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OCTOBER 2024

Within reach

The 2025 CO_2 targets for new passenger cars in the European Union

JAN DORNOFF

ACKNOWLEDGMENTS

Thanks to Marie Rajon Bernard, Peter Mock, and Uwe Tietge of the ICCT for their reviews. Thanks also to Yoann Gimbert of Transport & Environment; his review does not imply an endorsement.

International Council on Clean Transportation Europe
Fasanenstrasse 85, 10623 Berlin, Germany

communications@theicct.org | www.theicct.org | @TheICCT

EXECUTIVE SUMMARY

This analysis estimates the carbon dioxide (CO_2) targets manufacturers will face in 2025 and compares those with the CO_2 performance of their 2023 vehicle fleet if it were to remain unchanged until 2025. We find that, to meet 2025 CO_2 targets, manufacturers will need to reduce CO_2 emissions by 12%, on average, compared with the emissions of their 2023 vehicle fleet. The required reduction for individual manufacturers that were not already below the target ranges from 9%–21%.

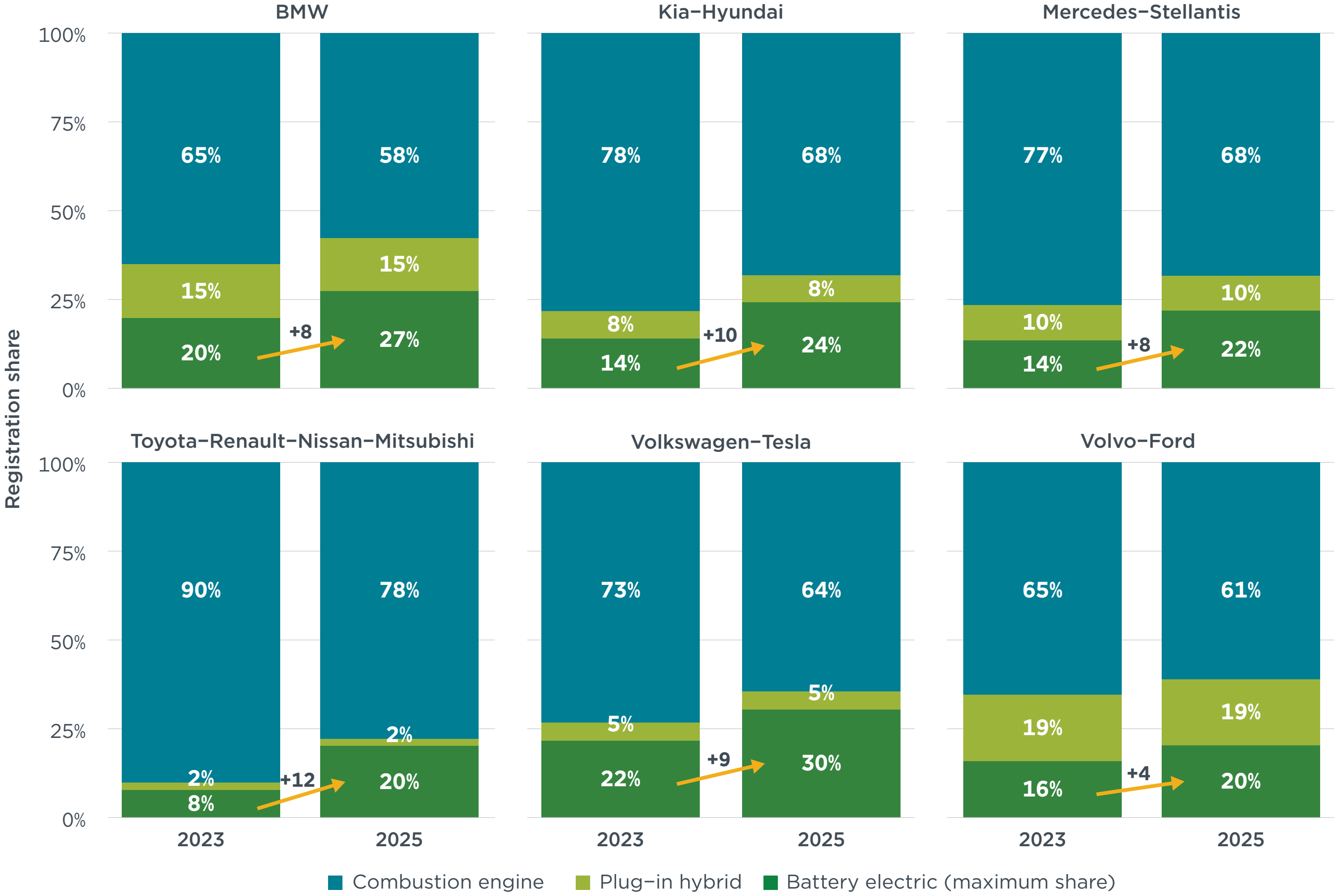
With advantageous pooling by manufacturers, the range of required CO_2 reductions could narrow to 6%–13%, which is close to the average required reduction of 12%. In an extreme case of the CO_2 emissions of combustion engine vehicles remaining constant, manufacturers would need to increase their battery electric vehicle (BEV) market shares within 2 years by a maximum of 8–18 percentage points compared with 2023. For the hypothetical pools in this analysis, the required BEV market share growth would drop to 4–12 percentage points.

The average CO_2 reduction of 12% required from 2023–2025 is about half the 23% fleet-average CO_2 reduction observed between 2019 and 2021. The increase in BEV market share required for the hypothetical manufacturer pools in this study is at most about 1–1.5 times as high as the 8 percentage point growth observed from 2019–2021; at that time, however, fewer BEV models with, on average, lower range were on the market and the charging infrastructure was much less developed. Besides increasing the BEV market share, manufacturers can reduce the average CO_2 emission levels of their internal combustion engine vehicles by promoting the more efficient vehicles of their portfolio. Furthermore, deploying mild hybridization can reduce CO_2 emissions by at least 7%–15%, depending on the technology package.

Although detrimental for real-world CO_2 emissions, manufacturers can also increase the share of plug-in hybrid vehicles and/or further lower their CO_2 emission values by extending the electric range of these vehicles.

Figure ES1

Powertrain type shares in 2023 and maximum required electric vehicle shares to meet 2025 CO_2 targets for hypothetical manufacturer pools



Notes: Data is shown for six hypothetical pools (sorted alphabetically) of the 10 largest manufacturers that did not produce only battery electric vehicles in 2023 plus Tesla. It assumes that manufacturers only adjust their BEV shares to meet targets.

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INTRODUCTION

Starting in 2025, the European carbon dioxide (CO_2) standards for new cars and vans, Regulation (EU) 2019/631, will set the next level of ambition for new vehicles registered in the European Economic Area (EEA) and put the region on the path to 100% zero-emission new vehicles by 2035. The CO_2 target applies to new vehicles registered from 2025–2029 and requires, on average, a 15% reduction in CO_2 emissions compared with a 2021 baseline. This is equivalent to an annual CO_2 emissions reduction rate of about 4% from 2021–2025.

