

【欧州】 【自動車】

Road/Railways - Environmentally friendly vehicle: European Environment Agency (EEA) figures confirm increase of GHG emissions of heavy-duty vehicles despite efficiency improvements

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【概要 : Summary】

In contrast to other sectors, the EU's transport sector's GHG emissions have increased by 33.5% between 1990 and 2019. In 2019, transport was responsible for about 25% of the EU's total GHG emissions and road transport alone accounted for with 72% of the transport sector's total GHG emissions. Since the European Green Deal aims at a decrease of the transport sector's GHG emissions by 90% by 2050, the projected decrease based on existing policy measures of 22% will not be sufficient to achieve the 2050 target.

The first legislation on GHG emission reduction in road transport was introduced for passenger cars and light-duty vehicles (LDVs) in 2015. In 2019, the share of GHG emissions of HDVs was the second largest in the road transport with 27.1% after passenger cars. GHG emissions from HDVs increased by about 29% from 1990 to 2019. However, regarding the reduction of the heavy-duty vehicles' (HDVs) GHG emissions, Regulation (EU) 2019/1242 was only introduced in 2019 and sets the first CO₂ emission standards for HDVs and covers large trucks, which account for 65-70% of all CO₂ emissions from HDVs. Data on new HDVs are collected and reported by both vehicle manufacturers and EU Member States and Regulation

(EU) 2019/1242 sets EU fleet-wide targets for reducing the average CO₂ emissions from new trucks as of 2025.

According to the European Environment Agency (EEA)'s briefing "Reducing greenhouse gas emission from heavy-duty vehicles in Europe" and the "Transport and Environment report. Decarbonising road transport - the role of vehicles, fuels, and transport demand" of March 2022, one of the main factors behind the increase of GHG emissions regarding HDVs for the period 2000-2019, was the increased demand in freight transport. The EEA's analysis shows that the improvements of energy efficiency of trucks could not compensate the increase of GHG emissions caused by the increase of freight transport demand. Therefore, the increase in HDVs' GHG emissions was mainly caused by road transport's dominant and rising share in freight transport. Considering the way forward, the European Environment Agency (EEA) points out that a combination of "avoid", "shift" and "improve" (ASI) strategies will be necessary to reverse the trend in road transport emissions, including the HDVs emissions.

【記事 : Article】**1. Background of regulating the heavy-duty vehicles' GHG emissions**

In 2019, transport was responsible for about 25% of the EU's total GHG emissions and road transport accounted for the greatest share of the transport sector's total GHG emissions, with 72% in 2019 (EEA 2022b). The EU Member States have committed to the Paris Agreement target, and to the European Green Deal's target to achieving climate neutrality to achieve net-zero GHG emissions by 2050. The transport sector's GHG emissions should be reduced by 90% by 2050 (EEA 2022a). However, with existing policy measures, the transport sector's GHG emissions are projected to decrease by only 22% in 2050 compared with 1990. Therefore this is not sufficient to reach the European Green Deal's target of reducing the transport sector's GHG emissions by 90% by 2050 (EEA 2022b).

Regarding the GHG emissions of heavy-duty vehicles (HDVs) including trucks, buses, and coaches, they are currently responsible for about a quarter of total road transport sector's GHG emissions in the EU (European Parliament 2022, EEA 2022c). Heavy-duty vehicles including lorries, buses and coaches are responsible for about 27% of CO₂ emissions from road transport in the EU and for some 6% of the EU's total CO₂ emissions (European Commission n.d., European Parliament 2019a). Regarding the development of GHG emission levels of HDVs, they increased by about 29% from 1990 to 2019, and they increased every year since 2014, except for a decline in 2020, caused by the COVID-19 pandemic (EEA 2022c).

Moreover, also the fuel consumption of new HDVs placed on the EU market has so far neither been certified, nor monitored or reported. However, projections indicate that without policy action GHG emissions of HDVs could increase by up to 10% between 2010 and 2030. The European automobile industry had long opposed the idea of introducing CO₂ emission standards for HDVs including trucks,

buses, and coaches. As a matter of fact, until 2019, HDVs' GHG emissions were neither measured nor reported. However, considering the Paris Agreement's ambitious targets and later also the European Green Deal's target for the transport sector, the pressure increased to significantly reduce the HDVs GHG emissions within the EU and to make HDVs contribute to the European Green Deal's target to reduce the transport sector's GHG emissions by 90% by 2050.

