CO2 emission standards on the fleet composition, zero-emission vehicle (ZEV) uptake, energy consumption and CO2 emissions.

#### 3.1 Scenarios and energy consumption

While we know the minimum level of charging infrastructure that will be built across Europe since the AFIR agreement, the minimum level of zero-emission vehicle sales in the next decades is only just now being negotiated at EU level. In February, the Commission brought forward its proposal to review the HDV CO2 standards<sup>28</sup> which will determine the pace of zero-emission sales and the resulting energy needs of the fleet. Based on the EUTRM, the future electricity demand from electric trucks, buses and coaches was

<sup>25</sup> ICCT (2022). A review of the AFIR proposal. Retrieved from: <https://theicct.org/wp-content/uploads/2022/03/review-afir-public-infrastructure-to-support-transition-to-zero-emission-truck-fleet-eu-mar22.pdf>

<sup>26</sup> ICCT (2022). Fuel-cell hydrogen long-haul trucks in Europe: a total cost of ownership analysis. Retrieved from: <https://theicct.org/wp-content/uploads/2022/09/eu-hvs-fuels-evs-fuel-cell-hdvs-europe-sep22.pdf>

<sup>27</sup> Transport & Environment (no date). Transport emissions: modelling and analysis. Retrieved from: <https://www.transportenvironment.org/transport-emissions-modelling-and-analysis/>

<sup>28</sup> European Commission (2023). Proposal for amending Regulation (EU) 2019/1242 as regards strengthening the CO<sub>2</sub> emission performance standards for new heavy-duty vehicles. Retrieved from: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52023PC0088&qid=1679592468900>

calculated for four different ambition levels regarding the recently proposed HDV CO2 standards which includes one scenario based on T&E's recommendations as laid out in its position paper<sup>29</sup>:

- **'Commission proposal'**: CO2 targets for trucks and coaches of -15% in 2025, -45% in 2030, -65% in 2035 and -90% in 2040, as well as a 100% ZEV target in 2030 for urban buses (and no targets for vocational and non-certified vehicles)
- **'Commission proposal +'**: CO2 targets of -15% in 2025, -50% in 2030, -70% in 2035 and -95% in 2040, 100% ZEV target in 2030 for urban buses (and no targets for vocational and non-certified vehicles)
- **'Commission proposal ++'**: CO2 targets of -15% in 2025, -55% in 2030, -75% in 2035 and -95% in 2040, 100% ZEV target in 2030 for urban buses (and no targets for vocational and non-certified vehicles)
- **'T&E recommendations'**: CO2 targets of -15% in 2025, -65% in 2030, -100% in 2035 for freight trucks and -100% in 2040 for all vehicles (including vocational and non-certified vehicles), 100% ZEV target in 2027 for urban buses

The EUTRM<sup>30</sup> calculates the final (or 'tank-to-wheel') electricity demand from electric trucks and buses. To estimate the gross (i.e. 'well-to-wheel') electricity demand from electric vehicles, grid transmission and distribution losses need to be accounted for. These were quantified at 6% based on previous work on efficiency losses.<sup>31</sup>

Based on these input assumptions and the most ambitious scenario ('T&E recommendations') which also includes targets for vocational and non-certified trucks which are not regulated under the Commission proposal, it is expected that electrifying trucks and buses would lead to an additional gross electricity demand across the EU per year of 57 TWh by 2030, 301 TWh by 2040, and 411 TWh by mid century.

This is then compared against the projected annual renewable electricity generation in the EU. Today, Europe's electricity grid is already 39% renewable.<sup>32</sup> Based on the already adopted policies by EU member states, the energy think tank *Ember*<sup>33</sup> projects that 63% of the EU's electricity generation will be renewable by 2030, 82% by 2040, and 89% by 2050.