Between 2021 and 2023, CO_2 emissions of internal combustion engine vehicles (ICEVs) remained largely constant; manufacturers achieved CO_2 emission reductions primarily by increasing their share of plug-in hybrid vehicles (PHEVs) and battery electric vehicles (BEVs) (Tietge et al., 2024). Because the official PHEV CO_2 emission values have been found to not adequately reflect emissions during real-world driving, revised calculation parameters for determining the official CO_2 emissions of new PHEV models will apply from 2025. One year later, the new parameters will apply to all new PHEVs registered (Dornoff, 2022). As a result, the higher type-approval CO_2 emission values will make PHEVs less effective for meeting the CO_2 targets.

This report estimates the CO_2 targets per manufacturer in 2025 and determines the maximum BEV share required to meet these targets, considering the adjusted PHEV CO_2 emission values and the effect of zero- and low emission vehicle incentives in the CO_2 target calculations. It assumes that manufacturers will not further reduce ICEV CO_2 emissions.

This report is structured as follows: First the mechanism for determining manufacturer CO_2 targets in 2025 is explained. Then, the estimated CO_2 targets in 2025 per manufacturer are presented, together with the share of electric vehicles that would be required to meet those targets. We compare the current state of fleet CO_2 emissions and required reductions with the 2019–2021 period, when the last strengthening of CO_2 targets occurred, and highlight compliance options for manufacturers to meet 2025 targets in addition to increasing their BEV shares, including pooling. The report closes with a summary and conclusions.

DETERMINATION OF 2025 MANUFACTURER CO_2 TARGETS

Following the same principle as the preceding CO_2 standards, EC 443/2009, a fleet-average CO_2 target is defined for the period 2025–2029. From this fleet-average target, individual targets for each year per manufacturer are derived, dependent on the average mass of the manufacturer's new vehicle registrations. Car manufacturers can pool together several brands, not necessarily from the same manufacturer, to meet CO_2 targets. Pools are treated as one manufacturer, and, therefore, CO_2 targets and performance are calculated based on all cars registered by the participating manufacturers.

To allow for a year-on-year comparison in this analysis, manufacturers that were subsidiaries of the same corporation in 2023 are grouped together and treated as a single manufacturer in all years analyzed. In the remainder of the report, the term manufacturer refers to both individual manufactures and groups of connected manufacturers.[1] The study focuses on the 10 largest manufacturers in terms of new registrations in 2023, leaving aside Tesla, a manufacturer that solely sells BEVs.

FLEET-AVERAGE TARGET APPLYING IN 2025–2029

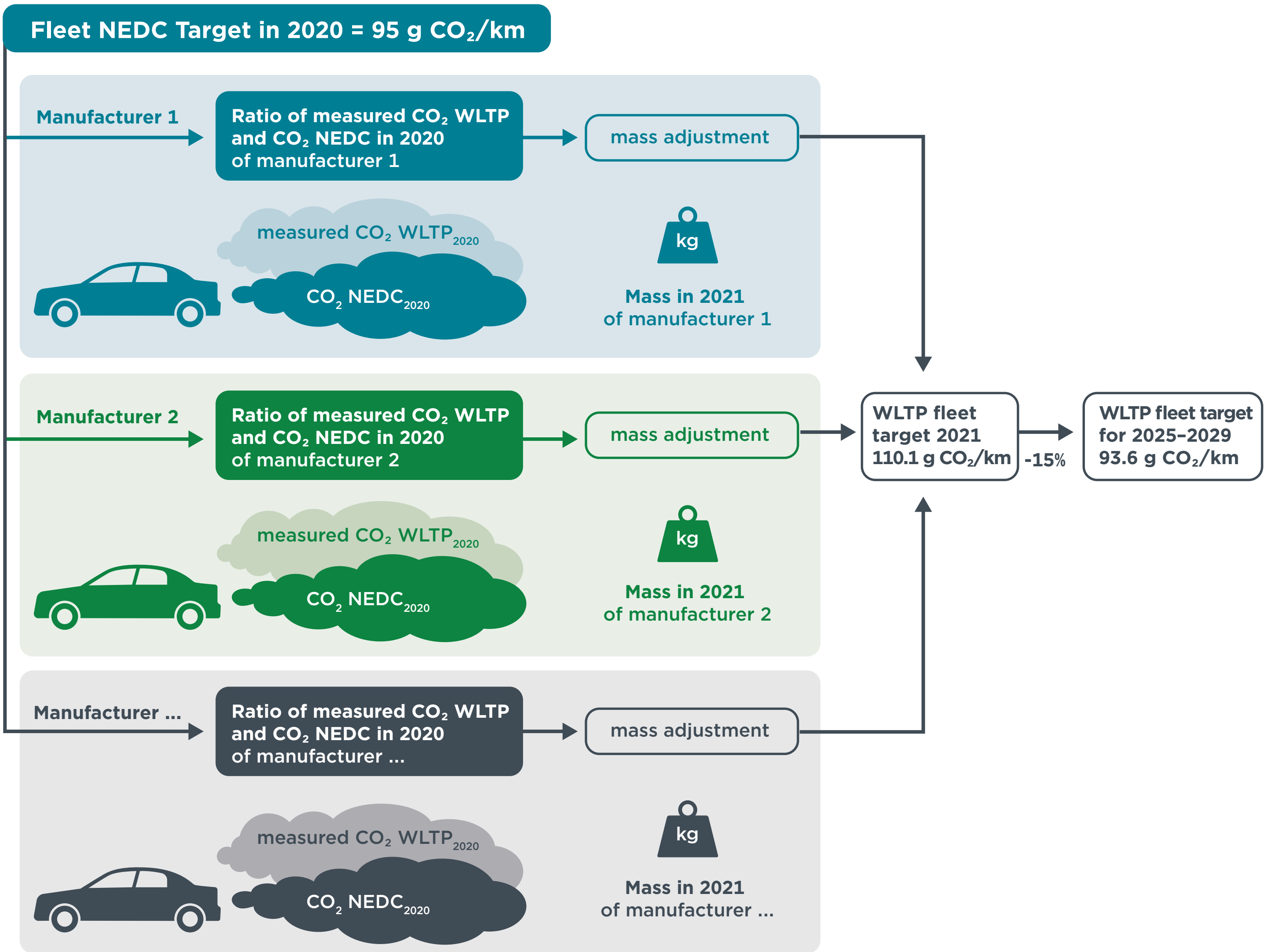
As Figure 1 shows, the Worldwide harmonized Light vehicles Test Procedure (WLTP) fleet target that applies from 2025–2029 is defined relative to a 2021 WLTP fleet target. It requires a 15% reduction in CO_2 emissions compared with the 2021 value, which corresponds to an annual reduction of about 4%. The WLTP fleet target for 2021 is determined for each manufacturer by first multiplying the 2020 New European Drive Cycle (NEDC) target of 95 g/km with the average ratio of measured WLTP and declared NEDC CO_2 emissions of all its cars registered in 2020. After correcting this value for the manufacturers average mass in 2021, a fleet-average target is calculated as the 2021 average weighted by number of registrations across all manufacturers, resulting in the 2021 WLTP fleet target of 110.1 g/km. Applying the 15% reduction yields a 2025–2029 WLTP fleet target of 93.6 g/km ((EU) 2023/1623, 2023).