The European Commission's 2014 heavy-duty vehicle strategy focused on certifying, reporting, and monitoring the HDVs' emissions in the short-term. The Commission developed a computer simulation tool, Vehicle Energy Consumption Calculation Tool (VECTO), which allows for measuring CO₂ emissions from new lorries above 7.5 tonnes. To reduce total GHG emissions from HDVs, improvements in vehicle fuel efficiency need to continue. To achieve the decarbonisation of the EU's transport sector, and a reduction of the HDVs' GHG emissions and other pollution, alternative fuels or propulsion systems are also needed. However, also further efforts are necessary, like shifting freight transport from road to rail and passenger transport from cars to buses and coaches (EEA 2022a).

Finally, Regulation (EU) 2018/956 of the European Parliament and of the Council of 28 June 2018 on the monitoring and reporting of CO₂ emissions from and fuel consumption of new heavy-duty vehicles was introduced and as of 1 January 2019. HDV manufacturers have to calculate the CO₂ emissions and fuel consumption of new vehicles they produce and want to place on the EU market, using the VECTO Tool. The latest change regards the data on new HDVs to be monitored and reported by Member States and by manufacturers and the reporting procedure (Commission Delegated Regulation (EU) 2022/247). This Commission Delegated Regulation (EU) 2022/247 of 14 December 2021 is based on the Consolidated text: Regulation (EU) 2018/956. The monitoring and reporting regulation supported the

implementation of trucks' CO₂ standards, which is a prerequisite for introducing further legislation on CO₂ emission standards for HDVs, which the Commission proposed in its Europe on the move package III on 17 May 2018 (Proposal for a Regulation setting CO₂ emission performance standards for new heavy-duty vehicles COM (2018) 284 final).

2. Legislation on CO₂ emission targets and the HDVs emissions ' monitoring and reporting

Besides passenger cars, it is the HDVs, including lorries, buses, and coaches, which are responsible for most of the road transport emissions. Together they account for almost 88% of the road transport sector's total GHG emissions in 2019 (EEA 2022b).

In the past decade, the EU had adopted several measures to reduce GHG emissions from road vehicles, including the binding GHG emissions targets for new passenger cars and van fleets. However, CO₂ emissions and fuel efficiency of HDVs were not yet regulated at EU level, in contrast to other countries like the United States, Canada, India, Japan and China (European Parliament 2019a). This only changed in 2019 with the introduction of Regulation (EU) 2019/1242.

According to the European Parliament's Research Service, around 70% of EU freight is transported by road and there are around 7 million trucks operating in the former EU-28, with annual registrations of new trucks in the EU increasing by 45% from 2010 to 2016, to around 380,000 vehicles (European Parliament (2019 b).

The HDV sector is characterised by many different vehicle categories, technologies, sizes and weights, as heavy-duty vehicles are typically customised for specific clients and uses. This range of different vehicle combinations made it difficult to estimate important parameters such as fuel consumption and CO₂ emissions in a reliable and cost-effective manner (European Parliament 2019a). On 17 May 2018, the European

Commission presented a proposal for a regulation setting the first-ever CO₂ emission standards for HDVs (trucks) in the EU, as part of the third "Europe on the Move" mobility package. Regarding HDVs, it contained a proposal to set up a system for monitoring and reporting CO₂ emissions and fuel consumption (European Parliament 2019b).

Regulation (EU) 2019/1242 of 20 June 2019 sets CO₂ emission performance standards and requirements for new HDVs. To contribute to achieving the EU's target of reducing its GHG emissions by 30% below 2005 levels by 2030 in the sectors covered by Article 2 of Regulation (EU) 2018/842 and to achieving the objectives of the Paris Agreement, the Regulation sets CO₂ emission performance for new HDVs for the reporting periods of the year 2025 onwards by 15% and for the reporting periods year 2030 onwards by 30%, unless decided otherwise ((Regulation (EU) 2019/1242). The 2025 target can be achieved using technologies that are already available on the market. The 2030 target will be assessed in 2022 as part of the review of the Regulation.

