POSITION BRIEF

icct
THE INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION

JULY 2018

RECOMMENDATIONS FOR THE PROPOSED HEAVY-DUTY VEHICLE CO_2 STANDARDS IN THE EUROPEAN UNION

On May 17, 2018, the European Commission issued a regulatory proposal[1] that would set initial carbon dioxide (CO_2) emission standards for new heavy-duty vehicles (HDVs) sold in the European Union. The Commission's proposal marks the starting point of a legislative process. At the conclusion of that process the EU will become the sixth government to regulate tailpipe CO_2 emissions from trucks. The United States, Canada, China, Japan and India already have HDV CO_2 emissions or fuel consumption standards in place.

Drawing on the ICCT's research and international regulatory experience, this position brief makes certain recommendations aimed at improving the environmental outcomes of the proposed standards.

POLICY RECOMMENDATIONS

This position brief presumes a general understanding of the proposed HDV CO_2 standards. The policy recommendations presented here note only essential details. For a fuller discussion of the regulatory proposal, please refer to ICCT's policy update.[2]

STRINGENCY

The proposed targets aim to reduce average CO_2 emissions from new HDVs belonging to the regulated categories by 15% in 2025 and 30% in 2030, both relative to a 2019 baseline. Setting mandatory CO_2 standards for trucks is a vital step towards the EU's climate mitigation goals. However, the standards proposed are not in line with either the targets set by the Commission for 2030 or the targets established by international agreements for 2050.

The European Union has set a short-term, binding target for greenhouse gas (GHG) emissions of 40% below 1990 levels in 2030.[3] To achieve this goal, the sectors covered by the EU Emissions Trading System (ETS)[4] must deliver a reduction of 43% in GHG emissions by 2030. The non-ETS sectors, to which transport belongs, must deliver a reduction of 30%. Both reduction targets are compared with 2005.[5]

Longer term, the EU is legally bound to pursue mitigation measures by the international agreement adopted in the Paris climate conference (COP21) in December 2015. In the Paris climate deal, governments agreed to keep the increase in global average temperature to well below 2°C above pre-industrial levels.

1 European Commission, "Proposal for a Regulation of the European Parliament and of the Council Setting CO_2 Emission Performance Standards for New Heavy-Duty Vehicles" (May 17, 2018). http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2018:284:FIN

2 Felipe Rodriguez, *The European Commission's proposed CO_2 standards for heavy-duty vehicles* (ICCT: Washington, DC, 2018). https://www.theicct.org/publications/european-commissions-proposed-co2-standards-heavy-duty-vehicles

3 European Commission, "A policy framework for climate and energy in the period from 2020 to 2030," Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions (2014). http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52014DC0015

4 The EU Emissions Trading System covers power and heat generation, energy-intensive industry, and domestic commercial aviation. Non-ETS sectors include transport, residential, small businesses, and agriculture.

5 European Commission, "A policy framework for climate and energy in the period from 2020 to 2030," Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions (2014). http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52014DC0015

