ACEA

European
Automobile
Manufacturers
Association

CO_2 emissions from heavy-duty vehicles

Preliminary CO_2 baseline (Q3-Q4 2019) estimate

March 2020

ACEA European Automobile Manufacturers Association

KEY MESSAGES

a. This paper by the European Automobile Manufacturers' Association (ACEA) provides an analysis of the CO_2-emission values of heavy-duty vehicles produced for the European market during the second half of 2019 (quarter 3 and 4).
b. In line with European Regulation (EU) 2017/2400, these values have been determined using VECTO, the official software tool of the European Commission.

c. VECTO categorises the many different heavy-duty vehicles into 'vehicle groups', each of which comprises a number of representative mission profiles to adequately reflect the very different characteristics and uses of heavy-duty vehicles – these are known as 'vehicle subgroups'.
d. This analysis shows that 68.2% of the CO_2 emissions of all analysed vehicles can be attributed to just one subgroup, namely 5-LH (4x2 tractors, GCW >16t).
e. It also reveals that 95% of all vehicles in 5-LH, the most important subgroup, have CO_2-emission values between 52 g/tkm and 64 g/tkm with an average of 56.5 g/tkm.

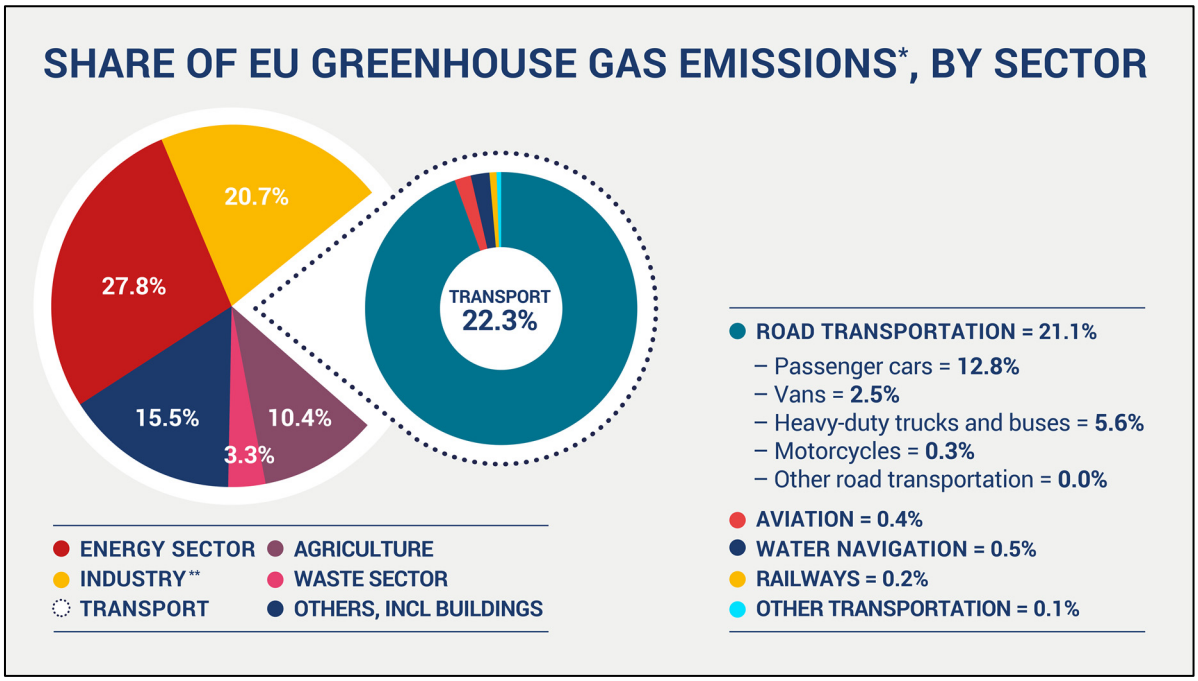
f. The spread of CO_2-emission values around the average for the 5-LH subgroup is only +13.3% to -8.0%, or about +/-10%.
g. This low spread demonstrates that truck manufacturers are already competing intensively, and successfully, to bring the most fuel-efficient vehicles to the market.

h. Other vehicle subgroups, especially those with high relevance for total CO_2 emissions – that is subgroups 9-LH (6x2 rigid, all weights) and 10-LH (6x2 tractors, all weights) – show a similar picture.

i. Even though the EU Regulation specifically allows the use of 'standard values' under certain conditions, over 90% of all CO_2 values determined with VECTO are based on measured component-input values for all components.
j. For each individual component (axles, transmission and air drag) 94-97% of the CO_2 calculations are based on measured input values.

