



Mission (almost) accomplished

Carmakers' race to meet the 2020/21 CO₂ targets and the EU electric cars market

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Executive Summary

After years of increasing car CO₂ emissions and SUV sales, the long awaited 2020/21 EU car CO₂ standard entered into force and **the CO₂ emissions of new cars dropped instantly in January 2020**. But as the electric car sales were taking off, the COVID-19 pandemic resulted in the lockdown on activity and brought car sales and dealerships to a virtual halt. As the CO₂ rules for 2020/21 remain in force despite a few opportunistic calls for delay, and as the car sales bounce back, the question is: will carmakers meet this year's target or be forced to pay fines? And what does this mean for Europe's nascent electric vehicle market? This report analyses the carmakers' performance in the first half of 2020 and their compliance strategies and forecasts the electric car market for 2020 and 2021.

Major drop in car CO₂ emissions in 1st half of 2020

Driven by the entry into force of EU 2020/21 car CO₂ emission standards and proof of their success, the **sales of electric cars** (battery electric, BEV and plug-in hybrid electric, PHEV) boomed in the first half of the year, reaching a **market share of 8%** (European Economic Area, EEA). This is more than triple the H1 2019 share as EV sales reach new heights with Volvo at 23%, BMW at 13%, Hyundai-Kia at 11% and Renault at 8%. Sales kept rising since January, so before and despite COVID-19, weathering the pandemic better than diesel or petrol cars. Post-COVID purchase incentives in Germany, France and other countries kicked in mid-summer, and are undoubtedly continuing the mobility momentum with recent reports of EV sales surpassing 10% in Germany and France.

The growing sales of electric cars across Europe have resulted in a significant drop in new car CO₂ emissions. This reduction means some OEMs have already achieved their 2020 CO₂ targets, whilst many others are getting very close to meeting theirs. From the levels of over 122g/km in 2019, the H1 2020 **new car CO₂ emissions dropped to 111 g/km**, the largest drop since the standards came into effect in 2008. As of 1 July, the PSA Group, Volvo, FCA-Tesla and BMW Group are already compliant based on their H1 2020 performance, while Renault, Nissan, the Toyota-Mazda pool and Ford have a mere 2 gCO₂/km gap left, or a gap of just 1%-2%. Those that achieved least improvement so far and furthest from their targets are Daimler and Jaguar-Land Rover, with a 9 g/km gap (9%) and 13 g/km (10%) respectively. The Volkswagen Group (awaiting the sales of ID.3) is in the middle with 5 g/km (or 5% gap), together with Hyundai-Kia with 7 g/km (8%) and 3 g/km gaps respectively (3%).

Most carmakers on track to meet CO₂ targets after the first half of the year

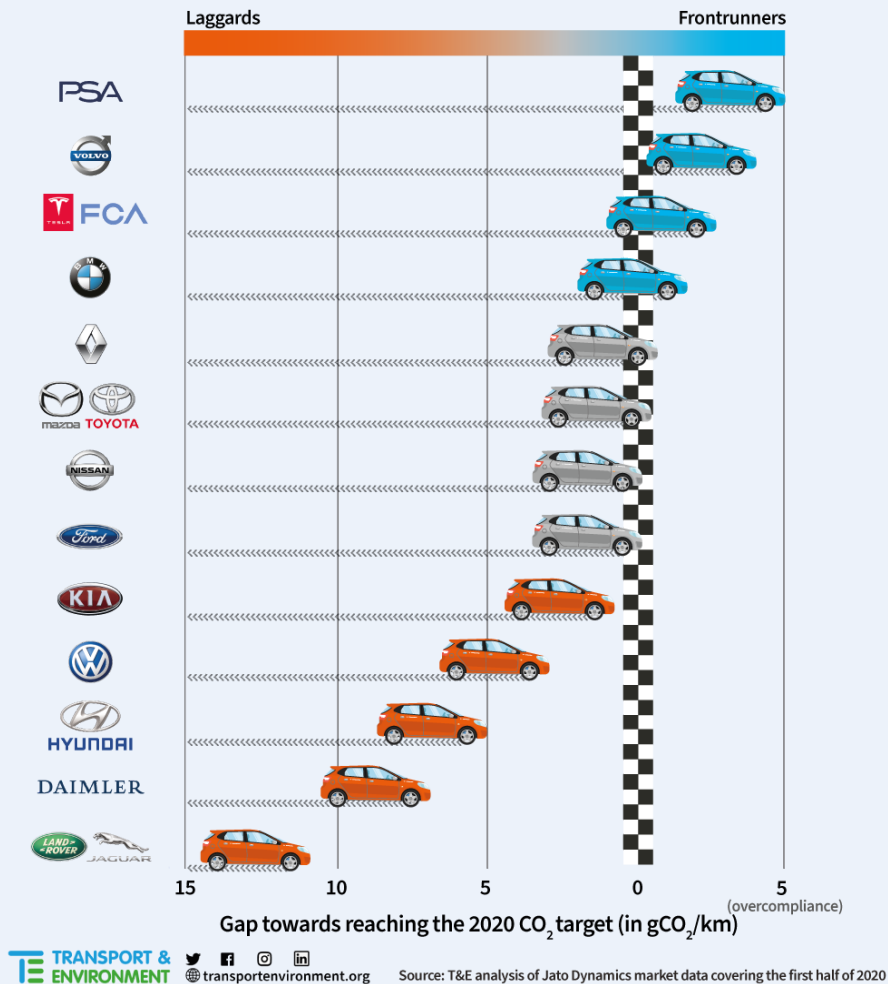


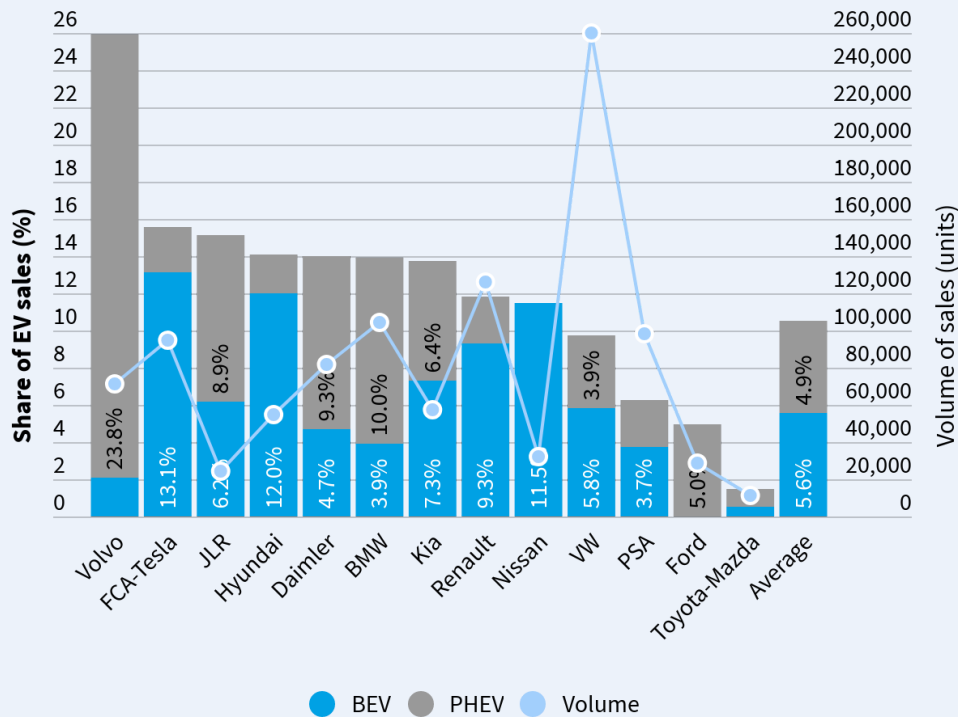
Figure 01: Carmakers remaining gap after the first half of 2020

Compliance with 2020 target within reach & booming EV sales

T&E has calculated the likely share of electric cars in Europe in 2020 and 2021 by analysing carmakers' individual compliance strategies, i.e. ramping up plug-in sales, improving fuel efficiency of conventional engines (including hybrids) or using the regulatory flexibilities such as pooling. T&E's modelling uses the sales composition and CO₂ emissions from the first half of 2020 as a basis, adjusts the relative importance of battery, plug-in hybrid and hybrid sales

based on production forecasts and incorporates the announcements of individual EV plans and launches. One stark finding is that **half, or over 13 g/km, of the gap to reach the 2020 target EU-wide will be closed by regulatory flexibilities**, chiefly super credits, the 95% phase-in, the mass adjustment and credits for eco-innovations. Only around 30% of the gap this year is expected to come from plug-in car sales, rising to almost half in 2021 as some flexibilities are exhausted.

Assuming automakers fully comply with the targets, Europe will see its **electric car sales** reach **10% by the end of 2020** (EU27, the UK, Norway, Iceland and Liechtenstein), or 9% for EU27. This would be triple the 3% EU28 sales share in 2019. **In 2021** this rises to an even more impressive **15% share** (14% for EU27). T&E projects that most of the carmakers' EV share in 2020 will range from 10% to 14%, with the exception of Volvo (26%) and FCA-Tesla (16%) on the high end, and PSA (6%), Ford (4%) and Toyota-Mazda (1%-2%) on the lower end. Despite the COVID-19 crisis, **the total number of electric cars sold in Europe is expected to double from half a million in 2019 up to one million in 2020, and reach 1.8 million in 2021**. However, the volumes of sales are currently hard to predict with a high level of certainty.



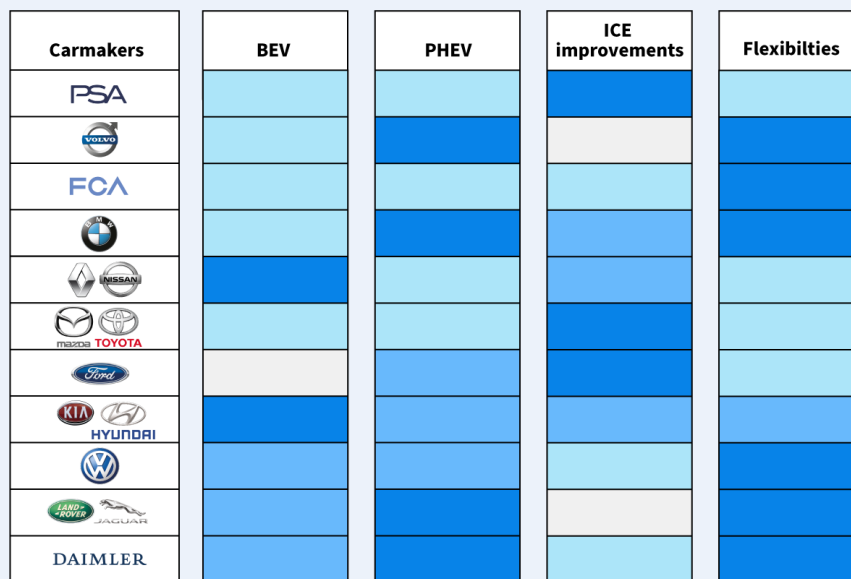
Source: T&E modelling of carmakers' CO₂ emission compliance based on passenger car registration data from the first half of 2020 (data from JATO Dynamics)

Figure 02: Expected carmaker EV sales in 2020

Thanks to flagship mass-market electric models like the Volkswagen ID.3 and the Renault Zoe, carmakers are able to significantly bring down their average CO₂ emissions. The cornerstone of Renault's compliance strategy, Zoe alone will cut the carmaker's CO₂ by 15 g/km in 2020, thus allowing Renault to overshoot its target by 13% (12 g/km). Similarly, for the Volkswagen Group, battery electric models based on the new platform architecture (MEB) would bring down the average emissions by 5 gCO₂/km in 2020 and 11 gCO₂/km in 2021. All MEB-based BEV sales allow the carmaker to close a quarter of its compliance gap from 2019 in 2020 and close to 40% in 2021. On the other hand, Toyota-Mazda meets the 2020 target with barely any electric car sales, relying instead on the strategy of hybridising their conventional models, while the FCA Group meets the 2020 target almost entirely thanks to its pooling arrangement with Tesla.

Electrification is now a core part of several carmakers' industrial strategies, including the Volkswagen Group, the Renault-Nissan-Mitsubishi Alliance, BMW and Hyundai-Kia. Although conceived as a climate regulation, the 2020/21 **EU vehicle CO₂ emission standards are the modern day example of an excellent industrial policy** that pushes the car industry to invest in and supply future-proof zero emission technologies in Europe.

Carmakers compliance strategy for 2020



Strategical importance: Lowest to highest



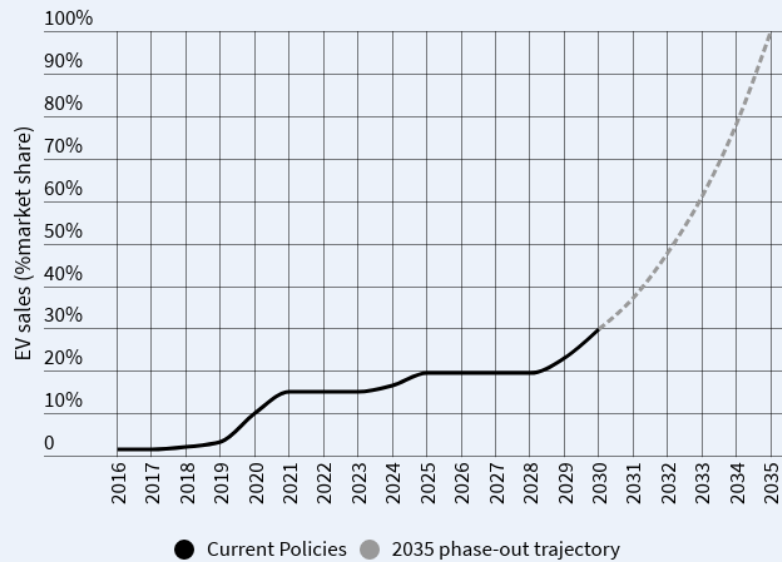
Figure 03: Carmakers' CO₂ compliance strategy for 2020

Beyond 2021: stagnating electric car supply

Despite the impressive electric car sales observed this year, the figures mask successive failures to cut vehicle CO₂ emissions over the past few years. New car CO₂ emissions were actually increasing between 2016 and 2019 as a lucrative but polluting SUV addiction was growing; in the first half of 2020 SUVs sales have crept up to 39%. Half of all the plug-in sales today are “fake electric” plug-in hybrids that are rarely charged and emit 2-4 times more CO₂ in real-world than the lab tests show. And, against soaring plug-in sales, carmakers such as

Daimler and Audi sell thousands of (premium) cars with emissions well above 200 g/km despite electrification technologies readily available for these high end models.

The expected plug-in sales in 2020/21 of 10-15% also serve to underline the inadequacy of the current 2025 and 2030 car CO₂ targets. There is a real danger that the **supply of electric cars will stagnate throughout 2020s** just as the technology matures and market demand surges. The European EV market share would only grow by one third over four years (between 2021 and 2025) under the current regulation, compared to a five fold increase between 2019 and 2021.



Current Policies trajectory is based on the current CO₂ emissions reduction targets of **-15% in 2025 and -37.5% in 2030**.

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Figure 04: EU trajectory for EV sales under current regulation

Instead of a stagnating market, electric car sales should in 2020s be entering the technology (s-shaped) uptake curve, with a mass market developing across Europe. Norway shows how fast the market can grow: from 6% sales in 2013 to almost 50% five years later, in 2018. With electric cars expected to reach price parity with diesels and petrols after 2022, the growth must accelerate much faster than the current pace of regulations in order to sell the last combustion engine car no later

than 2035 to reach zero emissions by 2050. **The revised CO₂ standards should therefore set more ambitious annual targets from 2025 onwards to achieve 100% zero emission sales in 2035.**



2020 was awaited by many as the year of the electric car in Europe. And while being overshadowed by the pandemic, the plug-in market has not disappointed. Diesel - once touted as the technology to meet car CO₂ standards - saw its sales remain low (27%), marking the point of no return following the dieselgate scandal and numerous city bans. But the battle for clean mobility is far from over: the sales of higher emitting SUV models are booming, and even larger cars previously seen in the U.S. - pick-up trucks - are slowly making their way into already congested European roads. Worse still, half of the plug-in sales today are “fake electric” plug-in hybrids, hardly a climate solution. 2020 also saw Chinese electric models enter markets in notably Norway, the Netherlands and the UK, a clear sign that the European automakers are still failing to supply the adequate numbers of EVs for the booming market. So while the electric car is finally entering the mainstream in Europe, there is a lot to do to deliver the Green Deal and zero emissions mobility promised by European and national politicians alike. For both climate and industrial growth, Europe cannot afford to leave anyone behind in the fossil age as it **enters the new Emobility Era.**

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Abbreviations

EV	Electric Vehicle (<i>In this report, this stands for vehicles propelled by an electric motor: battery electric vehicles, fuel cell electric vehicles and plug-in hybrid electric vehicles</i>)
BEV	Battery Electric Vehicle
FCEV	Fuel Cell Electric Vehicle
ZEV	Zero-Emissions Vehicle: BEV and FCEV
PHEV	Plug-in Hybrid Electric Vehicle
ZLEV	Zero and Low Emission Vehicles (Defined in Regulation EU 2019/631 as a passenger car or a van with CO ₂ emissions between 0 and 50 g/km)
HEV	Mild and Full Hybrids
ICE	Internal Combustion Engine
SUV	Sports Utility Vehicle
LIB	Lithium-Ion Battery
GHG	GreenHouse Gas
EU-27	EU member states (UK not included)

1. Introduction

1.1 Preamble

This report is part of a series of annual T&E reports looking into carmakers' compliance with the passenger car CO₂ emission standards in the EU. The report focuses on what has become the single most important regulatory driver for emission reductions from cars. The EU CO₂ standards oblige carmakers to sell cleaner vehicles, thereby lowering the average CO₂ emissions of their new cars fleet. With the 95 gCO₂/km car CO₂ standard entering into force on January 1st 2020, the European car market is undergoing a profound and irreversible transformation towards greener cars, which is captured in this report.

