BRIEFING

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CO_2 emissions from new passenger cars in Europe: Car manufacturers' performance in 2020

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This briefing paper provides an overview of CO_2 emission levels of new passenger cars in the European Union (EU) in 2020 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 2020 had average CO_2 emissions of 108 g CO_2/km, 14 g/km lower than in 2019, as measured over the New European Driving Cycle (NEDC). Including flexible compliance mechanisms, such as super-credits and phase-in provisions, lowers average NEDC CO_2 emissions to 96 g/km. Nearly all manufacturers met their 2020 CO_2 targets.

As an update to the previous year's briefing, this paper details manufacturer performance in terms of CO_2 emissions reduction, fuel type and technology trends, and market share.[2] 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 2021, so the specific values used in this report may change. The preliminary data for 2020 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," Data, European Environment Agency, June 29, 2021, https://www.eea.europa.eu/data-and-maps/data/co2-cars-emission-20.

2 Uwe Tietge, Peter Mock, and Jan Dornoff, "CO_2 Emissions from New Passenger Cars in Europe: Car Manufacturers' Performance in 2019" (Washington, D.C.: ICCT, August 26, 2020), https://theicct.org/publications/co2-new-passenger-cars-europe-aug2020.

3 Historically there had been little difference between preliminary and final data. In 2019, the difference between preliminary and final average CO_2 emissions was less than 1 g/km for NEDC and approximately 1 g/km for WLTP values.

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

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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 2020. 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 (EU) 2019/631.[5] 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 data. In the preliminary data, NEDC CO_2 emission values were reported for 99.6% of passenger cars registered in 2020; WLTP CO_2 emission values were reported for 97% of vehicles; and both NEDC and WLTP values were reported for 96.8% of vehicles. This section and sections 2 through 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 0.3% of 2020 passenger car registrations, were identified 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—count toward the 2020 CO_2 emission targets, the data include records 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 2020 were 108 g/km, 14 g/km (11.9%) lower than in 2019. Including flexible compliance mechanisms (see Section 4), emissions declined by 27 g/km (22%). Figure 1 plots the historical average CO_2 values relative to emission targets. Before standards were introduced, CO_2 emissions, on average, declined by 1.9 g/km 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 3.6 g/km annual reduction, average CO_2 emissions declined by 4.9 g/km per year. After 2015 targets were met, and in the absence of targets before 2020, average CO_2 emissions increased by 0.7 g/km per year. Currently adopted regulations set a −15% reduction target for 2025 and a −37.5% reduction target for 2030 compared to 2021 levels. A recent regulatory proposal by the European Commission includes strengthening the 2030 target to −55% and introducing a new −100% target for 2035.

5 European Union, "Regulation (EU) 2019/631 of the European Parliament and of the Council of 17 April 2019 Setting CO2 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

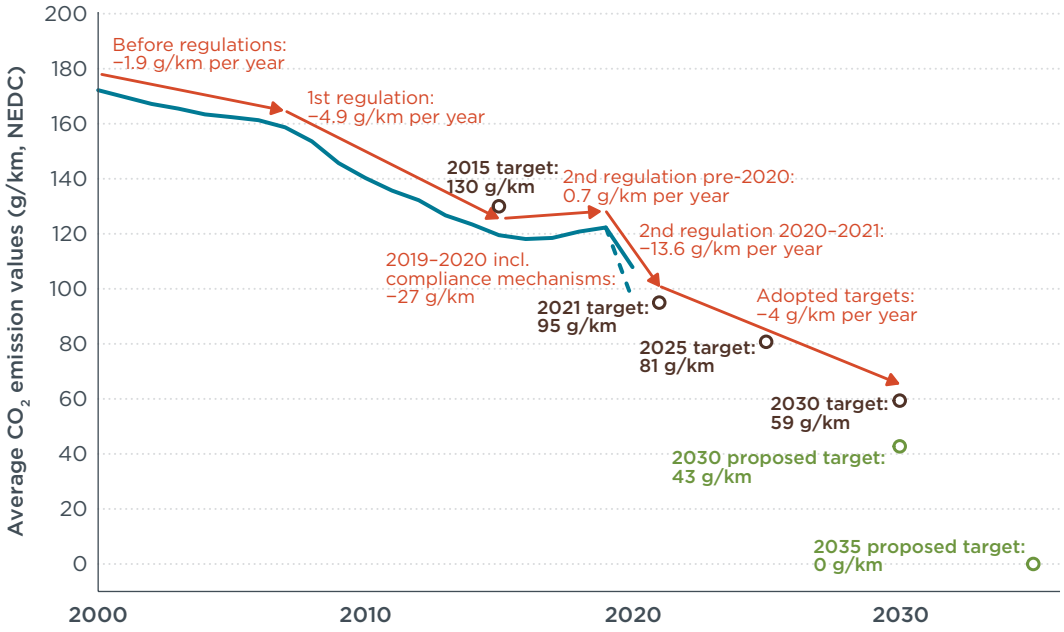

Figure 1. Historical average NEDC CO_2 emission values, targets, and annual reduction rates of new passenger cars.

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.[6] 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. This niche derogation will likely apply to the Suzuki pool in 2020 and is therefore omitted from the manufacturer pool analyses in this briefing.