In order to more accurately reflect the physical effect of the WLTP and NEDC test procedures on CO_2 emissions, and to prevent manufacturers from inflating the 2021 fleet target (and thereby the dependent 2025–2029 fleet target), the WLTP CO_2 emissions measured during type-approval are used for the 2021 fleet target calculation, and not the values declared by the manufacturer (Dornoff et al., 2020). The fleet-average ratio of measured WLTP and NEDC CO_2 emissions in 2020 of 1.157 used for the target calculation was determined by the Joint Research Centre of the European Commission. This means that WLTP CO_2 emissions are on average 15.7 % higher than the emissions determined under NEDC (Suarez et al., 2023).

1 Manufacturers and connected undertakings considered in this study: BMW Group (BMW, Mini); Ford (Ford); Hyundai (Hyundai); Kia (Kia); Mercedes-Benz (Mercedes-Benz, Smart); Renault-Nissan-Mitsubishi (Dacia, Mitsubishi, Nissan, Renault); SAIC (MG); Stellantis (Alfa Romeo, Citroën, Fiat, Jeep, Lancia, Opel, Peugeot); Suzuki (Suzuki); Toyota (Lexus, Toyota); Volkswagen (Audi, Cupra, Porsche, SEAT, VW, Škoda); and Volvo (Volvo).

Figure 1

Calculation of the 2025–2029 CO_2 fleet target



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INDIVIDUAL MANUFACTURER TARGETS IN 2025

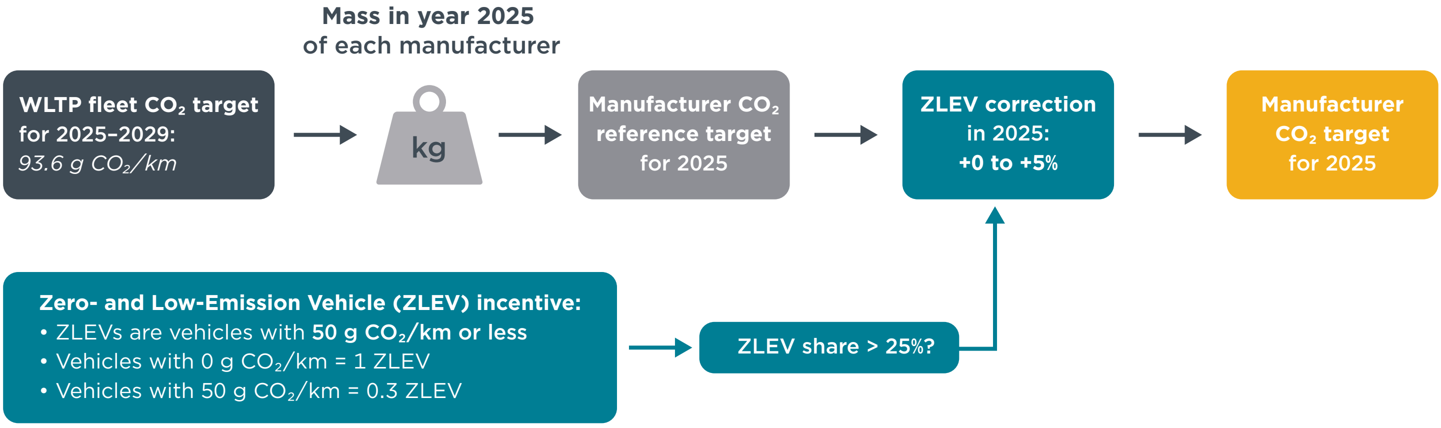
In 2025 and each calendar year up to 2029, specific CO_2 targets are determined for each manufacturer, as shown in Figure 2. First, a manufacturer reference target is calculated as the 2025 WLTP fleet target, adjusted for the average WLTP test mass of all vehicles registered by the manufacturer in each year.[2] The reference target is then multiplied with the zero- and low-emission vehicle (ZLEV) correction factor.[3] The ZLEV correction raises a manufacturer's CO_2 target by the number of percentage points the manufacturers ZLEV registration share exceeds 25%. For example, if 26.7% of a manufacturer's new registrations are ZLEVs, the CO_2 target is increased by 26.7%, minus 25%, equaling 1.7%. The correction is capped at 5%.

2 The vehicle test mass is used under WLTP to determine each vehicle's CO_2 emissions individually. It is defined as the mass in running order plus the mass of installed optional equipment plus 25 kg plus a mass representative of the vehicle load under average use.

3 ZLEVs are vehicles with CO_2 emissions of 50 g/km or less. A vehicle with 0 g CO_2/km is counted as 1 ZLEV, whereas a vehicle with 50 g/km is counted as 0.3 ZLEV. The ZLEV of vehicles with CO_2 emissions in between these boundaries are determined by linear interpolation between 1 and 0.3; e.g., a vehicle with 25 g CO_2/km is equivalent to 0.65 ZLEV.

Figure 2

Determination of manufacturer CO_2 targets in 2025



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ESTIMATED MANUFACTURER TARGETS IN 2025

Manufacturer CO_2 targets for 2025 do not only depend on the fleet-average test mass of all their vehicles registered in each year, but also on the share of vehicles with CO_2 emissions of 50 g/km or less through the ZLEV mechanism, as explained in the previous section. Therefore, to calculate manufacturer CO_2 targets, the average test mass, the CO_2 emissions of individual vehicles, and the market shares of ICEVs, fuel-cell electric vehicles, PHEVs, and BEVs must be known.

To check compliance with CO_2 targets, the manufacturer's CO_2 performance, which is the average the of type-approval CO_2 emissions of all its vehicles registered in one year, is compared with their target values.

Since calculation of the CO_2 targets and manufacturer performance both depend on the market share of the different powertrain types, determining the minimum BEV market share required for meeting the CO_2 target is an optimization problem. This means the BEV share is numerically optimized until the difference between the calculated CO_2 performance and calculated CO_2 target reaches zero.

ASSUMPTIONS MADE FOR CALCULATING THE MANUFACTURER CO_2 TARGETS

The assumptions made for estimating manufacturer 2025 CO_2 targets and minimum BEV share required to meet these targets are shown in Table 1.

To allow for a comparison between years, we assume for the period 2021–2025 that the brands belonging to one manufacturer are the same as in 2023, the latest year for which fleetwide CO_2 emission data is available. Considering that manufacturers largely focus on the transition to electromobility, we do not expect notable investments in efficiency measures for ICEVs, and, therefore, no improvements in the average CO_2 emissions of ICEVs, between 2023 and 2025. This is in line with the CO_2 performance data published by the European Environment Agency for the years 2021 to 2023, showing a CO_2 reduction for ICEVs of only 0.5% per year (Tietge et al., 2024).

