BRIEFING

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CO_2 emissions from new passenger cars in Europe: Car manufacturers' performance in 2019

Prepared by: Uwe Tietge, Peter Mock, Jan Dornoff

This briefing paper provides an overview of CO_2 emission levels of new passenger cars in the European Union (EU) in 2019 based on a preliminary dataset recently released by the European Environment Agency (EEA).[1] The dataset showed that new cars sold in the EU in 2019 had average CO_2 emissions of 122 g CO_2/km, 1 g/km higher than in 2018, as measured over the New European Driving Cycle (NEDC).

As a follow-up to the previous year's briefing,[2] this paper details manufacturer performance in terms of CO_2 emissions reduction, fuel type and technology trends, and market share. The paper focuses on differences between Member States, as well as between the major car makers. It also discusses flexible compliance mechanisms and presents data on the Worldwide Harmonized Light Vehicles Test Procedure (WLTP).

The preliminary EEA dataset used in this briefing has yet to be validated. The final dataset will be published at the end of 2020, so the specific values used in this report may change. The preliminary data for 2019 should, however, provide relatively reliable results.[3] The ICCT will review the final European emissions data in the next edition of the European Vehicle Market Statistics Pocketbook.[4]

1 European Environment Agency, "Monitoring of CO_2 Emissions from Passenger Cars – Regulation (EU) 2019/631 —European Environment Agency," Data, June 26, 2020, https://www.eea.europa.eu/data-and-maps/data/co2-cars-emission-18.

2 Uwe Tietge, Peter Mock, and Jan Dornoff, "CO_2 Emissions from New Passenger Cars in the European Union: Car Manufacturers' Performance in 2018" (Washington, D.C.: International Council on Clean Transportation, August 7, 2019), https://theicct.org/publications/CO2-emissions-PVs-Europe-2018.

3 Historically there had been little difference between preliminary and final data. In 2018, the difference between preliminary and final average CO_2 emissions was less than 1 g/km for both NEDC and WLTP values.

4 European vehicle market statistics pocketbook, International Council on Clean Transportation, http://eupocketbook.org

www.theicct.org

communications@theicct.org

twitter @theicct

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1. BACKGROUND

The EEA recently released a preliminary dataset on the CO_2 emissions performance of new passenger cars in the EU in 2019. This dataset is used by the European Commission to monitor and evaluate whether manufacturers are in compliance with mandatory CO_2 emission targets for passenger cars as defined in Regulation EC 333/2014. The EEA collects data from EU Member States, which are required to submit detailed information on each new car registered in each calendar year.

Three issues related to the quality and scope of the monitoring data may impact the results of the analysis. First, both NEDC and WLTP CO_2 emissions values are reported in the EEA monitoring data. In the preliminary 2019 data, NEDC CO_2 emission values were reported for 99.6% of passenger cars registered in 2019; WLTP CO_2 emission values were reported for 92.5% of vehicles, up from 29.0% in 2019; and both NEDC and WLTP values were reported for 92.1% of vehicles. This section and sections 2–4 focus on NEDC values relative to the 2020 CO_2 emission target, which is solely based on NEDC CO_2 emission values. Section 5 investigates WLTP-based CO_2 emission values, which will be used in post-2020 CO_2 targets. Second, a small number of records, equivalent to 0.2% of passenger car registrations, were marked as duplicates in the dataset. Duplicates refer to vehicles that appeared multiple times in the monitoring data, which will be consolidated in the final dataset. Duplicates were removed before aggregating the data for this briefing. Lastly, because vehicles registered in all countries in the European Economic Area—not only EU member states—will count toward future CO_2 emission targets, the monitoring data includes data for Iceland, Norway, and the United Kingdom.

The EEA data show that the sales-weighted average NEDC CO_2 emissions from new passenger cars in 2019 were 122 g/km, 1 g/km higher than in 2018, continuing the trend of increasing CO_2 emission values after 2016. Figure 1 plots the historical average CO_2 values relative to targets. Before CO_2 standards were introduced, CO_2 emissions, on average, declined by 1.2% per year from 2000 to 2007. When the first CO_2 standards were agreed upon in 2008, manufacturers significantly outperformed the annual reduction rates required to meet the 2015 target of 130 g/km; instead of the required 2.5% annual reduction, average CO_2 emissions declined by 3.5% per year. After 2015 targets were met, and in the absence of targets before 2020, average CO_2 emissions increased by 0.6% per year. As of 2019, fleet-average CO_2 emissions will have to decline by 11.9% per year to comply with the 2021 target. Manufacturers will likely also rely to a larger degree on flexible compliance mechanisms such as super-credits and eco-innovations (see Section 4) to comply with 2020/21 targets.