The [introduction](#) of this report lays out the background information relative to the CO₂ emission trends for transport in the EU, and how policymakers' response to the coronavirus crisis is likely to affect these trends.

The analysis of this report is based on recent passenger car market data from the first half of 2020 acquired by T&E. [Section 2](#) analyses the CO₂ emissions of new cars over this first half of the year while [Section 3](#) gives an overview of the sales of electric cars during the same period.

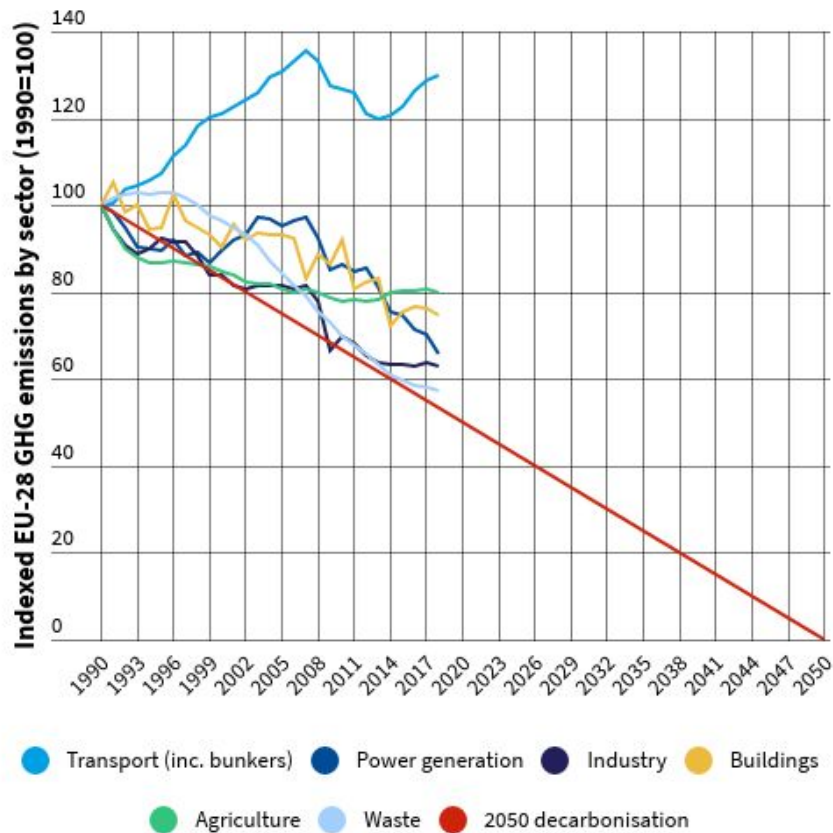
[Section 4](#) presents the outcome of T&E's in-house modelling of the outcome of the car CO₂ regulation on the car market over the full years 2020 and 2021 and provides a detailed forecast for the uptake of electric cars for each of the respective years. Then, [Section 5](#) explores the different flexibilities that are used by carmakers to comply with the new regulation and details each individual carmaker's compliance strategy.

Finally, [Section 6](#) shows that without change to the current car CO₂ regulation, EV sales would taper off until 2030 and provides recommendations on how this could be changed best to support and prepare favourable conditions for the uptake of EVs in the 2020s.

1.2 Transport emissions: Europe's biggest climate problem

Transport is Europe's biggest source of carbon emissions, contributing 28% to the EU's total CO₂ emissions in 2018 when aviation and shipping are included (21% excluding international aviation and shipping)¹ and is the only sector to have increased its emissions since 1990 (see Figure 1).

¹ European Parliament (2019). CO₂ emissions from cars: facts and figures (infographics). [Link](#)



Source: Transport & Environment from Member States' reporting to the UNFCCC (1990-2018 data) and EEA's approximated EU greenhouse gas inventory (2018 data)



Figure 1 - Evolution of EU GHG emissions per sector 1990-2017

Cars are the single biggest contributor to transport CO₂ emissions, accounting for 43% of the total (60% of road transport), see Figure 2. EU CO₂ emissions from cars have risen by 18% since 1990, from 462 to 543 million tonnes CO₂eq in 2018 making it the second biggest contributor to the

increase of transport emissions after aviation². Vehicle passenger-kilometers in the EU28 have increase by 26% between 1995 and 2018, or 1% annual increase³.

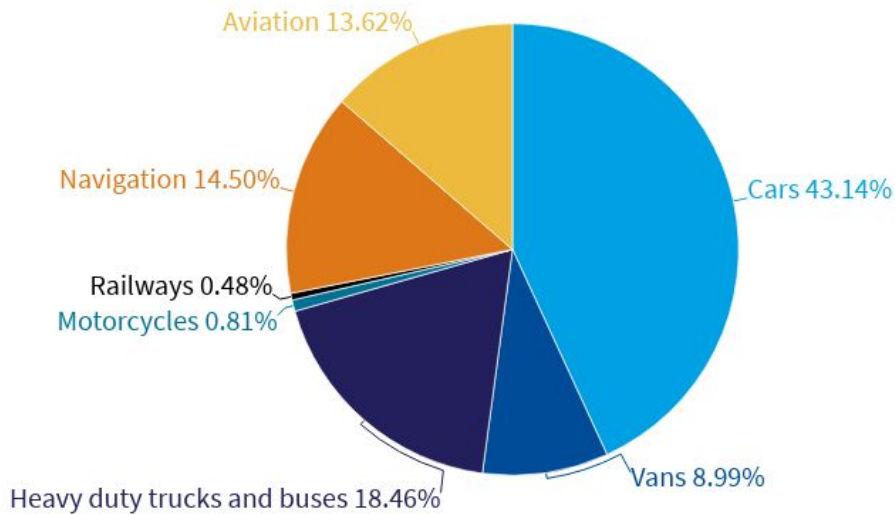


Figure 2 - EU transport greenhouse gas (GHG) emissions per sector in 2018

To achieve the Paris Agreement goal of limiting global warming to well below 2°C and to avoid a climate emergency, road transport CO₂ emissions will need to be entirely decarbonised by 2050, which will require the sale of the last new car with an engine ideally by 2030 and by 2035 at the latest⁴.

The increase in car CO₂ emissions is mainly driven by the increase in passenger kilometers travelled and the stagnating vehicle efficiency improvements on the road. This report focuses on one of the tools to reduce CO₂ emissions from cars, which is lowering the CO₂ emissions of new cars and driving the shift to zero (tailpipe) emissions through CO₂ regulation of new cars.⁵ But tackling car CO₂ emissions cannot rely exclusively on one approach and other policies to

² From 1990 to 2018: +81 Mt CO₂ for cars (28% of total transport CO₂ emission increase) and +99 MT CO₂ for aviation (34% of total increase). Together with vans (+42 Mt), light duty vehicles are the single biggest contributor (42%). Aviation includes both domestic and international aviation. Source: UNFCCC

³ From 3,902 Gpmks in 1995 to 4,917 Gpkms in 2018. European Commission (2020). Statistical pocketbook 2020. [Link](#)

⁴ Transport & Environment (2018). How to decarbonise European transport by 2050. [Link](#)

⁵ Transport & Environment (2019). Mission Possible. [Link](#)

encourage lower private car ownership and to lower the passenger-kms being driven are essential to reducing car CO₂ emissions, in particular in urban areas (including encouraging public transport, walking and cycling whenever feasible).

Furthermore air pollutant emissions from transport are an increasing source of concern in Europe. The newest data from the European Environment Agency confirms that air pollution is still the principal environmental factor driving disease, with around 400 000 premature deaths attributed to ambient air pollution annually in the EU. Reductions in air pollution from cars have been much more limited than expected, namely due to poor real-world performance, and improvements have almost stagnated for many pollutants over the past years. Road transport remains the primary source of nitrogen oxide emissions (39%) and the second source of particulate matter (11% of PM2.5).⁶

Levels of air pollution from traffic plummeted when countries imposed pandemic lockdown measures and a clear majority of urban residents across Europe (64%) do not want to see air pollution return to pre-Covid-19 levels, according to a recent international survey of public opinion in six European countries, published in June 2020.⁷ The same survey also indicates that 71% of Europeans expect the EU to propose additional measures against air pollution.

1.3 How the COVID-19 crisis impacts the car market

Over the first half of 2020, EU car sales dropped by 38.1% as a result of the COVID-19 lockdowns which have kept factories and showrooms closed for several months.⁸ Following the unprecedented downfall in car sales, public aid and recovery packages have been announced across Europe to help various industries recover, including automotive.

At EU level, the unprecedented new €750 billion recovery instrument, Next Generation EU (on top of the €1.1 billion new seven year budget) sets a 30% threshold that must go towards achieving the EU's climate goals of the European Green Deal (or a total of €555 million of green investment).⁹

⁶ EEA (2019). Air Quality in Europe. [Link](#)

EEA (2020). Healthy environment, healthy lives: how the environment influences health and well-being in Europe. [Link](#)

European Commission (2019). Eurobarometer: Attitudes of Europeans towards Air Quality. [Link](#)

⁷ Transport & Environment (2020). No going back to pre-Covid air pollution levels - opinion poll. [Link](#)

⁸ Among the four major EU markets, Spain saw the biggest decline (-50.9%) so far this year, followed by Italy (-46.1%), France (-38.6%) and Germany (-34.5%), compared to the first half of 2019. Source: Acea (2020). Quarterly Alternative Fuel Vehicle Registrations. [Link](#)

⁹ The share of spendings allocated to 'green' investments can still be increased when the new budget goes through the European Parliament for approval.

Member states will have to present their recovery plans to decide how they wish to spend the money and could decide to surpass this 30% ratio.

In addition, Member States are also setting up their own national recovery packages where a strong focus has been set on stimulating electric car sales (see below). Far from having killed the electric car, the coronavirus crisis is accelerating the transition to mobility in the EU and the European Green Deal is now firmly set as the new EU recovery and growth strategy.

Info: The European Green Deal¹⁰

On the 11th of December 2019 the newly elected European Commission President Ursula von der Leyen presented the EU's strategy for a climate neutral Europe, the European Green Deal. The European Green Deal aims to make the entire EU economy climate neutral by 2050 and commits to increase the European Union's 2030 GHG emission reduction target towards at least 50%, and if feasible 55% "in a responsible way".

To enable Europe to achieve higher CO₂ reductions by 2030 most EU's climate legislation is being reviewed in 2021. The Green Deal rightly commits to put light duty vehicles "**on a pathway towards zero emission mobility after 2025**" which marks a strong shift away from incremental improvements towards zero emission technologies.

National EV stimulus packages

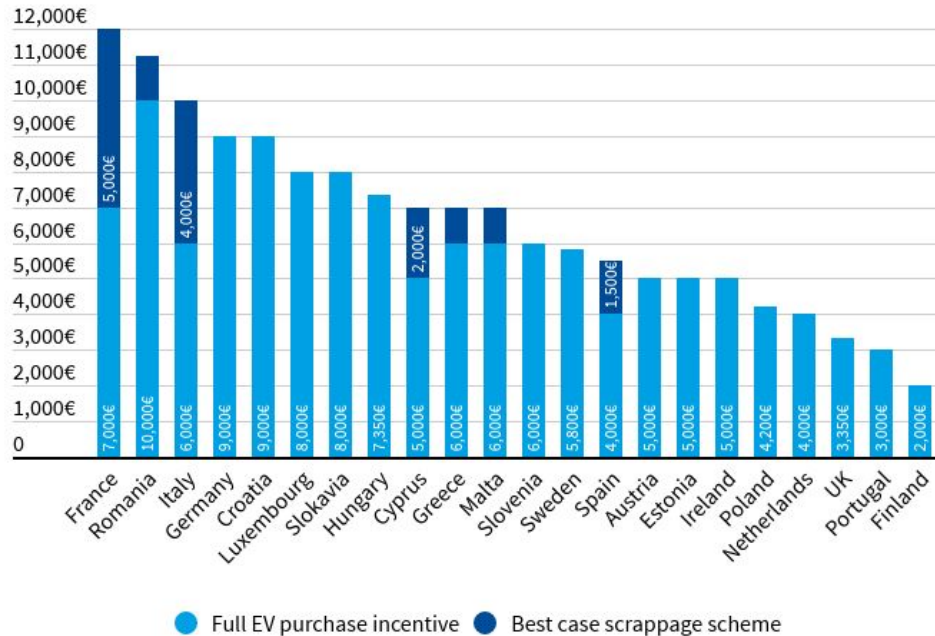
Given that a recovery rooted in subsidising the production and sales of combustion engine vehicles would not be in the interest of a competitive and resilient auto industry, many European countries decided to increase (or put in place) national electric vehicle (EV¹¹) purchase incentives to create favourable frameworks in line with the transition towards mobility and the wider European Green Deal. Today, **EV stimulus measures have been put in place in 26 out of the 27 EU countries¹² with 22 EU member states offering direct incentives** (such as bonus payments or premiums) to buyers of electric vehicles (including the UK), see Figure 3. Eight of the nine

¹⁰ European Commission (2019). Communication on the European Green Deal, COM(2019) 640 final. [Link](#)

¹¹ In this report electric vehicles - or EVs- cover battery electric vehicles (BEVs), plug-in hybrid vehicles (PHEVs) and fuel cell electric vehicles (FCEVs)

¹² ACEA (2020). Overview - Electric vehicles: Tax benefits & purchase incentives in the European Union. [Link](#)

countries worldwide with the largest national purchasing-subsidies are in Europe, according to BNEF.¹³



- All countries but Ireland and Malta have lower purchase subsidy for more expensive BEVs (typically above €45-50k).
- German, Malta and Netherlands also offer a subsidy on 2nd hand BEVs (not shown here)
- In some countries, the subsidy has either reached its limit or will end by 31/12/2020 (AT, FR, HR, IT, PL, PT and SK) but is expected to be renewed.



Figure 3 - BEV purchase subsidies and scrappage schemes in Europe (as of summer 2020)

The German COVID-19 stimulus package includes an incentive of up to €9,000 for a BEV (from €6,000 previously) and does not (at the time of writing) include any subsidies for the purchase of a new gasoline or diesel car. Among the other top EU markets, France offers €7,000 (up to €12,000 under the conditions of the scrappage scheme), Italy grants €6,000 (up to €10,000 under the

¹³ Automotive News Europe, July 2020, *Subsidies slash EV lease costs in Germany, France*. [Link](#)

scrappage scheme) and Spain offers €4,000 for a BEV (up to €5,500 under the scrappage scheme)¹⁴. In Croatia, the EV purchase incentive scheme of up to HRK 70,000 (around €9,000) ran out in just two minutes in July 2020.¹⁵ The Polish subsidy was only live for about one month and very few Polish benefited from the subsidy, partly due to a burdensome support system where money didn't go directly to the buyer, a lower subsidy than the €8,000 buyers were hoping for and the price cap was set too low. However, a new support system will be introduced in the coming months.

These recovery measures have been successful, given that despite the COVID-19 crisis, the stimulus has helped carmakers continue (or sometimes even increase) their EV production volumes, with the notable example of Germany, where both Volkswagen and BMW have increased their production¹⁶. The EV stimuluses have evidently helped maintain and even advance the EV sales momentum.

Nonetheless, carmakers had the legal obligation of cleaning up their new car sales, and, as a result of these recovery measures, taxpayers are subsidising carmakers with public money. For example, close to 18,000 Renault Zoes have been sold in France over the first half of 2020. In Germany, half of the €9,000 subsidy is paid by governments with the other half being paid by carmakers. Under the indicative assumption that around 100,000 BEVs could be sold in 2020, close to half a billion euros would be paid with taxpayers' money. This is a direct subsidy to carmakers who would have had to sell these electric cars anyway.

These demand-side direct incentives get expensive beyond the first ~5% of buyers, which is why a bonus-malus system like in France (which finances direct subsidies to low emitting vehicles through higher taxes on high emitting ones) is preferable and why supply side measures like the CO₂ regulation are important to further drive the market.

1.4 Current EU 2020/21 CO₂ emissions regulation

The current European 2020/21 CO₂ emissions regulation¹⁷ for passenger car manufacturers was adopted in 2009, later confirmed during the 2014 review. The regulation sets an effective target of

¹⁴ ICCT (2020). Economic recovery packages in response to COVID-19: Another push for electric vehicles in Europe? [Link](#)

¹⁵ AutovistaGroup, July 2020, *Croatian incentive funds spent in just two minutes*. [Link](#)

¹⁶ Electrive, August 2020, *BMW expands i3 production while VW looks to the e-Golf*. [Link](#)

¹⁷ European Commission (2019). Regulation (EU) 2019/631 of 17 April 2019 setting CO₂ emission performance standards for new passenger cars and for new light commercial Vehicles. [Link](#)

95 gCO₂/km for 2020 and 2021 (measured over the New European Drive Cycle - or NEDC - test) with which car manufacturers have to comply on average over the full calendar year. The regulation applies to all countries of the European Economic Area (EEA), this includes the 27 member states of the European Union, plus Iceland, Liechtenstein, Norway, and the United Kingdom (in 2020 only) and covers new passenger car registrations of category M1. New light commercial vehicles are covered in a separate CO₂ emission regulation with distinct targets and are not covered in this report.