As a first step, the CO₂ emission standards will cover large lorries, which account for 65% to 70% of all CO₂ emissions from HDVs (European Commission n.d.). As part of the 2022 review, the Commission should also assess the extension of the scope to other vehicle types such as smaller lorries, buses, coaches, and trailers.

By 2023, the European Commission shall evaluate the possibility of developing a common methodology for the assessment and reporting of the full life-cycle CO₂ emissions of HDVs (European Commission n.d.).

The reference CO₂ emissions shall be based on the monitoring data reported pursuant to Regulation (EU) 2018/956 for the "reference period" from 1 July 2019 to 30 June 2020, excluding vocational vehicles. Starting from 1 January 2019, and for each subsequent calendar year, EU Member States shall monitor the data based on specifications of

Part A of Annex I, relating to new HDVs registered for the first time in the EU (Regulation (EU) 2018/956).

Regulation (EU) 2018/956 lays down the requirements for the monitoring and reporting of CO₂ emissions from and fuel consumption of new heavy-duty vehicles registered in the EU. It sets up a system for monitoring and reporting CO₂ emissions and fuel consumption of HDVs and requires EU Member States and manufacturers to report data related to HDVs ((European Parliament 2019a). Member States report trucks, buses and trailers registered in their territory. Manufacturers report trucks of specific types that are subject to certification requirements. Regarding the monitoring and reporting CO₂ emissions and fuel, as of January 2019, Commission Regulation (EU) 2017/2400 requires manufacturers to calculate this information based on the standardised simulation tool “VECTO”. A similar monitoring and reporting system is already in place for light-duty vehicles (European Parliament 2019a).

The reporting periods are annual and run from 1st July to 30 June the following year (EEA 2021). In addition, the dataset covers the United Kingdom and Norway who reported data in line with the Regulation (EU) 2018/956 (the UK was subject to the Regulation in the reporting period 2019-20) (EEA 2021).

Regulation (EU) 2019/1242 also contains a date for review and by 31 December 2022, the Commission shall submit a report to the European Parliament and to the Council on the effectiveness of Regulation (EU) 2019/1242, on the CO₂ emissions reduction target and the level of the incentive mechanism for zero- and low-emission HDVs applicable from 2030, on setting CO₂ emissions reduction targets for other types of heavy-duty vehicles, including trailers, buses and coaches, and vocational vehicles, and on the introduction of binding CO₂ emissions reduction targets for heavy-duty vehicles for 2035 and 2040 onwards.

The 2030 target shall be assessed in accordance with the European Union commitments under the Paris Agreement (Regulation (EU) 2019/1242). Thereby, the Regulation’s application could be extended to smaller trucks, buses, coaches, and trailers (European Parliament 2019b).

Regulation (EU) 2019/1242 also includes an incentive mechanism for zero-emission vehicles (ZEV), lorries with no tailpipe CO₂ emissions and low-emission vehicles (LEV), lorries with a technically permissible maximum laden mass of more than 16t, with CO₂ emissions of less than half of the average CO₂ emissions of all vehicles in its group registered in the 2019 reporting period (European Commission n.d.). To incentivise the uptake of ZLEV and reward early action, a super-credits system applies from 2019 until 2024, and can be used to comply with the target in 2025 (European Commission n.d.). The Regulation (EU) 2019/1242 entered into force on 14 August 2019 and is expected to contribute to the achievement of the EU’s commitments under the Paris Agreement (European Commission n.d.). The Regulation (EU) 2019/1242 is expected to help to reduce CO₂ emissions by around 54 million tonnes in the period 2020 to 2030 (European Commission n.d.). Regarding the review of the CO₂ emission standards for HDVs under the Commission work programme 2022, the European Commission will assess the effectiveness of the Regulation by the fourth quarter of 2022, envisaging a revision of Regulation (EU) 2019/1242. For achieving the European Green Deal’s target to reduce the transport sector’s GHG by 90% by 2050. The revision of the Regulation (EU) 2019/1242 could also lead to an extension of the scope to buses and other types of HDVs, and the introduction of CO₂ emission reduction targets for 2035 and 2040 (European Parliament 2022).