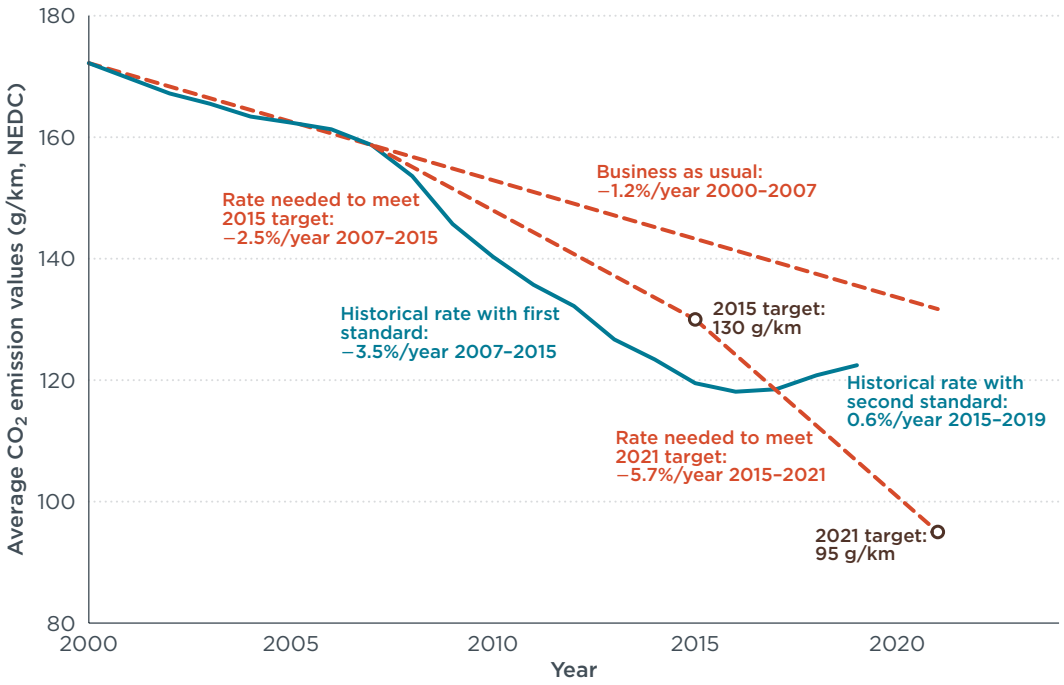

Figure 1. Historical average CO_2 emission values, targets, and annual reduction rates of new passenger cars.

2. CO_2 EMISSIONS BY VEHICLE MANUFACTURER

Car manufacturers can pool together several brands to meet CO_2 standards. For this analysis, unless otherwise noted, we track manufacturer pools and individual manufacturers with more than 250,000 registered passenger cars in 2019.[5] Vehicle manufacturers with less than 300,000 registered passenger cars per calendar year can apply for a niche derogation in order to receive non-standard, manufacturer-specific reduction targets for 2020 onward.

Figure 2 and Table 1 present data for 11 major manufacturer pools and two large manufacturers representing approximately 96% of all EU new passenger car sales in 2019. Figure 2 plots each manufacturer's average emissions relative to its 2015 and 2020/21 targets. The targets are adjusted for vehicle mass using limit value curves, which are displayed in the figure. Table 1 presents the same data but includes information on each manufacturer's market share in 2019 and emission reductions since 2018.

5 Manufacturer pools (and their major brands) are: BMW (BMW, Mini); Daimler (Mercedes-Benz, Smart); FCA-Tesla (Alfa Romeo, Fiat, Jeep, Lancia, Tesla); Ford (Ford); Hyundai (Hyundai); Kia (Kia); PSA-Opel (Citroën, DS Automobiles, Opel, Peugeot, Vauxhall); Renault (Dacia, Renault); Suzuki (Suzuki); Toyota-Mazda (Lexus, Mazda, Toyota); and Volkswagen Group (Audi, Porsche, SEAT, Škoda, VW). Two manufacturers outside of pools (Nissan, Volvo) registered more than 250,000 passenger cars in 2019. The four following pools (and their major brands) registered less than 250,000 passenger cars in 2019: Honda (Honda); MG-SAIC (MG); Mitsubishi (Mitsubishi); and Tata Motors-Jaguar Land Rover (Jaguar, Land Rover).