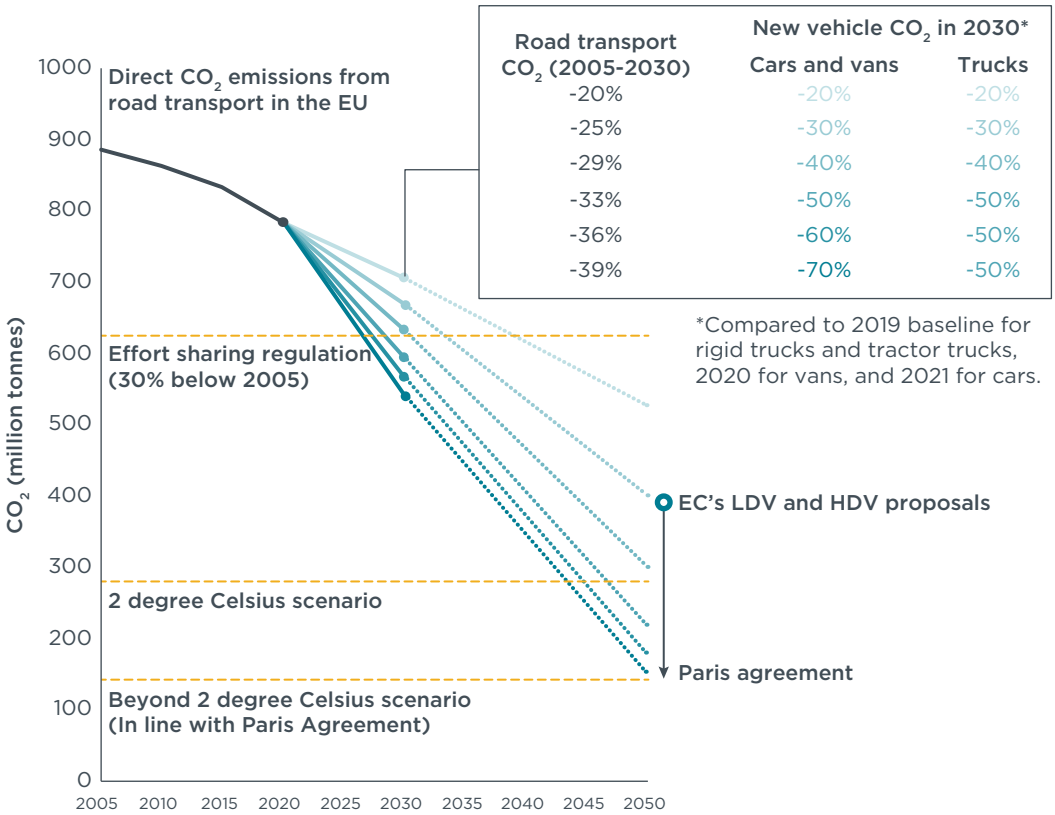

Figure 1. Direct CO_2 emissions from the transport sector under different reduction scenarios for the period 2020 to 2050. Results are estimated using the ICCT Roadmap Model.[6]

Figure 1 plots the development of direct CO_2 emissions from the road transport sector in the EU since 2005 and trends out to 2050 for six scenarios representing various possible stringency levels for the light-duty vehicle (LDV) and HDV CO_2 regulations, including the proposals for both that are presently under negotiation in the European Parliament and Council. The current proposals would mandate a 30% reduction for LDVs by 2030 relative to 2021 and a 30% reduction for HDVs by 2030 relative to 2019. As shown in the figure, the level of ambition represented by the proposed CO_2 standards is insufficient to meet either the short-term target set for non-ETS sectors or the long-term target set by the Paris Agreement.

The EU could meet the short-term targets for non-ETS sector by 2030 with a CO_2 reduction for new LDVs and HDVs greater than 40%. But anything less than 40% for HDVs would require the targets for LDVs to become more stringent. In the long-term, if the EU is to meet its obligations under the Paris Agreement, it must achieve a greater than 70% CO_2 reduction for LDVs and close to 50% for HDVs by 2030.

Although the CO_2 standards are drafted with these overall climate targets in mind, the climate targets do not directly inform the proposed stringency of the standards. Instead, the proposed CO_2 reduction targets are the result of a cost-effectiveness analysis of technology potential. The regulation aims to achieve CO_2 reductions at no extra cost to society. Even from this perspective, the HDV CO_2 reduction targets proposed by the Commission are insufficiently ambitious, because they do not exhaust the cost-effective technology potential. The Commission's own estimates, made for the regulatory impact assessment,[7] show

6 Direct CO_2 emissions from road transport in the EU, historically and considering a range of policy scenarios for the time period up to 2050. The scenarios assume the stated percentage reductions apply to all HDVs. Note that the current proposal scope does not cover all HDV classes. The 2 degree and Beyond 2 degree estimates are based on IEA data from Energy Technology Perspectives 2017 © OECD/IEA 2017. License: www.iea.org/t&c; as modified by ICCT.

7 European Commission, "IMPACT ASSESSMENT. Accompanying the Document Proposal for a Regulation of the European Parliament and of the Council Setting CO_2 Emission Performance Standards for New Heavy Duty Vehicles" (May 17, 2018). http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=SWD:2018:185:FIN

that CO_2 reductions of 20% in 2025 and 35% in 2030, relative to the 2019 baseline, are not only technologically feasible but would result in greater economic and societal benefits.

At minimum, the HDV CO_2 standards should establish limits that would necessitate exploiting the entire cost-effective potential identified in the Commission's impact assessment. The current proposal should, in the ICCT's view, be modified to raise the reduction targets to at least 20% in 2025 and 35% in 2030, relative to the 2019 baseline. Further, in view of the likelihood that CO_2 targets for trucks must decline by close to 50% by 2030 to meet the Paris Agreement, the ICCT recommends that the Commission evaluate the net economic and societal benefits of more stringent targets (e.g., 25%, 30%, and 35% in 2025; and 40%, 45%, and 50% in 2030) and that it explicitly take into consideration the role standards play in meeting long-term climate goals when determining where the standards should be set.

REGULATED CATEGORIES

The regulated categories in the proposal take in all rigid and tractor trucks of gross vehicle weight (GVW) exceeding 16 tonnes, and in either 4×2 or 6×2 axle configuration. These vehicles account for 65% to 70% of total CO_2 emissions from EU's HDV fleet, according to the Commission's estimates.[8] Concerning the remainder of the HDV fleet, the proposal would require the Commission to issue a report by 2022 addressing, among other things, the feasibility of setting CO_2 emissions targets for other vehicle categories and for trailers.