3. Increase of GHG emissions of HDVs

Based on the Regulation (EU) 2019/1242, the CO₂ performance of HDVs has been monitored since mid-

2019. Manufacturers report trucks of specific types that are subject to certification requirements. In addition, the dataset covers the United Kingdom and Norway who reported data in line with the Regulation (EU) 2019/1242. The reporting periods are annual and run from 1st July to 30 June the following year. The average specific CO₂ emissions of all new HDVs registered in the EU from 2019 to mid-2020 was 52.75g CO₂/tonne-kilometre (EEA 2022b). This will serve as the baseline for the 2025 and 2030 targets.

The European Environment Agency (EEA) briefing “Reducing greenhouse gas emission from heavy-duty vehicles in Europe” of 7 September 2022 presents comprehensive data and analysis on GHG emissions from trucks, buses, and coaches in European road transport. In contrast to other sectors, the transport sector’s GHG emissions have increased by 33.5% between 1990 and 2019 (EEA 2022b).

Regarding the development of freight transport in the EU, the EEA briefing underlines that trucks carried relatively more goods than other transport modes when comparing 2000 and 2019 (EEA 2022c). While transport activity in the EU’s inland waterways and railways increased by 5% between 2000 and 2019, truck transport rose by 31% (EEA 2022c). Accordingly, the share of freight transported by trucks increased from 72% in 2000 to 76.4% in 2019, whereas the share of rail and inland waterway freight transport decreased (EEA 2022c).

Comparing the GHG emissions’ share of modes of transport of the total road transport emissions in the EU-27 in 2019, cars had a share of 60.6%, followed by HDVs with 27.1%, light-duty vehicles had a share of 11% and motorcycles 1.3% (EEA 2022b). Among the various categories of HDVs, trucks are responsible for about 85% of GHG emissions in the HDV segment, whereas buses and coaches are responsible for the remainder. Different types of policies contribute to reducing CO₂ emissions from HDVs (EEA 2022c).

According to the EEA briefing “Reducing greenhouse gas emissions from heavy-duty vehicles in Europe” of 7 September 2022, HDVs are currently responsible for about a quarter of total road transport GHG emissions in the EU (EEA 2022c). According to the EEA’s “Transport and Environment report. Decarbonising road transport – the role of vehicles, fuels, and transport demand” of March 2022, the main factor behind the increase of GHG emissions of HDVs in the period 2000–2019, is the increased demand in freight transport (EEA 2022b). To explore the factors driving the increase of GHG emissions of HDVs over time, a decomposition analysis was conducted in the EU Member States (EU-27), for the period 2000–2019 (EEA 2022c).

The decomposition analysis compares the respective contributions of selected explanatory factors to GHG emissions of HDVs over time. The EEA analysis individualised factors including freight transport demand; the modal share of trucks in inland freight transport demand; the energy efficiency of trucks; the share of fossil fuels in truck fuel consumption, with biofuels assumed to be carbon neutral; and the carbon intensity of fossil fuels consumed by trucks as possible factors that drive emission trends (EEA 2022c).

The decomposition analysis shows that the effect of total inland freight transport demand was the most important driving factor for a continuous increase of the HDVs’ CO₂ emissions (EEA 2022b). The only exception is visible in a decline of freight transport CO₂ emissions in 2020, caused by the COVID-19 pandemic (EEA 2022c). Therefore, the growth in transport activity was the most important driving factor for the increase in CO₂ emissions. This trend was reinforced by a rising share of road transport and inland freight transport activity among land-based transport modes (i.e., transport by road, rail, inland waterways, and oil pipelines). Inland freight transport activity increased by 22% between 2000

and 2019 (EEA 2022b). The HDVs CO₂ emissions rose by 5.5% between 2000 and 2019, and although the period is marked by several years of reductions in emissions following the economic crisis, this did not have a lasting effect and emissions started rising again (EEA 2022c). Furthermore, the HDVs' efficiency improvements have not been high enough to balance out the continuous increase of GHG emissions from HDVs. The impact of growth on GHG emissions was mainly caused by road transport's dominant and rising share in freight transport, while the improvement in energy efficiency have been the main factor contributing to limiting the increase in emissions during the periods of growth in demand. Energy consumption per tonne-kilometre transported decreased by almost 15% between 2000 and 2019 (EEA 2022b). Therefore, energy efficiency could only partly compensate the increase of GHG emissions (EEA 2022b).