In contrast, the CO_2 emissions of PHEVs are expected to change considerably in 2025 compared with 2023 for the following reasons. The electric range of PHEVs continues to increase, which lowers the calculated official CO_2 emission value. Furthermore, an adjusted utility factor will apply from January 2025 onwards, which will yield official PHEV CO_2 emission values more representative of real-world usage. How we estimated the PHEV CO_2 emission values for 2025 is discussed in detail in the next section. Considering the higher type-approval CO_2 emissions of PHEVs from 2025 onwards, we expect the market share of PHEVs to not grow in the future. For this analysis, we assume that the market share in 2025 will be the same as in 2023.

Since the share of fuel-cell vehicles was well below 1% in 2023, and as we do not expect a considerable growth until 2025, we set their market share to zero for our analysis. ICEVs are expected to constitute the remaining vehicles in the fleet that are not PHEVs or BEVs.

As explained in the previous section, the ZLEV mechanism effect is considered when calculating the 2025 targets.

Table 1
Assumptions regarding fleet composition and CO_2 emissions by powertrain type for calculating 2025 manufacturer targets and performance

Parameter	Assumption
Composition of manufacturer pools	Same as in 2023
Manufacturer average CO_2 emissions of internal combustion engine vehicles (ICEVs)	Same as in 2023
Manufacturer average CO_2 emissions of plug-in hybrid vehicles (PHEVs)	Adjusted to account for historic developments in type-approval CO_2 reduction and utility factor adjustment in 2025
PHEV market share by manufacturer	Same as in 2023
Fuel-cell vehicle market share by manufacturer	Set to zero, as market share in 2023 was << 1%
Battery electric vehicle (BEV) market share by manufacturer	Optimized for CO_2 performance to match CO_2 target. If BEV share in 2023 was sufficient to meet 2025 target, 2023 market share was used
ICEV market share by manufacturer	Calculated as share of vehicles that are not BEVs or PHEVs
ICEV average test mass per manufacturer	Same as in 2023
PHEV average test mass per manufacturer	Same as in 2023
BEV average test mass per manufacturer	Same as in 2023
Zero- and Low Emission Vehicle (ZLEV) credits effect	Calculated for vehicles with CO_2 emissions < 50 g/km as per regulation. Calculation was performed after adjustment of PHEV CO_2 emissions and powertrain type market shares.

PHEV CO_2 emissions: Effect of increasing electric range

PHEVs can operate in two modes. In charge depleting mode, they operate mostly on electric energy taken from the battery. In charge sustaining mode, they are mostly powered by the combustion engine; the battery charge level remains constant over time. The latter mode is usually associated with a depleted battery. The official CO_2 emissions value of a PHEV is calculated from the CO_2 emissions measured in both modes, weighted by a utility factor. The utility factor describes the share of driving performed in charge depleting mode and depends on the range a PHEV can drive in this mode; the higher the range, the higher the utility factor and the lower the official CO_2 emissions (Dornoff, 2021).

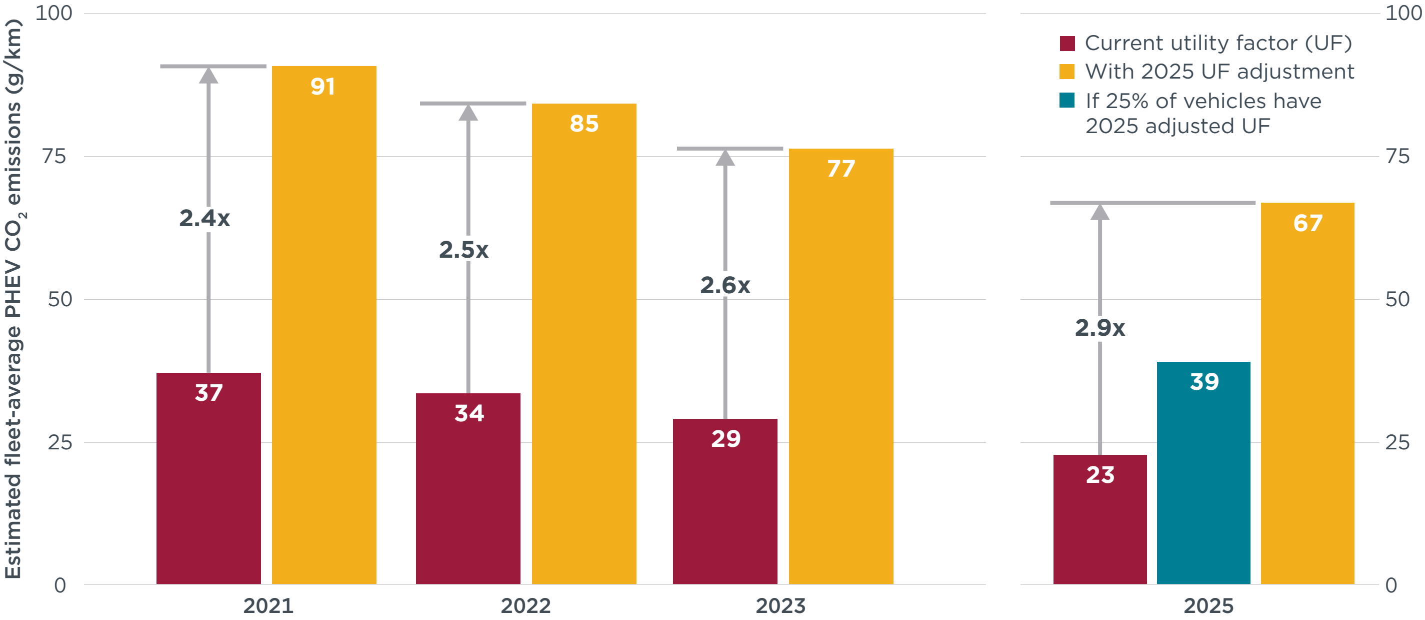
As Figure 3 shows, official CO_2 emission of PHEVs in the years 2021–2023 dropped from about 37 g/km to 29 g/km, which is equivalent to an annual reduction of about 11.5% (European Environment Agency, 2023). This reduction coincides with an increase in electric range from 58 km in 2021 to 69 km in 2023. On this basis, we expect that PHEV CO_2 emissions will continue to drop until 2025 by 21.8% compared with 2023 and assume that CO_2 reductions are mainly achieved by increasing the electric range to yield a higher utility factor. By this approach, we estimate that the average electric range will reach about 82 km in 2025.

For estimating the effect of the utility factor adjustment on PHEV CO_2 emissions in 2025, we apply the methodology described in Plötz et al. (2022) for deriving the CO_2 emissions in charge sustaining mode for PHEVs registered in 2023. Assuming the CO_2 emissions in charge sustaining mode would remain constant over the next few years, like the observations made for ICEVs, we adjust the electric range to derive the utility factor that would results in 21.8% lower PHEV CO_2 emissions by 2025.

The derived charge sustaining CO_2 emission values and electric ranges are then used to calculate the effect of the utility factor adjustment and, subsequently, the estimated CO_2 emission values of PHEVs type-approved in 2025, as explained in the next section.