Figure 2 and Table 1 present data for ten manufacturer pools representing approximately 96% of all EU new passenger car registrations in 2020. Figure 2 plots each manufacturer's average emissions relative to its 2020 target. The target is adjusted for vehicle mass using a limit value curve, which is displayed in the figure. Table 1 presents the same data but includes information on each manufacturer's market share in 2020. Both Figure 2 and Table 1 account for the impact of various flexible compliance mechanisms, including:

- a phase-in provision allowing manufacturer emission targets to only apply to 95% of vehicles registered in 2020;
- super-credits for which vehicles with NEDC CO_2 emissions below 50 g/km are counted twice in the calculation of average emissions; and
- eco-innovation credits rewarding innovative technologies that produce real-world CO_2 savings beyond what is measured over a standardized test cycle during vehicle type approval.

These mechanisms are described in more detail in Section 4.

6 In 2020, manufacturer pools (and their major brands) were: BMW (BMW, Mini); FCA-Tesla-Honda (Alfa Romeo, Fiat, Honda, Jeep, Lancia, Tesla); Ford-Volvo (Ford, Volvo); Hyundai (Hyundai); Kia (Kia); PSA (Citroën, DS Automobiles, Opel, Peugeot, Vauxhall); Mercedes-Benz (Mercedes-Benz, Smart); Renault-Nissan-Mitsubishi (Dacia, Mitsubishi, Nissan, Renault); Suzuki (Suzuki); Toyota-Mazda (Lexus, Mazda, Toyota); and Volkswagen (Audi, MG, Porsche, SEAT, Škoda, VW).

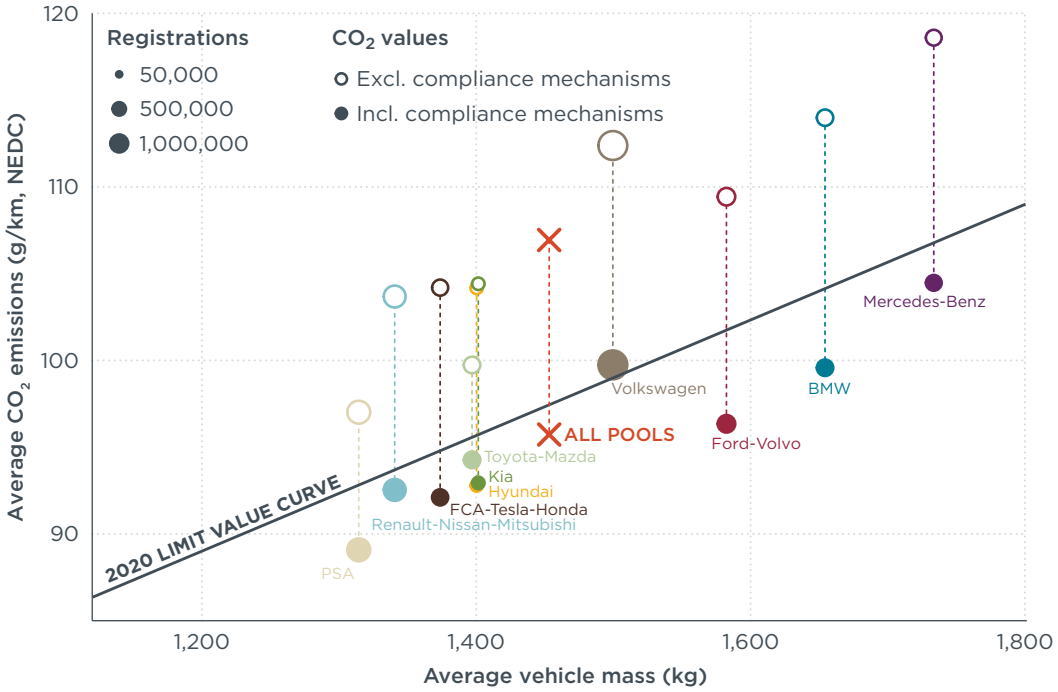

Figure 2. Performance of passenger car manufacturer pools in 2020 compared to the emissions target compliance curve.

As shown, all major manufacturer pools except Volkswagen appear to have met their 2020 CO_2 targets, although only with the use of flexible compliance mechanisms. The phase-in provision, on average, shaved 4 g/km off manufacturer pools' CO_2 emission levels; eight out of ten pools took full advantage of super-credits, which are capped at 7.5 g/km for the period 2020–2022; and eco-innovation technologies lowered CO_2 emission levels by 0.1 to 1.9 g/km. According to the data presented in Table 1, Volkswagen would face penalties on the order of 200 million euros for non-compliance.

Table 1. Manufacturer pool market shares, average vehicle mass and CO_2 emissions, impact of flexible compliance mechanisms, and CO_2 emission targets for 2020.

Manufacturer pool	Market share	Average mass (kg)	CO_2 values (g/km, NEDC)						
			2020 average	Phase-in	Super-credits	Eco-innovations	Adj. 2020 average	Target	Distance to target
Ford-Volvo	8%	1,582	109	-4	-7.5	-1.3	96	102	-5
BMW	7%	1,654	114	-5	-7.5	-1.9	100	104	-5
PSA	15%	1,314	97	-2	-5.2	-0.8	89	93	-4
Hyundai	3%	1,400	104	-4	-7.5	-0.2	93	96	-3
Kia	4%	1,401	104	-4	-7.5	-0.1	93	96	-3
FCA-Tesla-Honda	7%	1,374	104	-4	-7.5	-0.4	92	95	-3
Mercedes-Benz	6%	1,734	119	-6	-7.5	-0.6	104	107	-2
ALL POOLS	**96%**	**1,453**	**107**	**-4**	**-6.6**	**-0.8**	**96**	**97**	**-2**
Toyota-Mazda	7%	1,397	100	-3	-1.8	-0.2	94	96	-1
Renault-Nissan-Mitsubishi	14%	1,341	104	-3	-7.5	-0.7	93	94	-1
Volkswagen	25%	1,500	112	-4	-7.5	-0.6	100	99	1

Note: Rows are sorted by the distance to 2020 target levels.