The EU regulation includes numerous flexibilities intended to aid compliance:

1. **95% phase-in (2020 only):** In 2020, only 95% of sold cars count towards the 2020 target with all cars being included in 2021. Carmakers can thus exclude the 5% most highest-emitting cars from this year's reporting which granted carmakers a one year delay for the full entry into force of the regulation. This flexibility was introduced after heavy pressure from German Chancellor Angela Merkel in 2014.
2. **Mass-based target:** For each manufacturer pool, a specific 2020/21 CO₂ target value applies, depending on the average mass of the new cars registered - the heavier the average vehicle the more lenient the target is. The current mass used as a reference is 1379.88 kg (average mass from 2014 to 2016). Above this value, the target is higher than 95 g/km and below the target is lower¹⁸. The average mass of new cars has been growing in the past years, from 1,375 kg in 2014 it has increased to 1,390 kg in 2018 and 1,420 in 2019.
3. **Pooling:** OEMs are allowed to form pools to jointly comply with CO₂ targets. In a pool, emissions across manufacturer groups included in it are averaged out. Manufacturers who don't sell (many) electric cars can benefit through such collaborations (such as FCA in the FCA-Tesla pool). The list of manufacturer pools is provided in the Annex. The deadline to notify the Commission of a pool for 2020 is the 31st of December of that year¹⁹.
4. **Eco-innovations:** OEMs can also claim credits, called eco-innovation credits, for fitting technology to the car that delivers emissions reductions on the road but not during the test (such as LED headlamps that are not switched on during the test or coasting). The contribution of eco-innovation credits is capped at 7 gCO₂/km
5. **Super-credits:** OEMs can claim up to 7.5 gCO₂/km of super-credits - additional credits for sales of cars with emissions below 50 gCO₂/km which can be used between 2020 and 2022. As shown in this report, most OEMs are expected to use up all their super-credits in the

¹⁸ The average mass of new passenger cars (M0) is updated every three years (2019, 2022, 2025, etc) to account for changes in the market. This is meant to ensure the targets are met even if the average mass of all manufacturers increases (as is likely the case with the market SUV mix rising).

¹⁹ For open pools, the submission of the joint pooling declaration must be preceded by a declaration of interest to form a pool, to be submitted at the latest by 31 October. A pool is an 'open' pool when at least one pool member is not part of the same group of connected undertakings as the other members (e.g. FCA-Tesla).

year 2020 when zero and low emission vehicles (below 50 g/km) are counted double. In 2021 and 2022, ZLEVs are weighted as 1.67 and 1.33 sales respectively.

6. **Derogations for certain carmakers:** OEMs producing a small volume of vehicles are treated differently. A weight-based target only applies to pools selling more than 300,000 cars in Europe in a given year. Carmakers selling between 10,000 and 300,000 cars can apply for 'niche volume' derogations, which sets a target based on a 45% reduction of 2007 average fleet levels.²⁰ This particularly benefits Jaguar-Land Rover which has an easier target of 132 gCO₂/km compared to around 115g/km under the mass-based system. Carmakers selling less than 10,000 cars effectively set their own targets ('small volume' derogation), while carmakers that sell less than 1,000 cars are fully exempt.

²⁰ Niche derogation will be phased out by 2028. In the years 2025 to 2028, the derogation target for those manufacturers will be 15% below the 2021 derogation target.

2. Unprecedented new car CO₂ emissions drop

2.1. Emissions trends analysis (H1 2020)

After several years of increasing emissions, **carmakers have reduced the CO₂ emissions of new car sales by 9.2% in just 6 months from 122.4 g/km in 2019²¹ to 111.2 in H1 2020** (NEDC). This drop is the largest drop in new car CO₂ emissions in Europe since data has been available. The previous biggest drop was -5% in 2009, in the aftermath of the 2008/9 financial crisis when average size and weight of new cars fell. However, unlike in 2009, this unprecedented drop is the result of the 2020/21 car CO₂ standards entering into force.

Compliance with, and the current gap that remains for some OEMs to reach the 95 gCO₂/km CO₂ regulation is explored in section 4.3. The 2020/21 car CO₂ standards are effectively the first standards driving the car industry towards significant emissions reductions from their new cars. The previous target of 130 g/km in 2015 was easily achieved several years in advance thanks mainly to NEDC test manipulation. As the 2019 car CO₂ data shows, no progress has taken place since 2015.

European market data for the first half of 2020: short methodology

This report is based on a dataset covering the sales of passenger cars in the European market including 19 EU markets and the UK and Norway. The 8 missing countries are the following: Cyprus, Malta, Romania, Bulgaria, Luxembourg, Lithuania, Latvia and Estonia. Together these markets account for 2.4% of the total EEA car market (EU27 and the UK and Norway here). The data was purchased from JATO Dynamics, it covers both NEDC and WLTP CO₂ values and it is broken down between segment (A, B, C, D, E+), body type (SUV or not SUV), and fuel type (diesel, petrol, gas, hybrid, PHEV, FCEV and BEV). For simplicity, FCEVs are counted under the BEV category as only 263 units have been sold. The database covers 4.65 million car registrations over six months. For more details on the data and methodology please see the Annex.

Rise of SUVs drove the 2016-2019 emissions increase (not the decline of diesel)

²¹ Transport & Environment, June 2020, *New car CO₂ still rising as carmakers push polluting SUVs one year before deadline.* [Link](#).

In reality, carmakers' performance in 2020 should be put into perspective with the increase in CO₂ emissions over recent years. The previous lowest average CO₂ reached by carmakers' was 118.1 g/km in 2016, from which point onwards emissions increased annually to 122.4 g/km in 2019 as carmakers focused on selling profit-making large vehicles. Hence, the actual reduction achieved since the lowest point in 2016 is **6% over a four year period**, much less than the 9% improvement observed between 2019 and H1 2020.

In the 2019 car CO₂ report, *Mission Possible*²², T&E showed that, although carmakers usually portray the 2016-2019 increase in emissions as the result of the diesel sales decline caused by Dieselgate, the main reason is the result of the long-term trends towards bigger and more powerful cars.

Instead of investing in zero and low emissions technology, carmakers sold an increasing number of larger and heavier cars - mostly SUVs - which allowed them to maximise their profits since larger and heavier vehicles have higher margins. Given the much higher emissions from SUVs - average new SUV emissions are at 134g/km while average new petrol cars sold in 2019 emitted 121g/km - T&E has shown that for every 1% shift in the market to more SUVs, the CO₂ emissions increase by 0.15 gCO₂/km on average. This means that the increase in SUVs since 2013 has had a CO₂ effect 10 times greater than the diesel decline.

The first half of 2020 saw a continuing increase in the sales of SUVs, reaching 39% of the sales, up from 4% in 2001, 26% in 2016²³ and 38% in 2019²⁴. Most of the SUV sales were in the small (B) and medium (C) segment accounting for two thirds of all SUV sales (around a third each). As a result, half of all the car sales in the medium segment are SUVs and 41% of the small cars sold are small SUVs (17% for the large and executive segment).

Conventional engine SUVs emit on average 130 g/km (NEDC) which is 18 g/km more than the average for hatchbacks (+16%). When comparing emissions across equivalent segments, we see that this difference is biggest for large cars (segment D) with large ICE SUVs emitting on average 53% (66 g/km) more than their equivalent non-SUV. The emissions gap is smallest for compact SUVs in the small segment B (11% higher emissions or +11 g/km) while medium SUVs emit 20% more than their non-SUV equivalent (22 g/km). On the other hand, when the additional emissions of going from an hatchback or sedan to an SUV are weighted by the total sales in each segment, **the most impactful segment for SUV sales is by far the medium segment C with around**

²² Transport & Environment (2019). *Mission Possible*. [Link](#)

²³ Transport & Environment (2018). *CO₂ emissions from cars: the facts*. [Link](#)

²⁴ EEA, June 2020. *Average CO₂ emissions from new cars and new vans increased again in 2019*. [Link](#)

400,000t of extra CO₂ in the first year of use (4.9 Mt over the lifetime) compared to a scenario where these vehicles would not be SUVs. The compact SUVs rank second with around 100,000t extra CO₂ emitted over the first year (1.2 Mt over the lifetime) and the large + executive SUVs would account for 85,000t extra CO₂ (1.0 Mt over the lifetime)²⁵.

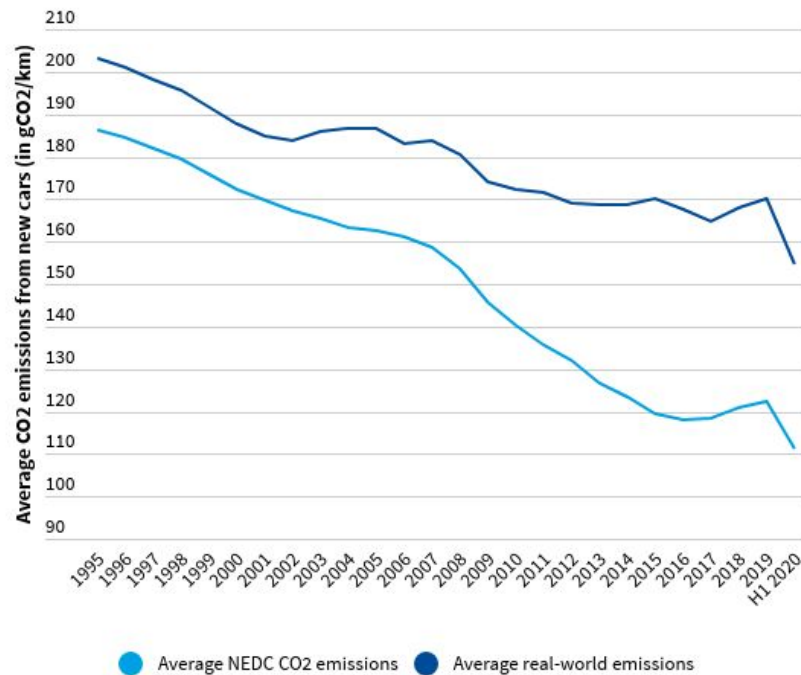
The increasing trend towards SUVs has made carmakers' compliance with the 2020/21 targets more challenging, thus the shift towards low and zero emission vehicles required is all the more important.

Half of the official emissions reductions are not achieved on the road

While EU car CO₂ targets - as measured in lab tests - are often said to be the most ambitious in the world, the biggest weakness of the regulation is the failure to achieve the required CO₂ reduction in the real world. This is due to the fact that the automotive industry has been able to exploit ever more flexibilities in the NEDC test to lower emissions in the lab²⁶ while the real-world CO₂ performance has hardly improved: mainly by manipulating the emission test and choosing to fit technology to improve the efficiency of the car that works much better in the test than on the road.

²⁵ Weighted by the total distance driven during the first year of the vehicle based on T&E's EV LCA methodology: Small: 14,000 km, Medium 18,000 km, Large: 23,000 km and Executive: 27,000 km. 15 year lifetime and 3% annual decrease in annual distance driven. T&E (2020). How clean are electric cars? [link](#)

²⁶ Both T&E and the ICCT produced a series of critical reports drawing attention to the practices to deflate test results and the Dieselgate scandal exposed the way carmakers cheated and exploited loopholes in regulations. The European Commission has now closed some of the most egregious loopholes in the NEDC test and with the switchover to the WLTP test, the gap between NEDC test and real-world emissions in 2017 actually shrunk to 39%.



Source: Transport & Environment from European Commission & EEA (average NEDC CO₂ emissions) and the ICCT (gap with real-world emissions). The real world gap for the period 1995-2000 is assumed to be equal as in 2001



Figure 4 - Average NEDC and real world CO₂ emissions in the EU

In its series of Mind the Gap reports²⁷, T&E has shown that the gap between official test results and real world performance of new cars' CO₂ emissions has grown alarmingly. The average gap has jumped from 8% in 2001 to 28% in 2012 and 42% in 2016, before stabilising at 39% in 2018.

Since 2008, half of the emissions reductions happened through manipulation of the official laboratory tests (-28% CO₂ emissions in NEDC while only -14% in real world emission reduction). This means that the average real-world emissions of a new car sold today are at the same level as the laboratory emissions in 2008, or 154-155 g/km.

²⁷ Transport & Environment (2016). Mind the Gap. [Link](#)

If the emission gap between real world emissions and laboratory NEDC emissions would have stayed at its 2010-2011 level of 25%, then official CO₂ emissions would have been 139 g/km in the first half of 2020 rather than 111 g/km (or 25% higher). In this case where emissions from ICEs and PHEV would have been 25% higher, carmakers would have had to sell 3.8 times more electric cars to achieve the same emission average of 111 g/km: 31% EVs (17% BEV and 14% PHEV). Alternatively, the same result could have been reached by making the ICEs 20% more efficient on average (and selling the same share of EVs as today).

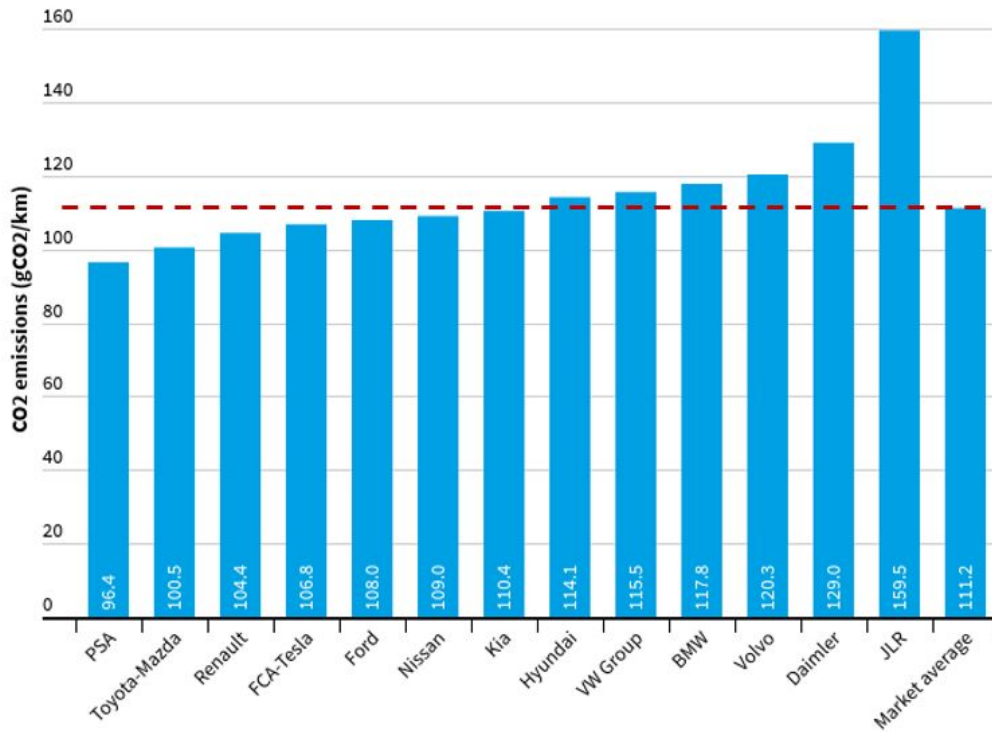
The new WLTP laboratory test has been in force since 2019 and limits some of the loopholes used to date, however, the 2020/21 CO₂ targets are still based on the 95 g/km NEDC target (though the CO₂ emissions are measured on WLTP and then converted back to NEDC). The new post-2020 car CO₂ regulation will require real-world CO₂ emissions to be reported from 2021 onwards using the fuel consumption meters, but the effectiveness of this voluntary measurement remains to be seen unless it is used for reducing the gap between real world and test emissions.

2.2 Carmakers' CO₂ per km emissions: where are we today?

In this section we focus on the main 13 OEM pools which cover together 96% of the registrations over the first half of the year in the JATO DYNAMICS database.

Among the 12 carmaker pools regulated under the mass-adjusted 95 gCO₂/km target, the **average CO₂ emissions are 111 g/km** (NEDC) but there are important disparities between them. **PSA** performs the best with **96 g/km** followed by **Toyota** with **100g/km** (see Figure 5). Third and fourth place goes to **Renault** and **FCA-Tesla** with **104 g/km** and **107 g/km**. The worse-performing OEMs are **Daimler** with **129 g/km** and **Volvo** at **120 g/km**. Both **Volkswagen Group** and **BMW Group** perform worse than the average with **115 g/km** and **118 g/km** respectively. The compliance gap for each manufacturer is explored in detail in Section 4. **Jaguar-Land Rover (JLR)** performs the worst with 159.5 g/km but benefits from derogations which allows the carmaker to sell more polluting vehicles.

The values presented in this section do not include the effect of regulatory flexibilities like super-credits, eco-innovation credits and the 95% phase-in of the target and thus shows the actual official type approved laboratory CO₂ emissions. This is addressed in Section 4.3 'Carmakers' gap to reaching the 2020 target'. The data is presented in detail in the Annex 7.3 'Data tables'.

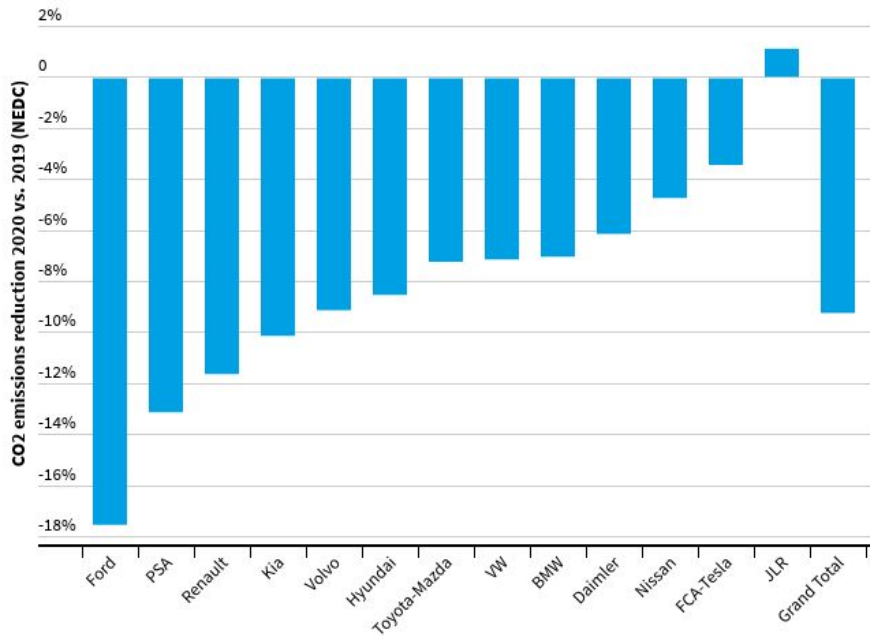


Source: T&E analysis of H1 2020 passenger car registration data from JATO Dynamics.