However, the proposal does not include heavy-duty engines as a regulatory category. This is unfortunate, because engine standards would be an effective way to immediately cover, at least partially, the HDV categories outside of this proposal's scope. In contrast with some vehicle-level technologies, engine improvements translate to CO_2 benefits across a wide range of vehicle duty cycles and payloads, and they remain with a vehicle for its full lifetime. A separate engine standard in conjunction with a full-vehicle standard would send a regulatory signal to encourage long-term investment in the research and development of engine efficiency technologies. This would help maintain the European Union's international leadership on heavy-duty engine regulations and reduce CO_2 emissions and fuel consumption in vehicle segments that are not included in the roll-out of the CO_2 standard. A related ICCT briefing paper[9] describes the benefits of engine standards in detail and outlines an implementation pathway within the regulatory framework of the EU. It is the ICCT's position that the Commission proposal should be broadened to incorporate engine standards in order to cover vehicle groups that are not subject to any CO_2 regulation.

VOCATIONAL TRUCKS

Vocational trucks are defined as HDVs not intended for the delivery of goods; examples include refuse collection trucks and construction vehicles. Vocational trucks are excluded from the scope of the proposed CO_2 standards. However, neither the current CO_2 certification regulation[10] nor the CO_2 standards proposal provide the technical criteria required for the identification of vocational vehicles. As a result, manufacturers would have the discretion to certify trucks under the vocational category to effectively exempt them from the CO_2 standards.

In its impact assessment, the Commission recognizes the need to modify the current type-approval legislation to ensure an unambiguous identification of vocational trucks based on technical parameters. To minimize the possibility that manufacturers will be able to game the standards by excluding high-emitting vehicles from their CO_2 average calculation, the proposal should be amended to mandate the modifications

8 European Commission, "Proposal for a Regulation of the European Parliament and of the Council Setting CO_2 Emission Performance Standards for New Heavy-Duty Vehicles," (17 May 2018). https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2018%3A284%3AFIN

9 Rachel Muncrief, Felipe Rodríguez, *A Roadmap for Heavy-Duty Engine CO_2 Standards within the European Union Framework* (ICCT: Washington, DC, 2017). http://www.theicct.org/publications/roadmap-heavy-duty-engine-co2-standards-within-european-union-framework

10 Regulation (EU) 2017/2400 of 12 December 2017 Implementing Regulation (EC) No 595/2009 of the European Parliament and of the Council as Regards the Determination of the CO_2 Emissions and Fuel Consumption of Heavy-Duty Vehicles and Amending Directive 2007/46/EC of the European Parliament and of the Council and Commission Regulation (EU) No 582/2011, Official Journal of the European Union, L 349 (December 29, 2017), http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:L:2017:349:TOC.

to the certification procedure identified in the Commission's impact assessment before the implementation of the first CO_2 reduction target in 2025.

The Commission excluded vocational trucks from the scope of the proposed CO_2 standards on the grounds of their limited cost-effective technology potential. However, engine-only standards or reduced stringency levels for these trucks would still ensure technological improvements that have a positive cost-benefit ratio.

MILEAGE AND PAYLOAD WEIGHTING FACTORS

The proposed CO_2 standards set fleet-average targets derived from the weighted sum of the CO_2 emissions of the individual regulatory categories, which are called subgroups. For the calculation of manufacturer-specific average CO_2 emissions, used to demonstrate compliance, the Commission proposes a set of mileage and payload weighting (MPW) factors to account for the differences in average payload and annual distance traveled (i.e., the freight activity) between the different subgroups. Details on the calculation can be found in the annex to this paper.

The MPW factor is defined as the product of the typical vehicle annual mileage and the average payload in the subgroup, normalized by the subgroup with the highest freight activity. This definition results in a weighted average in which the weighting factors don't add up to a value of one, diminishing the physical meaning of the metric used for compliance. Distortion of the manufacturer-specific average CO_2 emissions is illustrated by the example in Box 1.

The weighting factors should be redefined so that the physical meaning of the metric is maintained and does not distort the significance of the "manufacturer-specific average CO_2 emissions." See the annex to this paper for a proposed redefinition of the weighting factors under which, without any additional data requirements, the average CO_2 emissions of the hypothetical manufacturer in Box 1 would match the average CO_2 emissions of the trucks in the subgroup.

ZLEV INCENTIVES FOR REGULATED VEHICLE CLASSES

The Commission's proposal includes incentives, in the form of super-credits, to accelerate the development and adoption of zero-emission and low-emission heavy-duty vehicles (ZLEVs). The ZLEV incentive would be implemented in the calculation of the manufacturer-specific average CO_2 emissions through the use of a multiplier called *ZLEV factor* (see Figure 2 in the annex). The ZLEV factor is applied directly to the manufacturer's fleet average CO_2 emissions and is solely based on the number of ZLEVs and regulated vehicles sold by a manufacturer. Thus, the proposed ZLEV factor does not take into account the differences in annual mileage and payload between the different

Box 1. Example of the CO_2 metric distortion through the use of the MPW factors.