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

Uptake of all forms of electrified powertrain vehicles dramatically increased from 2019 to 2020. Battery electric vehicle (BEV) shares nearly tripled (from 2.2% to 6.2%), plug-in hybrid electric vehicle (PHEV) shares more than quadrupled (from 1.2% to 5.2%), hybrid electric vehicle (HEV) shares grew by roughly one third (from 3.8% to 5.0%), and mild hybrid electric vehicle (MHEV) shares using 48-volt systems quadrupled (from 2.1% to 8.2%). Plagued by the aftermath of Dieselgate, diesel market shares, including mild-hybrid electric vehicles, continued to fall, decreasing from 32% in 2019 to 29% in 2020. Other powertrains, predominantly compressed natural gas and liquified petroleum gas vehicles, accounted for 1.8% of the market.

Table 2 presents the market share of various fuels and technologies in 2020 by country.[7] Norway continues to dominate the European electric vehicle (EV) market, with more than 54.3% of new car registrations in 2019 being BEVs and another 20.4% being PHEVs. Iceland, another non-EU member country, also recorded high EV market shares of 24.0% for BEVs and 22.3% for PHEVs. Within the EU, Sweden (9.5% BEV and 22.3% PHEVs) and the Netherlands (20.5% BEVs and 4.3% PHEVs) saw the highest uptake of electric vehicles. Germany, the largest vehicle market in the EU, saw a dramatic increase in PHEV shares (1.1% in 2019 to 6.9% in 2020) and BEV (1.8% in 2019 to 6.9% in 2020) shares. Shares of hybrid electric vehicles were particularly high in Finland (12.8%) and Ireland (10.6%) and exceeded 5% in 15 countries. Mild hybrid-electric vehicles using 48-volt systems spread from being most common in Germany in 2019 with 3.8% to exceeding 10% in four markets in 2020. Among major EU vehicle markets, Italy had the highest diesel share despite a 6-percentage-point drop from 2019 to 2020. Italy also was the only major market with a significant share of compressed natural gas and liquified petroleum gas vehicles.

Table 3 presents the market share of various fuels and technologies in 2020 for car manufacturer pools and select brands. Among pools, Mercedes-Benz had the highest EV share (PHEVs and BEVs) with more than 20%, followed by Kia, BMW, and Hyundai, each with more than 15%. Toyota-Mazda stands out with a 55.6% share of HEVs. Among brands, Volvo, Mitsubishi, Porsche, DS Automobiles, and Mercedes-Benz topped the ranking of PHEV shares, while Tesla, Smart, MG, Porsche, and Hyundai topped the BEV ranking. More than half of passenger cars registered by Suzuki and Mazda in 2020 were mild hybrid electric vehicles, a technology previously championed by German premium brands. Two German premium manufacturer pools, Mercedes-Benz and BMW, stood out with the highest diesel shares (46% and 38%, including MHEVs, respectively). Outside those pools, diesel accounted for more than half of the passenger car registrations of two brands, Alfa Romeo and Jeep, both from the FCA-Tesla-Honda pool. Only the manufacturer pool Renault-Nissan-Mitsubishi had more than a 5% share of compressed natural gas and liquified petroleum gas vehicles.

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

Table 2. Market share of fuels and technologies for new passenger cars in 2020 by country.

Market	Diesel	Petrol	Mild hybrid electric	Hybrid electric	Plug-in hybrid electric	Battery-electric	Other	Market share
Germany	32%	52%	9.0%	2.2%	6.9%	6.7%	0.5%	24.8%
France	32%	51%	5.1%	5.1%	4.5%	6.7%	1.0%	14.1%
United Kingdom	20%	63%	11.0%	6.7%	4.1%	6.6%	0.1%	13.9%
Italy	35%	47%	11.3%	4.7%	2.0%	2.3%	9.0%	11.8%
Spain	34%	52%	7.3%	8.1%	2.6%	2.0%	1.5%	7.6%
Belgium	34%	51%	6.9%	3.4%	7.3%	3.4%	0.9%	3.7%
Poland	21%	67%	5.6%	8.4%	1.0%	0.9%	2.2%	3.6%
Netherlands	4%	64%	6.8%	6.9%	4.3%	20.5%	0.6%	3.0%
Sweden	22%	37%	8.7%	7.7%	22.5%	9.5%	1.2%	2.5%
Austria	40%	48%	8.3%	2.1%	3.0%	6.3%	0.2%	2.1%
Czechia	30%	63%	2.7%	2.6%	1.0%	1.6%	2.2%	1.7%
Denmark	23%	56%	4.7%	4.6%	9.2%	7.1%	0.0%	1.7%
Portugal	36%	47%	3.8%	3.3%	7.7%	5.2%	1.2%	1.2%
Norway	9%	8%	1.9%	8.2%	20.4%	54.3%	0.0%	1.2%
Hungary	24%	65%	18.8%	6.3%	2.1%	2.4%	0.3%	1.1%
Romania	28%	58%	6.5%	4.0%	0.8%	2.3%	7.3%	1.1%
Finland	15%	53%	6.7%	12.8%	13.7%	4.4%	1.9%	0.8%
Ireland	44%	38%	2.4%	10.6%	2.8%	4.5%	0.0%	0.8%
Greece	28%	61%	8.1%	6.5%	1.8%	0.9%	2.3%	0.7%
Slovakia	27%	65%	5.2%	4.3%	1.1%	1.3%	1.3%	0.7%
Luxembourg	39%	47%	7.0%	1.6%	5.9%	5.5%	0.0%	0.4%
Slovenia	32%	60%	3.4%	2.9%	0.6%	4.0%	0.5%	0.3%
Lithuania	18%	73%	13.1%	7.0%	0.5%	1.1%	0.2%	0.3%
Croatia	41%	52%	4.4%	2.5%	0.7%	1.6%	2.5%	0.3%
Estonia	27%	58%	4.4%	9.6%	0.6%	1.8%	3.4%	0.2%
Latvia	35%	50%	3.2%	9.9%	0.6%	2.6%	1.0%	0.1%
Iceland	21%	24%	2.8%	9.0%	22.3%	24.0%	0.4%	0.1%
Cyprus	0%	56%	0.0%	3.8%	0.8%	0.4%	9.5%	0.1%
Total	**29%**	**53%**	**8.2%**	**5.0%**	**5.2%**	**6.2%**	**1.8%**	