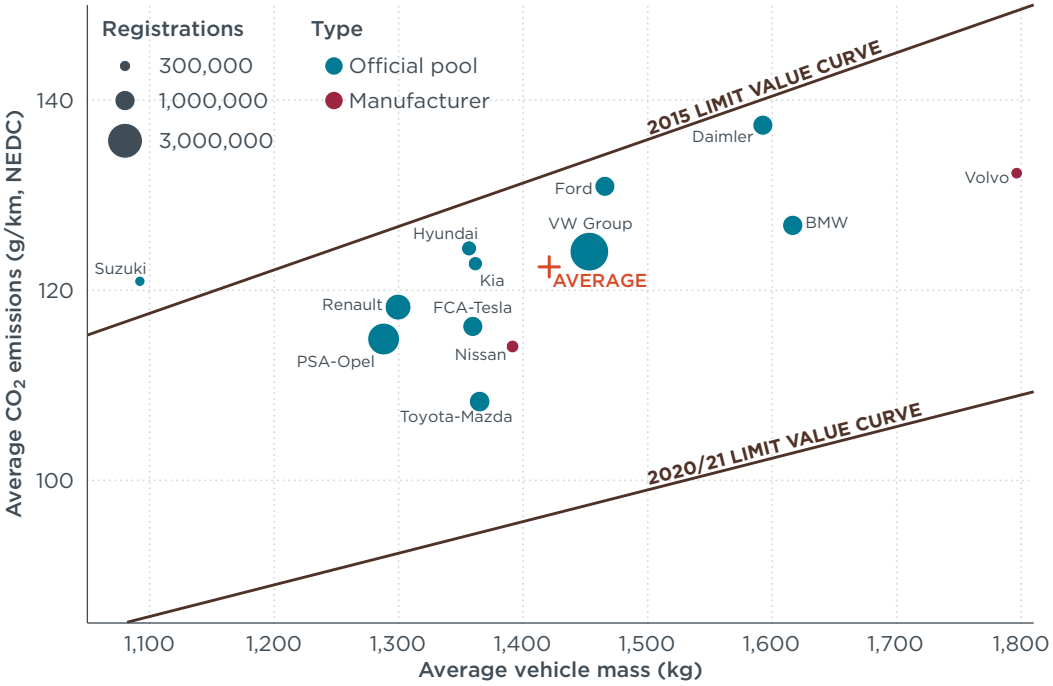

Figure 2. Performance of top-selling EU passenger car manufacturers in 2019 compared to 2015 and 2020/2021 emissions target compliance curves.

Overall, fleet-average CO_2 emissions increased by 1 g/km from 2018 to 2019. Toyota-Mazda had the lowest CO_2 emissions out of all major manufacturer pools in 2019 and was the closest to its 2020/21 limit value. Three manufacturers recorded a decrease in average CO_2 emissions. By paying Tesla to join its pool in 2019, Fiat-Chrysler Automobiles (FCA) saw the largest decrease, 6 g/km, due to a fivefold increase in Tesla registrations from 2018 to 2019. Without Tesla, the pool would have had a 6 g/km increase in average CO_2 emissions in 2019. Ford recorded the largest increase in CO_2 emissions at 8 g/km. Suzuki was in the worst position to meet its 2020/21 target, with a 36 g/km (29%) reduction remaining, but will likely be awarded a niche derogation. Ford and Daimler were in second and third place in terms of furthest distance away from the 2020/21 target. Fleet-average CO_2 emissions will have to decline by 26 g/km (21%) to be compliant with 2020/21 targets.

Table 1. Manufacturer and manufacturer pool market shares, average vehicle mass and CO_2 emissions, and CO_2 emission targets for 2020 (effectively 2021). Rows are sorted by average CO_2 emissions in 2019. The impact of flexible compliance mechanisms (see section 4) are not considered.

Manufacturer pool/ manufacturer	EU market share	Average mass (kg)	CO_2 values (g/km, NEDC)			
			2019 average	Change 2018–2019	2020/21 target	Distance to target
Toyota-Mazda	7%	1,365	108	-2	95	13 (12%)
Nissan	3%	1,391	114	-1	95	19 (16%)
PSA-Opel	16%	1,288	115	1	92	23 (20%)
FCA-Tesla	6%	1,360	116	-6	94	22 (19%)
Renault	11%	1,299	118	5	92	26 (22%)
Suzuki	2%	1,092	121	7	85	36 (29%)
AVERAGE	**100%**	**1,421**	**122**	**1**	**96**	**26 (21%)**
Kia	3%	1,362	123	2	94	29 (23%)
Hyundai	4%	1,357	124	0	94	30 (24%)
VW Group	24%	1,453	124	2	97	27 (21%)
BMW	6%	1,616	127	1	103	24 (19%)
Ford	6%	1,466	131	8	98	33 (25%)
Volvo	2%	1,796	132	0	109	23 (18%)
Daimler	6%	1,592	137	3	102	35 (25%)

3. FUEL TYPE AND TECHNOLOGY TRENDS BY MEMBER STATE AND MANUFACTURER

Fuel type and power train technology trends from previous years continued into 2019. Plagued by the aftermath of Dieselgate, diesel market shares continued to fall, from 36% in 2018 to 31% in 2019. Electrified powertrains generally gained ground during the same time period: hybrid-electric vehicles (HEVs) grew from 3.4% to 3.7%; plug-in hybrid electric vehicles (PHEVs) remained stable at 1.2%; battery electric vehicles (BEVs) grew from 1.3% to 2.2%; and mild hybrid-electric vehicles grew from 0.4% to 2.0% of registrations in 2019. Overall gains in electrified powertrains almost offset the 5-percentage-point decline in diesel sales, limiting the growth in petrol vehicles to 2 percentage points. Other powertrains, predominantly compressed natural gas and liquified petroleum gas vehicles, accounted for 1.6% of the market.

Table 2 presents the market share of various fuels and technologies in 2019 by country.[6] Norway continues to dominate the European electric vehicle (EV) market, with 42.4% of new car registrations in 2019 being BEVs and another 13.6% being PHEVs. Iceland, another non-EU member country, also recorded high EV market shares of 14.4% for PHEVs and 8.0% for BEVs. Within the EU, the Netherlands (13.8% BEV and 1.2% PHEVs) and Sweden (4.4% BEVs and 7.0% PHEVs) saw the highest uptake of electric vehicles. Germany, the largest vehicle market in the EU, saw an increase in PHEV (0.9% in 2018 to 1.1% in 2019) and BEV (1.0% in 2018 to 1.8% in 2019) shares. Shares of hybrid-electric vehicles (HEVs) were particularly high in Norway (11.4%) and Finland (11.0%) and exceeded 5% in twelve countries. Mild hybrid-electric vehicles using 48-volt systems were most common in Germany, comprising 3.8% of passenger car registrations. Italy was the major EU market with the highest diesel share despite a 9-percentage-point drop from 2018 to 2019. Italy also was the only market with a significant share of compressed natural gas and liquified petroleum gas vehicles.