Figure 4 shows that even under an ambitious scenario with a -65% CO2 target in 2030 and a -100% in 2035 for all freight trucks (and a 100% target in 2040 for vocational and non-certified vehicles), HDVs will only

---

<sup>29</sup> Transport & Environment (2023). Truck CO2: Europe's chance to lead. Position paper on the CO2 standards for heavy-duty vehicles. Retrieved from: <https://www.transportenvironment.org/discover/truck-co2-europes-chance-to-lead/>

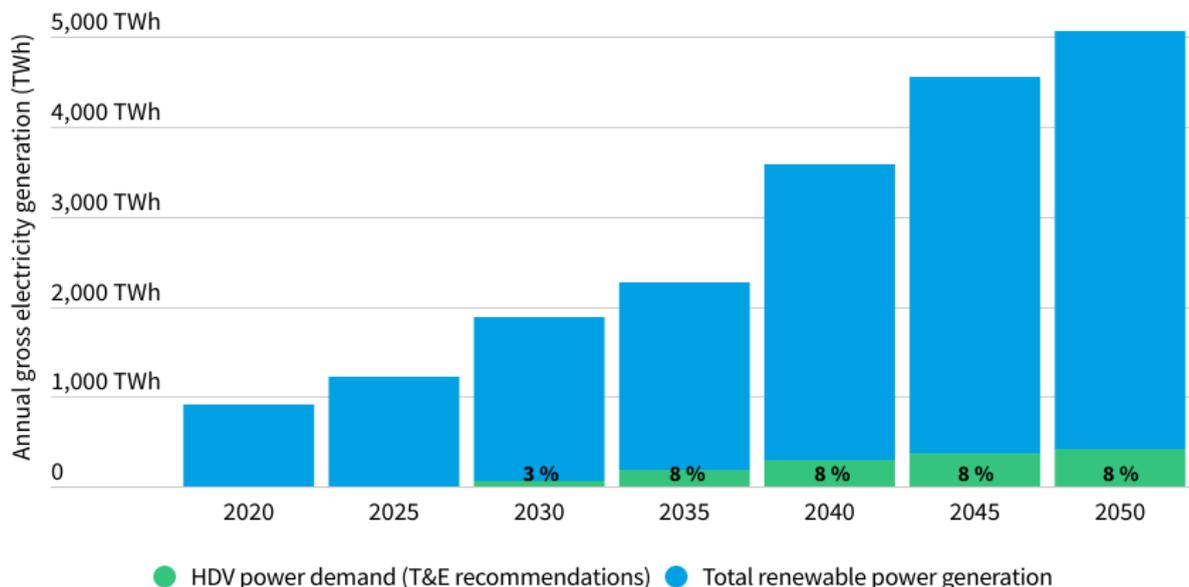
<sup>30</sup> A more detailed explanation of how the EUTRM works can be found in the Annex

<sup>31</sup> Transport & Environment (2020). Electrofuels? Yes, we can ... if we're efficient. Retrieved from: <https://www.transportenvironment.org/discover/electrofuels-yes-we-can-if-were-efficient/>

<sup>32</sup> European Union (2022). EU energy in figures. Statistical pocketbook 2022. Retrieved from: <https://op.europa.eu/en/publication-detail/-/publication/7d9ae428-3ae8-11ed-9c68-01aa75ed71a1/language-en>

<sup>33</sup> Ember (2022). European Clean Power Pathways Explorer. Stated Policy scenario. Retrieved from: <https://ember-climate.org/data/data-tools/european-clean-power-pathways-explorer/>

marginally increase the total renewable energy demand in Europe. From the mid 2030s onwards, around 8% of the projected renewable electricity generation will be due to electric trucks, buses and coaches. As the EUTRM calculates that the vast majority of the legacy fleet will have been replaced by 2050, this energy demand will only grow marginally after mid-century.