Notes: Countries are sorted by descending market share. "Diesel" and "Petrol" columns include mild hybrid-electric vehicles. "Other" column primarily covers compressed natural gas and liquified petroleum gas fuels.

Table 3. Market share of fuels/technologies for new passenger cars in 2020 for manufacturer pools.

Manufacturer pool	Diesel	Petrol	Mild hybrid electric	Hybrid electric	Plug-in hybrid electric	Battery-electric	Other	Market share
Volkswagen	31%	56%	7.3%	0.0%	4.3%	6.6%	1.7%	25.4%
VW	32%	55%	2.0%	0.0%	3.2%	8.8%	1.3%	11.2%
Škoda	33%	60%	0.2%	0.0%	3.1%	2.3%	2.1%	5.3%
Audi	42%	44%	31.2%	0.0%	7.8%	5.9%	0.5%	5.0%
SEAT	20%	71%	2.4%	0.0%	1.7%	2.1%	5.4%	3.0%
Porsche	0%	64%	0.0%	0.0%	19.2%	16.5%	0.0%	0.6%
MG	0%	48%	0.0%	0.0%	0.8%	51.2%	0.0%	0.2%
PSA	34%	59%	0.0%	0.0%	2.7%	4.1%	0.0%	14.8%
Peugeot	39%	52%	0.0%	0.0%	3.0%	5.8%	0.0%	6.4%
Opel/Vauxhall	24%	70%	0.0%	0.0%	1.9%	4.0%	0.0%	4.1%
Citroën	37%	61%	0.0%	0.0%	1.4%	0.6%	0.0%	3.9%
DS Automobiles	40%	31%	0.0%	0.0%	18.5%	11.3%	0.0%	0.4%
Renault-Nissan-Mitsubishi	25%	56%	0.0%	0.8%	2.8%	8.6%	6.7%	13.5%
Renault	29%	51%	0.0%	1.5%	2.2%	12.7%	3.6%	6.8%
Dacia	29%	51%	0.0%	0.0%	0.0%	0.4%	19.3%	3.4%
Nissan	19%	69%	0.0%	0.0%	0.0%	11.4%	0.0%	2.4%
Mitsubishi	1%	72%	0.0%	0.0%	26.8%	0.0%	0.2%	0.8%
Ford-Volvo	34%	53%	20.1%	0.8%	11.2%	0.5%	0.6%	8.2%
Ford	32%	62%	20.1%	1.1%	3.7%	0.0%	0.8%	5.8%
Volvo	38%	31%	20.2%	0.0%	29.5%	1.7%	0.0%	2.4%
FCA-Tesla-Honda	24%	57%	12.3%	3.4%	1.0%	12.0%	3.1%	7.3%
Fiat	24%	71%	18.7%	0.0%	0.0%	1.2%	3.5%	4.2%
Jeep	51%	42%	0.0%	0.0%	7.0%	0.0%	0.0%	1.0%
Tesla	0%	0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.8%
Honda	3%	54%	0.0%	37.2%	0.0%	5.0%	0.0%	0.7%
Lancia	0%	78%	33.4%	0.0%	0.0%	0.0%	21.9%	0.4%
Alfa Romeo	62%	38%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%
Toyota-Mazda	4%	38%	10.0%	55.6%	0.8%	1.2%	0.1%	7.0%
Toyota	3%	31%	0.0%	65.3%	1.0%	0.0%	0.2%	5.4%
Mazda	9%	85%	57.1%	0.0%	0.0%	6.5%	0.0%	1.2%
Lexus	0%	4%	0.0%	95.7%	0.0%	0.7%	0.0%	0.4%
BMW	38%	45%	9.0%	0.0%	12.1%	4.7%	0.0%	7.0%
BMW	47%	37%	11.3%	0.0%	13.2%	3.5%	0.0%	5.6%
Mini	7%	76%	0.0%	0.0%	8.0%	9.5%	0.0%	1.4%
Mercedes-Benz	46%	34%	6.4%	0.0%	14.8%	5.8%	0.0%	6.4%
Mercedes-Benz	48%	35%	6.6%	0.0%	15.4%	2.3%	0.0%	6.2%
Smart	0%	1%	0.0%	0.0%	0.0%	98.6%	0.0%	0.2%
Kia	14%	57%	6.6%	8.1%	8.0%	9.4%	3.2%	3.5%
Kia	14%	57%	6.6%	8.1%	8.0%	9.4%	3.2%	3.5%
Hyundai	15%	60%	8.2%	9.4%	1.5%	13.9%	0.9%	3.5%
Hyundai	15%	60%	8.2%	9.4%	1.5%	13.9%	0.9%	3.5%
Suzuki	0%	97%	69.7%	1.2%	1.2%	0.0%	0.1%	1.4%
Suzuki	0%	97%	69.7%	1.2%	1.2%	0.0%	0.1%	1.4%
Total	**29%**	**53%**	**8.2%**	**5.0%**	**5.2%**	**6.2%**	**1.8%**	