Figure 5 - Average NEDC emissions per OEM (H1 2020)

Because all carmakers have different gaps between their average NEDC and WLTP emissions (ranging from 13% to 28%), this ranking changes slightly when carmakers are compared based on their average WLTP emissions, measured for all new cars since 2019 (see Annex 7.3 WLTP-NEDC gap). In this configuration, Renault leads the pack (120.6 g/km), followed by PSA (124 g/km) while Daimler, Volvo and JLR are again the worst (147, 148, 179 g/km respectively). On average WLTP emissions are at 134 g/km over the whole market (and 133 g/km for the key 12 OEM pool identified in this report).

From 2019 to 2020, four manufacturers performed better than the EU average emission reduction of -9%, namely Ford, PSA, Renault and Kia with -18%, -13%, -12% and -10% respectively (see Figure 6). On the other hand, Jaguar Land Rover has even increased its emissions by 1% compared to 2019, and FCA-Tesla only reduced emissions by 3%.



Source: T&E analysis of H1 2020 passenger car registration data from JATO Dynamics.



Figure 6 - CO₂ emission reduction H1 2020 vs. 2019, per OEM)

2.3 CO₂ emissions per country

The CO₂ targets are enforced at European level, which means that the CO₂ emissions and sales mix per country can vary from one country to another. In most countries the CO₂ performance of the passenger car sales during the first half of 2020 is between 100 g/km and 120 g/km (Figure 7). A few countries can be found outside of this bracket: firstly Norway whose CO₂ emissions of 47 g/km are about half of the second and third - France and Portugal - which are at 98 and 99 gCO₂/km respectively. The Netherlands and Sweden follow closely with an average of 100 and 101 gCO₂/km. Amongst the countries performing badly, are countries from Central and Eastern Europe: Czech Republic and Romania at 120 g/km, Hungary at 121 g/km, Slovakia at 122 g/km and Poland at 123g/km. Germany closely follows this group with 119 g/km.



Source: T&E analysis of passenger car registration data from the first half of 2020 from JATO Dynamics


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Figure 7 - CO₂ emissions per country (gCO₂/km NEDC)

Without Norway, the average CO₂ emissions would be around 1 g/km higher than under the current scope of the regulation.

2.4 High emitting vehicles

Although the CO₂ standards have had a significant impact on the average emissions of new sales in the first half of 2020, there are still numerous high emitting vehicles on the road sold in 2020. In

fact, the weight and CO₂ emissions of new cars has been on the increase for years²⁸ despite carmakers being well aware of the 2020/21 CO₂ standards since 2008. Instead of timely investments into cleaner technology, the industry pursued profits and drove the market towards bigger gas guzzlers, for example through their advertising and marketing strategies.

About 45,000 vehicles emitting more than 200 gCO₂/km have been sold in the first half of 2020, almost exclusively sport cars or luxury SUVs. Being in the premium segment, hybrid or other CO₂ reducing technology can be easily fitted onto these models, but it is usually not. Table 1 below shows the most emitting models (above 200 g/km) with at least 200 units sold during the first half of 2020 (covering about 40,000 vehicles out of the 45,000). Many of the models below fall under a derogation target as only the following are covered by a mass-adjusted target: Audi, Mercedes, Porsche, Ford, Jeep, Toyota, Kia and Lada.

Model	Brand	Units sold (H1 2020)	NEDC (gCO ₂ /km)
812	FERRARI	375	340
HURACAN	LAMBORGHINI	202	310
R8	AUDI	241	296
URUS	LAMBORGHINI	442	288
G-CLASS	MERCEDES	3,155	273
MUSTANG	FORD	3,347	269
CONTINENTAL GT	BENTLEY	665	266
488	FERRARI	567	264
PORTOFINO	FERRARI	493	246
LEVANTE	MASERATI	791	245
AMG GT	MERCEDES	1,917	244
DB11	ASTON MARTIN	260	237
GRAND CHEROKEE	JEEP	1,609	235
TAIGA	LADA	631	226
911	PORSCHE	6,557	217
GHIBLI	MASERATI	335	217
718	PORSCHE	2,762	216
F-TYPE	JAGUAR	1,127	212
STINGER	KIA	700	211
REXTON	SSANGYONG	211	211
GLE-CLASS COUPE	MERCEDES	472	210

²⁸ Transport & Environment (2019). Mission Possible. [Link](#)

SL-CLASS	MERCEDES	231	210
BENTAYGA	BENTLEY	315	209
WRANGLER	JEEP	2,685	206
LANDCRUISER	TOYOTA	2,054	203
DEFENDER	LAND ROVER	1,830	202
Q8	AUDI	5,669	200

Table 1: Sales of most emitting vehicles in the EU, first half of 2020

The high emitting vehicles that are sold in large volumes are a much bigger problem for the climate than the niche high emitting vehicles sold in a couple hundred units or less. To take this into account, the cumulative emissions of the high emitting models sold in the period is a better indicator. Table 2 below shows the top 20 sales-weighted high emitting vehicles above 150 gCO₂/km. Together, these vehicles account for 107,000 units (or 2.3% of total sales), and their average CO₂ emissions combined is 190 g/km, or twice the CO₂ target for 2020/21, i.e. 95 g/km. Luxury SUVs from Mercedes, Jaguar-Land-Rover but also sport cars from Porsche take up a significant part of these worst climate-impact vehicles. Amongst the models shown below, only Land Rover benefits from a derogation target.

Model	Brand	Volume	NEDC (gCO ₂ /km)	Type
911	PORSCHE	6,557	217	Sport
MUSTANG	FORD	3,347	269	Sport
G-CLASS	MERCEDES	3,155	273	Luxury SUV
GLE	MERCEDES	15,631	171	Luxury SUV
MACAN	PORSCHE	6,204	199	Sport
Q8	AUDI	5,669	200	Luxury SUV
RANGE ROVER SPORT	LAND ROVER	8,263	173	Luxury SUV
TOUAREG	VOLKSWAGEN	6,834	177	Luxury SUV
Q7	AUDI	7,698	174	Luxury SUV
718	PORSCHE	2,762	216	Sport
AMG GT	MERCEDES	1,917	244	Sport
DISCOVERY	LAND ROVER	3,190	200	Sport
WRANGLER	JEEP	2,685	206	off-road SUV
RANGE ROVER	LAND ROVER	3,640	190	Luxury SUV
SERIES 8	BMW	3,446	190	Coupe
GRAND CHEROKEE	JEEP	1,609	235	SUV
E-PACE	JAGUAR	7,351	168	Luxury SUV

X6	BMW	4,367	181	Luxury SUV
RANGE ROVER VELAR	LAND ROVER	5,998	170	Luxury SUV
ECLIPSE CROSS	MITSUBISHI	7,071	165	SUV

Table 2: Top 20 sales-weighted high emitting vehicles above 150 gCO₂/km, H1 2020

Electrification technologies are already available for these high-end polluting vehicles where the higher upfront cost makes it easier to integrate the extra cost of the technology. Given that these vehicles can easily be electrified (full electric or plug-in hybrids) and that they emit significant amounts of CO₂, they should also be the first to fully move away from conventional engines.

If we shift these top 20 sales-weighted high emitting models to PHEVs (CO₂ emissions are approx divided by 3), it would lead to a total CO₂ decrease by 3 g/km (or about 3%). If they are converted to BEVs, CO₂ emissions drop by more than 4 g/km on average (or around 4%). This would, of course, disproportionately impact the manufacturers which produce these vehicles, in particular Daimler and JLR (see example for Daimler in Section 5).

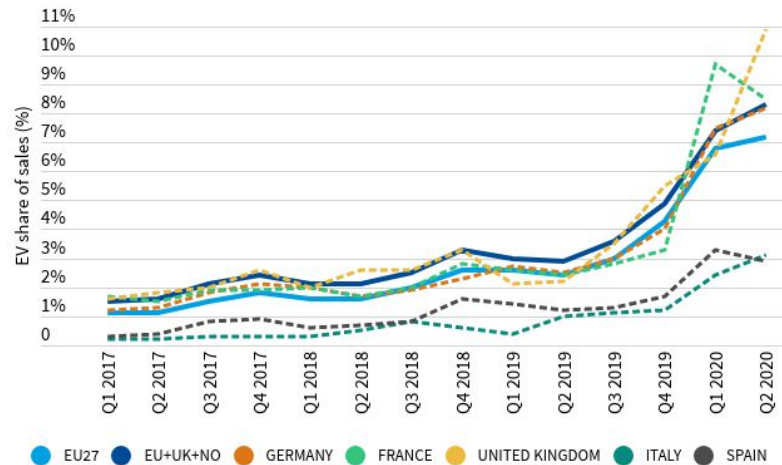
3. Electric car sales surge to 8%

3.1. EV sales trend analysis (H1 2020)

The entry into force of the EU CO₂ targets can be correlated with the sharp increase of sales of electric cars that reached a market share of **8% over the first half of 2020 in the EU27 + UK + NO (7% for the EU27 only). This represents a three fold increase** compared to the 2.4% in the first half of last year, see Figure 8. The focus here is the scope of the EU regulation (EU27 + UK + NO²⁹), which has a higher EV share than the EU27 chiefly thanks to Norway's very high market penetration of EVs (69% of the first half of 2020). In this subsection we use ACEA quarterly registration data.

The impact of the new car CO₂ regulation on the sales of electric cars is clear. In the last quarter of 2019, EV sales had started by increasing to about 5% (4% for the EU27) as carmakers were ramping up their production of electric cars and Tesla started delivering the Model 3. Then, as soon as 2020 started, electric cars sales surged to 7.4% (6.8% for the EU27) in the first quarter of the year, then to 8.3% (7.2% for the EU27) in the second quarter of the year. Already some indications suggest that the market will continue to grow even more in the second half of the year, aided by post-COVID stimulus measures (see section 3.3).

²⁹ Iceland and Liechtenstein excluded here



Source: Transport & Environment analysis of ACEA Quarterly Alternative Fuel Vehicle Registrations



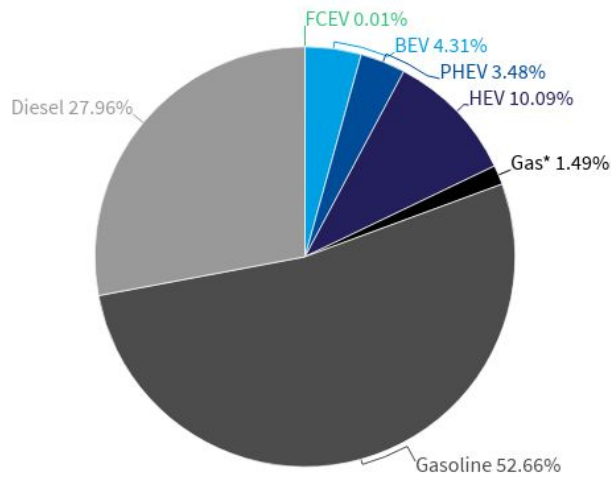
Figure 8: Share of EV sales in Europe (source: ACEA)

Sales split

Together, BEV and PHEV sales account for 7.8% of sales in H1 2020, of which 55% of these car sales are BEVs (4.3% BEV and 3.5% PHEV). In 2019, the split between BEVs and PHEVs was 63% BEVs and 37% PHEVs which shows that the share of PHEVs in the EV mix is increasing as a short term compliance strategy. Fuel cell electric vehicles (FCEV) play a very marginal role as only 263 units were sold in the first half of the year (or 0.005% of total sales), see Figure 9.

Gas vehicle cars also play a minor role with compressed natural gas (CNG) cars accounting for 0.5% of sales and LPG sales for 1%. More than two thirds of the gas cars sold in Europe were sold in Italy (50,000 out of 74,000). Total gas-powered car sales (CNG and LPG) have been between 1% and 2% every quarter since 2015. Although listed as an alternative fuel, gas cars have no or very marginal benefit in terms of greenhouse gas emission savings³⁰. Volkswagen Group has said in March 2020 that it will stop developing natural gas fuelled cars. This will bring down the sales of CNG cars further and could mean the end of this technology in Europe.

³⁰ Transport & Environment (2018). Natural gas-powered vehicles and ships – the facts. [Link](#)



*Gas includes CNG and LPG with CNG accounting for 0.5% and LPG for 1%
 Source: T&E analysis of ACEA passenger car quarterly registration statistics



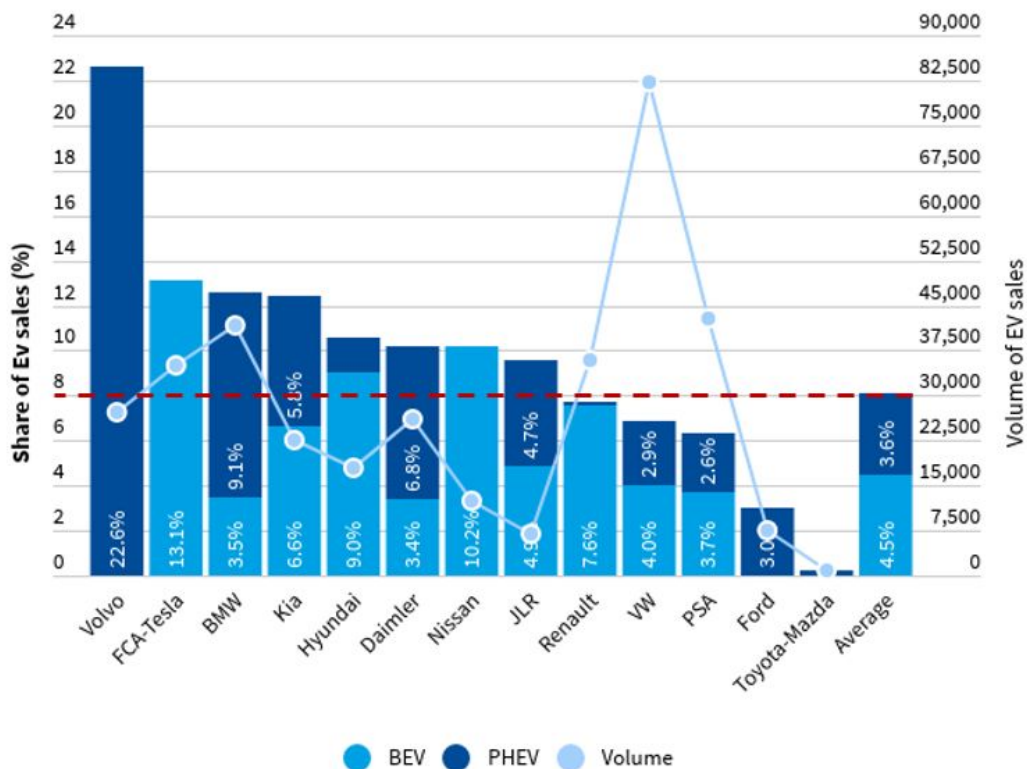
Figure 9: Car sales during the first half of 2020, split per type (EU27 + UK + NO)

As regards conventional powertrains, petrol cars made up the largest share of sales in H1 2020, or almost 53%. Diesel cars continued the downward trend and stand at 28%. Once promoted by carmakers as the technology to meet the EU car CO₂ targets, it appears the 2020 CO₂ target is not driving the increase in diesel market penetration. Following the Dieselgate scandal and ensuing diesel bans in cities, the decline of diesel now seems to be set in stone. The market seen in the first half of this year is a strong sign of no return for the car diesel technology in Europe.

The split in car sales per country over the first half of 2020 is available via a [T&E online tool](#).

3.2. Electric car sales by OEM and model

All carmakers (except Toyota-Mazda) have increased their sales of EVs in 2020, with shares reaching 23% for Volvo, 13% for FCA-Tesla and BMW, 12% for Kia, 11% for Hyundai, 10% for Daimler, Nissan and JLR, 8% Renault, and 7% for Volkswagen Group (see Figure 10). With regards to BEV sales only, the ranking changes slightly and FCA-Tesla takes the lead thanks to sales from Tesla as FCA alone sold virtually no EV in the first half of 2020. Nissan comes second with 10% BEVs (Leaf), Hyundai 9%, Renault 8%, Kia 7%, Jaguar-Land-Rover 5%, and Volkswagen Group 4%.

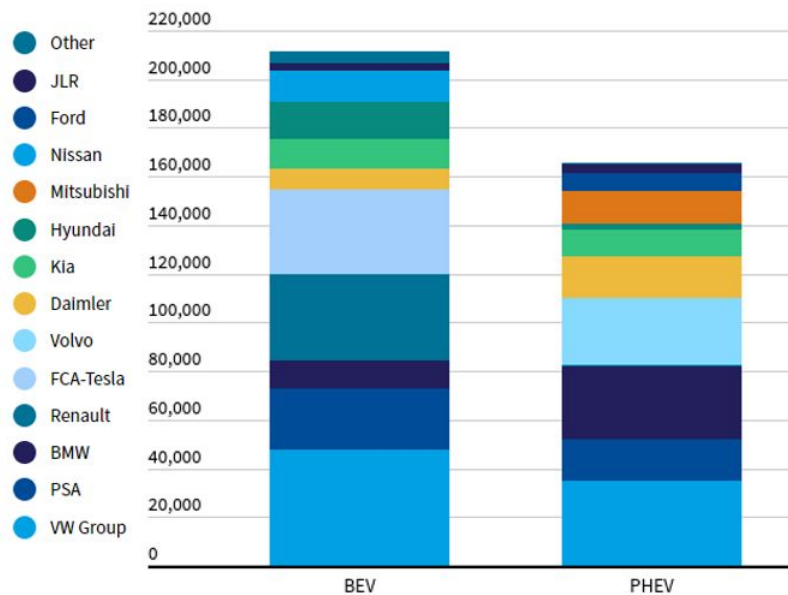


Source: T&E analysis of H1 2020 passenger car sales data from JATO Dynamics.

Figure 10: Share of EV sales per carmaker (H1 2020)

Some carmakers have a strong focus on full hybrids, chiefly the Toyota-Mazda pool, which sold 55% HEVs in the first half of the year (see Annex). When we account also for mild hybrids, Jaguar-Land-Rover comes second with HEVs accounting for 23% of the sales, then Volvo, Ford and Hyundai with HEVs accounting for between 12% and 13% of the sales.