**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).

Figure 4: Energy demand from electric trucks and buses in the EU

### 3.2 Public energy demand

The majority of truck charging will occur at private or semi-public locations such as depots and logistic centres. While there is no clear consensus among stakeholders on the exact share, charging at public locations is expected to range between 10-40%<sup>34</sup>. It is mostly the long-haul trucks, which operate for multiple days or weeks without returning to their depot, that will need public charging. Most trucks in Europe however drive less than 500 km a day and do return to their depot overnight. For those, private charging offers a number of distinct advantages. First of all private charging will likely remain the more cost effective option. Fleet operators can tailor their number of charging points to the number of HDVs, ensuring optimal utilisation of each charging point. Moreover, private charging typically occurs at slower charging speeds of 50-100 kW, which places less strain on the grid and thus requires a smaller sized grid connection.

<sup>34</sup> Based on conversations with various stakeholders.

In this analysis we estimate that approximately 70% of the electricity delivered to the truck fleet will be charged at these private locations. Urban buses are excluded from the scope of this analysis as it is reasonable to assume that 100% of their charging will occur at the depot. Under the 'T&E recommendations' scenario the battery electric HDV fleet will have a public final energy demand of 14.25 TWh in 2030.

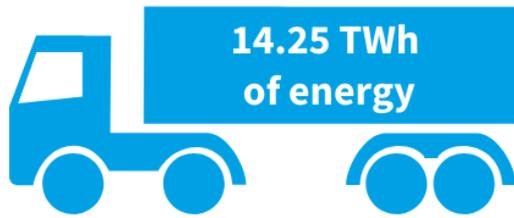
Hydrogen-powered HDVs on the other hand are assumed to be only refuelled at publicly accessible HRS since private HRS will likely remain the exception. Our analysis estimates that the projected fleet of hydrogen-powered vehicles will have an annual energy demand of 344,000 tonnes of hydrogen in 2030 under the 'T&E recommendations' scenario.

## **4. Sufficiency of available infrastructure in 2030**

Now that we calculated in section 2 how much charging energy will be available and in section 3 how much energy the fleet will need under different policy scenarios, we can calculate which policy scenarios are feasible from a charging infrastructure point of view. The results show that the ambition level under the HDV CO<sub>2</sub> standards can be significantly increased for 2030 based on the available charging infrastructure: from the current -45% CO<sub>2</sub> reduction target to -65%. Below we first look at the sufficiency of charging infrastructure and then of refuelling infrastructure.

### **4.1 Excess infrastructure calls for higher 2030 HDV CO<sub>2</sub> target**

Based on the aforementioned assumptions we estimate that the total available energy that will be available annually through the publicly accessible EU truck charging network amounts to 13.79 TWh by 2030. The Commission's proposal for the HDV CO<sub>2</sub> standards on the other hand would only lead to an electricity demand from HDVs of 8.13 TWh. This means that we would be over dimensioning the charging network in 2030. If on the other hand the ambition level for 2030 under the CO<sub>2</sub> standards is increased and truck manufacturers are required to meet a -65% CO<sub>2</sub> target by 2030, the public charging demand of the total fleet of battery electric HDVs (excluding buses) in 2030 will amount to 14.25 TWh.