Notes: Brand shares may not add up to manufacturer pool totals because not all brands are included. Manufacturer pools are sorted by descending market share. "Diesel" and "Petrol" columns include mild hybrid electric vehicles. "Other" column primarily covers compressed natural gas and liquified petroleum gas fuels.

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 principal mechanisms to account for varying consumer preferences (see Section 2). Other compliance 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 cars in 2014, and 1.5 cars in 2015. In the 2020/21 standard, each low-emission car will count as 2 cars in 2020, 1.67 cars in 2021, and 1.33 cars in 2022. The combined impact of super-credits for the years 2020–2022 for compliance with CO_2 targets is capped at 7.5 g/km per manufacturer pool. For 2025–2030 targets, super-credits were removed in favor of EV sales targets.

Figure 3 plots historical average emissions excluding low-emission vehicles, including low-emission vehicles, and including the super-credit effect. The figure indicates that the share and impact of low-emission vehicles has been growing over the years, reaching 11 g/km in 2020. With eight out of ten manufacturer pools topping out at the maximum allowable super-credit reduction of 7.5 g/km (see Table 1), super-credits reduced fleet-average CO_2 emissions by an additional 7 g/km. Excluding low-emission vehicles, average CO_2 emissions in 2020 were comparable to 2016 levels.

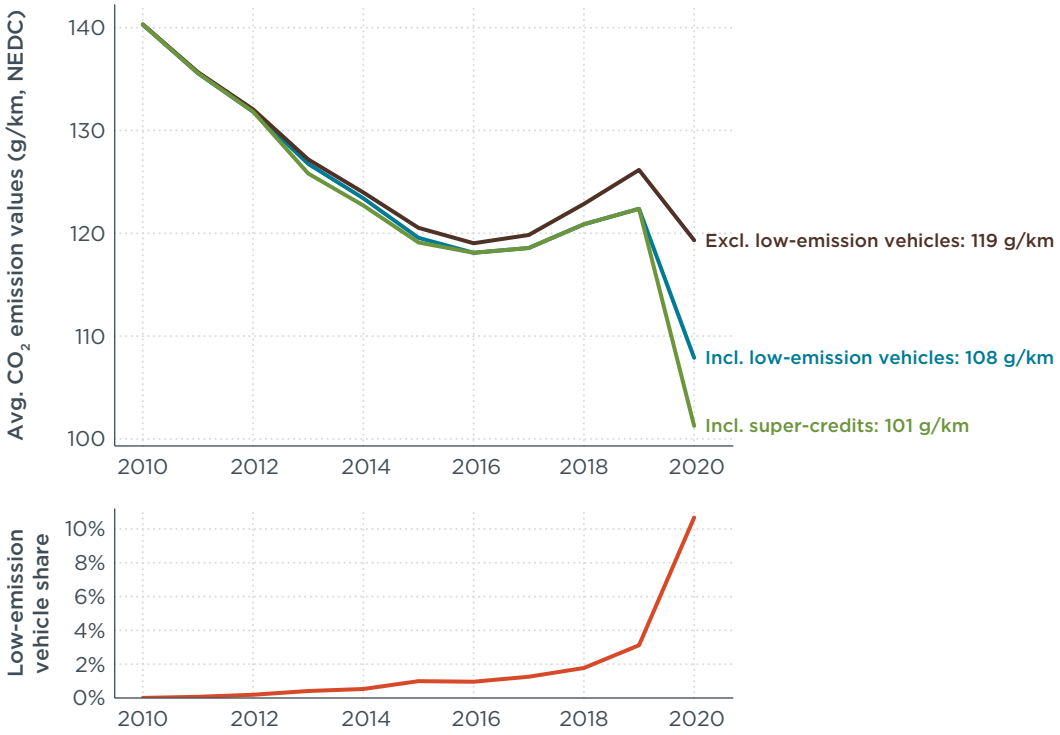

Figure 3. Top panel: Historical average CO_2 emissions (g/km, NEDC) excluding low-emission vehicles, including low-emission vehicles, and including the effect of super-credit multipliers. Bottom panel: Share of low-emission vehicles.

Figure 4 plots average CO_2 emissions over average vehicle mass, both including and excluding low-emission vehicles. The figure indicates that 2016–2020 efficiency improvements in conventional vehicles were offset by a 41 kg increase in average

vehicle mass, which was largely driven by the increasing share of sport utility vehicles and crossover utility vehicles.[8] Moreover, because 2020 manufacturer targets are calculated against a baseline mass of 1,379.88 kg, and the average mass of vehicles belonging to manufacturer pools increased to approximately 1,453 kg in 2020, manufacturer targets were, on average, approximately 97 g/km instead of the intended 95 g/km.