6 Because the EEA data do not include details on electric powertrains, EEA data have been supplemented with proprietary data content supplied by Dataforce and AAA DATA.

Table 2. Market share of fuels/technologies for new passenger cars in 2019 by country, sorted by descending market share. "Other" column primarily covers compressed natural gas and liquified petroleum gas fuels.

Market	Diesel	Petrol	Mild hybrid-electric	Hybrid-electric	Plug-in hybrid electric	Battery-electric	Other	Market share
Germany	32%	59%	3.8%	1.7%	1.1%	1.8%	0.4%	22.9%
United Kingdom	26%	65%	1.4%	4.2%	1.5%	1.6%	0.0%	14.7%
France	34%	58%	1.2%	3.6%	0.8%	1.9%	0.4%	14.1%
Italy	42%	44%	1.7%	3.5%	0.3%	0.5%	8.4%	13.5%
Spain	30%	58%	2.0%	6.2%	0.6%	0.8%	2.0%	8.4%
Poland	21%	73%	0.7%	5.2%	0.2%	0.3%	0.1%	3.5%
Belgium	32%	61%	0.8%	2.8%	1.6%	1.6%	0.7%	3.5%
Netherlands	7%	70%	1.9%	5.3%	1.2%	13.8%	0.2%	2.8%
Sweden	32%	45%	2.6%	6.9%	7.0%	4.4%	1.7%	2.3%
Austria	39%	53%	2.6%	1.7%	0.7%	2.8%	0.2%	2.1%
Czechia	28%	70%	0.0%	0.1%	0.2%	0.3%	1.7%	1.6%
Denmark	27%	63%	1.6%	4.3%	1.7%	2.4%	0.0%	1.4%
Portugal	41%	49%	0.7%	3.4%	2.5%	2.9%	1.0%	1.4%
Romania	27%	67%	1.4%	3.0%	0.3%	0.9%	0.9%	1.0%
Hungary	20%	73%	1.7%	4.1%	0.7%	1.2%	0.1%	1.0%
Norway	16%	15%	1.6%	11.4%	13.6%	42.4%	0.0%	0.9%
Ireland	47%	40%	0.1%	8.6%	1.1%	3.0%	0.0%	0.8%
Finland	19%	60%	1.3%	11.0%	4.9%	1.7%	1.9%	0.7%
Greece	27%	65%	1.2%	4.3%	0.4%	0.2%	2.1%	0.7%
Slovakia	26%	69%	1.6%	2.7%	0.2%	0.2%	0.5%	0.7%
Croatia	40%	55%	0.4%	2.2%	0.1%	0.3%	1.4%	0.4%
Slovenia	31%	63%	0.8%	2.7%	0.3%	1.1%	0.2%	0.4%
Luxembourg	42%	51%	2.9%	1.3%	1.6%	1.8%	0.0%	0.3%
Lithuania	18%	74%	1.3%	6.0%	0.1%	0.4%	0.0%	0.3%
Estonia	23%	65%	1.6%	8.1%	0.1%	0.3%	2.1%	0.2%
Latvia	36%	52%	1.2%	8.6%	0.1%	0.6%	0.7%	0.1%
Iceland	30%	39%	1.2%	7.2%	14.4%	8.0%	0.4%	0.1%
Cyprus	35%	56%	0.1%	8.1%	0.6%	0.2%	0.1%	0.1%
ALL COUNTRIES	**31%**	**58%**	**2.0%**	**3.7%**	**1.2%**	**2.2%**	**1.6%**	

Table 3 presents the market share of various fuels and technologies in 2019 for major car manufacturer pools and select brands, sorted by descending market shares of manufacturer pools. Among pools, FCA-Tesla and BMW had the highest EV (PHEVs and BEVs) share with more than 8%, followed by Hyundai and Kia, each with more than 5%. Toyota-Mazda stands out with a 47.8% share of HEVs. Among brands, Mitsubishi, Porsche, Volvo, Mini, and BMW topped the ranking of PHEV shares, while Tesla, Smart, Nissan, Hyundai, and Renault topped the BEV ranking. German premium car brands Audi and Mercedes-Benz were the only brands with a significant uptake of mild hybrid-electric powertrain technology in 2018, and were joined by Mazda, Suzuki, and Volvo in 2019. Two German premium manufacturer pools, Daimler and BMW, stood out with the highest diesel shares (48% and 44%, respectively). Outside those pools, diesel accounted for more than half of passenger car registrations of three brands: Alfa Romeo, Jeep, and Volvo. The manufacturer pools FCA-Tesla and Renault had significant shares of compressed natural gas and liquified petroleum gas vehicles.

Table 3. Market share of fuels/technologies for new passenger cars in 2019 for major manufacturer pools and select brands. Brand shares may not add up to manufacturer pool totals because not all brands are included. Manufacturer pools are sorted by descending EU market share. "Other" column primarily covers compressed natural gas and liquified petroleum gas fuels.