**HDV energy-demand in 2030**  
(T&E recommendations)



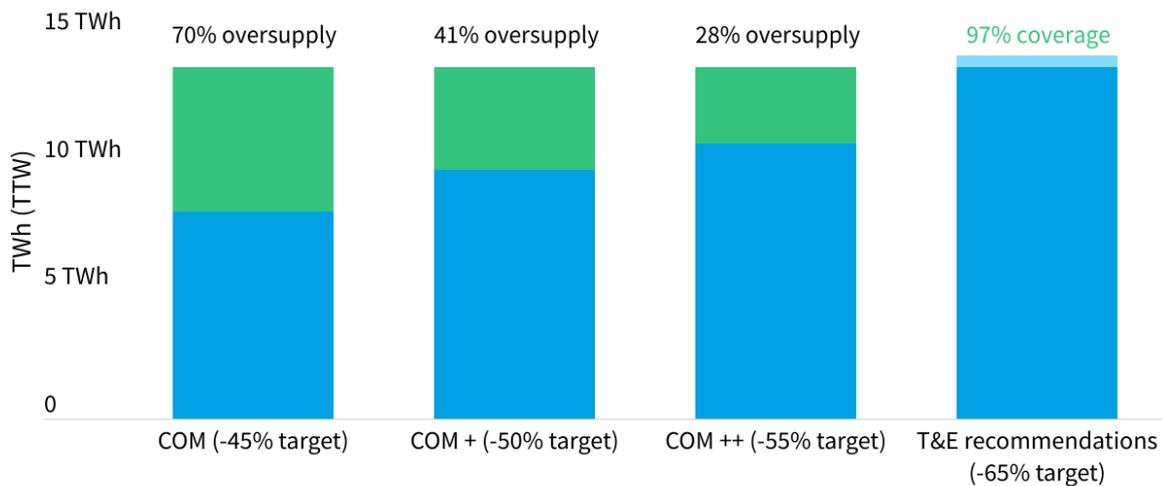
**Available charging energy in 2030**

**Notes:** Projected gross energy demand from HDVs in EU-27 (TTW) in 2030 that needs to be provided by public charging, based on T&E recommendations scenario and available charging energy (AFIR+DE).

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

Figure 5: Enough charging infrastructure to set a -65% CO2 target for 2030 under the HDV CO2 standards

This means that the known deployment plans are de facto sufficient to fully charge the electric truck fleet in 2030 under the ‘T&E recommendation scenario’<sup>35</sup>. The Commission proposal could potentially result in an underutilisation of the charging network and thus undermine the financial sustainability of CPOs.



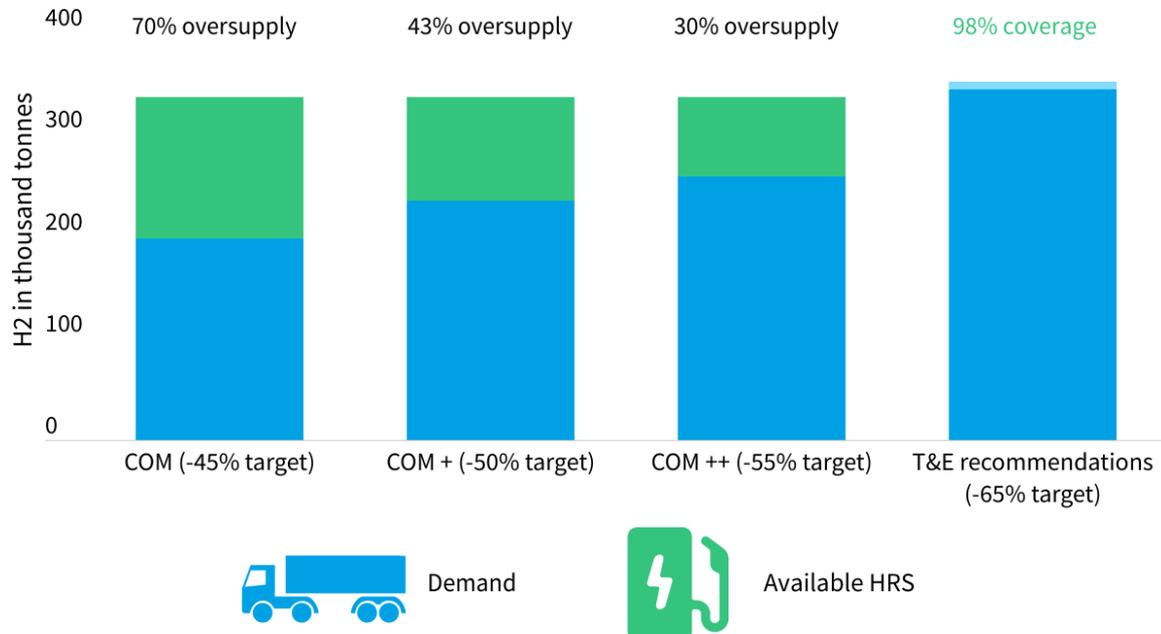
**Notes:** Projected gross energy demand from HDVs in EU-27 (TTW) in 2030 that needs to be provided by public charging and available charging energy.