CONTEXT

The transport sector is responsible for 22.3% of total EU greenhouse gas (GHG) emissions, with road transport representing 21.1% of total emissions. Breaking this down further, passenger cars account for 12.8% of Europe's emissions, vans for 2.5%, while heavy-duty trucks and buses are responsible for 5.6%. Transport is therefore a key focus and driver for climate protection measures.



* All CO_2 equivalent
** Industry = 'Manufacturing industries and construction' + 'Industrial processes and product use'
Source: European Environment Agency (EEA)

For a number of reasons, heavy-duty vehicles are fundamentally different from passenger cars. The end-use or 'mission' of trucks varies widely – they may for instance be used for long-haul or regional delivery, for construction or for municipality use.

Depending on their mission, most trucks are custom-built on an individual basis in order to meet the specific requirements of transport operators, from the number of axles to the size of the engine and fuel tank, to the size of the cab or the height of the chassis.

Furthermore, when we take the complete vehicle into account – the rigid body or a tractor plus trailer – the heavy-duty vehicle market becomes even more complex. There are literally thousands of shapes and sizes of trucks.

This complexity is also reflected in the CO_2 legislation for heavy-duty vehicles adopted by the European Union over the last few years, which differs significantly from the regulations setting CO_2 targets for passenger cars and light commercial vehicles (ie vans).

CO_2 REGULATION FOR HEAVY-DUTY VEHICLES

The regulation of CO_2 emissions from new heavy-duty vehicles in the European Union rests on three major pillars:

1.) Determination of CO_2 emissions using the VECTO tool – Regulation (EU) 2017/ 2400

- The European Commission has developed a computer simulation tool called VECTO, which determines the CO_2 emissions of new heavy-duty vehicles using measured and certified input data for the properties of a vehicle's components and detailed specifications of the vehicle.
- VECTO can be used to determine the CO_2 emissions for a wide variety of complete truck and trailer configurations.
- VECTO provides vehicle-specific CO_2 data for different mission profiles (eg long-haul, regional/urban delivery, construction, etc), taking into account important variables such as specific usage patterns, vehicle configurations and different payloads.
- As from January 2019, every new truck in the VECTO vehicle groups 4 and 5 (ie 4x2 tractors and rigid lorries >16t) and groups 9 and 10 (ie 6x2 tractors and rigid lorries, all weights) gets an 'official' CO_2 value – ie specific CO_2 emissions in g CO_2/tkm, determined using VECTO.

2.) Monitoring and reporting – Regulation (EU) 2018/ 956

- The CO_2 values of every newly-registered heavy-duty vehicle, as calculated by VECTO, are collected by vehicle manufacturers.
- By the end of September 2020, manufacturers of heavy-duty vehicles will be reporting this data to the European Environment Agency (EEA); first for the so-called baseline period (new vehicles registered from 1 July 2019 to 30 June 2020) and subsequently in regular annual intervals.

3.) CO_2 emission standards – Regulation (EU) 2019/ 1242

- The EU regulation setting CO_2 standards for trucks obliges manufacturers to reduce their average fleet emissions across the regulated vehicle groups by -15% (by 2025) and -30% (by 2030) compared to the earlier-mentioned baseline.
- This industry baseline will be determined based on the reported CO_2-emission data and will be published by April 2021. In case the European Commission identifies an undue inflation of the input data, a corrected baseline will be published by April 2022 at the latest.