A hypothetical manufacturer specializes in 4×2 rigid trucks with low-power engines that are used in urban delivery (i.e., subgroup 4-UD). Based on best available data, this example assumes that the average CO_2 emissions of the trucks in this subgroup equal 150 gCO_2/tonne-km. The MPW factor defined in the current proposal for this vehicle subgroup has a value of 0.1. As a result, the manufacturer's average CO_2 emissions will equal 15 gCO_2/tonne-km, which is the result of multiplying the MPW factor with the average emissions of the subgroup. Thus, despite the fact that the manufacturer only produces vehicles in a single subgroup, the average emissions of the subgroup, and the manufacturer's average CO_2 emissions differ by a factor of 10. Although this hypothetical example represents a worst-case scenario, the current definition of the MPW factors would invariably distort the physical meaning of the manufacturer-specific average CO_2 emissions, inhibiting direct comparisons between manufacturers.

Box 2. Example of CO_2 savings of zero-emission trucks in different regulatory subgroups.

Consider two zero-emission vehicles (ZEVs): a 4×2 rigid truck used in urban delivery and a 4×2 tractor-trailer used in long-haul applications. Using the annual mileage and average payload for the respective vehicle subgroups (Table 1), we can estimate the annual CO_2 savings resulting from these two zero-emission trucks.

Table 1. Illustrative example of the differences in CO_2 benefits from zero-emissions HDVs in different subgroups

Vehicle subgroup	Annual mileage*	Average payload*	Illustrative average CO_2 emissions of subgroup**	Annual CO_2 savings by a single ZEV in subgroup***
4×2 rigid, urban	60,000 km	2.7 tonnes	200 gCO_2/tkm	32 tonnes
4×2 tractor, long-haul	116,000 km	13.8 tonnes	60 gCO_2/tkm	96 tonnes

* The annual mileage and average payload used in this example are the same as are used in the CO_2 standards proposal
** Estimated using VECTO simulations for two typical vehicles in these subgroups.
*** The annual CO_2 savings of a ZEV are calculated as the annual CO_2 emissions of a conventional HDV (i.e. non-ZEV): product of the annual mileage, average payload, and average CO_2 emissions of the subgroup.

As shown in Table 1, the annual CO_2 savings of a zero-emissions 4×2 long-haul tractor are approximately three times the CO_2 savings of a zero-emissions 4×2 urban rigid truck. Yet the current proposal would reward these two ZEVs equally.

subgroups, with consequences illustrated by the example in Box 2.

A super-credit system should take into account the increased compliance cost associated with ZLEV technologies across the different categories. The proposed system disincentivizes efforts for freight vehicles that transport high payloads over long distances, as they face greater challenges in transitioning to ZLEV technologies but receive no greater benefit than smaller urban ZLEVs.

The Commission proposal should be revised to apply the ZLEV super-credit correction to the average CO_2 emissions of the individual subgroups. See the annex to this paper for a proposal that would accomplish this change, under which the incentive would be proportional to actual CO_2.

It should also be noted that a binding mandate would be a more effective measure to promote technology development in this area. The cost-effective diesel technologies available are only enough to reduce CO_2 emissions by 40%–45%[11] in the 2020–2030 time frame. Emerging zero-emission technologies are key to achieving the long-term reductions needed.

ZEV INCENTIVES FOR UNREGULATED VEHICLE CLASSES

The regulated subgroups in the standards proposal consist of all rigid and tractor trucks designed for goods delivery with a GVW exceeding 16 tonnes, in either 4×2 or 6×2 axle configuration. No CO_2 standards are proposed for buses, vocational trucks, trucks with other axle configurations, and trucks with GVW less than 16 tonnes.

Zero-emissions trucks in these unregulated categories would be eligible to take part in the super-credits scheme, with the same super-credits multiplier as ZEV in the regulated subgroups. The super-credits gained from ZEVs in unregulated categories can only reduce the CO_2 emissions of a manufacturers fleet by a maximum of 1.5%.

Super-credits can provide short-term benefits by taking into account the increased compliance cost of ZEV technologies, relative to conventional diesel technologies. But it is not appropriate to extend the super-credits scheme outside of the vehicle subgroups covered by the CO_2 standards, because vehicles in unregulated categories have no compliance cost.

11 Oscar Delgado and Felipe Rodriguez, CO_2 Emissions and Fuel Consumption Standards for Heavy-Duty Vehicles in the European Union (ICCT: Washington, DC, 2018). https://www.theicct.org/publications/co2-emissions-and-fuel-consumption-standards-heavy-duty-vehicles-european-union

In its current form, the ZEV incentive for unregulated vehicles would give manufacturers the ability to reach the 1.5% cap with relatively little effort. This will undermine zero-emission transition efforts for the regulated categories, and effectively reduce the stringency and environmental benefits of the regulation.