Manufacturer pool/brand	Diesel	Petrol	Mild hybrid-electric	Hybrid-electric	Plug-in hybrid electric	Battery-electric	Other	Market share
VW Group	**37%**	**57%**	**3.5%**	**0.0%**	**0.5%**	**1.3%**	**1.5%**	**24.2%**
VW	41%	55%	0.0%	0.0%	0.3%	1.8%	1.5%	11.1%
Audi	38%	41%	17.7%	0.0%	0.5%	2.4%	0.5%	4.7%
Škoda	36%	62%	0.0%	0.0%	0.0%	0.0%	1.3%	4.7%
SEAT	24%	72%	0.0%	0.0%	0.0%	0.0%	4.0%	3.1%
Porsche	1%	85%	0.0%	0.0%	13.4%	0.9%	0.0%	0.5%
PSA-Opel	**32%**	**66%**	**0.0%**	**0.0%**	**0.0%**	**0.2%**	**1.0%**	**15.8%**
Peugeot	41%	59%	0.0%	0.0%	0.0%	0.1%	0.0%	6.2%
Opel/Vauxhall	19%	77%	0.0%	0.0%	0.0%	0.3%	3.1%	5.2%
Citroën	35%	65%	0.0%	0.0%	0.0%	0.2%	0.0%	4.1%
DS	43%	56%	0.0%	0.0%	0.5%	0.4%	0.0%	0.3%
Renault	**30%**	**63%**	**0.0%**	**0.0%**	**0.0%**	**2.7%**	**4.3%**	**10.3%**
Renault	31%	63%	0.0%	0.0%	0.0%	4.2%	1.1%	6.7%
Dacia	26%	63%	0.0%	0.0%	0.0%	0.0%	10.2%	3.7%
FCA-Tesla	**28%**	**57%**	**0.0%**	**0.0%**	**0.0%**	**9.5%**	**5.4%**	**7.0%**
Fiat	24%	70%	0.0%	0.0%	0.0%	0.0%	5.7%	4.5%
Jeep	58%	42%	0.0%	0.0%	0.0%	0.0%	0.0%	1.1%
Tesla	0%	0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.7%
Lancia	2%	66%	0.0%	0.0%	0.0%	0.0%	32.4%	0.4%
Alfa Romeo	66%	34%	0.0%	0.0%	0.0%	0.0%	0.2%	0.4%
Toyota-Mazda	**5%**	**44%**	**3.3%**	**47.8%**	**0.2%**	**0.0%**	**0.0%**	**6.6%**
Toyota	3%	36%	0.0%	60.5%	0.3%	0.0%	0.0%	4.6%
Mazda	13%	73%	13.9%	0.0%	0.0%	0.0%	0.0%	1.6%
Lexus	0%	5%	0.0%	95.0%	0.0%	0.0%	0.0%	0.4%
BMW	**44%**	**47%**	**0.2%**	**0.0%**	**5.8%**	**3.1%**	**0.0%**	**6.5%**
BMW	52%	38%	0.2%	0.0%	5.4%	3.8%	0.0%	5.2%
Mini	12%	80%	0.0%	0.0%	7.3%	0.2%	0.0%	1.4%
Daimler	**48%**	**44%**	**4.9%**	**0.0%**	**1.1%**	**1.8%**	**0.0%**	**6.5%**
Mercedes	55%	38%	5.6%	0.0%	1.3%	0.2%	0.0%	5.7%
Smart	0%	86%	0.0%	0.0%	0.0%	14.2%	0.0%	0.8%
Ford	**31%**	**67%**	**0.1%**	**1.0%**	**0.0%**	**0.0%**	**1.1%**	**6.3%**
Ford	31%	67%	0.1%	1.0%	0.0%	0.0%	1.1%	6.3%
Hyundai	**14%**	**72%**	**1.9%**	**4.2%**	**0.9%**	**5.6%**	**1.1%**	**3.5%**
Hyundai	14%	72%	1.9%	4.2%	0.9%	5.6%	1.1%	3.5%
Kia	**17%**	**66%**	**1.6%**	**7.4%**	**3.2%**	**2.7%**	**2.4%**	**3.2%**
Kia	17%	66%	1.6%	7.4%	3.2%	2.7%	2.4%	3.2%
Suzuki	**1%**	**89%**	**10.5%**	**0.0%**	**0.0%**	**0.0%**	**0.1%**	**1.6%**
Suzuki	1%	89%	10.5%	0.0%	0.0%	0.0%	0.1%	1.6%
Other brands								
Nissan	31%	60%	0.0%	0.0%	0.0%	8.8%	0.9%	2.5%
Volvo	52%	33%	5.2%	0.0%	10.1%	0.0%	0.0%	2.1%
Mitsubishi	4%	72%	0.0%	0.0%	23.7%	0.1%	0.5%	0.9%
ALL BRANDS	**31%**	**58%**	**2.0%**	**3.7%**	**1.2%**	**2.2%**	**1.6%**	**0.0%**

4. FLEXIBLE COMPLIANCE MECHANISMS

A number of flexible compliance mechanisms were included in the EU CO_2 standards to reduce compliance costs, foster innovation, and accommodate changes in the vehicle market. Mass-based CO_2 targets are one of the principle mechanisms to account for varying consumer preferences (see Section 2). Other flexible mechanisms include incentives for electric vehicles and innovative technologies, manufacturer pooling, derogations for small manufacturers, and phase-in provisions for CO_2 targets.