Considering the fuels used by HDVs, according to the EEA (2022c), currently, most trucks are powered by diesel. To reduce GHG emissions from HDVs and to meet the European Green Deal targets, also trucks will have to be increasingly powered by alternative fuels in future, including electric batteries or fuel cells (hydrogen). Electric road systems are also being considered in some countries as a potential measure to facilitate the uptake of hybrid trucks. However, the EEA expects that around one quarter of the trucks in 2050 would be fuel cell vehicles and around 14-20% BEVs (EEA 2022b). Among buses and coaches, the uptake of electric buses could be expected to accelerate, driven by the implementation of the Clean Vehicles Directive and air quality concerns in many cities resulting in the banning of combustion engine buses (EEA 2022b). The Alternative Fuels Infrastructure Directive 2014/94/EU will be revised as part of the "Fit for 55" package to establish a sufficient network of recharging and refuelling infrastructure.

The Alternative Fuels Infrastructure Regulation will require Member States to expand charging capacity in line with zero-emission car sales (COM (2021) 559 final). In addition, hydrogen refuelling stations will be deployed for light, but also for heavy duty vehicles. Public charging and hydrogen refuelling stations will be widely available, interoperable, also along Europe's major transport corridors (COM (2021) 559 final). The remaining HGVs would be hybrid or ICEVs, which would require low and zero carbon fuels to achieve climate neutrality (EEA 2022b).

Considering the way forward, the EEA points out that a combination of 'avoid', 'shift' and 'improve' (ASI) strategies will be necessary to ensure that the trend in road transport emissions is reversed. "Avoid" strategies intend to reducing the number of trips and their length (i.e., addressing demand), while "shift" strategies aim to shift transport activity to more efficient modes. "Improve" strategies focus on improving vehicle and fuel technologies to make them more efficient (EEA 2022b).

4. Conclusion

The analysis of factors responsible for the increase of GHG emissions of HDVs shows that while the reduction in freight transport demand after the economic crisis played a role in the decrease in emissions between 2008 and 2014, it has also a key factor contributing to the increase of the GHG emissions of HDVs since 2014. At the same time, efficiency gains that have been achieved in vehicles and transport operations have been outpaced by the growing demand for freight transport, which ultimately caused a continued growth in GHG emissions.

The EU has introduced GHG emission performance standards for large trucks, the tracking of data on vehicle performance as well as the fuel efficiency and carbon intensity of the HDV fleet. These will continue to be important tools to control the further development of GHG emissions

from HDVs. Considering the further way forward, the EEA pointed out that to reduce total GHG emissions from HDVs, improvements in vehicle fuel efficiency need to continue, but further efforts will be necessary, like shifting transport activities to more efficient modes, e.g., from trucks to rail freight and inland waterways. It will be necessary to introduce a combination of measures that will include strategies to “avoid”, “shift” and “improve” (ASI) freight transport with HDVs.

However, improving the efficiency of vehicles and fuel technologies will remain one of the keys to reducing overall GHG emissions. Furthermore, it will be important to introduce alternatively powered vehicles and to use new technologies to complement the modal shift in decreasing emissions from HDVs.

However, after years of promoting the modal shift in the EU, also recent trends reveal that the share of trucks used for inland freight transport are still growing, and therefore it increases the total negative impact of the transport sector on the climate. The transport efficiency of HDVs must be further improved, and alternative fuels will have to be introduced while modal shift has to be even more supported and encouraged than in the past to finally achieve a decrease of GHG emissions of HDVs.