Including buses in the super-credits system will have a particularly damaging effect. The electric bus market, like the electrification of vocational trucks, is driven in significant part by fleet procurement trends rooted in the need to address the problem of air pollution in EU cities. The Clean Vehicles Directive[12] and the associated platform created to help cities on public procurement,[13] which accounts for 75% of new buses,[14] are already priming that market. Sales of electric buses will rise rapidly, independent of the super-credit incentive proposed, as manufacturers ramp-up production to meet rising demand from cities that want emissions-free buses. For example, Daimler will start series production of electric buses by end of 2018,[15] and MAN Truck & Bus will start series production of electric buses by the end of 2019.[16] Volvo has commercial models available already; about 7% of the electric buses in service or on order in Europe at the end of 2017 were Volvo products.[17]

The ICCT projects that manufacturers will sell enough electric buses in the coming years to reach the proposed cap, effectively reducing the stringency of the standard to 13.7%[18] in 2025, instead of the proposed 15%. It is not clear that this incentive would lead to more zero-emission buses compared to the baseline situation. And because every zero-emission vehicle would count equally under the current proposal, every zero-emission bus would diminish the incentive to develop a zero-emission truck in the regulated categories. The ZEV incentives should, therefore, be limited to the regulated categories and exclude unregulated vehicles.

BASELINE

The proposed CO_2 reduction targets are defined relative to a 2019 baseline. For each regulated category, the numerical value of the 2019 baseline will be determined from the data reported by manufacturers under the monitoring and reporting regulation.[19] That regulation requires manufacturers to report, among other things, the fuel consumption and CO_2 emissions of vehicles registered in the previous year. The first year for which the monitoring and reporting data will be available is 2020, covering vehicles that were manufactured and registered after 1 January 2019, or that were registered after 1 July 2019 regardless of their production date.

Using the 2019 data from the monitoring and reporting regulation as the regulatory baseline presents the following problems:

1. It creates uncertainty concerning the required absolute reductions because their value will remain unknown until 2020, when the numerical value of the baseline is determined.
2. It does not include all vehicle registrations of the year 2019, because vehicles produced in 2018 but registered in the first half of 2019 are not subject to the CO_2 certification regulation, and thus no data will be reported for them.
3. Because 2019 would be the first year for which official data on the CO_2 emissions of HDVs would be publicly available, it will not be possible to assess whether the CO_2 emissions of the 2019 fleet are statistically coherent with historical data.

12 Directive 2009/33/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of clean and energy-efficient road transport vehicles, Official Journal of the European Union, (May 15, 2009). https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:L:2009:120:TOC

13 "Clean transport, Urban transport. Clean Vehicles Directive," European Commission. https://ec.europa.eu/transport/themes/urban/vehicles/directive_en

14 Gregor Erbach, "Review of the Clean Vehicles Directive," EU Legislation in Progress Briefing, European Parliament (5 February, 2018). http://www.europarl.europa.eu/RegData/etudes/BRIE/2018/614690/EPRS_BRI(2018)614690_EN.pdf

15 "Bus charging ahead. Countdown for the Mercedes-Benz Citaro E-Cell," Daimler. http://www.daimler.com/products/buses/mercedes-benz/citaro-e-cell.html

16 Martin-Werner Buchenau, Markus Fasse, "German Truck Makers Hitch onto Electromobility," *Handelsblatt Global Edition*, December 4, 2017. https://global.handelsblatt.com/mobility/german-truck-makers-hitch-onto-electromobility-860678

17 Stefan Baguette, "The European market for electric buses in 2017," http://www.linkedin.com/pulse/european-market-electric-buses-2017-stefan-baguette/

18 The effective target would be the original target (85% of reference 2019 emissions) divided by 0.985, an effective reduction of 13.7%.

19 European Commission, "Proposal for a Regulation of the European Parliament and of the Council on the Monitoring and Reporting of CO_2 Emissions from and Fuel Consumption of New Heavy-Duty Vehicles" (May 31, 2017). http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52017PC0279

4. It would give manufacturers direct influence on the baseline through their product portfolios, and thus on the benefits of the standard.

To safeguard the environmental benefits of the regulation, the data available to the Commission for the development of the impact assessment[20] should be used to develop a validation mechanism for the 2019 baseline.

ADJUSTMENTS TO THE BASELINE

To ensure that the standards can adapt over time to technological progress and that certified CO_2 emissions remain representative of actual, real-world emissions, under the Commission proposal the Commission itself would be empowered to make changes to the CO_2 certification methodology (e.g., cycles, payload, simulation tool) and to the weighting factors used to determine manufacturers' fleet-average CO_2 emissions.