PRELIMINARY CO_2 BASELINE ESTIMATE 2019

In order to get an early understanding of the baseline, ACEA worked with a consultancy (Sioux LIME) that collected the CO_2 data as determined by VECTO from manufacturers, and subsequently aggregated and anonymised this data at fleet level for the European market.

This analysis is based on the following preconditions:

- Sioux LIME collected VECTO output data for the heavy-duty vehicles – in vehicle groups 4, 5, 9 and 10 – produced in the third and fourth quarter of 2019 for the EU market, including the United Kingdom.
- ACEA strictly adhered to its competition law policy with regard to collecting and analysing data.
- Accordingly, Sioux LIME:
    - Made no reference to any individual data of the manufacturers.
    - Made no reference to any manufacturer's sales volumes.
    - Omitted the data for vehicle subgroup 4-UD (urban delivery) due to strict compliance requirements specifying that the number of manufacturers contributing to every subgroup had to be five at least.

It is important to note that this preliminary analysis of the CO_2 baseline for heavy-duty vehicles will differ from the official baseline that will be determined and published by the European Commission because of the following reasons:

- ACEA's analysis looks at vehicles that have been **produced** during the second half of 2019. The official EU baseline, however, will be based on vehicle **registrations** during the reference period (from 1 July 2019 to 30 June 2020).
- This analysis excludes vehicles that are seen as so-called 'vocationals' based on their status at the time of production, which might change by the time of registration of the vehicle.
- The preliminary estimate is based on 2019 data for the EU28 market, including the UK. Brexit might have an impact on the official baseline.
- While this industry analysis is only based on data collected by ACEA members, the official baseline will include all heavy-duty manufacturers with vehicles registered in the EU.
- For earlier-mentioned compliance reasons, vehicles in subgroup 4-UD are excluded from this analysis. Indeed, the official EU baseline will include all vehicle subgroups.

RESULTS

Our findings show that 83.6% of all vehicles in the groups 4, 5, 9 and 10 are concentrated in just four vehicle subgroups (4-LH, 5-LH, 9-LH and 10-LH) which comprise all long-haul applications.

With a 62.8% share of total sales, 5-LH is by far the most relevant subgroup.

SUBGROUP SHARE

	Q3-Q4 share	Configuration	GCW [T]	Engine [kW]	Cabin
4-UD	**0.4%**	R 4x2	>16	<170	All
 **4-RD**	**7.9%**	R 4x2	>16	≥170 day cab ≥170 <265 sleeper cab	Day & sleeper
4-LH	**1.9%**	R 4x2	>16	≥265	Sleeper
 **5-RD**	**0.8%**	T 4x2	>16	All-day cab <265 sleeper cab	Day & sleeper
5-LH	**62.8%**	T 4x2	>16	≥265 sleeper cab	Sleeper
 **9-RD**	**7.2%**	R 6x2			Day
9-LH	**9.2%**	R 6x2			Sleeper
 **10-RD**	**0.1%**	T 6x2			Day
10-LH	**9.7%**	T 6x2			Sleeper

On the other hand, subgroups 4-UD (4x2 rigid lorries, GCW >16t), 5-RD (4x2 tractors, GCW >16t) and 10-RD (6x2 tractors, all weights) each have a share of less than 1% of total sales during quarter 3 and 4 of 2019, and together account for only 1.3% .