A total of 211,000 BEVs and 166,000 PHEV have been sold during the first half of the year (see Figure 11). While Tesla was the leading EV carmaker in Europe in 2019, Volkswagen Group has for the first time, claimed the position of the leading carmaker for volume of EV sales in Europe. Indeed Volkswagen Group sold 22% of all the EV sales in the first half of 2020, with more than 80,000 units sold. PSA and BMW come second with about 11% of the total EV sales, and Renault (chiefly thanks to the Renault Zoe) comes third with 9%, followed closely by FCA-Tesla with about 35,000 Tesla BEVs sold over the first half of the year.



*Others include also Toyota, Mazda and Honda here

Figure 11: Volume of EV sales per carmaker (H1 2020)

Looking into the breakdown of EV sales per model provides a more granular picture. The sales of BEVs are dominated by the two most successful models: the Renault Zoe with 35,000 units, and the Tesla Model 3 with 30,000 units sold. Together they account for close to a third (31%) of the total BEV sales. In third position, the Volkswagen e-Golf (17,000 units), followed by the Peugeot e208 (13,000), the Nissan Leaf and the Audi e-tron (both at 12,000 units). For PHEVs, the leading model is the Mitsubishi Outlander (13,000 units), comes second the Volkswagen Passat, third the BMW 3-series and fourth the Volvo V60 (all three at 8,000 units). Fifth and sixth comes the Ford Kuga and the Volvo XC60 with 7,000 units.

Top 15 BEV and PHEV models sold during the first half of 2020

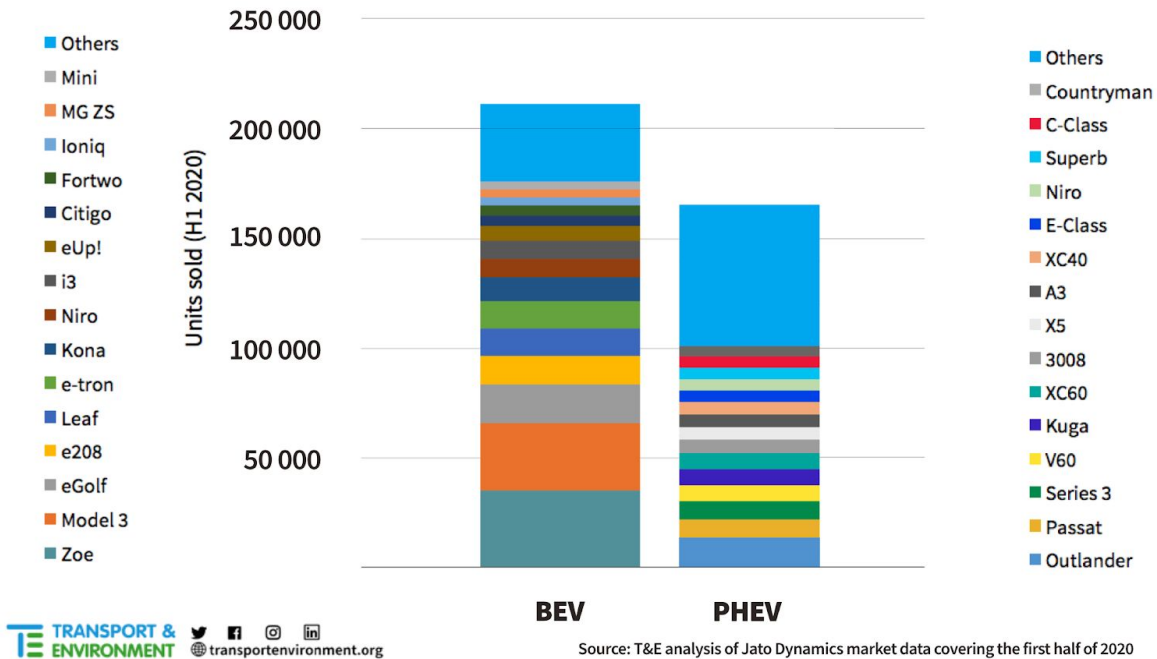


Figure 12: Top 15 BEV and PHEV models (H1 2020)

The BEV market is less mature in terms of wide-spread model availability, however it outperforms in PHEV market share thanks to good value offering. Indeed Also while, PHEV are

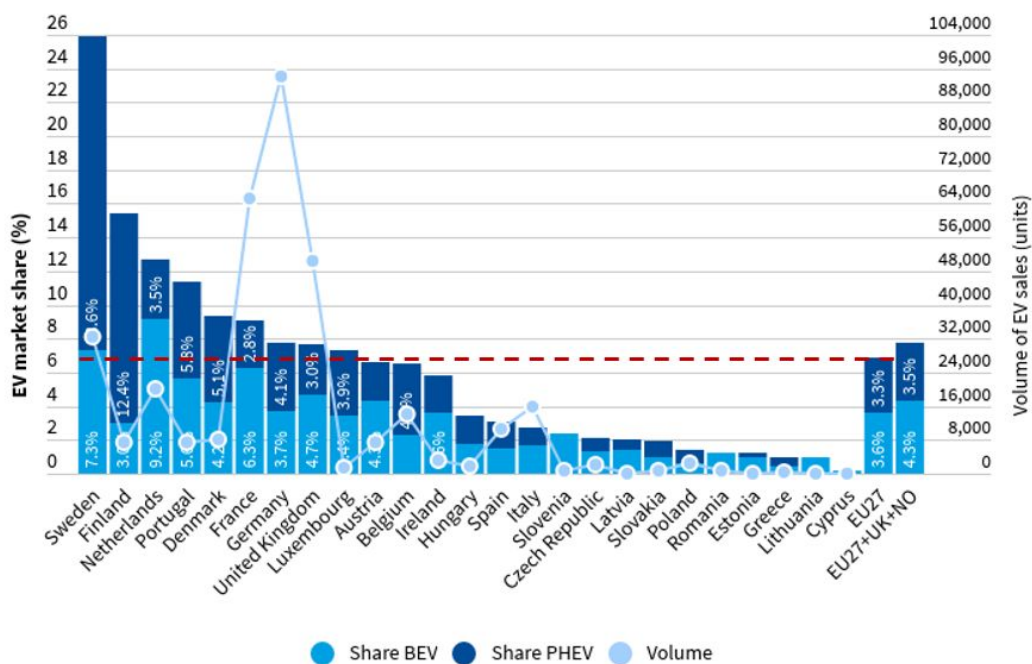
3.3 EV sales per country

The CO₂ targets are set as an average at European level which means that the ability of an individual member state to attract sales of electric cars depends mostly on the national incentives that are in place. But the overall supply of zero and low emission vehicles is limited by the CO₂ regulations, meaning that selling significantly more EVs in one country will result in selling less in another country. Any individual country has little impact on carmakers' overall production plans or volumes.

Countries with favourable taxation and good charging infrastructure deployment have experienced higher EV sales in the last years. The best example is Norway, which is a clear world

leader for EV market share, where EV sales have reached two thirds of the total car sales during the first half of the year (48% BEVs and 20% PHEVs). The following two countries are also Nordic: Sweden with 26% EV sales (7% BEV) and Finland with 15% (3% BEV), see Figure 13. Next comes the Netherlands, which is the EU leader for BEV sales (13% EV sales with 9% BEVs) and Portugal with 11% (6% BEVs and 6% PHEVs). Denmark and France reach 9% EV sales (6% BEV in France and 4% in Denmark), Germany and the UK 8% (4% BEV in Germany and 5% in the UK).

At the moment of writing this report, there are already some good indications that EV share will continue to increase in the second half of the year, with the notable examples of EV sales in July with Sweden reaching 29%, Netherlands 16%, Germany 12%, the UK 9%, and France 10%³¹. In August, France EV sales reached 11% even though France’s scrappage scheme closed out at the end of July (being capped at a total transaction number of 200,000) and Germany reached 14%³².



Source: T&E analysis of ACEA quarterly registration statistics



Figure 13: EV share of sales per country, EU27+ UK (H1 2020)

³¹ ICCT (2020). Market monitor: European passenger car registrations, January–July 2020. [Link](#)

³² ICCT (2020). Market monitor: European passenger car registrations, January–August 2020. [Link](#)

In volumes, Germany is the clear leader with 94,000 units sold in the first half of 2020. Next comes France (65,000 units), the UK (50,000 units) and Sweden (33,000 units).

4. Compliance with 2020 & 2021 targets

Given the market trends analysed in the previous sections it is clear that carmakers are on the right track towards reaching the EU targets. Many carmakers including Volkswagen³³, PSA³⁴, BMW³⁵ and other ‘top executives brands’³⁶ have been confident that their auto groups would comply with the EU rules and would not face fines. This chapter analyses the compliance of the OEMs, including the individual CO₂ gaps to target and the required EV sales for 2020/21. .

4.1 Methodology

T&E has modelled the expected compliance with the EU car CO₂ regulations for 2020, and expected EV shares for 2020 and 2021. Below the different steps of the modelling are briefly detailed.

First, the CO₂ emissions gap between the target and the status in the first half of the year is calculated. This is based on car registration data from the first half of 2020 from JATO Dynamics. The CO₂ emissions average is calculated for each pool over this period and the contribution of the flexibilities were add (more details on this in Section 4.2):

- Super-credit: CO₂ benefits from double counting (1.67 in 2021) the contribution of zero and low emission vehicles (below 50 gCO₂/km)
- Eco-innovation credits: CO₂ benefits from the use of additional technologies to the car that delivers emissions reductions on the road but not during the test.
- 95% phase-in: we model on the sales of the first half of 2020 the effect of the exclusion of the 5% most emitting vehicles from the sales.

The mass of each OEM pool is estimated in 2020 and 2021 based on the average mass in 2019, adjusted for the increasing sales of heavier electric cars in 2020 and 2021. The difference between the mass-adjusted target and the CO₂ status (including flexibilities) gives the current CO₂ gap. See Section 4.3 *Carmakers’ gap to reaching the 2020 target* to see the compliance gap of each carmaker as of July 1st 2020.

Second, we model the outcome for each OEM pool over the full years 2020 and 2021:

³³ Volkswagen Newsroom, March 2020, *Volkswagen brand about to leap into the electric era*. [Link](#)

³⁴ Just-auto, January 2020, *PSA will avoid EU CO2 fines in 2020*. [Link](#)

³⁵ Newsmobility, June 2020, *Pieter Nota: ‘BMW doesn’t want EU to loosen CO2 deadline’*. [Link](#)

³⁶ Automotive News Europe, January 2020, *How automakers plan to avoid CO2 fines in Europe*. [Link](#)

1. The starting point are the sales and average CO₂ emissions per type (BEV, PHEV, HEV and other ICEs) as seen in the first half of 2020, from which the compliance gap is derived as explained above.
2. Carmakers sales of BEVs, PHEVs are adjusted to account for expected market development during the second half of 2020 based on IHS Markit light duty vehicle production forecast (updated in July 2020). When calculating the predicted EV shares (BEVs and PHEVs), T&E assumes that a manufacturer cannot reach sales that are significantly above its expected production in that year, so other compliance strategies will have to be employed. For HEVs (including both full and mild), the share obtained during the first half of 2020 is increased in line with the expected production increase from the IHS Markit light duty vehicle production forecast from the first half to the second half of the year. Increasing the sales HEV contributes to the overall improvement of the conventional (or ICE) vehicles.
3. For the carmakers where the remaining gap after accounting for EV sales is still higher than 3 g/km, an additional reduction of ICE CO₂ emissions of 1% was assumed to account for a likely shift towards lower emitting variants in the second half of 2020 or the full year 2021. In the case of Daimler and JLR -which have done very little ICE improvement as of July 2020- the compliance gap is above 8 g/km and a 4% ICE improvement was assumed given their higher potential to further reduce ICE emissions in order to meet the targets (more details in Section 5).
4. In a few cases where a gap remains following the three steps above, it is closed by adjusting the share of EVs upwards to ensure carmakers achieve the target, which corresponds to a further increase in EV sales in the second half of the year. At this point the split between BEVs and PHEVs remains the same, which means that they both increase by the same factor. See Section 4. *How many Evs will carmakers sell in 2020/21* to see how many EVs are expected to sell.

In practice the share of EV sales is only increased and ICE emissions are only decreased (compared to the level during the first half of the year) for those carmakers that are not on track to meet the target as of the 1st of July 2020. The carmakers on track to meet the target would simply pursue the same (and do not rely on a ramp up of EV sales in the second half of the year).

In the year 2021, the general methodology is the same with the difference that the target is correlated from NEDC to WLTP, which means that the 95 g/km mass-adjusted NEDC target is increased by carmaker's average 2020 WLTP-NEDC percentage gap (see details on carmaker-specific WLTP-NEDC gap in Annex) and that the stringency of the 95 g/km target is preserved (as long as the OEM-specific WLTP-NEDC gap doesn't change much between 2020 and

2021).³⁷ The average gap between WLTP and NEDC for each carmaker is assumed to stay the same in 2021. From 2020 to 2021, the average improvement of conventional cars is assumed to be 4.5% (all carmakers between 3% and 6%, mainly depending on the penetration of HEVs, see ‘improvement to conventional engines’ in Section 4.4 for more).

Moreover, the average mass of each manufacturer is forecasted for the year 2020 and 2021 to take into account the higher EV sales which are also heavier vehicles (see mass-adjustment in section 4.2).

In addition to the 13 carmakers in the scope of this report, the compliance analysis was also undertaken for Honda and Mitsubishi to obtain the EV share which is most representative of the market. Together they both account for 1.9% of the sales in the first half of 2020. This compliance analysis thus covers 98% of the market (based on H1 2020 sales).

4.2 CO₂ regulation flexibilities

95% phase-in

In 2020, only 95% of sold cars count towards the 2020 target and carmakers can thus exclude the 5% most highest-emitting cars from this year’s reporting. As a result, carmakers with the widest spread of CO₂ emissions with some very high emitting vehicles benefit the most from this. For example, the average CO₂ emissions of the 5% most emitting cars of Daimler are at 243 g/km and 254 g/km for JLR whereas for Renault it is 142 g/km and PSA only 127 g/km. Based on the distribution of CO₂ emissions for each carmaker we were able to calculate the effect of this flexibility for each of the OEMs individually.

On average carmakers benefit from the phase-in by 3.4 gCO₂/km but given the different CO₂-emissions distribution of the new car sales per carmaker, there are significant differences between carmakers. Those that benefit the most from this flexibility are Daimler (6 g/km), JLR (5g/km), BMW, FCA-Tesla, Ford and VW Group (4 g/km), then Hyundai-Kia, Nissan, Toyota-Mazda, and Volvo (3 g/km), finally PSA and Renault only earn 2 g/km from this flexibility.

³⁷ The 2021 target is calculated by multiplying the mass-adjusted OEM-specific 2020 NEDC target with the carmaker-specific average WLTP-NEDC gap in 2020.

Pooling

Pooling sales together is an important flexibility and allows carmakers with a large CO₂ compliance gap to average their sales with frontrunners like Tesla. For the moment the main existing open pools³⁸ (when at least one pool member is not part of the same group of connected brands) are FCA-Tesla, Toyota-Mazda, the Volkswagen Group and the Chinese manufacturer SAIC (which owns the brand MG). The London EV company (LEVC), famous for its London black taxi cabs has declared the intent to form a pool but no pool declaration has been announced at the moment of writing this report (applications will have to be submitted by 31st October 2020³⁹). According to the data from JATO, LEVC has only sold one EV during the first half of 2020. In the scenario where the carmaker would increase its sales in the second half of 2020 and in 2021, we could speculate that a pool would be formed with Daimler since Geely fully owns LEVC and is also a stakeholder of Daimler.

Based on T&E modelling, BMW, FCA-Tesla, PSA, Renault and Volvo are likely to overcomply by about more than 1 g/km in 2020 (up to 6 g/km for Volvo and 3.5 g/km for FCA-Tesla and Renault) so new pools or additions to the current ones are possible to aid the compliance with 2020 and 2021 targets. For example, without forming a pool carmakers like Daimler or Jaguar-Land Rover could have to shift the sales of their high emitting ICE towards lower emitting models, thus reducing their profits. In a scenario where they would instead make arrangements with OEMs that are over-compliant - like entering the FCA-Tesla pool or creating one with BMW, PSA, Renault or Volvo-, they could continue selling the high profit emitting cars. Given that Geely also owns Volvo, we could also see Daimler and forming a pool with Volvo.

As a result of additional pool formation, the actual EV sales across Europe could decrease as laggards would sell EVs while the carmakers like Tesla would probably have sold a similar amount of electric cars anyway. T&E estimates that the formation of new pools can bring down the overall share of EV by a few tenths of percentage point (see example for Daimler in Section 5).

Super-credits

Carmakers benefit to a very large extent from the super-credits thanks to increasing sales of EVs (effectively only applies to vehicles under 50g/km) and all them reach the 7.5 gCO₂/km cap except PSA, Ford, Toyota-Mazda and JLR only. On average across the carmakers analysed here, the

³⁸ Circabc, European Commission. Declarations of intent to form Open Pools pursuant to Article 6(5) of Regulation (EU) 2019/631 (passenger cars). Version of 15th of September. [Link](#)

³⁹ 31th of December with a declaration of interest submitted by the 31th of October at the latest for an open pool

weakening from super-credits would reach about 9 gCO₂/km if there were no cap. These manufacturers that have reached the super-credit cap in 2020 are not able to benefit from this any more in 2021. Therefore, to a very large extent, the increase in EV sales between 2020 and 2021 is necessary to compensate for the absence of super-credits.

Eco-innovation credits

OEMs can claim off-cycle credits, called eco-innovation credits, for fitting technology to the car that delivers emissions reductions on the road but not during the test. Eco-innovations are another compliance mechanism that can reduce a few gCO₂/km from conventional ICE vehicles. The overall average contribution of eco-innovation credits is capped at 7 gCO₂/km at manufacturer pool level, which means that individual vehicles can go much beyond.

As pressure builds on manufacturers to meet 2020/21 CO₂ targets, an increasing number of eco-innovation technologies is expected to be fitted. As reported by ICCT⁴⁰ in July 2018, the level of untapped technological opportunities indicate that eco-innovations are likely to gain momentum as targets loom. Indeed, the number of eco-innovation technologies approved by the European Commission⁴¹ has since increased to include many technologies submitted by the European Automotive Association (ACEA)⁴², as shown in the table below.