However, changes in the certification methodology would have to be retroactively applied to the 2019 baseline, which would in turn affect the numerical values of the 2025 and 2030 CO_2 targets (in g/tkm). This creates uncertainty, as manufacturers cannot foresee how their vehicles will perform under a different certification procedure.

To avoid the possibility of having a series of small changes to the methodology, the CO_2 certification procedure, and the corresponding weightings used to calculate manufacturer fleet CO_2 emissions, should remain frozen at least until the 2022 review. During the 2022 review, changes in the methodology should be retroactively applied to the 2019 baseline, and the 2025 targets readjusted.

MID-TERM REVIEW

In the proposal, 2030 stringency is set at an indicative level. A mid-term review of the standards would be undertaken for 2022. Depending on the outcome, the stringency and regulatory design for 2030 onwards could be adjusted.

Long-term efficiency standards create the necessary certainty for industry to invest in sustainable low-carbon technologies. Potentially reducing the stringency of a CO_2 target in the future would penalize suppliers and manufacturers that have made investments in good faith to comply with the target. Safeguards should be created to ensure that the CO_2 reduction target will effectively be at least 30% in 2030, and that the review process in 2022 can only increase the mandatory reductions.

Trailers can provide cost-effective CO_2 reductions of up to 12% in 2030.[21] To guarantee regulatory certainty for the trailer market, safeguards should be implemented to ensure that the planned 2022 review does not result in trailers being excluded from 2030 targets.

PUBLICATION OF DATA AND MANUFACTURER PERFORMANCE

A manufacturer's compliance with the CO_2 standards is measured using a weighted sum of the CO_2 emissions of all the subgroups to which the manufacturer's vehicles belong. In the current proposal, the average CO_2 emissions for each manufacturer would be made publicly available. This is an important step to ensure the transparency of the compliance process. However, it does not provide any information of the manufacturer's performance in each of the regulated subgroups. Note that the subgroups are only defined as part of the proposed CO_2 standards and were not previously defined in the certification regulation, which can create gaps in the available data.

The reference, target, and actual CO_2 emissions of each subgroup should be made public for each manufacturer, in addition to the manufacturer's fleet-average CO_2 emissions. This would enable closer scrutiny of the compliance pathways and help identify unforeseen exploitations of the regulatory design. Also, the certification regulation should be amended to guarantee feasible identification and reporting of the subgroups to which each vehicle corresponds.

20 European Commission, "IMPACT ASSESSMENT. Accompanying the Document Proposal for a Regulation of the European Parliament and of the Council Setting CO_2 Emission Performance Standards for New Heavy Duty Vehicles" (May 17, 2018). http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=SWD:2018:185:FIN

21 Oscar Delgado, Felipe Rodríguez, Rachel Muncrief, *Fuel Efficiency Technology in European Heavy-Duty Vehicles: Baseline and Potential for the 2020–2030 Time Frame* (ICCT: Washington DC, 2017). http://www.theicct.org/EU-HDV-fuel-efficiency-tech-2020-2030

SUMMARY OF POLICY RECOMMENDATIONS

The Commission's longstanding efforts to release this proposal are commendable, and the proposal is a welcome and important step toward slowing the growth of transportation CO_2 emissions, reducing transportation costs, and maintaining EU manufacturers' global competitiveness. The revisions to the proposal that the ICCT recommends are intended to enhance the current proposal so that it advances the EU's climate objectives more effectively, yields CO_2 benefits and fuel savings for the full spectrum of HDV categories, appropriately incentivizes HDV ZEV technologies, provides manufacturers and suppliers with certainty to make investments in low-carbon technology, and has a robust regulatory design that achieves its intended environmental and economic benefits.