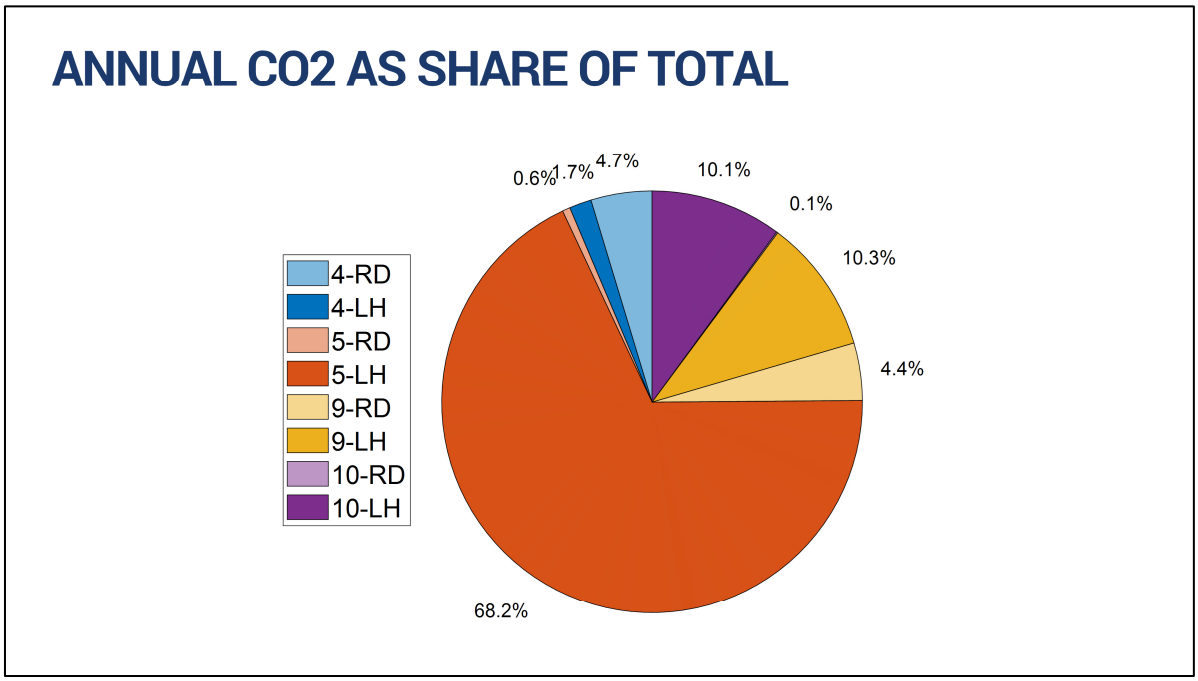
AVERAGE CO2 PERFORMANCE PER SUBGROUP

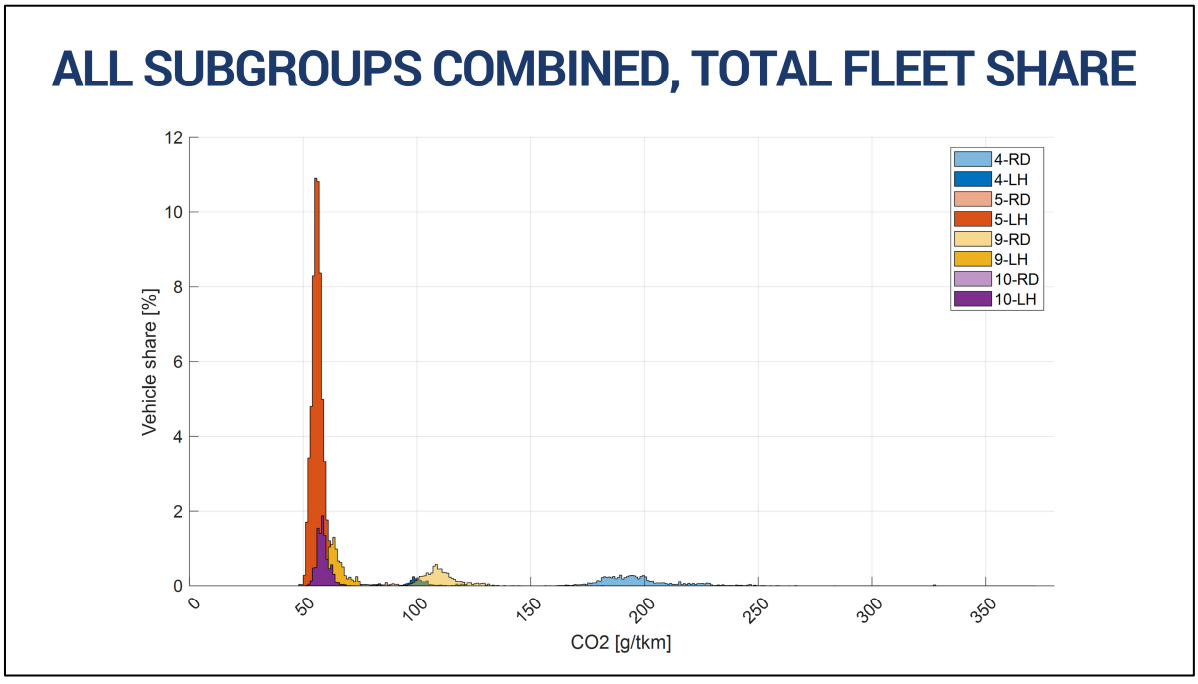
	Q3-Q4 share	Average CO2 [g/tkm]	Payload [tonne]	Annual mileage [km]	Annual CO2 [% of total] excl 4-UD
4-UD	0.4%		2.7	60,000	
4-RD	7.9%	**198.1**	3.2	78,000	4.7%
4-LH	1.9%	**102.9**	7.4	98,000	1.7%
5-RD	0.8%	**84.0**	10.3	78,000	0.6%
5-LH	62.8%	**56.5**	13.8	116,000	68.2%
9-RD	7.2%	**110.9**	6.3	73,000	4.4%
9-LH	9.2%	**64.7**	13.4	108,000	10.3%
10-RD	0.1%	**84.0**	10.3	68,000	0.1%
10-LH	9.7%	**58.6**	13.8	107,000	10.1%