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

Figure 6: Charging demand vs. availability for 2030

<sup>35</sup> Results vary from member state to member state. While some member states will need to build more than they are obliged due to AFIR, others will briefly overbuild the infrastructure. This is due to the ‘once size fits it all’ approach of the AFIR. A revision of the regulation in 2026 needs to address this and ideally change the target methodology to a demand and traffic based approach.

The anticipated fleet of fuel cell electric vehicles (FCEV) will require 344,000 tonnes of hydrogen annually by 2030. The mandated targets in AFIR alone will be able to provide 337,000 tonnes of hydrogen per year. This is enough to cover almost 98% of the hydrogen needs for a scenario with a -65% CO2 target in 2030. Similar to the charging infrastructure, lower CO2 targets for 2030 might lead to quite a significant underutilization of the deployed HRS infrastructure.



**Notes:** Projected gross energy demand from HDVs in EU-27 in 2030 that needs to be provided by hydrogen refueling stations and available hydrogen refueling capacity.

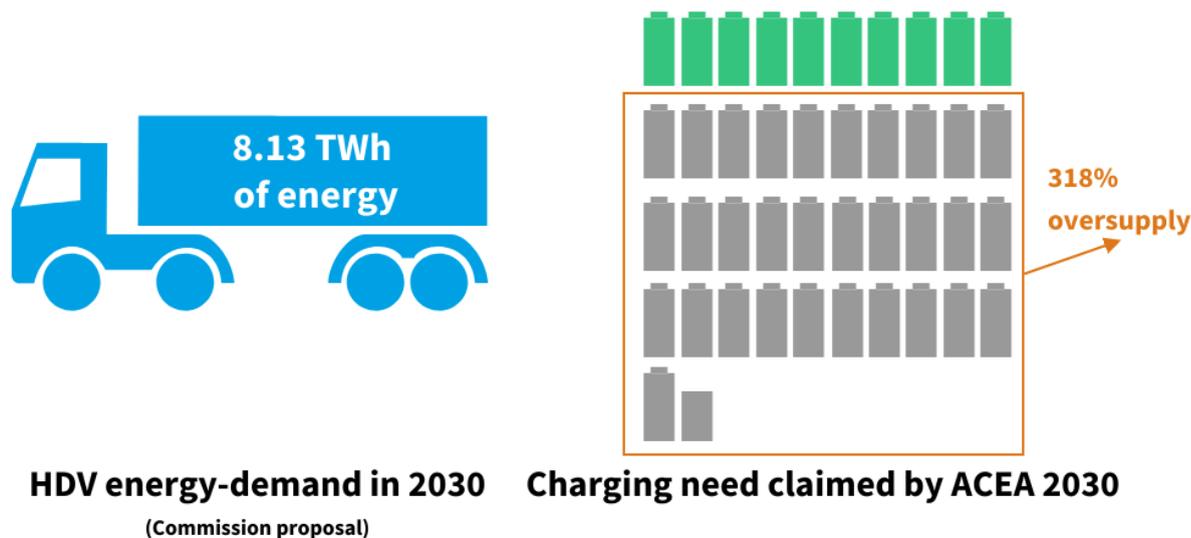
**Sources:** T&E calculations based on T&E (2022), EU (2023).

Figure 7: Hydrogen refuelling demand vs. availability in 2030

### 4.3 Truck makers' claims threaten to thwart CPOs' business case

As previously mentioned, most stakeholders take similar assumptions to those used in this analysis, with some minor deviations. However, the European Automobile Manufacturers' Association (ACEA), which represents all major European HDV manufacturers, has called for a significantly higher number of public charging points. ACEA claims<sup>36</sup> that by 2030, 50,000 public accessible charging points for HDVs would be necessary to cover the energy needs if truck makers were obliged to reduce their fleet's CO2 emissions in line with the Commission's proposal of -45% by 2030. They argue that 35,000 of these charging points should have a power output of at least 800 kW, while the remaining 15,000 charging points would be overnight chargers with a power output of 150 kW each. This would lead to a total installed charging power of 30.25 GW in 2030.