Figure 3

Effect of the 2025 utility factor adjustment on the official PHEV CO_2 emissions of vehicles registered in 2021–2023 and 2025



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PHEV CO_2 emissions: Effect of utility factor adjustment

As shown on the left side of Figure 3, applying the new utility factor to the 2021 fleet would have resulted in the official PHEV CO_2 emission value increasing from 37 g/km to 91 g/km (about 2.4 times higher). The relative increase is higher for the 2022 and 2023 fleets, coinciding with the lower type-approval CO_2 emission values. This is owed to the increasing average electric range of PHEVs registered in 2021–2023, in combination with the current utility factor curve having a stronger effect for range increase on the CO_2 emissions than the new utility factor curve.

The diagram on the right side of Figure 3 shows the expected effect of the new utility factor on the CO_2 emissions of PHEVs registered in 2025. Since the new utility factor applies only to new models in 2025 and to all models from 2026 onwards, we had to make an assumptions about the share of PHEVs that would be newly type-approved in 2025. Due to higher CO_2 emissions under the new utility factor, it is more beneficial for manufacturers to sell PHEVs type-approved with the current utility factor. We, therefore, assume that only the 25% of PHEVs per manufacturer with the lowest CO_2 emissions under the old utility factor will be replaced by new models in 2025. The remaining 75% of PHEVs sold in that year are expected to be models that were introduced into the market before 2025.

As a result, we assume that average CO_2 emissions of PHEVs registered in 2025 are about 39 g/km, compared with 23 g/km if all were subject to the current utility factor and 68 g/km if all were subject to the new utility factor.

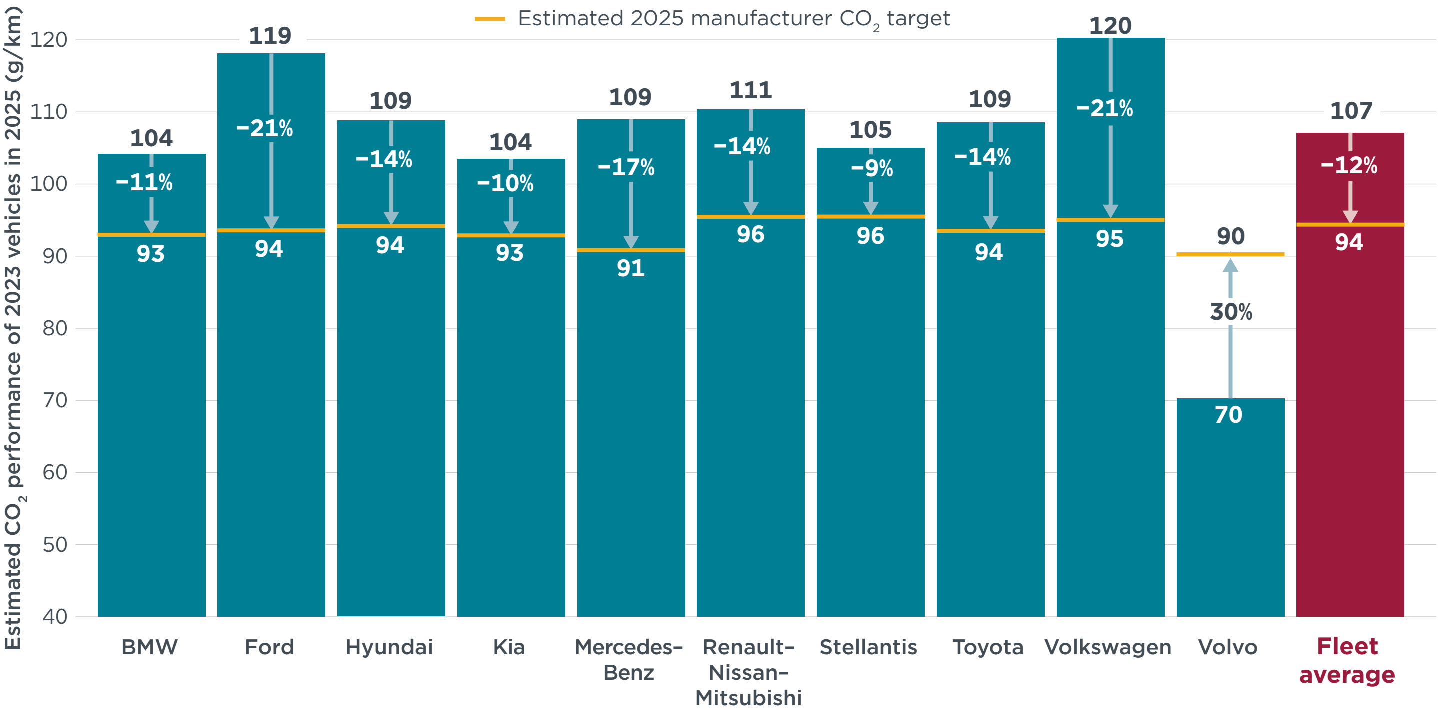
MANUFACTURER CO_2 TARGETS IN 2025

After optimizing the BEV share per manufacturer for 2025 to have the manufacturers' CO_2 performance match their specific CO_2 targets, we arrive at the targets presented in Figure 4 by the horizontal lines. The targets are compared with the CO_2 performance of 2023 vehicles, adjusted for expected changes in plug-in hybrid CO_2 emissions applying from 2025. The comparison reveals that all manufacturers except Volvo will need to reduce their CO_2 emissions to meet the new targets.

Under our assumptions, Volkswagen and Ford face the largest reduction effort of the brands assessed at about 21%. The CO_2 reduction required by Hyundai, Mercedes-Benz, and Toyota is also higher than the average of 12%. BMW, Kia, and Stellantis are closest to meeting their target with required CO_2 reductions of 9% to 11%. It should be noted that manufacturers have the flexibility to form pools with other manufacturers and thereby lower their average CO_2 performance and subsequently reduce the required reduction. This is analyzed further below.

Figure 4

Manufacturer CO_2 targets applying from 2025 in comparison with the performance of their 2023 fleet, adjusted for expected changes in plug-in hybrid CO_2 emissions



Note: Data (sorted alphabetically) is shown for the 10 largest, leaving aside Tesla, a manufacturer that solely sells BEVs.