The analysis also shows that (as expected) the average CO_2 emissions per vehicle subgroup vary significantly as a result of the very different mission profiles, average payloads and annual mileages

of these vehicles. However, the biggest share (68.2%) of total CO2 emissions of all vehicle classes analysed can be attributed to just one subgroup: 5-LH.

Moreover, more than 90% (90.3%) of all CO2 emissions from heavy-duty vehicles stem from subgroups 4-LH, 5-LH, 9-LH and 10-LH, with 88.6% of total emissions concentrated in vehicle subgroups 5-LH, 9-LH and 10-LH.

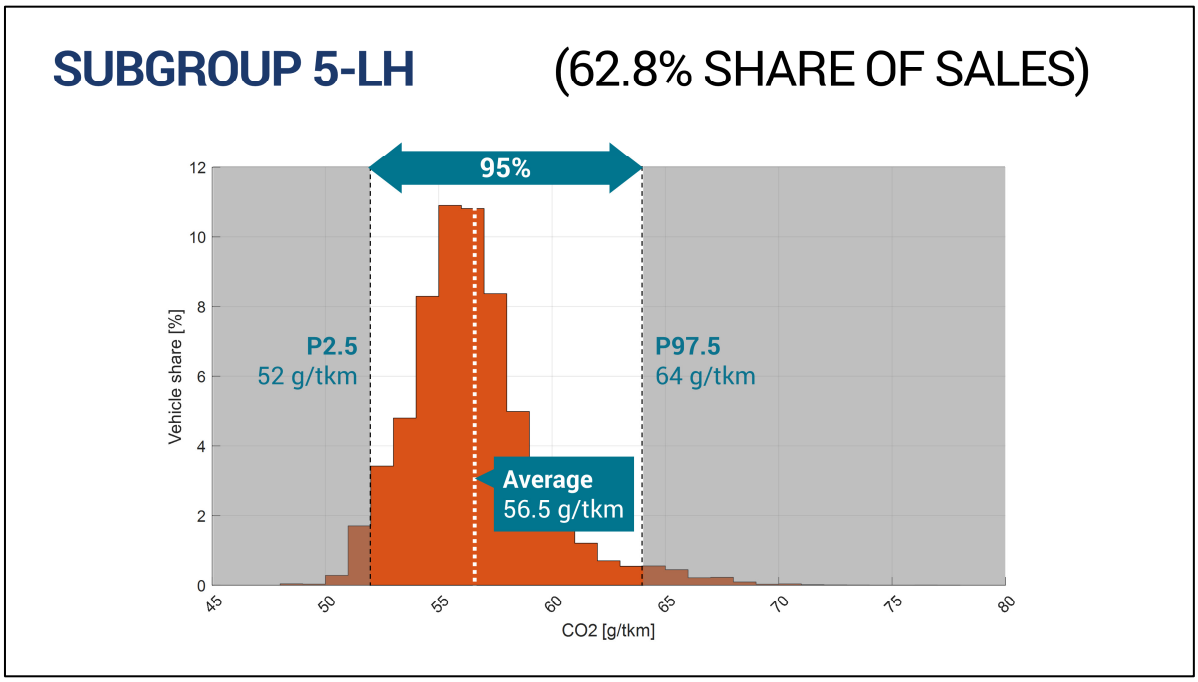




Looking at all vehicle subgroups combined, the findings show that the CO2-emission values for different subgroups differ significantly from each other. Although the long-haul subgroups (5-LH, 9-LH and 10-LH) are more or less in a similar range of CO2 emissions, other subgroups such as 9-RD and 4-RD show higher CO2 values. The main reasons for this are the different payload definitions and duty