- **Stringency**
  - Modify the reduction targets to at least 20% in 2025 and 35% in 2030, to utilize the available cost-effective technology potential supported by the impact assessment.
  - Evaluate the net economic and societal benefits of more stringent targets and explicitly consider the role of the standards in meeting long-term climate targets.
- **Regulated categories**
  - Include engine standards in order to cover the vehicle groups that are not subject to any CO_2 regulation.
- **Vocational trucks**
  - Amend the certification procedure to ensure unequivocal identification of vocational trucks based on technical parameters.
  - Consider engine standards or reduced stringency levels for vocational trucks according to their cost-effective technology potential.
- **Mileage and payload weighting factors**
  - Redefine the weighting factors for the calculation of manufacturer-specific average CO_2 emissions so the compliance metric is an actual weighted average with physical meaning.
- **ZLEV incentives for regulated vehicles**
  - Apply the ZLEV super-credit correction to the average CO_2 emissions of the individual subgroups in order to take into account the differences in payload and mileage of the different vehicle subgroups and make the ZLEV incentive to be proportional to lifetime CO_2 savings of ZLEVs.
- **ZLEV incentives for unregulated vehicles**
  - Limit the ZLEV incentives to only the regulated vehicle classes. Vehicle groups not subject to mandatory CO_2 reductions (e.g., vocational trucks and buses) that therefore have no associated compliance cost should not be part of the ZLEV incentive.
- **Baseline**
  - Develop a validation mechanism for the future 2019 baseline. The data available to the Commission for the development of the regulatory impact assessment can be used to develop a validation mechanism of the future 2019 baseline.
- **Adjustments to the baseline**
  - The CO_2 certification procedure, and the weighting of the different payloads and mission profiles used in the context of the CO_2 standards for the calculation of the vehicle's CO_2 emissions, should remain frozen at least until the 2022 review. Any change in methodology must be retroactively applied to the 2019 baseline and readjust the 2025 targets.
- **Mid-term review**
  - Implement regulatory safeguards to ensure that the planned 2022 review does not result in reduction targets lower than the ones proposed for 2030 in the current CO_2 standards (i.e., lower than 30%).
  - Implement regulatory safeguards to ensure that the planned 2022 review does not result in trailers being excluded from 2030 targets.
- **Publication of data and manufacturer performance:**
  - The reference, target, and actual CO_2 emissions of each subgroup for each manufacturer should be made publicly available in addition to manufacturer-specific average CO_2 emissions.

ANNEX

CURRENT PROPOSAL

The calculation of the average specific CO_2 emissions (in g/tkm) of a manufacturer is as follows:

$$CO_2\,[g/tkm] = ZLEV \times \sum_{sg} \times share_{sg} \times MPW_{sg} \times avgCO_{2\,sg}$$

Where $_{sg}$ stands for subgroup, and $\sum_{sg}$ stands for the sum over all the subgroups.

ZLEV	Zero-emission and low-emission vehicles factor, defined as the ratio of the total number of vehicles (over all subgroups) without accounting for ZLEV super-credits to the total number of vehicles (over all subgroups) after accounting for ZLEV super-credits. The ZLEV factor is limited to a minimum of 0.97.
***share*$_{sg}$**	Share of new heavy-duty vehicles in a subgroup. Takes a value between 0 and 1.
***MPW*$_{sg}$**	Mileage and payload weighting factor of a subgroup. Defined as the product of the predefined values for annual mileage and payload (i.e., freight activity) of the subgroup, normalized by the value of the subgroup with the highest freight activity. $$MPW_{sg} = \frac{AM_{sg} \times PL_{sg}}{AM_{sg\ \text{with highest freight activity}} \times PL_{sg\ \text{with highest freight activity}}}$$
***avgCO*$_2$**	Simple average of the CO_2 emissions (in g/tkm) of HDVs in subgroup

This calculation is illustrated in Figure 2 below.

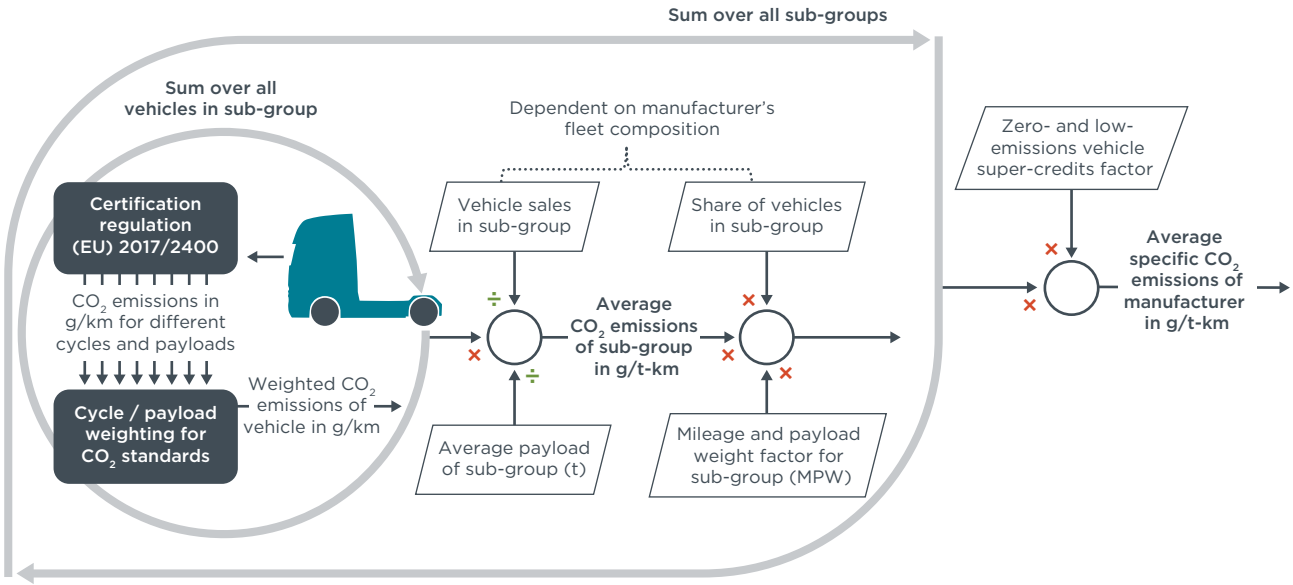

Figure 2. Calculation of the average specific CO_2 emissions of a manufacturer in a given year