In the 2015 and 2020/21 CO_2 standards, super-credits were included to incentivize sales of low-emission vehicles that emit less than 50 g CO_2/km. Super-credit multipliers increase the weighting of low-emission vehicles in the calculation of manufacturers' CO_2 emission averages. In the 2015 CO_2 standard, each low-emission vehicle counted as 3.5 cars in 2013, 2.5 in 2014, and 1.5 in 2015. In the 2020/21 standard, each low-emission car will count as 2 cars in 2020, 1.67 in 2021, and 1.33 in 2022. The combined impact of super-credits for the years 2020 to 2022 for compliance with CO_2 targets is capped at 7.5 g/km per manufacturer or manufacturer pool. For 2025–2030 targets, super-credits were removed in favor of EV sales targets. In 2019, the impact of applying a super-credit multiplier of 2.0 would have ranged from close to 0 g/km for manufacturers with little to no EV sales (Ford, Suzuki, Toyota-Mazda) to 7.5 g/km for manufacturers with comparatively high EV shares (FCA-Tesla and Nissan).

The development and adoption of innovative fuel-efficiency technologies is incentivized by eco-innovations. Eco-innovation credits reward innovative technologies that produce real-world CO_2 savings beyond what is measured over a standardized test cycle during vehicle type approval. Because CO_2 savings from eco-innovations count toward manufacturers' CO_2 targets, automakers have an incentive to develop and deploy cost-effective eco-innovation technologies.[7] For the purpose of complying with CO_2 emission targets, the total impact of eco-innovation technologies each year is limited to 7 g/km per manufacturer pool. The share of new passenger cars with eco-innovation technologies installed has increased over time, most recently from 5% in 2018 to 12% in 2019. The fleet-wide average CO_2 reductions over the NEDC also increased from less than 0.1 g/km in 2018 to almost 0.2 g/km in 2019. Two manufacturers, BMW and Daimler, stand out with eco-innovation technologies installed in over 40% of vehicles registered in 2019, causing a respective 0.9 and 0.7 g/km reduction in the manufacturers' average CO_2 emissions. Another five manufacturers installed eco-innovation technologies in more than 10% of cars registered in 2019. The average CO_2 emission reduction in vehicles that had eco-innovations installed was 1.6 g/km in 2019. For individual vehicles, the maximum recorded CO_2 emission reduction from eco-innovation technologies was 9.2 g/km in 2019.

The phase-in provision allows manufacturers to base average CO_2 emission values in 2020 on the best-performing 95% of vehicles. The phase-in ends in 2021, when all vehicles count toward manufacturers' CO_2 emission targets. If applied in 2019, the phase-in provision—removing each manufacturer's highest-emitting 5% of vehicles—would have reduced each manufacturers' average CO_2 emissions by 2–5 g/km.

7 Uwe Tietge, Peter Mock, and Jan Dornoff, "Overview and Evaluation of Eco-Innovations in European Passenger Car CO_2 Standards," Briefing (ICCT, July 11, 2018), https://www.theicct.org/publications/eco-innovations-european-passenger-car-co2-standards.

5. TRANSITION TO THE WLTP

The WLTP was phased in for new passenger cars in the EU starting in September 2017 and became mandatory for most new passenger cars in September 2018. Due to its more dynamic speed profile, more realistic vehicle test mass and road load, lower ambient temperature, and other factors, the WLTP has been shown to produce more realistic CO_2 emission values than the NEDC-based procedure.[8] Contrary to the NEDC procedure, a CO_2 emission value will be determined for each individual vehicle, taking into account details like the mass of fitted optional equipment and the aerodynamics of the installed wheels.

The manufacturer-specific ratio between WLTP and NEDC CO_2 emission values in 2020 will be used to determine the WLTP 2021–2030 CO_2 emission targets. This provides manufacturers an incentive to record the highest-possible WLTP-NEDC CO_2 ratio.[9] In July 2018, the European Commission estimated that manufacturers were artificially inflating the measured WLTP values by approximately 5%, with additional inflation when declaring those measured WLTP values by approximately another 4.5%.[10] In response, the European Commission revised the WLTP-NEDC correlation procedure in December 2018 to close identified loopholes.

Figure 3 presents the distribution of the ratio between WLTP and NEDC CO_2 emission values in 2019. The mean and median ratio were 1.21 and 1.2, respectively, and the vast majority of passenger cars (99.8%) had a ratio between 0.9 and 1.6. Average ratios ranged from 1.14 to 1.25 per manufacturer (see Figure 4). These values are almost identical to the 2018 averages, when the fleet-wide mean and median ratio were 1.21 and manufacturer averages ranged from 1.15 to 1.24. The CO_2 monitoring data therefore offer no evidence that the revised WLTP-NEDC correlation procedure affected the WLTP-NEDC ratio. Some research has been conducted to explore determinants of the WLTP-NEDC ratio and the relation to real-world CO_2 emissions,[11] but this topic will require continued scrutiny in the run-up to 2020/21 CO_2 emission targets.