cycles of these subgroups. Indeed, vehicles in these subgroups with higher CO2 values are not 'less efficient', they simply operate under different payload and duty-cycle conditions.

SUBGROUP 5-LH BREAKDOWN

The analysis also demonstrates the overwhelming dominance of vehicle subgroup 5-LH (again), which – together with the other long-haul subgroups, 9-LH and 10-LH – has the lowest average CO2-emission values. Due to its particular relevance, a further breakdown of the distribution of vehicles in subgroup 5-LH, and their CO2 values, is justified.

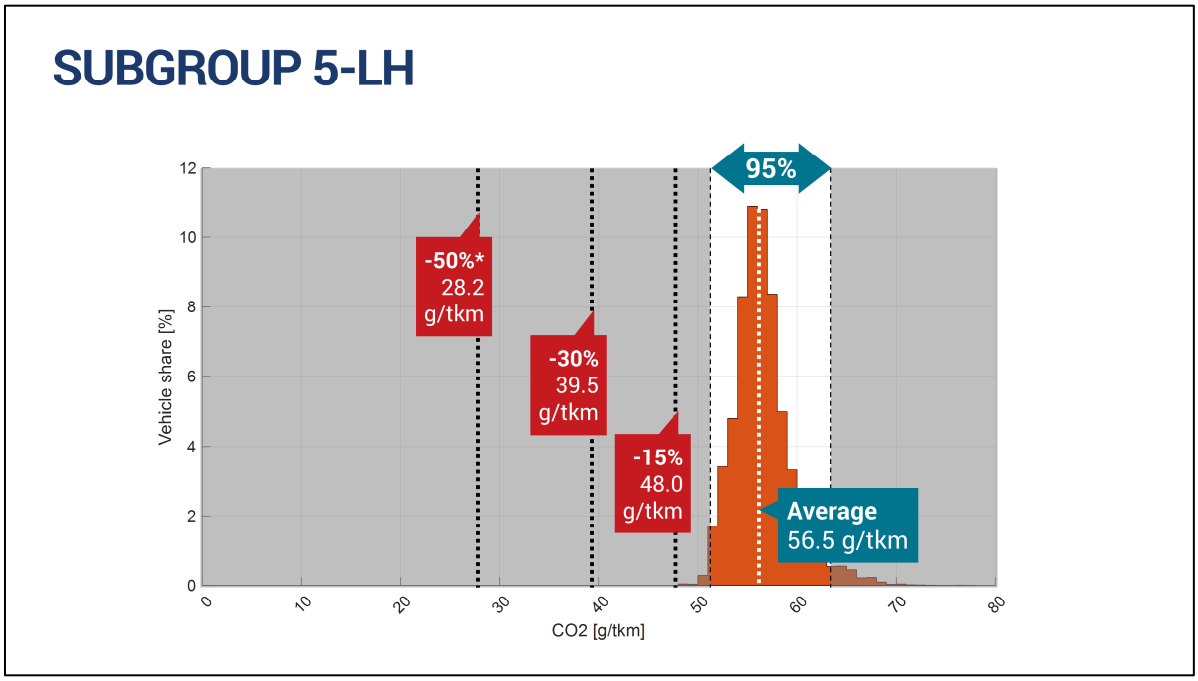


Here the findings indicate that 95% of all vehicles in subgroup 5-LH have CO2-emission values between 52 g/tkm and 64 g/tkm, with an average of 56.5 g/tkm. The spread of CO2 values around the average is only +13.3% to -8.0%, or about +/-10%. This low spread proves that Europe's truck manufacturers are already competing intensively, and successfully, to bring the most fuel-efficient vehicles to the market.