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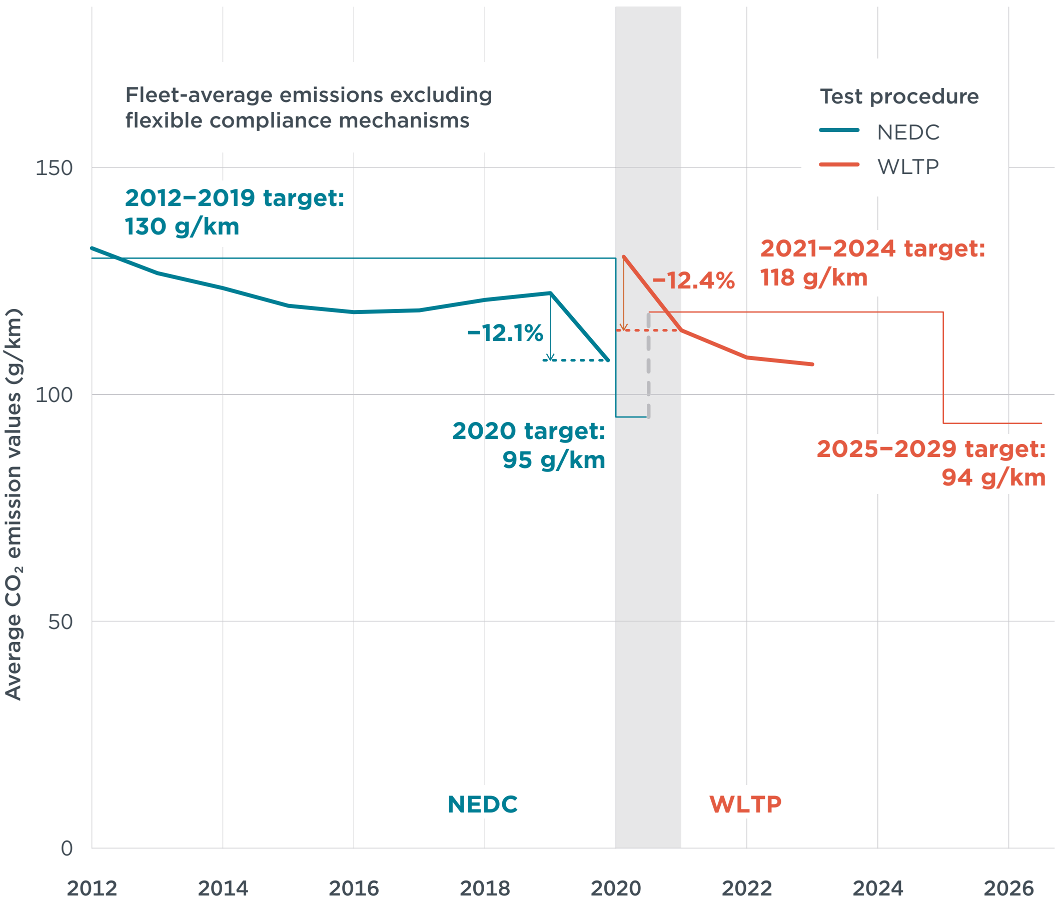
To put the required reduction effort into perspective, Figure 5 shows the historic fleet-average CO_2 performance of manufacturers compared with the targets, with a focus on the years 2019–2021 when the last strengthening of CO_2 targets applied. It reveals that manufacturers did not notably reduce their CO_2 emissions between 2014 and 2019, until the new targets applied in 2020. A similar observation can be made today. Fleet-average CO_2 emissions remained almost level over the past 2 years, dropping by only 1 g/km in 2023 compared with 2022 (Tietge et al., 2024).

Manufacturers reduced CO_2 emissions by about 12% in 2020, and again by 12% in 2021. This means manufacturers reduced CO_2 emission by about 23% from 2019–2021. Therefore, the fleet-average reduction of 12% required from 2023–2025 is only half as much as demonstrated feasible by manufacturers from 2019–2021.

Figure 5

Fleet-average CO_2 performance compared with CO_2 targets, 2012–2025



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MAXIMUM BEV SHARE REQUIRED BY MANUFACTURERS IN 2025 TO MEET THEIR CO_2 TARGETS

As an extreme scenario, we assume that manufacturers will rely solely on increasing their BEV shares to meet 2025 CO_2 targets. Under our assumptions, manufacturers will need to increase their BEV shares at most by 12 percentage points on average, from about 16% in 2023 to approximately 28% in 2025. The increase required per manufacturer varies, as shown in Figure 6.

Except for Volvo, all manufacturers require a higher BEV share in 2025 than in 2023. The largest increases are required by Ford and Volkswagen, at about 18 and 17 percentage points, respectively. Stellantis, BMW, and Kia require a BEV share increase of between 8 and 9 percentage points. A 11–13 percentage point increase is required by Hyundai, Mercedes, Renault-Nissan-Mitsubishi, and Toyota.

Figure 6

Powertrain type shares in 2023 and maximum required electric vehicle shares to meet the 2025 CO_2 targets for the 10 largest manufacturers in terms of 2023 registrations

Notes: Tesla is not included. Manufacturers are assumed to only adjust their BEV shares to meet the targets.

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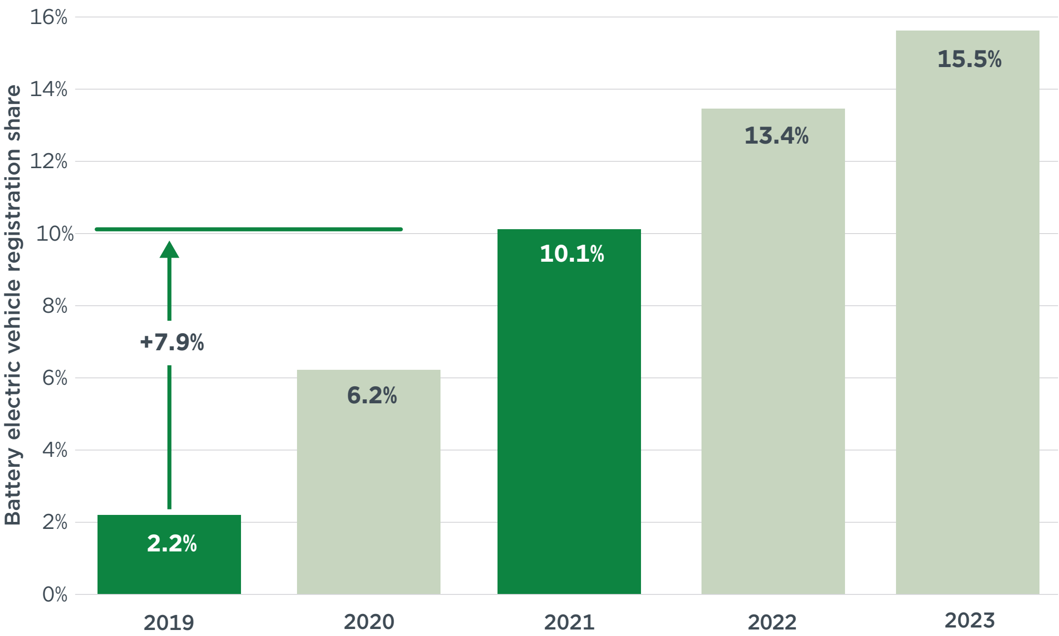
In 2019–2021, manufacturers increased the registration share of BEVs to lower their CO_2 emissions, as shown in Figure 7. Despite a relatively small variety of BEV models on the market and much less available charging infrastructure at that time, manufacturers were able to increase the BEV registration share by about 8 percentage points on average over these 2 years. The average increase of about 12 percentage points required between 2023 and 2025, therefore, seems to be within reach.