8 Jan Dornoff, Uwe Tietge, and Peter Mock, "On the Way to 'Real-World' CO_2 Values: The European Passenger Car Market in Its First Year after Introducing the WLTP" (Washington, D.C.: International Council on Clean Transportation, May 19, 2020), https://theicct.org/publications/way-real-world-co2-values-european-passenger-car-market-its-first-year-after.

9 Jan Dornoff et al., "The European Commission Regulatory Proposal for Post-2020 CO_2 Targets for Cars and Vans" (The International Council on Clean Transportation, January 9, 2018), https://www.theicct.org/publications/ec-proposal-post-2020-co2-targets-briefing-20180109.

10 European Commission, "Non-paper. CO_2 Regulations for cars/vans. Risk of inflated starting point for calculating the 2025 and 2030 targets" (July 18, 2018), https://www.transportenvironment.org/sites/te/files/2018_07_18_Commission_non-paper_WLTP_manipulation.pdf

11 Dornoff, Tietge, and Mock, "On the Way to 'Real-World' CO_2 Values: The European Passenger Car Market in Its First Year after Introducing the WLTP."

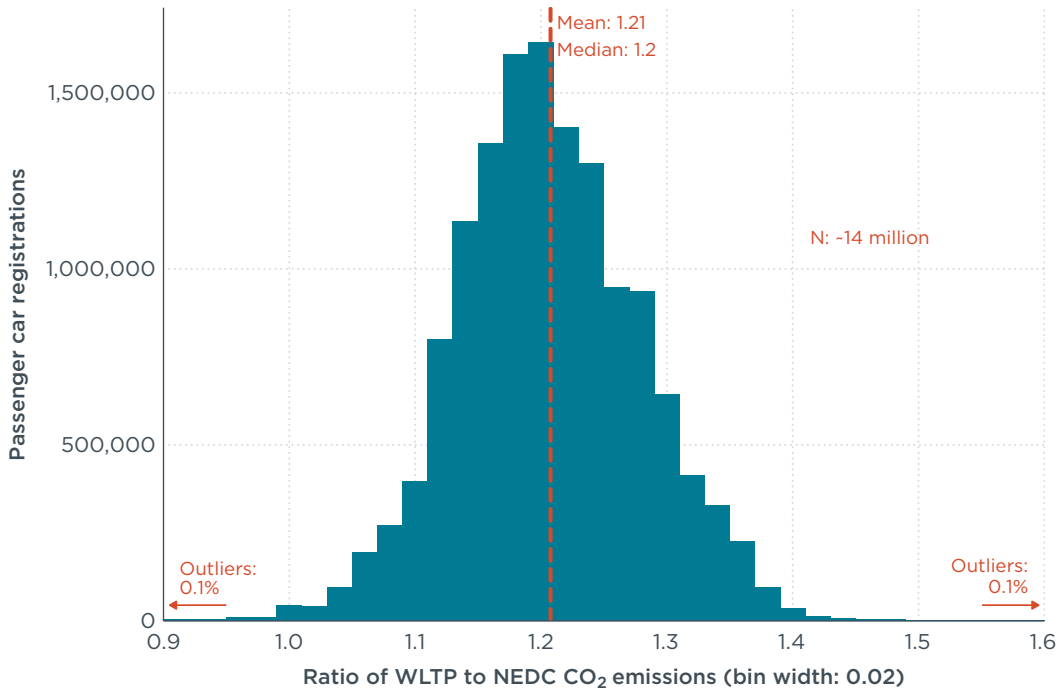

Figure 3. Distribution of the ratio between WLTP and NEDC CO_2 emission values of new passenger cars registered in 2019, for which both NEDC and WLTP values were provided. Zero-emission vehicles were removed.