ICCT PROPOSAL

We propose a method for the calculation of the average specific CO_2 emissions (in g/tkm) of a manufacturer that maintains the physical meaning of the metric and correctly accounts for the lifetime CO_2 savings of ZLEVs, as shown below and depicted in Figure 3.

$$CO_2\ [g/tkm] = \sum_{sg} ZLEV_{sg} \times MPSW_{sg} \times avgCO_{2\,sg}$$

Where $_{sg}$ stands for subgroup, and $\sum_{sg}$ stands for the sum over all the subgroups.

ZLEV$_{sg}$	Each subgroup has its own ZLEV factor. It is defined in a similar way as the Commission's, but only takes into account the vehicles within the subgroup. The $ZLEV_{sg}$ factor is then the ratio of the number of vehicles in the subgroup without accounting for ZLEV super-credits to the number of vehicles in the subgroup after accounting for ZLEV super-credits. The $ZLEV_{sg}$ factors are not capped a priori. Yet, as in the Commission's proposal, the combined application of the $ZLEV_{sg}$ factors cannot reduce the average specific emissions of a manufacturer by more than 3%.
MPSW$_{sg}$	Mileage, payload and sales weighting factor of a subgroup. It is defined as the product of the predefined values for annual mileage and payload (i.e., freight activity) of the subgroup and the number of new HDVs in the vehicle subgroup. The factor is normalized by the sum over all subgroups. $$MPSW_{sg} = \frac{AM_{sg} \times PL_{sg} \times \#\ veh_{sg}}{\sum_{sg} AM_{sg} \times PL_{sg} \times \#\ veh_{sg}}$$
avgCO$_2$	Simple average of the CO_2 emissions (in g/tkm) of HDVs in subgroup.

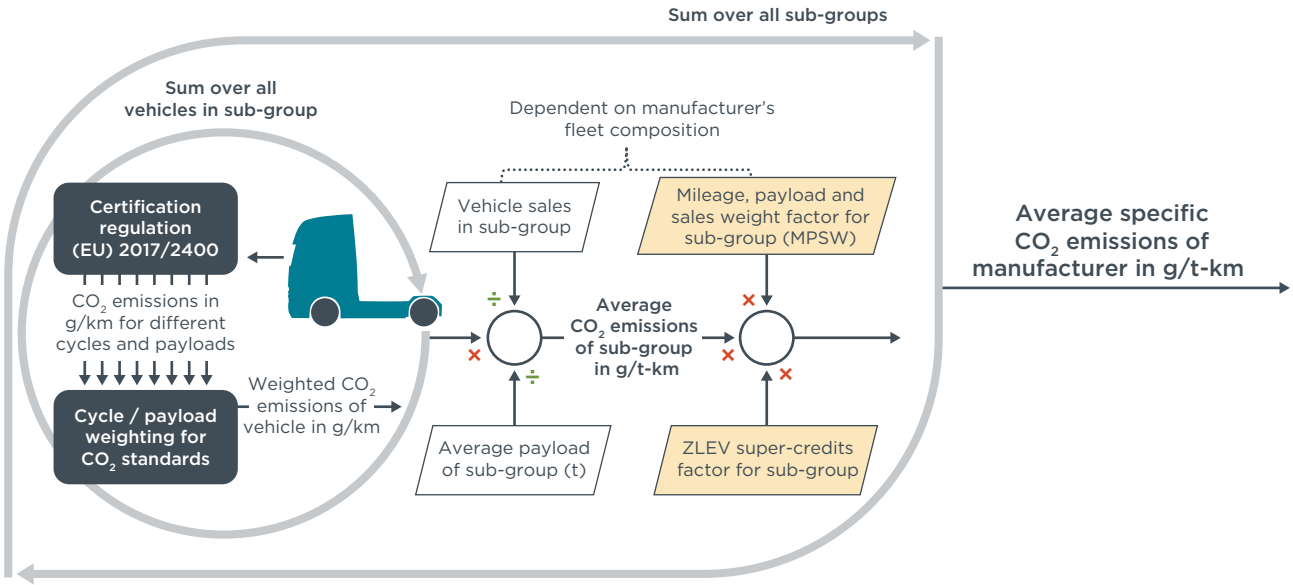

Figure 3. ICCT proposal for the calculation of the manufacturer's average specific CO_2 emissions. Yellow boxes highlight the proposed changes.

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