At the same time, even within subgroup 5-LH there are a number of vehicles with higher CO2-emission values. However, these heavy-duty vehicles are not less efficient either, they are simply configured to serve different purposes.

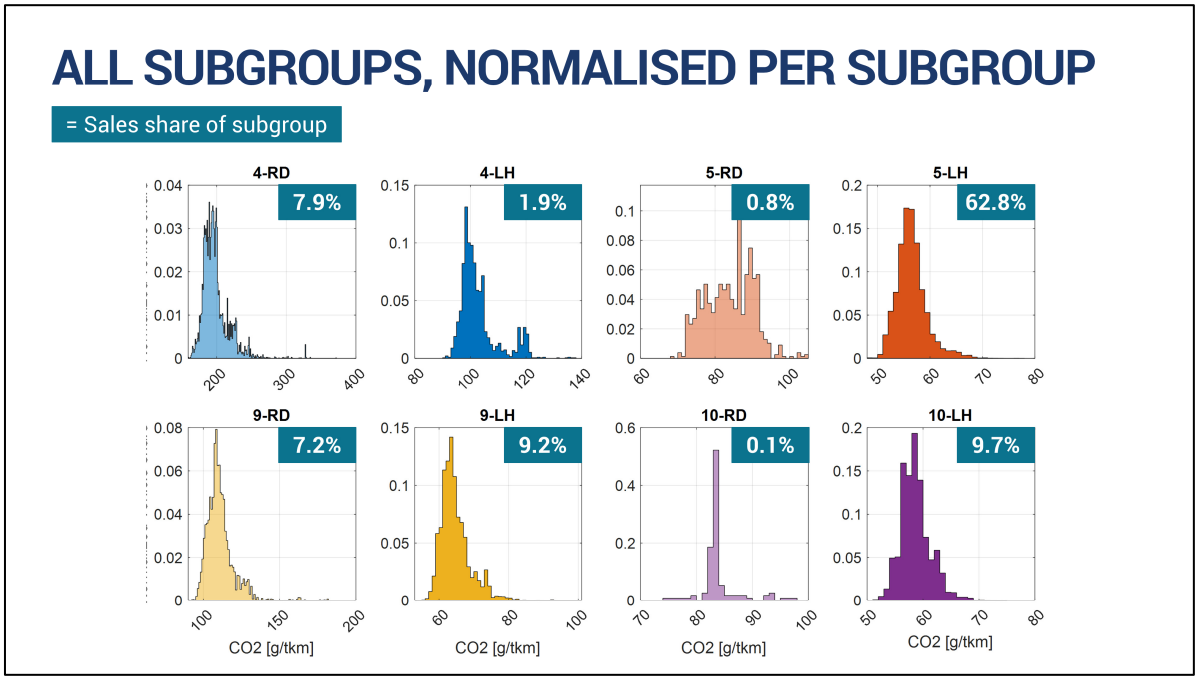
Adding the CO2 reduction targets that were recently set by the EU for heavy-duty vehicles (-15% by 2025 and -30% by 2030) to the picture, puts the extremely ambitious targets that manufacturers are

facing into perspective – see chart below.



* According to Art 3 (12) of Regulation (EU) 2019/1242 low-emission vehicles are defined as those having less than half (-50%) of the reference CO_2 emissions of the vehicle subgroup concerned.

The chart above also shows that literally none of today's heavy-duty vehicles qualify as low-emission vehicles (LEV), which are defined by the EU as vehicles emitting less than half (-50%) of today's average CO_2 emissions.