Figure 7

Fleet-average battery electric vehicle registration share, 2019–2023



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OPTIONS FOR MANUFACTURERS TO MEET 2025 TARGETS

MANUFACTURERS CAN FORM POOLS

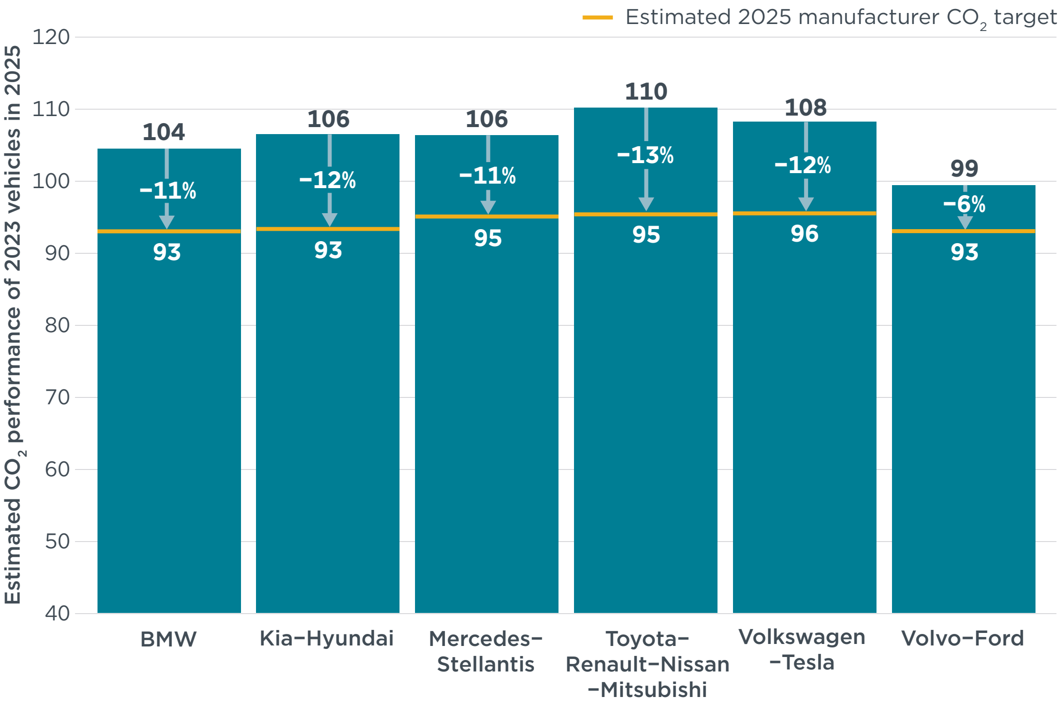
The CO_2 standards provide manufacturers with the flexibility to form pools. Pools are treated as one manufacturer for compliance purposes, which means that CO_2 targets and CO_2 performance are determined for all the vehicles in a pool. Therefore, manufacturers with higher CO_2 emissions can advantageously form a pool with manufacturers with lower CO_2 emissions, resulting in lower pool average CO_2 emissions and, thereby, requiring a lower CO_2 reduction effort than the higher CO_2 emission manufacturer would face alone.

To assess the potential of pooling, we analyzed the CO_2 reduction effort and the related increase in BEV share required from hypothetical pools formed by manufacturers with higher and lower CO_2 performances. In addition to the 10 manufacturers analyzed in the previous sections, we included Tesla in this analysis due to its high number of registrations over the past years. The pool compositions considered are Kia-Hyundai, Mercedes-Stellantis, Toyota-Renault-Nissan-Mitsubishi, Volkswagen-Tesla, and Volvo-Ford. BMW was not assumed to form a pool with other manufacturers since its performance is close to the fleet average.

Figure 8 shows that forming the hypothetical pools reduces the required CO_2 reduction between 2023 and 2025 for all pools to a value close to the fleet average of 12%. The Volvo-Ford pool would face the lowest reduction of 6%, while all other pools would need to reduce CO_2 emissions by 11%–13%.

Figure 8

CO_2 targets applying in 2025 for hypothetical manufacturer pools compared with their 2023 fleet performance, adjusted for expected changes in plug-in hybrid CO_2 emissions



Notes: Data is shown for 6 hypothetical pools (sorted alphabetically) of the 10 largest manufacturers that not only produced battery electric vehicles in 2023 plus Tesla.

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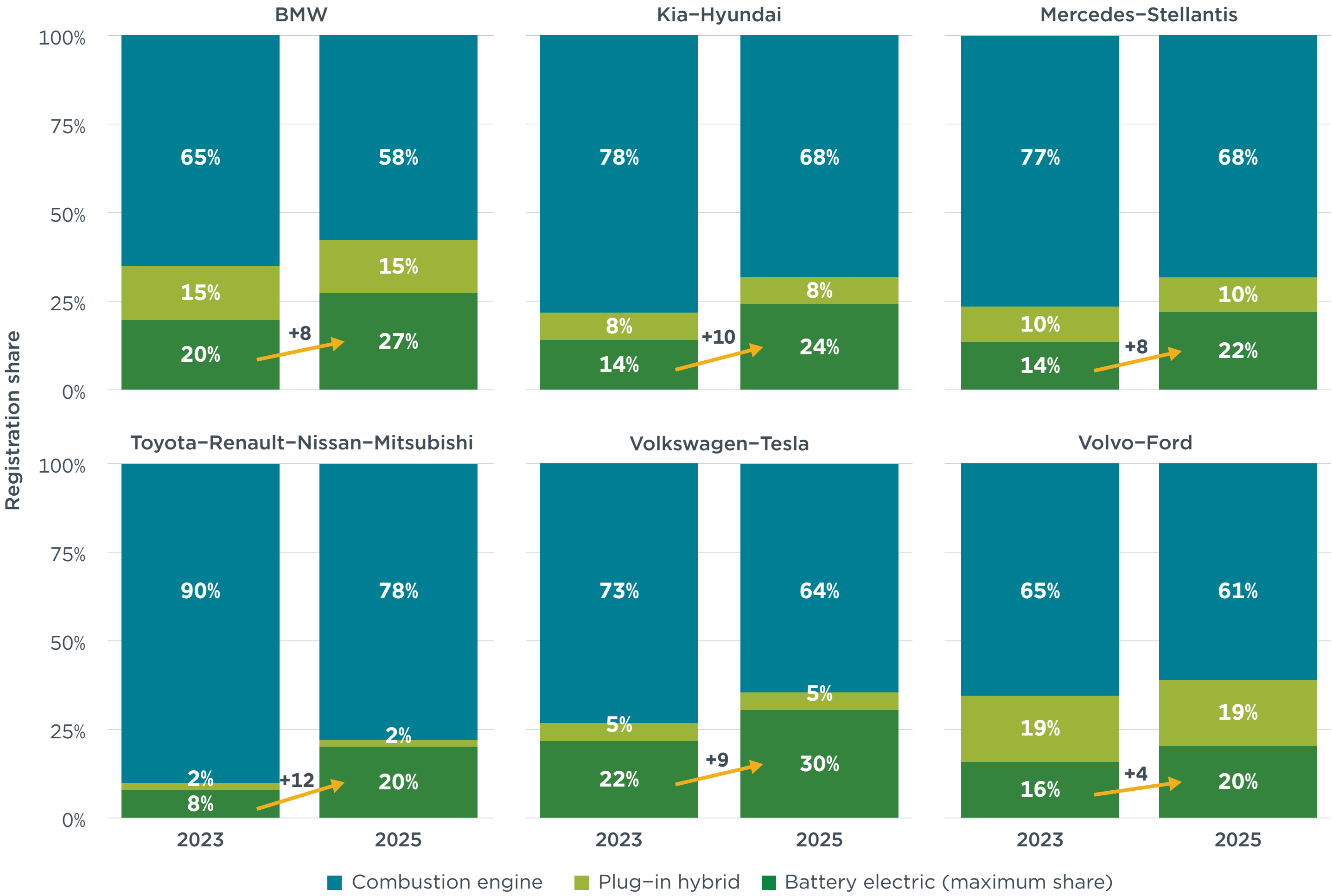
The BEV share required by the hypothetical pools for meeting the targets is more equalized than for individual manufacturers, as Figure 9 shows. While the increase in BEV share ranged from 8–18 percentage points for individual manufacturers, the hypothetical pools need to increase their BEV share by maximum of 12 percentage points in case of Toyota-Renault-Nissan-Mitsubishi. Volvo-Ford would need to raise the BEV share by 4 percentage points and Kia-Hyundai by 10 points. For the remaining three pools, an increase of 8 percentage points would be sufficient to meet the targets; that is the same as the fleet average increase observed from 2019–2021.