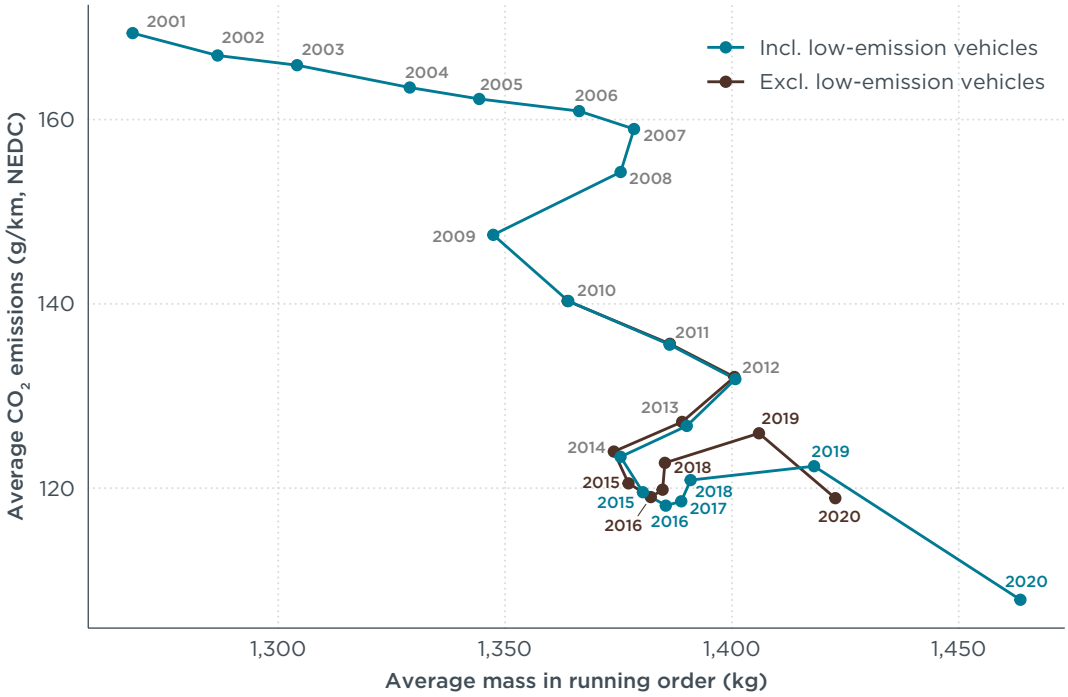

Figure 4. Annual average CO_2 emissions (g/km, NEDC) over average mass in running order (kg), including and excluding low-emission vehicles.

Eco-innovation credits incentivize the development and adoption of innovative fuel-efficiency technologies by rewarding 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.[9] 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 15% in 2019 to 43% in 2020. Figure 5 plots the average CO_2 emission reduction through eco-innovation technologies per manufacturer pool. Market-wide average CO_2 reductions from eco-innovation technologies were 0.8 g/km in 2020, up from 0.2 g/km in 2019. BMW stands out with eco-innovation technologies installed in approximately 73% of new passenger cars registered in 2020 for a 1.9 g/km reduction in average CO_2 emissions.

8 Sonsoles Díaz et al., "European Vehicle Market Statistics 2020/21" (Washington, D.C.: ICCT, December 18, 2020), https://theicct.org/publications/european-vehicle-market-statistics-202021.

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

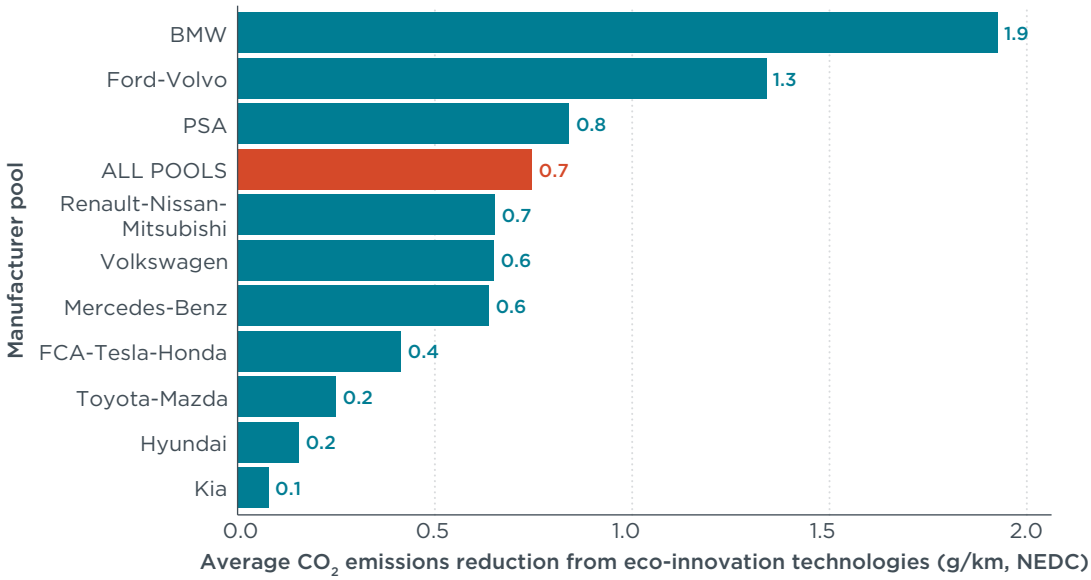

Figure 5. Average CO_2 emission reduction (g/km, NEDC) per manufacturer pool from eco-innovation technologies. Results include interaction effects with the phase-in provision and super-credits multipliers.