Generally speaking, for all vehicle subgroups the distribution of CO_2 emissions shows quite a similar pattern with a tendency towards lower values. Also this indicates that already today, manufacturers strive to further bring down fuel consumption and CO_2 emissions. The notably different shape of subgroup 5-RD can mainly be attributed to its relatively low share (ie less than 1% of all covered vehicles) and the low total number of vehicles in this subgroup.

ANALYSIS OF VECTO INPUT DATA

Regulation (EU) 2017/2400 sets detailed provisions for how the necessary VECTO input data for different vehicle components should be determined. These inputs for VECTO are characteristic parameters to determine the power consumption of every relevant vehicle component. Amongst others, the parameters for rolling resistance, air drag, masses and inertias, gearbox friction, auxiliary power and engine performance are component-input values used to simulate fuel consumption and CO_2 emissions based on standardised driving cycles.

In some cases, measured values are not available, which is why manufacturers are allowed to use standard 'fall-back' values. This in order to account for low-volume components, high costs, the (timely) availability of measurements, or the switch to a new supplier which might not have provided measured values (yet).

The analysis shows that more than 90% of all CO_2 values (determined for regulated vehicle classes) are based on measured values for all components, including axles, the transmission and air drag.

- For more than **94%** of all CO_2 calculations, the **axles** have measured input values.
- For more than **97%** of all CO_2 calculations, the **transmission** has measured input values.
- For more than **96%** of all CO_2 declarations, the vehicles have measured input values for **air drag**.

CONCLUSIONS

- This preliminary analysis of the CO_2-emission values of heavy-duty vehicles produced in the second half of 2019 highlights the strong dominance of just a few vehicle subgroups.
- Indeed, 88.6% of all vehicles are concentrated in subgroups 5-LH, 9-LH and 10-LH.
- 5-LH accounts for more than two thirds (68.2%) of total CO_2 emissions of all analysed vehicles.
- The analysis also shows that 95% of all vehicles in subgroup 5-LH have a CO_2 value between 52 g/tkm and 64 g/tkm, with an average of 56.5 g/tkm.
- The spread of the CO_2-emission values around the average is only +13.3% to -8.0%, or about +/-10%. This low spread demonstrates that Europe's truck manufacturers are already competing intensively, and successfully, to bring the most fuel-efficient vehicles to the market.
- Other relevant vehicle subgroups, such as 9-LH and 10-LH, show a similar picture.
- More than 90% of all CO_2 values determined with VECTO are based on measured component-input values for all components.
- The findings also indicate that for axles, the transmission and air drag 94-97% of the CO_2 calculations are based on measured input values.

GLOSSARY

- The **Vehicle Energy Consumption Calculation Tool (VECTO)** has been developed by the European Commission as the official tool for certifying and monitoring the CO_2 emissions and fuel consumption of whole heavy-duty vehicles. Manufacturers are obliged to use it for determining the CO_2 emissions and fuel consumption of heavy-duty vehicles (trucks, buses and coaches) with a gross vehicle weight above 3,500 kg.

- **Vehicle groups and subgroups**: Five different mission profiles for trucks and five different mission profiles for buses and coaches have been developed and implemented in the VECTO tool to reflect the different characteristics and uses of the European fleet. Depending on the vehicle group, a vehicle is typically used for certain purposes, which is why the cycles ('mission profiles') represent different usage profiles. Consequently, the vehicle group determines which cycles are simulated. The allocation of vehicle groups to mission profiles is defined in Regulation (EU) 2017/2400 on the determination of CO_2 emissions and fuel consumption of heavy-duty vehicles (Annex I, Table 1).

- **Standard values or 'fall-back' values** can be used under certain conditions according to Article 13 of Regulation (EU) 2017/ 2400. The properties of components related to CO_2 emissions and fuel consumption should be based either on the values determined for each component family in accordance with Article 14 and certified in accordance with Article 17 ('certified values') or, in the absence of certified values, on the standard values determined in accordance with Article 13.

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ABOUT THE EU AUTOMOBILE INDUSTRY

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

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