Figure 9

Powertrain type shares in 2023 and maximum required electric vehicle shares to meet 2025 CO_2 targets for hypothetical manufacturer pools



Notes: Data is shown for six hypothetical pools (sorted alphabetically) of the 10 largest manufacturers that did not produce only battery electric vehicles in 2023 plus Tesla. It assumes that manufacturers only adjust their BEV shares to meet targets.

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MANUFACTURERS CAN REDUCE CO_2 EMISSIONS OF COMBUSTION ENGINE VEHICLES

As mentioned previously, the CO_2 emissions of ICEVs have remained at a high level since 2021. Therefore, we assumed for this analysis that no substantial improvements in the CO_2 emissions of ICEVs will be seen until 2025. However, manufacturer have options to reduce the CO_2 emissions of these vehicles.

Within their existing model portfolio, manufacturers can adjust their sales strategy away from heavy and high-emitting vehicles towards more efficient models. Furthermore, manufacturers can effectively reduce the CO_2 emissions of individual models by deploying mild-hybrid technology. As shown in our 2022 mild-hybrid study, this technology offers a high type-approval CO_2 reduction potential of 7% to over 15%, depending on the system architecture and electric motor power (Dornoff et al., 2022). This means a large share of the required fleet-average CO_2 reduction of 12% could be achieved by deploying mild hybridization.

MANUFACTURERS CAN INCREASE THE SHARE OF PLUG-IN HYBRID VEHICLES

For our analysis, we estimated that the electric range of PHEVs will reach about 82 km in 2025. However, PHEVs with electric ranges above 100 km are also currently on the market (ADAC, n.d.). Consequently, the average range of PHEVs registered in 2025 could be higher than assumed here. Higher ranges result in higher utility factors and, subsequently, very low CO_2 emission values of around 10 g/km and even less, as shown in Table 2 for two selected PHEV models. While detrimental for the climate due to their much higher real-world CO_2 emissions, increasing the market share of these PHEVs would substantially reduce manufacturers fleet-average CO_2 emissions (European Environment Agency, n.d.; Plötz et al., 2022).

Table 2
Examples of plug-in hybrid vehicle models with CO_2 emissions around 10 g/km and electric ranges above 100 km

Brand & model	Fuel type	System power	Electric range	Unladen mass	CO_2 emission values: Official value	CO_2 emission values: Value with empty battery
Mercedes GLC 300 de EQ Hybrid	Diesel	245 kW	121 km	2,385 kg	11 g/km	155 g/km
Volkswagen Tiguan Life 1,5 l eHybrid	Petrol	150 kW	129 km	1,866 kg	8 g/km	126 g/km

Sources: Mercedes-Benz (n.d.); Volkswagen AG (n.d.)

SUMMARY AND CONCLUSIONS

In this analysis, we estimated the CO_2 targets manufacturers will face in 2025 and compared those with the CO_2 performance of their 2023 vehicle fleet if it would remain unchanged until 2025. On this basis, we derived the CO_2 reductions required and calculated how much manufacturers would at most need to increase their BEV shares to meet targets, assuming they solely rely on BEVs for compliance. We also analyzed how manufacturers could advantageously form pools to alleviate the CO_2 reduction effort for individual manufacturers. This study reached the following results:

- To meet 2025 CO_2 targets, manufacturers will need to reduce CO_2 emissions by 12%, on average, compared with the emissions of their 2023 vehicle fleet. The required reduction for individual manufacturers that were not already below the target ranges from 9%–21%.
- By advantageous pooling by manufacturers, the range of required CO_2 reductions could narrow to 6%–13%, bringing the pools close to the average required reduction of 12%.
- As an extreme case, assuming that CO_2 emissions of combustion engine vehicles will remain constant, manufacturers will need to increase their BEV market shares within 2 years by a maximum of 8–18 percentage points compared with 2023.
- For the analyzed hypothetical pools, the required BEV market share growth would reduce to 4-12 percentage points.

The results highlighted above present the following conclusions:

- The average CO_2 reduction of 12% required from 2023–2025 is about half the 23% fleet-average CO_2 reduction observed between 2019 and 2021.
- For this extreme scenario, the increase in BEV market share required for the hypothetical manufacturer pools is about 1–1.5 times as high as the 8 percentage point growth observed from 2019–2021; at that time, however, fewer BEV models with, on average, lower range and slower charging were on the market and the charging infrastructure was much less developed.
- Besides increasing the BEV market share, manufacturers can reduce the average CO_2 emission levels of their ICEVs. Foremost, manufacturers can encourage consumers to buy the smaller and more efficient vehicles in their model portfolios. In addition, manufacturers can deploy mild hybridization, which can reduce CO_2 emission by at least 7%–15% depending on the technology package.
- Although detrimental for real-world CO_2 emissions, manufacturers can increase the share of PHEVs and/or further lower their CO_2 emission values by extending the electric range of these vehicles.

The current trends in the vehicle market appear similar to those during the previous strengthening of the CO_2 targets in 2020. While the 2020 targets were adopted in 2014, the average CO_2 emission level of new cars increased prior to 2019, before abruptly decreasing throughout 2020 and 2021. Comparing the time periods 2015–2019 and 2019–2021, average CO_2 emission levels increased by approximately 1% *per year* until 2019 and decreased by about 1% *per month* between 2019 and 2021 when the new target came into effect.

The historic experience from 2019 to 2020/21 demonstrates vehicle manufacturers' ability to adapt their product portfolio and consumer marketing efforts, even within a few months, and suggests that 2025 CO_2 targets are well in reach.

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www.theicct.org

communications@theicct.org

@theicct.org

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