The phase-in provision allows manufacturers to base average CO_2 emission values in 2020 on the best-performing 95% of vehicles. Figure 6 plots the average CO_2 emissions reduction from removing each manufacturer pool's highest-emitting 5% of vehicles in 2020. On average, the phase-in provision reduces CO_2 emissions by almost 4 g/km, but German premium manufacturers Mercedes-Benz and BMW reduce average emissions by approximately 5 g/km–6 g/km using the phase-in provision. The phase-in ends in 2021, when all vehicles count toward manufacturers' CO_2 emission targets.

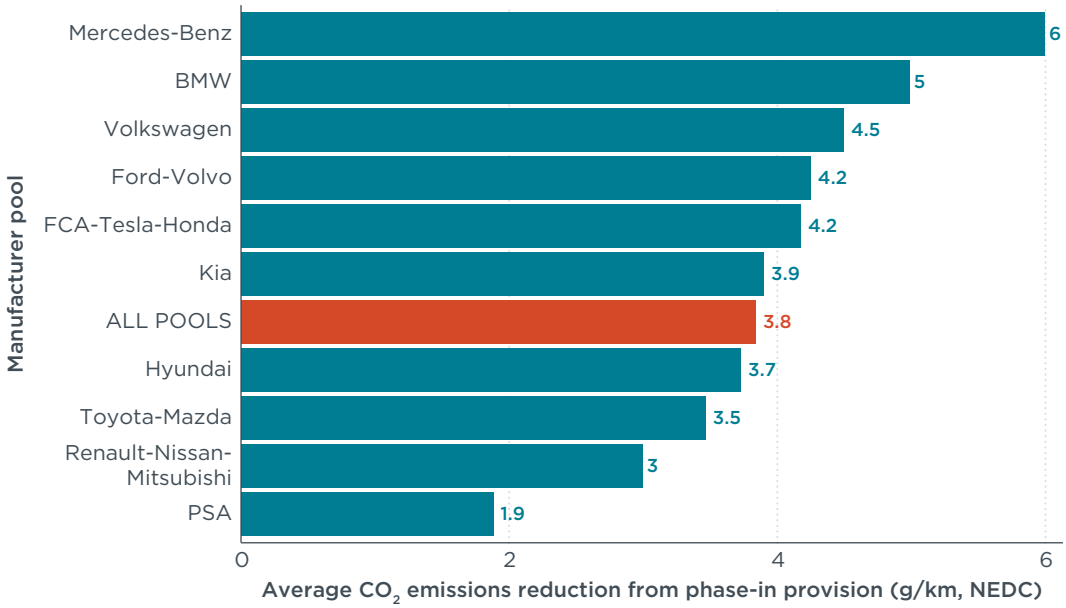

Figure 6. Average CO_2 emissions reduction (g/km, NEDC) from the phase-in provision.

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.[10] Contrary to the NEDC procedure, a CO_2 emission value is determined for each individual vehicle, taking into account details like the mass of fitted optional equipment and the driving resistance of the installed wheels.

Figure 7 presents the distribution of the ratio between WLTP and NEDC CO_2 emission values in 2020. The mean and median ratio were both 1.21 in 2020, virtually identical to the central tendencies recorded in 2018 and 2019. The vast majority of 2020 passenger cars (99.8%) had a ratio between 0.7 and 1.5. Average ratios ranged from 1.12 to 1.29 per manufacturer pool (see Figure 8). Differences between manufacturer pools are partly explained by varying shares of plug-in hybrid-electric vehicles, which generally have considerably lower WLTP-NEDC ratios (mean: 1.02; median: 0.97) than other vehicles (mean: 1.22; median: 1.22). Eight of the ten manufacturer pools saw higher WLTP-NEDC ratios for diesel vehicles than for petrol vehicles.

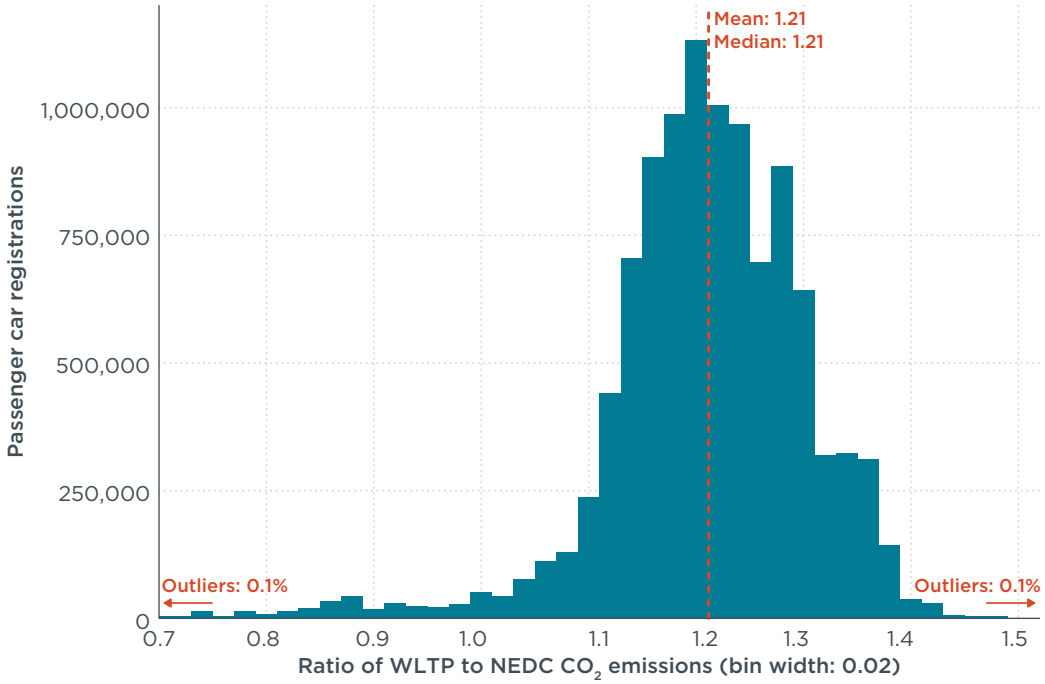

Figure 7. Distribution of the ratio between WLTP and NEDC CO_2 emission values of new passenger cars registered in 2020. Zero-emission vehicles were removed.