References

Commission Delegated Regulation (EU) 2022/247 of 14 December 2021 amending Regulation (EU) 2018/956 of the European Parliament and of the Council as regards the data on new heavy-duty vehicles to be monitored and reported by Member States and by manufacturers and the reporting procedure. In: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32022R0247>, OJ L 41, 22.2.2022, p. 11-13, accessed 12 September 2022

European Commission (n.d.): Reducing CO₂ emissions from heavy-duty vehicles. In:

https://ec.europa.eu/clima/eu-action/transport-emissions/road-transport-reducing-co2-emissions-vehicles/reducing-co2-emissions-heavy-duty-vehicles_en

EEA (2021): Monitoring of CO₂ emissions from heavy-duty vehicles. Prod-ID: DAT-251-en. In: <https://www.eea.europa.eu/data-and-maps/data/co2-emission-hdv>, 01 Jun 2021, accessed 14 September 2022

European Environment Agency (EEA) (2022a): Europe's growing transport demand increases emissions from heavy-duty vehicles. In: <https://www.eea.europa.eu/highlights/europes-growing-transport-demand-increases>, 07 Sep 2022, accessed 12 September 2022

European Environment Agency (EEA) (2022b): Transport and environment report 2021. Decarbonising road transport – the role of vehicles, fuels and transport demand. EEA Report No 2/2022. In: <https://www.eea.europa.eu/publications/transport-and-environment-report-2021>, 17 Mar 2022 Published 01 Jun 2022, accessed 12 September 2022

European Environment Agency (EEA) (2022c): Briefing. Reducing greenhouse gas emissions from heavy-duty vehicles in Europe. In: <https://www.eea.europa.eu/publications/co2-emissions-of-new-heavy>, 07 Sep 2022, accessed 12 September 2022

European Parliament, EPRS (2019a): [CO₂ emission standards for heavy-duty vehicles](https://www.europarl.europa.eu/RegData/etudes/BR/IE/2018/628268/EPRS_BRI(2018)628268_EN.pdf), Briefing, EU legislation in progress, August 2019 [https://www.europarl.europa.eu/RegData/etudes/BR/IE/2018/628268/EPRS_BRI\(2018\)628268_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/BR/IE/2018/628268/EPRS_BRI(2018)628268_EN.pdf), accessed 12 September 2022

European Parliament (2019b): CO₂ emission standards for heavy-duty vehicles. In: Briefing, [https://www.europarl.europa.eu/thinktank/fr/document/EPRS_BRI\(2018\)628268](https://www.europarl.europa.eu/thinktank/fr/document/EPRS_BRI(2018)628268), 30-08-2019, accessed 12 September 2022

European Parliament (2022): Review of the CO₂ emission standards for heavy-duty vehicles. In: “A European Green Deal”. In:

<https://www.europarl.europa.eu/legislative-train/theme-a-european-green-deal/file-review-of-the-co2-emission-standards-for-heavy-duty-vehicles>, Legislative Train Schedule. 20/08/2022, accessed 12 September 2022

Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the deployment of alternative fuels infrastructure and repealing Directive 2014/94/EU of the European Parliament and of the Council. COM(2021) 559 final. In: https://ec.europa.eu/info/sites/default/files/revision_of_the_directive_on_deployment_of_the_alternative_fuels_infrastructure_with_annex_0.pdf, 14.7.2021, accessed 12 September 2022

Regulation (EU) 2018/956: Consolidated text: Regulation (EU) 2018/956 of the European Parliament and of the Council of 28 June 2018 on the monitoring and reporting of CO₂ emissions from and fuel consumption of new heavy-duty vehicles. OJ L 173, 9.7.2018, p. 1-15. In: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02018R0956-20220314>, 14.03.2022, accessed 12 September 2022

Regulation (EU) 2019/1242 of the European Parliament and of the Council of 20 June 2019 setting CO₂ emission performance standards for new heavy-duty vehicles and amending Regulations (EC) No 595/2009 and (EU) 2018/956 of the European Parliament and of the Council and Council Directive 96/53/EC. In: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32019R1242&qid=1663073503651>, OJ L 198, 25.7.2019, p. 202-240, 25 July 2019, accessed 12 September 2022