<sup>36</sup> ACEA (2023). AFIR: 'Infrastructure gap' will limit CO2 reductions from road transport. Retrieved from: <https://www.acea.auto/press-release/afir-infrastructure-gap-will-limit-co2-reductions-from-road-transport/>

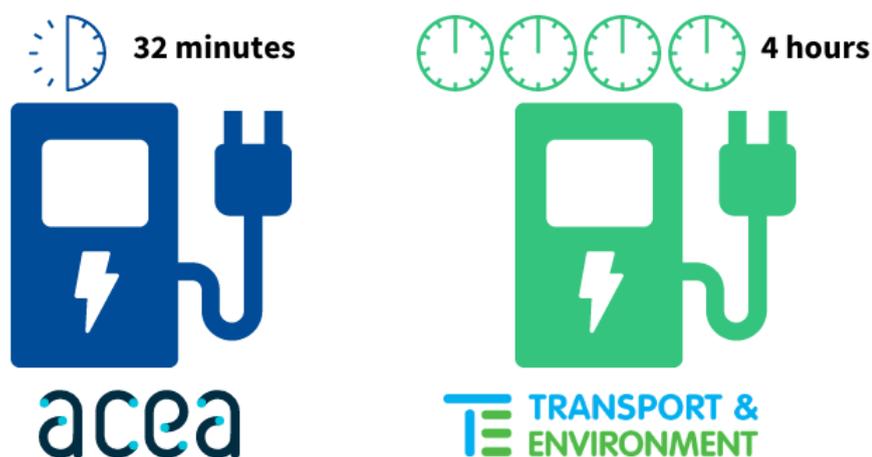


**Notes:** Projected gross energy demand from HDVs in EU-27 (TTW) in 2030 that needs to be provided by public charging, based on the Commission proposal scenario and needed charging energy claimed by ACEA.

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

Figure 8: Available charging energy 2030 (ACEA)

According to T&E analysis, this proposal would result in a level of infrastructure that could power a fleet almost 4.2 times the projected size in 2030, disregarding the fact that many electric trucks will charge at private locations entirely. In reality this would mean that each HPC would only be used for a mere 32 minutes each day. The deployment of a charging infrastructure of this magnitude would require oversized grid connections, which would further increase the strain on the grid and the costs involved. As a result, this would make any business model of CPOs impossible or require significant amounts of public funding, not only for deploying the charging infrastructure but also for operating it. Alternatively, it could dramatically increase the charging price and, in turn, harm the economics of operating an electric truck.



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

Figure 9: Utilisation high power chargers (ACEA)

## 4. Recommendations

Alternative fuel infrastructure is often cited to be the main obstacle for a quicker transition towards zero-emissions in the road freight sector. EU lawmakers have however largely removed that obstacle with their agreement on the charging and refuelling infrastructure regulation (AFIR). The opportunity to significantly strengthen the 2030 target within the CO2 standards for heavy-duty vehicles should not be missed. Our analysis shows that it is possible to increase the target from the -45% proposed by the Commission to -65% without danger that not enough public charging infrastructure would be available. On the contrary, leaving the Commission proposal unchanged would lead to underused infrastructure and tougher business cases for charge point operators. The charging needs put forward by the ACEA, the association of truck manufacturers, overestimate the 2030 truck fleet by 4.2 times or would lead to an oversized infrastructure that would hardly be used.

After 2030, infrastructure targets should continue to align with the projected uptake of zero-emission HDVs. This should be prominently addressed in the already foreseen 2024 review of the AFIR and subsequently in the revision in 2026. The further in the 2030s, the less we will need to rely on infrastructure targets and the more market forces will ensure the infrastructure follows the zero-emission fleet uptake.