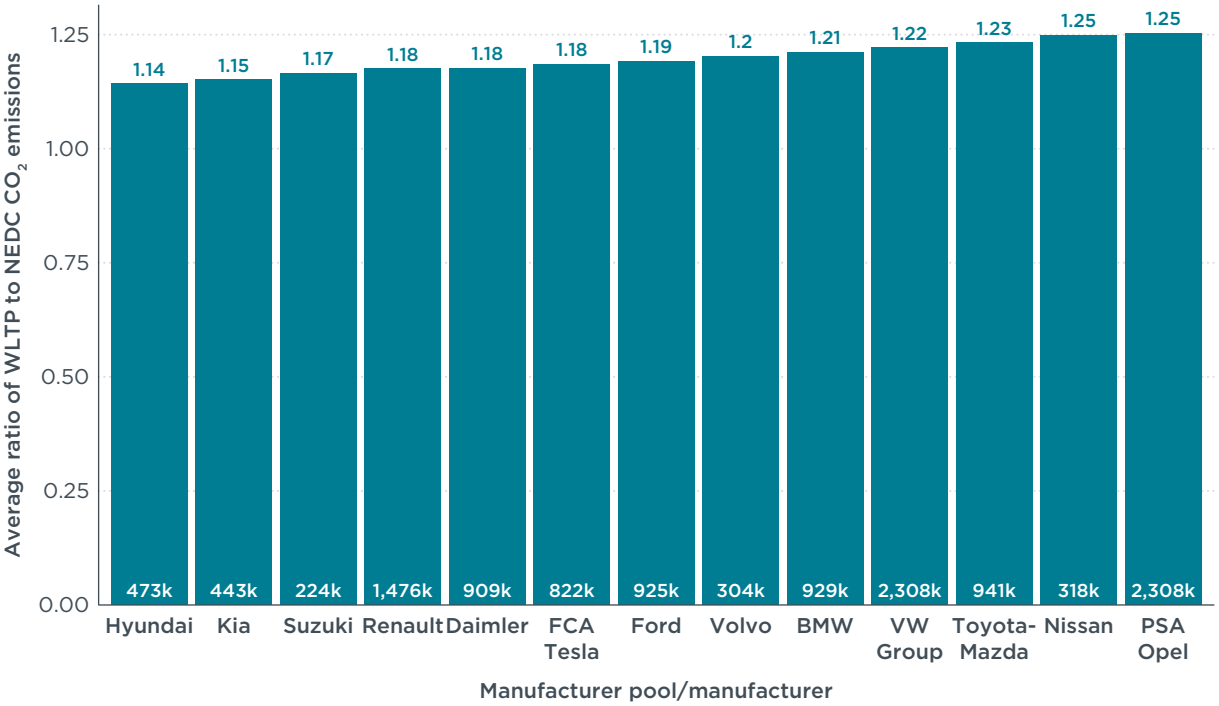

Figure 4. Average ratio between WLTP and NEDC CO_2 emission values of new passenger cars registered in 2019 for which both NEDC and WLTP values were provided, per manufacturer pool or manufacturer. The number of vehicles (in thousands) is presented at the bottom of each column.

6. OUTLOOK

After having met the 2015 CO_2 emissions target, manufacturers' efforts to further decrease emission levels seem to have come to a halt, with fleet-average CO_2 emission levels increasing for the third year in a row in 2019. Unprecedented CO_2 emission

reduction rates will be needed for all manufacturers by 2020 and 2021 to meet their respective targets and to avoid substantial fines.

However, unlike in U.S. regulations where manufacturers have to comply with annual targets, there are no targets for the years 2016–2019 in the EU CO_2 standards, allowing for a delay of technology introduction during these years. As a result, the 2019 data presented in this Briefing should not be extrapolated to future years. There are a number of factors that will affect manufacturers' compliance with the 2020/21 CO_2 targets:

- There remains CO_2 emissions reduction potential for conventional combustion engine vehicles, including lightweighting and improvements in aerodynamic and rolling resistance.
- There may be substantial growth in the hybrid electric vehicle market. At present, Toyota remains the only manufacturer in Europe with a significant share of HEVs. But a number of manufacturers—including Audi, BMW and Daimler—have announced plans to ramp up the market shares of 48-volt mild hybrid-electric vehicles.
- All major manufacturers have announced plans to substantially electrify their fleets in time for the 2020/21 targets, with numerous new electric vehicle models scheduled to enter the market from 2020 onwards. An increased uptake of electric vehicles will have a direct effect on manufacturers' compliance, plus an indirect effect, via super-credit multipliers.
- The application of eco-innovation credits could greatly increase. The number of approved eco-innovation technologies reached 30 in 2020, but only a fraction of them have been installed in significant numbers.
- Manufacturers can form or modify manufacturer pools for compliance with the 2020/21 CO_2 targets.

Monthly data collected from January to June of 2020 indicate that electrified power trains will play an increasingly important role in meeting 2020 targets.[12] The market-wide EV share more than doubled from 3% in 2019 to 8% in January–June 2020; HEV shares increased from 4% to 5%; and shares of mild hybrid-electric vehicles increased from 2% to 5%. Because 2020 year-to-date passenger car sales were about half of the 2019 figures due to the COVID-19 pandemic, it remains uncertain if market shares of electrified power trains will remain at these levels throughout 2020.

While the focus of the EU CO_2 emission standards is on official type-approval emissions, it is important to ensure that real-world emissions decrease over time. Real-world emissions are significantly higher than the official values presented in this briefing. The gap between real-world and NEDC CO_2 emission values of European cars widened over time and reached approximately 39% in 2018, with the WLTP narrowing the gap between real-world and official figures to approximately 14%.[13] In 2020, on-board fuel consumption meters will be phased-in to monitor the real-world fuel consumption of all new European passenger cars and light commercial vehicles. The European Commission is tasked with using these data to prevent a widening of the gap between type-approval and real-world emission values in the future.[14]

12 Peter Mock and Uwe Tietge, "Market Monitor: European Passenger Car Registrations, January–June 2020" (Washington, D.C.: International Council on Clean Transportation, August 5, 2020), https://theicct.org/publications/market-monitor-european-passenger-car-registrations-january-june-2020.

13 Dornoff, Tietge, and Mock, "On the Way to 'Real-World' CO_2 Values: The European Passenger Car Market in Its First Year after Introducing the WLTP."

14 European Union, "Regulation (EU) 2019/631 of the European Parliament and of the Council of 17 April 2019 Setting CO_2 Emission Performance Standards for New Passenger Cars and for New Light Commercial Vehicles, and Repealing Regulations (EC) No 443/2009 and (EU) No 510/2011 (Text with EEA Relevance.)," Pub. L. No. 32019R0631, 111 OJ L 13 (2019), http://data.europa.eu/eli/reg/2019/631/oj/eng.