10 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.: ICCT, May 19, 2020), https://theicct.org/publications/way-real-world-co2-values-european-passenger-car-market-its-first-year-after.

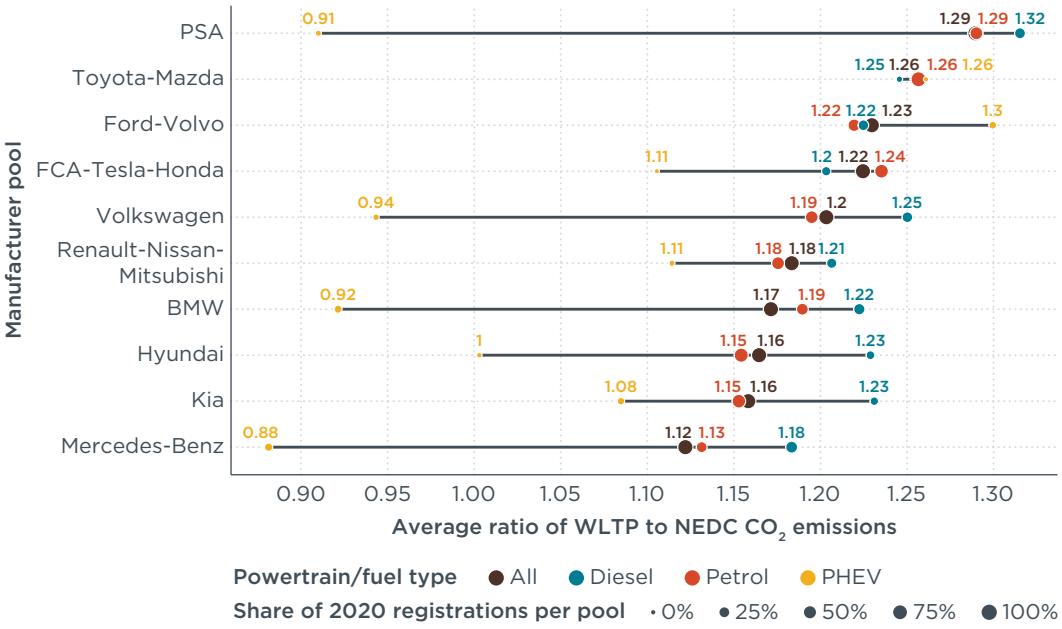

Figure 8. Average ratio between WLTP and NEDC CO_2 emission values of new passenger cars registered in 2020, per manufacturer pool and powertrain/fuel type.

6. OUTLOOK

Nine out of ten major manufacturer pools met their 2020 CO_2 targets, with the Volkswagen manufacturer pool appearing to have narrowly missed their target by approximately 1 g/km of CO_2. Thus, CO_2 standards thus led to a dramatic decrease in average NEDC CO_2 emissions from 2019 to 2020 and an equally significant increase in electric vehicle shares.

At the same time, all manufacturer pools relied on one or more of the flexible compliance mechanisms afforded by EU regulations—the phase-in provision, super-credits for low-emission vehicles, and eco-innovation technology credits—to meet their targets. Reliance on compliance mechanisms means that roughly half of the CO_2 reductions in 2020 were only achieved on paper. Compliance mechanisms and increasing electric vehicle market shares also allowed average CO_2 emission levels from combustion engine vehicles to remain at approximately 2016 levels.

Because the phase-in provision ended in 2020, and eight out of ten manufacturer pools have exhausted the 7.5 g/km super-credit budget for 2020–2022, manufacturers will have to achieve an approximate reduction of 10 g/km in 2021 without these aids. Recent data indicate that manufacturers intend to meet the 2021 targets by further electrifying their fleets: shares of battery-electric and plug-in hybrid electric vehicles increased from 11% in 2020 to approximately 16% in the first half of 2021.[11]

A recent regulatory proposal by the European Commission includes strengthening the 2030 CO_2 target to −55% compared to 2021 levels and introduces a new −100% target for 2035. In order to meet these targets, manufacturers will have to continue to electrify their fleets in the coming years. However, with the 2025 target remaining at −15% for the moment, and in the absence of annual or additional interim targets, there remains a risk that automakers will postpone the introduction of innovative vehicle technologies to the late 2020s, similar to the pattern observed in 2016–2019.

11 Peter Mock et al., "Market Monitor: European Passenger Car and Light-Commercial Vehicle Registrations, January–June 2021" (Washington, D.C.: ICCT, August 10, 2021), https://theicct.org/publications/market-monitor-eu-jul2021.

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%.[12] In 2020, on-board fuel consumption meters were 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.[13] For meaningful monitoring of real-world emission levels, detailed fuel and energy consumption data must become publicly available.

12 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."

13 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.)".