The overall contribution of eco-innovation credits on carmakers' average CO₂ in 2019 is relatively low, around 0.3 g/km on average, suggesting under-reporting. BMW has been the carmaker using the most eco-innovation credits with 1.1 g/km in 2019, followed by Daimler with 0.8 g/km. This low use of eco-innovation technologies in 2019 is explained by the fact that carmakers didn't have to comply with the stringent CO₂ targets therefore didn't have any incentive to fit them on the vehicles given that most eco-innovations can be relatively expensive. It is thus expected that carmakers could be underreporting the use of eco-innovation technologies as doing so is an unnecessary burden in the absence of targets.

Technology	Average CO ₂ gains (g/km), 2019	Total registrations (2019)
Thermal	2.2	26,848 (0.2%)
Kinetic	1.8	343 (0.0%)
Alternator	1.4	1,744,360 (12%)

⁴⁰ ICCT (2018). Overview and evaluation of eco-innovations in European passenger car CO₂ standards. [Link](#)

⁴¹ European Commission, DG CLIMA. Reducing CO₂ emissions from passenger cars - before 2020. [Link](#)

⁴² Circabc, European Commission. List of eco-innovation applications. [Link](#)

LEDs	1.2	941,201 (6%)
Solar	1.2	230 (0.0%)
All	1.4	2,939,526 (20%)

Table 3: Eco-innovation technologies used in 2019, per type

Table X shows the main 5 categories of eco-innovation technologies used in 2019. The most wide-spread technology is the efficient alternator (used to charge the Lead-acid battery and to power the electrical system when its engine is running), which was used on 12% of the vehicles, with an average gain of 1.4 g/km. The LED lights also play an important role, accounting for 6% of the registrations and delivering an additional 1.2 g/km benefit. Three other types of technologies can also help carmakers reduce their emissions but were not used to a significant extent, namely thermal technologies (mainly the engine compartment encapsulation system and the enthalpy storage tank) with an average gain of 2.2 g/km, kinetic technologies which includes both adaptive state of charge control in hybrids and coasting⁴³ with 1.8 g/km (driving with a disengaged engine) and solar roofs with 1.2 g/km.

In the analysis above, we focused on vehicles which had only fitted one technology. For 8% of the vehicles registered with an eco-innovation technology, two or more technologies were used (excluding the vehicles with a missing technology identification).

Number of eco-innovation technologies	Average CO₂ gains (g/km), 2019	Total registrations (2019)
1	1.3	2,714,700 (19%)
2	2.5	207,944 (1%)
3	3.6	12,050 (0.1%)
4	5.4	4,832 (0.03%)
Missing ID	1.9	271,119 (2%)
Average	1.4	2,939,526 (22%)

Table 4: Eco-innovation technologies used in 2019, per number used

⁴³ It can be argued that the benefit of this technology is already (at least partially) captured by a more representative WLTP, so such a generous eco innovation is not justified.

The average gain from vehicles that are fitted with two or more technologies is 2.6 g/km, with BMW accounting for around half of those vehicles (average 3.1 g/km), Volkswagen Group a fifth of those vehicles (average 2.1 g/km) and Ford 16% of these vehicles (2g /km).

In particular we notice some associations of all technology types (except solar): efficient alternators, LED lights, thermal (engine compartment encapsulation system and kinetic (coasting). For example for BMW, this association grants on average 5.4 g/km and the combination without the coasting accounts for 3.8 g/km. Together these two associations account for only 1.4% of the vehicles registered by the brand BMW and they were all registered by the same type approval authority (number 24).

Given that most technologies are registered by ACEA and that one carmaker can use a technology which was declared by another company, we expect carmakers, especially the premium ones like Daimler, JLR and BMW to benefit from eco-innovation credits to a greater extent as the higher vehicle prices are more likely to absorb the additional technology cost.

In this report, we assumed that BMW, Daimler and JLR would fit on average two technologies for their new sales in 2020 and would thus benefit from 2.5 g/km of eco-innovations in 2020. This is supported by the fact that BMW is a clear leader for eco-innovation credits in 2019 while Daimler and JLR are high-end car manufacturers (bigger margins allow them to fit the extra cost from these technologies more easily) and are furthest away from the target (have a high incentive to pay to extra cost of technologies and avoid penalties). Three carmakers are assumed here to use up only 0.5 g/km because they comply easily and are less likely to fit the technologies on their lower-end vehicles: FCA-Tesla, PSA and Renault. All remaining carmakers are assumed to use of 1.5 g/km of eco-innovation credits in 2020, which is roughly equivalent to fitting one technology per car on average. The amount of eco-innovation credits used in 2021 is the same as for 2020, increased by 0.5 g/km (i.e. 3 g/km, 2g/km and 1g/km depending on the carmakers).

It is still unclear to what extent eco-innovation credits deliver real-world CO₂ reductions, and real-world tests should in the future help assess the emission reductions to avoid over-generous eco innovation credits.

Mass adjustment factor

The OEM specific CO₂ targets are adjusted every year based on the difference between the average mass of its vehicles sold in that given year and to the EU reference mass (called M_0 , set

every 3 years)⁴⁴. From 2019 to 2022, the reference mass is 1,379.88 kg -which is set as the EU average mass over 2014-2016⁴⁵-, which means that the overall target of a manufacturer is 95 g/km only if the average mass of the car sales is precisely 1,379.88 kg. The higher the average mass of vehicles sold, the higher (less strict) the target is (and vice versa).

In practice, PSA has the lowest target with 92 g/km (1,284 kg average in 2019) and Volvo has the highest target, 109 g/km (1,796 kg in 2019). Only PSA, Renault and Toyota-Mazda actually have the target below 95 gCO₂/km. For every 100 kg a carmaker adds to the average mass of new sales, its target gets relaxed by 3.33 g/km.

The average mass of each manufacturer is forecasted for the year 2020 and 2021 to take into account the higher EV sales which are also heavier vehicles. In 2019 the average mass of ICEs was 1,398 kg, while it was 1,759 kg for BEVs (+26% vs. ICE) and 1,938 kg for PHEVs (+39% vs. ICE). On average EVs weigh 1,821 kg, or +30% vs. ICE. Given the increasing market uptake of EVs, we calculate that the average mass of vehicles increases by 33 kg in 2020 and 23 kg in 2021⁴⁶ which has the consequence to relax further the target from 95g/km to 97 g/km on average in 2020 (+1.1 g/km vs. 2019) and to 98 g/km NEDC in 2021 (+ 0.8 g/km vs. 2020). The carmakers which benefit from this the most are Daimler (more than 3 g/km), Volkswagen Group (3 g/km), JLR and Volvo (more than 2 g/km).

As the average mass of cars sold is likely to continue to increase, the reference mass will always be lower than the market's average mass because of the three to five year delay between the monitoring years and the application of the new targets⁴⁷. In other words, the 95 g/km average target will never be effectively enforced over the period 2020-2024. It can be noted that carmakers can continue to increase the mass of their car sales for a last time in 2021 and benefit from a higher baseline for the whole post-2020 car CO₂ regulation (and thus more lenient targets).

The mass-adjustment was originally designed to ensure the targets are met even if the average mass of all manufacturers increases since heavier conventional cars emit more CO₂. However,

⁴⁴ OEM-specific mass-adjusted target = 95 + 0.0333 * (M - 1379.88) with M being the average mass of cars sold in 2020

⁴⁵ European Commission, CO2 expert group, December 2017. Monitoring of CO2 emissions data and the average mass adjustment for cars. [Link](#)

⁴⁶ The 2019 mass of different powertrains (ICE, PHEV and BEV) is used to calculate the mass (and thus the target) for each manufacturer in 2020 and 2021 by adjusting the sales ratio of each powertrain while the average mass for each powertrain is kept constant (to 2019 levels). As a consequence, this approach is conservative given that it doesn't take into account the increase in SUV sales (within one powertrain type)

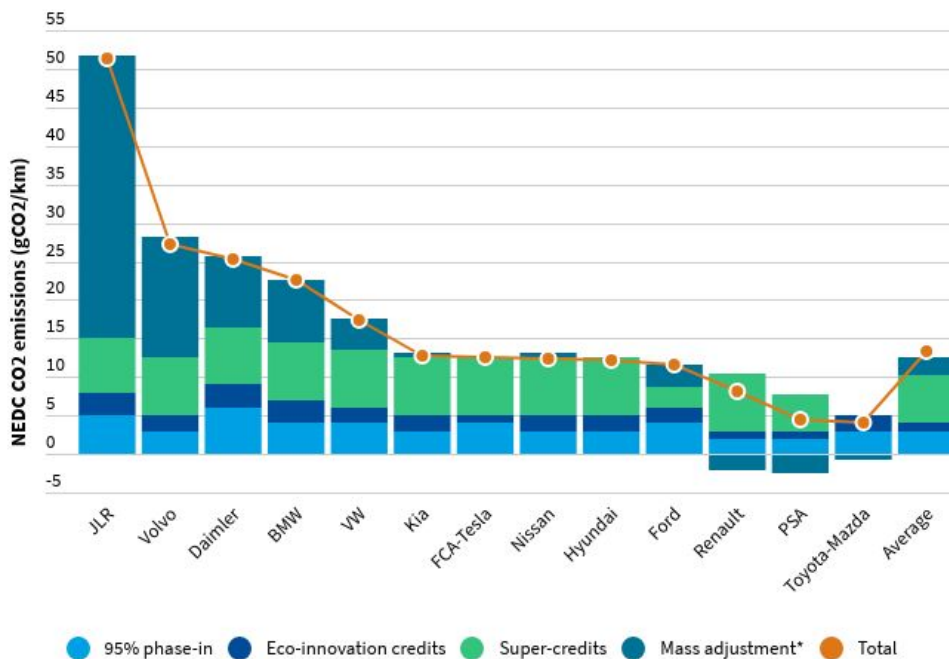
⁴⁷ The 2022 new mass reference for the adjustment will be calculated as the market average from the years 2017-2019.

with the mass deployment of hybridisation and electrification technologies - notably PHEVs - heavy cars no longer have to emit more CO₂. This mass-adjustment factor has the adverse effect to dis-incentivise OEMs to use light-weighting as a means to reduce emissions, and even provides an incentive to increase vehicle mass. It can be said to be one of the key regulatory design flaws that is favouring the current shift to SUVs⁴⁸.

Overall contribution of flexibilities

Taking into account the contribution of the mass-adjustment factor and the three flexibilities described above, the 95 g/km target is in reality 108 g/km in 2020 (6.3 g/km for the super-credits, 3.4 g/km for the phase-in, 2.3 g/km for mass and 1.3 g/km for eco-innovation credits). This amounts to an average contribution of 13.4 gCO₂/km (excludes the contribution of JLR's derogation target on the average mass-adjusted target). The contribution of each of these flexibilities per carmaker is shown Figure 14 below (the mass adjustment for JLR includes the derogation). When considering only the carmakers which have a mass-adjusted target, the 2019 average CO₂ emissions are 121.7 g/km, which is 26.7 g/km above the 95 g/km target. In other words, **the four flexibilities contribute to closing exactly half of the compliance gap in 2020.**

⁴⁸ ICCT (2018). Adjusting for vehicle mass and size in European post-2020 CO₂ targets for passenger cars.
[Link](#)



* The mass-adjustment doesn't apply to JLR given that the carmaker benefits from a derogation target
 On average, the flexibilities account for 13 g/km, meaning that the 95 gCO₂/km average target is actually a 108 g/km average target (excludes the contribution of JLR's derogation target on the average mass-adjusted target).
Source: T&E modelling of carmaker's compliance the EU 2020 CO₂ emission target. Partly based on analysis of H1 2020 passenger car sales data from JATO Dynamics.

Figure 14: Contribution of each flexibility in 2020, per OEM

The data is presented in detail in the Annex 7.3 'Data tables'.

WLTP-NEDC gap inflation

The OEM-specific 2021 targets are set first by calculating the mass-adjusted 95 g/km NEDC target multiplied by the 2020 WLTP-NEDC uplift, then by adjusting this to the mass variation of the sales between 2020 and 2021. The bigger the WLTP-NEDC difference in 2020, the higher the WLTP derived target in 2021 (which also serves as the baseline for the 2025/2030 targets). Carmakers can therefore make the 2021 target relatively less stringent by inflating the difference between the two values in 2020 through test manipulation and optimisation, and then reduce this gap later in 2021.

Carmakers are allowed and are expected to rely to a large extent on double testing of cars using both the NEDC and WLTP procedures to optimise separately each of the tests⁴⁹. In other words, while complying with the NEDC target in 2020, carmakers might aim for low NEDC and high (inflated) WLTP values in 2020, and low (realistic) WLTP values in 2021.⁵⁰

In 2018, 2019 and during the first half of 2020 the WLTP-NEDC uplift has been 21%. Increasing the uplift also means less electric car sales as the artificially inflated CO₂ targets can be easily met by using more realistic (lower) test results at a later stage (i.e. deflating the gap). We estimate that by deflating the gap by a mere 10% (i.e. from 21% gap to 19%, or two percentage points) the average EV share of the market reduces by about 0.5%.

The average uplift between the two tests is 21% over the first half of the year (see Annex 7.5 'WLTP-NEDC gap' for an infographic). PSA and Toyota-Mazda have the highest WLTP-NEDC uplift with 28% and 27%, while Hyundai and JLR have the lowest with 13% and 12%.

4.3 Carmakers' gap to reaching 2020 CO₂ target

The majority of the CO₂ compliance gap was already closed in the first half of 2020 thanks to the increasing sales of EVs and efficient ICE as much as the regulatory flexibilities (super-credits, eco-innovation credits, 95% phase-in).

Based on sales from the first half of 2020, **PSA, Volvo, BMW and FCA-Tesla are already compliant with their respective CO₂ targets over these six months**. If they are to continue over this trajectory and sell at least as many plug-ins as they did in the first half of the year (which is likely given that EV sales are constantly increasing), they would easily be compliant over the full year. Therefore, their compliance strategy over the full year is expected to be the same as in the first half of the year. PSA is even overachieving its target by about 3 gCO₂/km. BMW has a gap of 0.3 g/km which is rounded to zero here given the very little progress that would have to be made.

⁴⁹ Transport & Environment (2018). Ending the cheating and collusion: Using real-world CO₂ measurements within the post-2020 CO₂ standards. [Link](#)

⁵⁰ Carmakers can deliberately produce high values for WLTP. The two main approaches are:

- Carmakers can fit devices to recognise when the car is being tested on the WLTP and alter how it operates to make the vehicle less efficient (for example the stop-start system can be deactivated or the test can start with a depleted car battery so that additional fuel was consumed to charge the battery during the test).
- Declaring a higher value than measured on the test (there are rules governing declaring a lower value however the Commission did not regulate to prevent higher numbers being declared).

We estimate that by deflating the gap by 10% (i.e. from 21% gap in 2020 to 19% in 2021), the WLTP value is thus more 'fair' because less-inflated (or lower) which makes the target easier to reach. In this situation, the average EV share of the market reduces by about 0.5% and several OEMs start overachieving the target.

Four carmakers have the remaining gap of less than 2 g/km: Renault, Toyota-Mazda, Ford and Nissan. For these carmakers, incremental improvement will be sufficient in the second half of the year to comply. The change or increase in sales of electric cars that needs to be done in the second half of the year is relatively easy in the light of the important efforts that were carried out in a very short amount of time between the end of 2019 and beginning of 2020. For these carmakers, the sales of electric cars (HEVs for Toyota) would continue to gradually increase over the year leading them to comply comfortably by the end of 2020.

Finally several carmakers have a higher gap to close and would have to either reduce further the emissions from their ICE sales (including hybrids) or ramp-up the sales of electric cars more than expected, or both. This affects Hyundai-Kia which has a remaining gap of about 5 g/km (when combined), Volkswagen Group with a gap of about 5 gCO₂/km, Daimler with 9 g/km, and JLR with 13 g/km. The data is presented in detail in the Annex 7.3 'Data tables'.

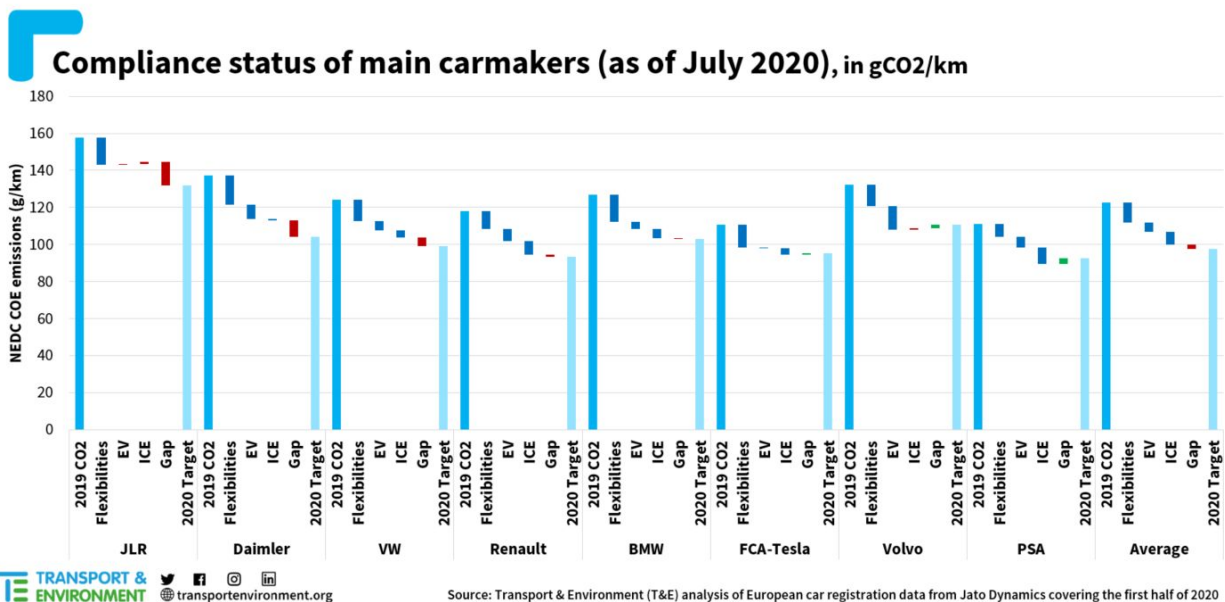


Figure 15 - Current state of compliance of OEMs over the first half of 2020

With regards to the contribution of flexibilities, the only difference compared to the full year 2020 analysis is a lower contribution of super-credits for OEMs with lower EV sales over the first half of the year compared to the full year, on average the total contribution increases from 6.0 g/km during the first half of 2020 to 6.3 g/km during the whole of 2020). Daimler, JLR and BMW benefit

the most from these flexibilities with respectively 17 g/km, 16 g/km and 15 g/km. This is analysed for each individual OEM in Section 5. The targets have been adjusted based on the OEM-specific average mass of cars sold in 2019.