## Further information

Fabian Sperka

Vehicles policy manager

Transport & Environment

[fabian.sperka@transportenvironment.org](mailto:fabian.sperka@transportenvironment.org)

Mobile: +32 486 17 10 85

## Annex - EUTRM

Historical data on activity and growth projections (in tonne-kilometres for trucks and passenger-kilometres for buses and coaches) are extracted from the EU Reference Scenario<sup>37</sup>, and split across the above mentioned categories using the proportions from TRACCS data relative to the 2005-2010 period<sup>38</sup>. Since both sources refer to activity as per country where the vehicles are registered, a matrix switching from registration to territorial activity has been applied to the dataset using data from the EU Statistical Pocketbook<sup>39</sup>. A more detailed description of the methodology can be found in a previous publication.<sup>40</sup>

The EUTRM has been expanded to include the same vehicle types as defined in the VECTO certification regulation<sup>41</sup>: It differentiates between small, medium and heavy trucks, vehicles with special axle combinations, vocational and non-certified vehicles as well as urban buses and coaches.

The EUTRM also takes into account the gradual energy efficiency improvements of diesel, electric and hydrogen trucks through improved aerodynamics, reduced rolling resistance and weight reduction based on vehicle modelling from a previous report by TNO.<sup>42</sup>

In terms of the share between battery electric (BEVs) and fuel cell electric vehicles (FCEVs), the EUTRM assumes that 100% of sales of small and medium trucks as well as urban buses will be BEVs, 90% of heavy trucks will be BEVs and 10% FCEVs, 80% of vocational and non-certified vehicles will be BEVs and 20% FCEVs, and 50% of coaches will be BEVs and 50% FCEVs. These sales assumptions are also largely based on the report by TNO mentioned above.

Aggregating this for the sales split between the vehicle segments, this results in an overall split of around 90% BEV and 10% FCEV sales. This is comparable to the recently published sales forecasts by European vehicle manufacturers based on official talks with German government authorities - the so-called

---

<sup>37</sup> European Commission (no date). EU Reference Scenario 2020. Energy. Retrieved from:

[https://energy.ec.europa.eu/data-and-analysis/energy-modelling/eu-reference-scenario-2020\\_en](https://energy.ec.europa.eu/data-and-analysis/energy-modelling/eu-reference-scenario-2020_en)

<sup>38</sup> European Commission (2013). Transport data collection supporting the quantitative analysis of measures relating to transport and climate change (TRACCS). Retrieved from: <https://tracccs.emisia.com/index.php>

<sup>39</sup> Eurostat. (n.d.). Statistical pocketbook 2021. Chapter 2.2: Performance of Freight Transport expressed in tonne-kilometres. Retrieved from:

[https://transport.ec.europa.eu/document/download/817097f1-8e8c-4208-a327-6329d1d79915\\_en?filename=pb2021-section22.xlsx](https://transport.ec.europa.eu/document/download/817097f1-8e8c-4208-a327-6329d1d79915_en?filename=pb2021-section22.xlsx)

<sup>40</sup> Transport & Environment (2022). Addressing the heavy-duty climate problem. Retrieved from:

<https://www.transportenvironment.org/discover/addressing-the-heavy-duty-climate-problem/>

<sup>41</sup> European Union (2022). Regulation (EU) 2022/1379 as regards the determination of the CO2 emissions and fuel consumption of medium and heavy lorries and heavy buses and to introduce electric vehicles and other new technologies. Retrieved from: <https://eur-lex.europa.eu/eli/reg/2022/1379/oj>

<sup>42</sup> TNO (2022). Techno-economic uptake potential of zero-emission trucks in Europe. Retrieved from:

<https://www.transportenvironment.org/discover/electric-trucks-take-charge/>

'cleanroom talks'<sup>43</sup> which project a ZEV sales share of 63% in 2030 in the EU of which 89% are expected to be BEVs and 11% FCEVs.<sup>44</sup>

---

<sup>43</sup> NOW GmbH (2023).

<sup>44</sup> The scope of the 'cleanroom talks' is limited to trucks above 12 tonnes and excludes buses and coaches. When adjusting the EUTRM to the same scope, it results in a similar split between BEVs and FCEVs.