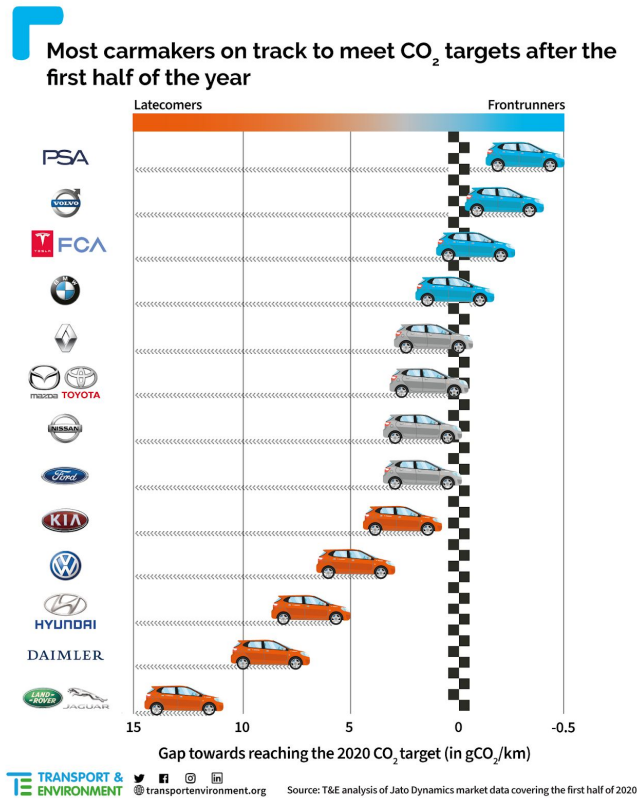


Figure 16 - Current compliance gap of OEMs over the first half of 2020

4.4 Compliance strategies: ICE improvements and EVs

In this section we give some details about the two main compliance mechanisms on top of the use of flexibilities (super-credits, eco-innovation credits, 95% phase-in and mass-adjustment): conventional improvement and increasing EV sales. The results of our modelling is presented in the next sub-section (4.5 How many Evs will carmakers sell in 2020/21?).

Improvements to conventional engines

When the CO₂ standards were initially agreed in 2008 improved fuel efficiency was expected to be a key compliance strategy. In reality carmakers have left a lot of conventional improvements untapped, meaning they could still improve the fuel efficiency of their vehicles which rely at least partly on an internal combustion engine, namely ICE (petrol, diesel, gas), HEV and PHEVs. We focus here on the average improvement of ICEs and HEVs together, referred to as conventional cars.

There are several ways that the efficiency of a conventional car can be improved: aerodynamics, engine efficiency, downsizing, lightweighting, and more. Also, the average CO₂ emissions from ICE cars sold by carmakers also depends on the sales distribution between lower emitting models and higher emitting ones.

We model that the average emissions of conventional cars drop by 7% in 2020 (to compare with the 9.2% drop in overall new fleet CO₂ emissions), mainly thanks to increasing sales of hybrids. On the other hand the average conventional car had increased by 1% between 2018 and 2019.

Average conventional car emissions from two carmakers have continued to increase even in the first half of 2020 as both Volvo and Jaguar-Land-Rover saw their emissions increase by about 1%. Daimler's conventional cars also didn't improve much, only around 1%. For the moment Volkswagen Group's conventional cars improved by 3%, same as FCA and Nissan. Renault (7%), Toyota-Mazda (7%), PSA (8%) and Ford (16%) all perform better than the market average. From 2020 to 2021 we model that the average emissions from conventional cars decrease by 4%.

Figure 17 shows the evolution of the CO₂ emissions of all new cars (i.e. ICEs, hybrids and EVs) versus conventional cars (ICE + HEV) from 2018 to 2021. The years 2018 and 2019 are based on historic data while 2020 and 2021 are outputs of our compliance modelling, which rely to a great extent on historic data from the first half of 2020 and forecasted production data.

In blue, the decrease of overall average OEM CO₂ emissions from new sales and in red the trend for the average emissions of conventional cars per OEM or pool (including hybrids). The more the red and blue curves diverge, the higher the contribution of EV sales.

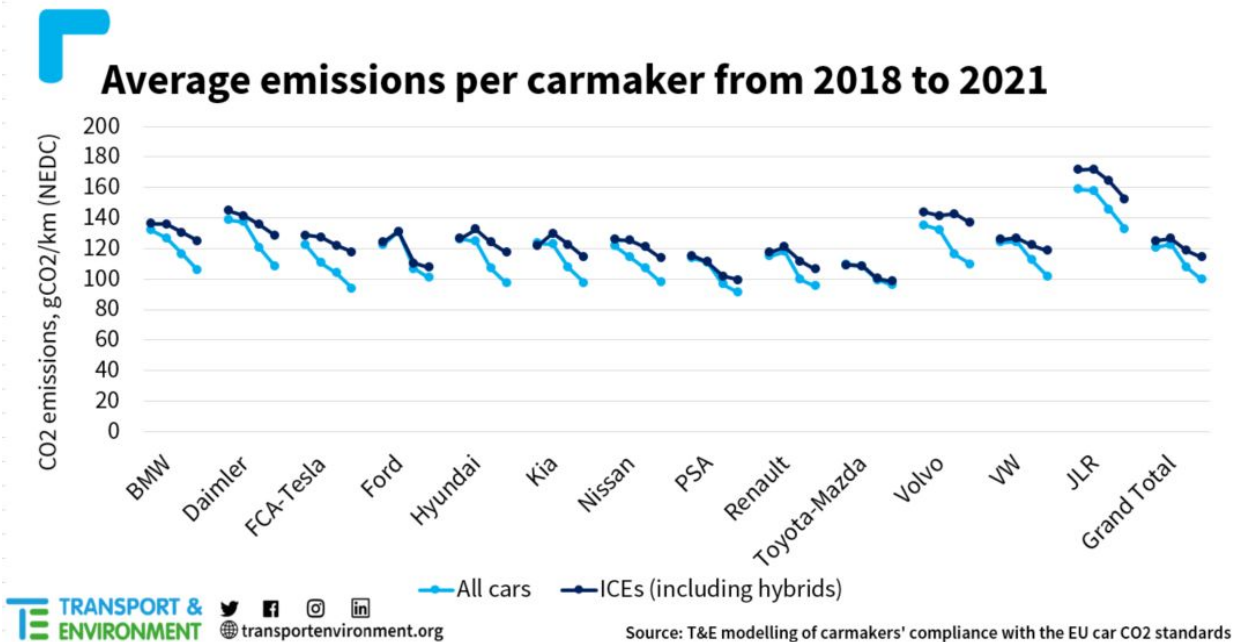


Figure 17: Average emissions per OEM 2018-2020

We estimate that fuel efficiency of conventional cars (including hybrids), will improve by 6.4%, with almost all manufacturers achieving between 3% and 8% fuel economy gains (only exceptions are Volvo and Ford). For most carmakers, the majority of the ICE improvement is achieved already in the first half of the year, although some carmakers with low improvement from 2019 to the first half of 2020 are expected to catch up in the second half of the year (mainly Daimler and Jaguar-Land-Rover). From 2020 to 2021, the average improvement of conventional cars is assumed to be 4.5% (all carmakers between 3% and 6%, mainly depending on the penetration of HEVs).

Widening EV portfolio

Table X below presents what is in OEMs’ product BEV pipeline for the release of BEV models, which has recently become the predominant compliance strategy for carmakers (and the most future-proof pathway). New products are shown as well as the products with significant ramp up (in *italic*). Together these products make up a large part of the expected increase in EV sales in 2020/21.

Carmakers BEV portfolio

Carmakers	Pre-2020 models	H1 2020	H2 2020	2021
 PSA	Ampera-e, C-zero, iOn	e208, e2008, Corsa-e, DS 3 Crossback	e-C4	Mokka-e
 VOLVO			XC 40, Polestar 2	
 FCA	Model 3, S, and X		500e	Model Y
 BMW	i3	Mini		iX3, iNext, i4
 Renault	Zoe		Twingo	Dacia EV
 MAZDA TOYOTA			MX-30, Lexus UX	
 NISSAN	Leaf			Ariya
 Ford				Mach-E
 KIA HYUNDAI	Ioniq, Kona, e-Soul, e-Niro			
 VW	eGolf, e-tron, Taycan, Mii, Citigo, eUp!	e-tron Sportback	ID.3, ID.4, Cupra el-Born	Enyaq, ID.5, e-tron GT, Q4 e-tron
 LAND ROVER JAGUAR	I-Pace			XJ, J-Pace
DAIMLER	EQ C, Fortwo, Forfour			EQ A, EQ B, EQ S, EQ E

Table 4: Available BEV models in the EU market (from main OEMs)

Carmakers PHEV portfolio












Carmakers	Pre-2020 models	H1 2020	H2 2020	2021
 PSA	508, DS7 Crossback, 3008, Grandland X		C5 Aircross	308
 VOLVO	V60, V90, XC60, XC90, Polestar 1	XC40		XC40 Coupe
 FCA			Compass, Renegade	Wrangler
 BMW	3, 5, 7-series, Mini, i8, X1, X5	X3	X2	
			Captur, Megane	Kadjar
 MAZDA TOYOTA		Prius	RAV4	
				Qashqai
		Kuga, Explorer		
 KIA HYUNDAI	Optima, Ioniq	Ceed, XCeed		Sportage, Tucson
	A3, A8, Q5, Q7, Passat Cayenne, Panamera, Golf	A6, A7, Superb	Leon, Octavia, Q3, Tarraco, Q3 Sportback, Q8, Tiguan	Arteon, Touareg
 LAND ROVER JAGUAR	Range Rover, Range Rover Sport		Evoque, Velar, F-Pace, E-Pace, Discovery	Defender
DAIMLER	A, C, E, S-Classes, GLC, GLE		B-Class, CLA	GLA, GT-4

Table 5: Available PHEV models in the EU market (from main OEMs)

By the end of 2019, the number of PHEVs available on the market (34) was higher than the number of BEVs (23). The gap between the number of PHEV and BEV on the market further widens by the end of 2020 with 16 additional BEVs models and 31 additional PHEV models. However, in 2021, the trend is reversed and there are more BEV models coming to market than PHEV models (18 vs. 12). In total by the end of 2021 there will be 77 PHEVs and 57 BEVs on the market for a total of 134 EV models, which is more than double the number of models that were available at the end of 2019 (57), see Figure 18. This excludes variants of models (e.g. there are 3 variants for the ID.3 with three different battery sizes: 45, 58 or 77kWh) as well as other automakers not included in the scope of this paper (e.g. Mitsubishi Outlander the early 2010s, Honda-e from 2020, MG ZS from 2019, Airways U5 from 2020, MG HS PHEV from late 2020, MG5 from 2021, Byton M-Byte from 2021 and Light year One in 2021). For these reasons, the results

here are slightly lower than in the previous analysis done by T&E in the 2019 *Electric Surge* report⁵¹.

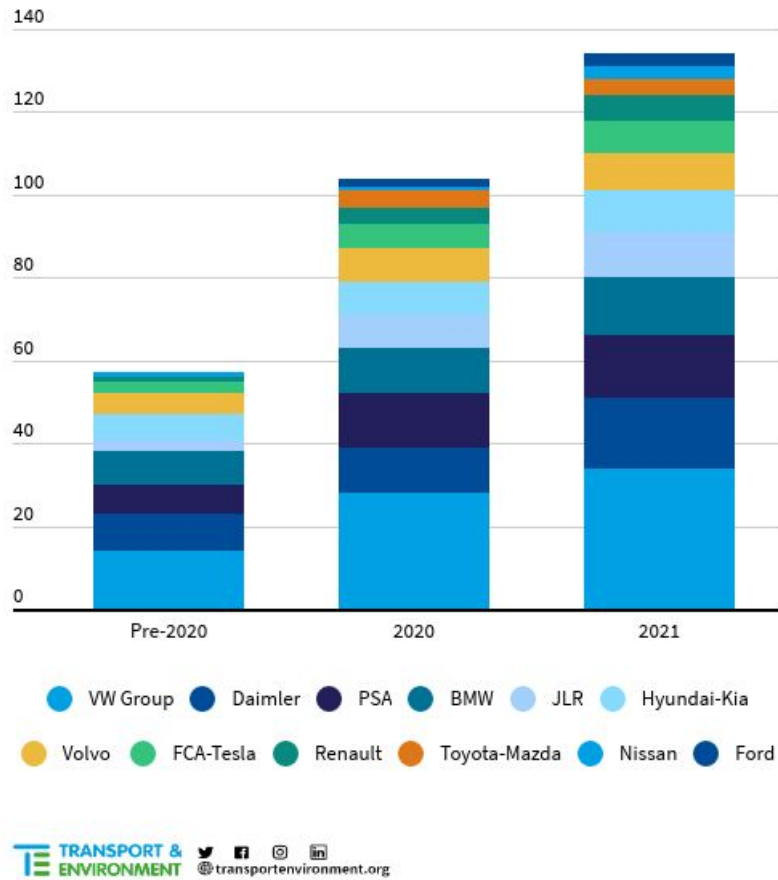


Figure 18: EV model availability in the EU, variants and small OEMs not included

PHEVs: a compliance strategy with questionable real world benefits

PHEVs currently make up around half of the sales of plug-in cars. They often are big heavy SUVs that are rarely charged and sold as company cars three times out of four⁵². PHEVs are treated very generously towards claiming super-credits given they are doubled counted when under 50 g/km, just like BEV.

⁵¹ Transport & Environment (2019). *Electric Surge*. [Link](#)

⁵² Transport & Environment (2020). *Company cars: How European governments are subsidising pollution and climate change*. [Link](#)

PHEVs are a compliance strategy for many carmakers but do not deliver much real world benefit. Plug-in hybrids weigh on average close to two tonnes (1,938 kg in 2019), which is 39% higher than the average ICE and allows carmakers to have a significantly higher target thanks to the mass-adjustment parameter (PHEV-reliant Volvo's target is 19% higher than PSA's target). Furthermore, because of their limited electric range today and the low charge rates, they often drive mainly on the conventional engine and emit two to four times more CO₂ than the official type approval values (three to four times more for company cars which are reported to be charged only every second day)⁵³.

The PHEV compliance strategy makes it easy for carmakers such as Volvo, BMW, Daimler and JLR to reach the targets. If the PHEV emissions were accounted for in a more representative way under the WLTP emission test, then the OEM efforts would have to be much higher (see example with Volvo in next section).

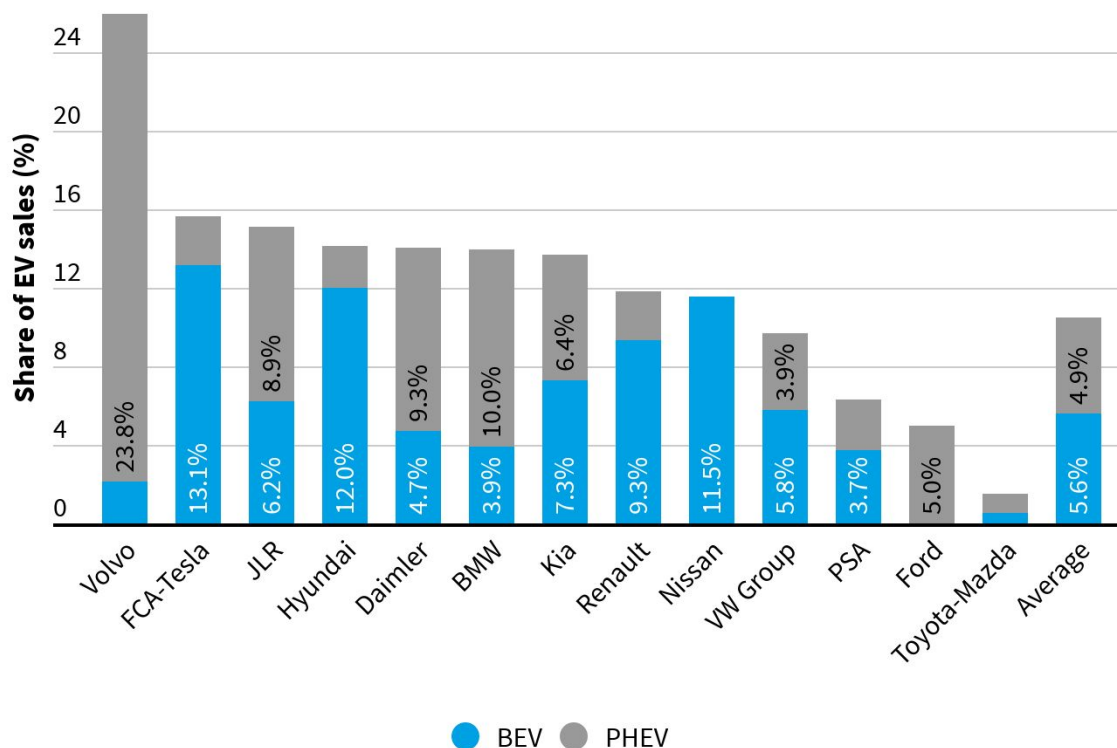
4.5 How many EVs will carmakers sell in 2020/21?

Share of EV sales in 2020 and 2021

Based on the T&E methodology, the average EV sales are estimated to reach **10% of the EEA market sales in 2020 and 15% in 2021**, a significant surge from the 3% in 2019. This analysis looks at what carmakers need to sell to achieve compliance. Results for EV sales by volume - a crucial indicator - change significantly compared to the share of EV sales and are presented at the end of the section.

In 2020 the European market leader is expected to be Volvo with 26% EV sales (only 2% BEVs), followed by FCA-Tesla with 16% (mainly Tesla BEVs), Jaguar-Land-Rover, Hyundai-Kia, BMW and Daimler at 14%, and Renault and Nissan at 12%, see Figure 19 below. Volkswagen Group reaches 10% (same as European average) and PSA 6%.

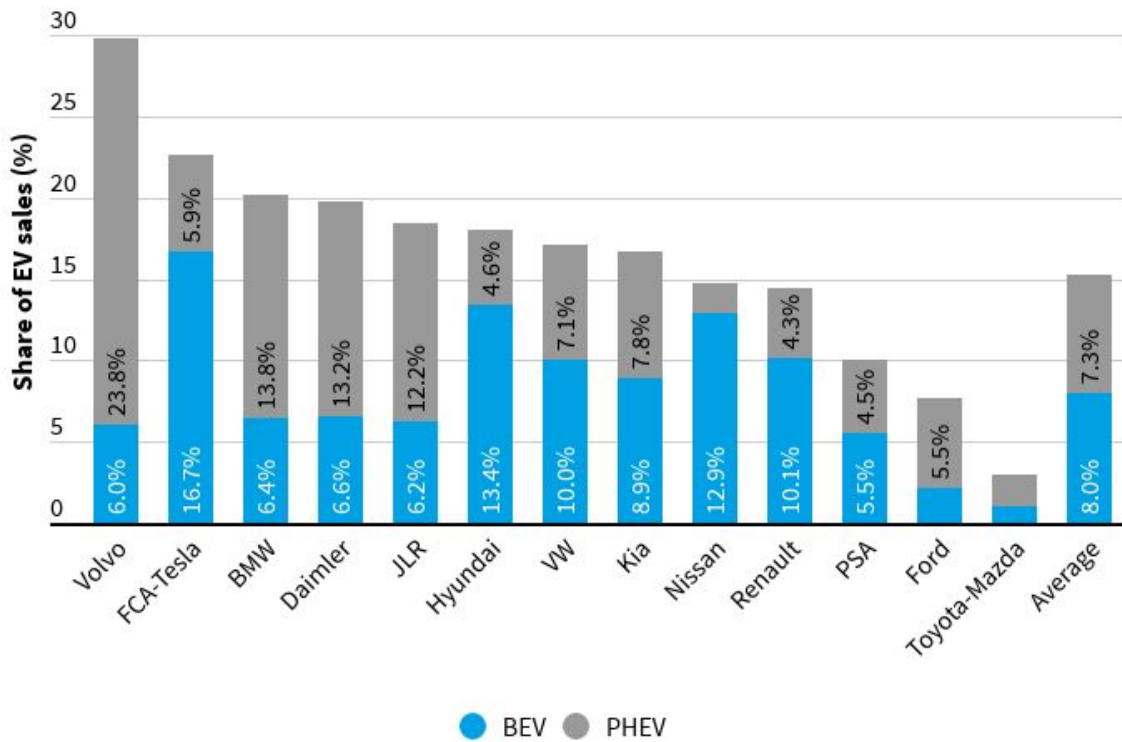
⁵³ ICCT (2020). Fact sheet: Real-world usage of plug-in hybrid electric vehicles. [Link](#)



Source: T&E modelling of carmakers' CO2 emission compliance based on passenger car registration data from the first half of 2020 (data from JATO Dynamics)

Figure 19: Forecasted EV sales per carmakers in 2020

In 2021, Volvo remains the leader with 30% EV share (mostly PHEVs), followed by FCA-Tesla at 23%, BMW and Daimler at 20%, JLR and Hyundai 18%, Volkswagen Group 17% and Renault 14%, see Figure 20.



Source: T&E modelling of carmakers' CO2 emission compliance based on passenger car registration data from the first half of 2020 (from JATO Dynamics)

Figure 20: Forecasted EV sales per carmakers in 2021

The infographic below summarises and compares the electric car sales from 2019 to 2021 (Figure 21)



Forecasted EV sales per carmaker in 2020 and 2021

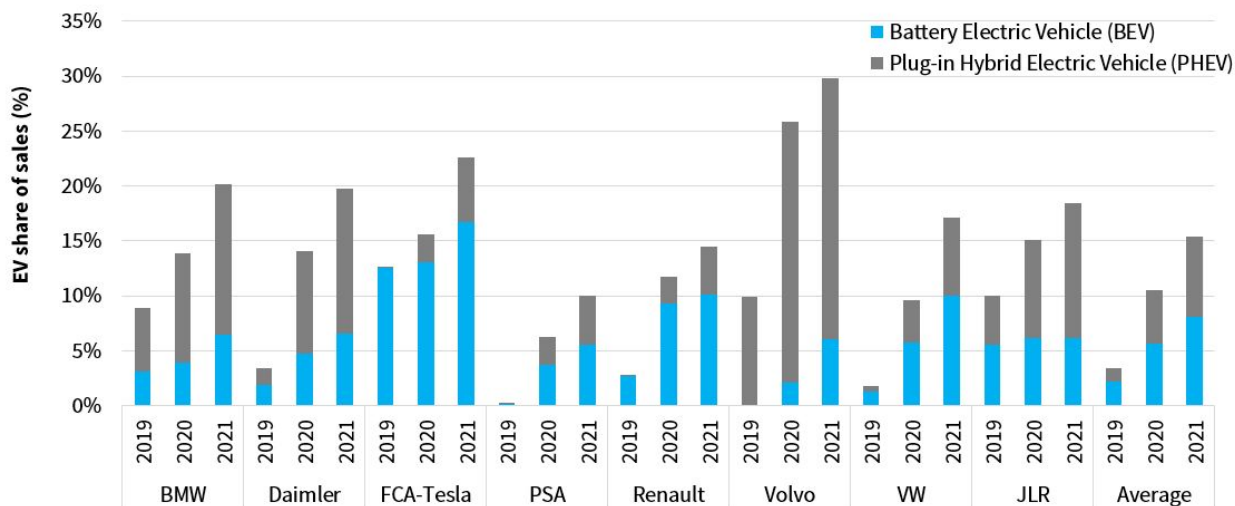


Figure 21: Forecasted EV sales per carmaker in 2020 and 2021

It should be noted that these findings cover the EU27, NO and UK, corresponding to the scope of the car CO₂ regulation as it applies today to the EEA area.⁵⁴ Given that Norway is expected to continue to attract a large part of the EU's EV sales (10% of EV were sold in Norway in H1 2020 with 13% of the BEVs and 6% of the PHEVs), and the UK has left the EU, we calculate -based on H1 2020 sales- that the EV shares in the EU27 in 2020 and 2021 can be approximated by applying the following reduction factors to the EEA EV shares: -15% for BEVs and -3% for PHEV (about -10% overall for EVs).

The UK is roughly on par with EU average during the first half of 2020, therefore, in the situation that this remains the case, the difference between the average EV share in the EU27 and the average share in the EU27+UK would be marginal (about one tenth of a percentage point).

As a result, it is estimated that the share of EV sales in the EU27 would be around 9% in 2020 and 14% in 2021, or about one percentage point lower than what is calculated for the EEA (EU27 + UK + NO here) see Table 6 below:

⁵⁴ Iceland, Liechtenstein excluded because of data availability

		BEV	PHEV	EV
2020	EEA	6%	5%	10%
	EU27 + UK	5%	5%	9%
	EU27	4.8%	4.7%	9.4%
2021	EEA	8%	7%	15%
	EU27 + UK	7%	7%	14%
	EU27	6.8%	7.1%	13.8%

Table 6: Comparison of EV shares in the EEA vs. the EU in 2020 and 2021

Norway has joined the 2020/21 EU car CO₂ regulation in 2019 which means that car sales in Norway count towards reaching the average CO₂ target in the same way as cars sold in the EU as carmakers have to achieve EU-wide compliance. Given that close to half of new car sales in Norway in the first half of 2020 were zero emission (all new cars in Norway are expected to be zero emission from 2025), the inclusion of Norway in the EU car CO₂ makes it much easier for carmakers to reach compliance and de facto reduces the number of EVs that need to be sold in the EU for compliance.

In the scenario where Norway would not have been included in the scope of the regulation, carmakers would have to reach 10.5% EV sales in the EU, not 9.4% (see Table X). As a result, the average share of EV would be on average 1 percentage point higher in 2020 (1.5% in 2021), which is equivalent to more than 100,000 EV units in 2020 and around 180,000 EV in 2021.

Volume of EV sales in 2020 and 2021

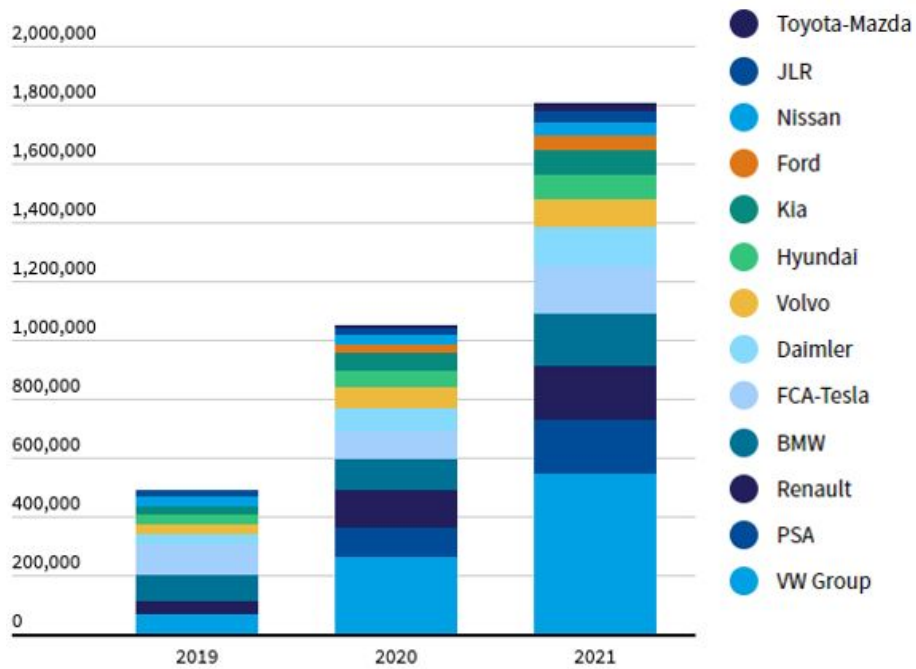
Looking at volumes is also important but given the unpredictability regarding the speed of the COVID-19 recovery and the possibility of another wave of the virus (or another lockdown), there remain uncertainties on the total volume of sales delivered across the whole market and for all

OEMs. Here we assume that 2020 car sales are 25% below 2019 level and 2021 sales are 12.5% below 2019 level and that the OEMs' overall market share during the first half of the year 2020 can be extrapolated to the full year 2020 and the year 2021.

Despite the COVID-19 crisis, **the total number of EVs sold in Europe is expected to double from half a million in 2019 up to one million in 2020 and reach 1.8 million in 2021** (see Figure 22).⁵⁵

In 2019, Tesla (FCA-Tesla), BMW and Volkswagen Group occupied the podium for the EV sales volume. However in 2020, the picture changes significantly as Volkswagen becomes the clear leader for volume of EV sales (about 260,000 units), while Renault takes the second place (about 125,000 units) and BMW, PSA, and Tesla (FCA-Tesla) would sell around 100,000 units. Tesla drops from first place in 2019 to fifth place. In 2021, Volkswagen comfortably retains its leading position (more than half a million EVs) and PSA, Renault and BMW follow with approximately 180,000 EVs. FCA-Tesla, and Daimler are at fifth and sixth position.

⁵⁵ Given that this analysis does not cover small-volume carmakers like Honda, Mitsubishi or start-up like e.GO or Chinese carmakers, it is likely that sales in 2021 reaches 1.9 million.

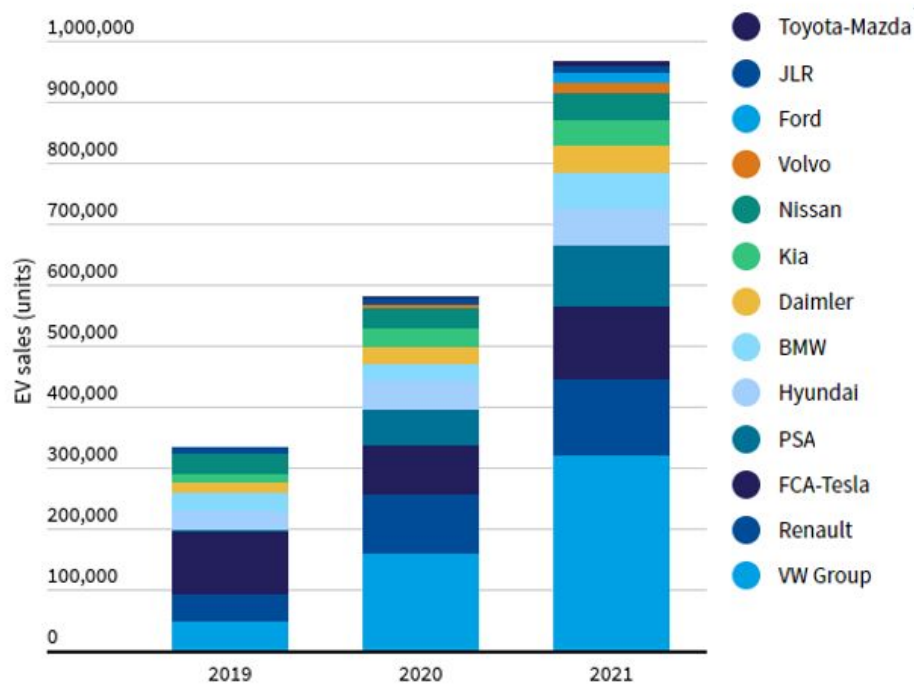


Source: EEA car registration data (2019) and T&E analysis of carmakers' compliance for 2020 and 2021 based on car registration data from the first half of 2020 from JATO Dynamics.
 2020 total EU sales are assumed to be 25% lower in 2020 (vs. 2019) and 12.5% lower in 2021 (vs. 2019).



Figure 21: EV sales volume per carmaker from 2019 to 2021

BEVs sales are expected to triple from 2019 as they reach close to one million in 2021 (up from about 350,000 in 2019 for the EU27 + UK + NO). Here, the ranking is the same in 2020 and 2021 (also the same as the total EV ranking from 2020): Volkswagen Group leads with more than 300,000 units in 2021 (see Figure 23), Renault is second (about 130,000 units in 2021) and FCA-Tesla third (about 120,000 units in 2021).



Source: EEA car registration data (2019) and T&E analysis of carmakers' compliance for 2020 and 2021 based on car registration data from the first half of 2020 from JATO Dynamics. 2020 total EU sales are assumed to be 25% lower in 2020 (vs. 2019) and 12.5% lower in 2021 (vs. 2019).

Figure 23: BEV sales volume per carmaker from 2019 to 2021

Closing the compliance gap

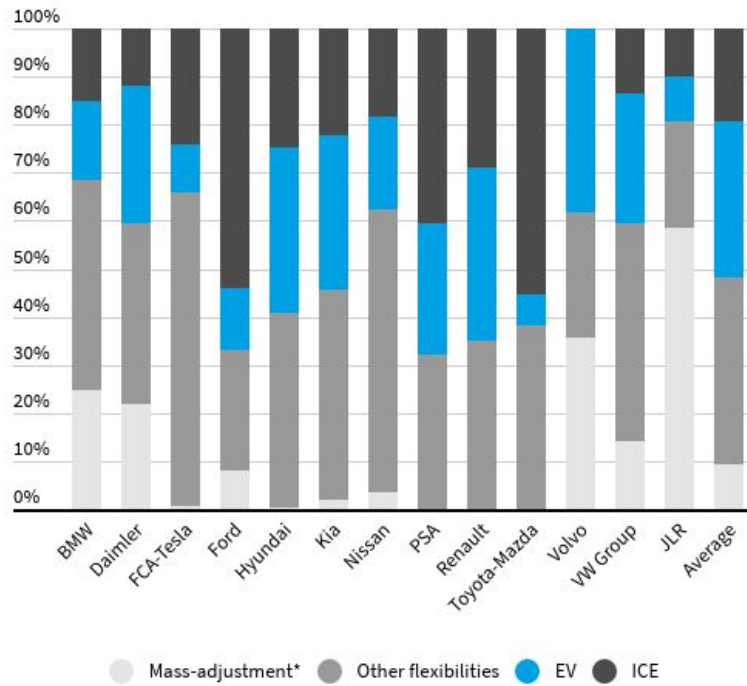
When comparing carmakers' CO₂ performance with what is modelled for their compliance in 2020 and 2021, we are able to distinguish the contribution for each of the three main compliance strategies: flexibilities (super-credits, eco-innovation credits and 95% phase-in for 2020), ICE improvement, and EV sales (PHEV and BEV together).

In 2020, half of the of the compliance gap is closed thanks to flexibilities (48%, or 13g/km, including mass-adjustment)⁵⁶, while increases in EV sales account for a third (9 g/km) and ICE improvement for around a fifth (19%, or 5.5 g/km), see Figure 24.

Seven carmakers are projected to close more than half the 2019 compliance gap thanks to flexibilities: BMW, Daimler, FCA-Tesla, Nissan, Volvo, Volkswagen Group and Jaguar-Land Rover. Only Volvo and Renault are expected to close more than a third of the gap with EVs.

FCA-Tesla already sold high levels of electric cars in 2019 (around 13%, only Tesla BEVs). As a result, the relative increase in EV sales in 2020 doesn't contribute much to close the compliance gap.

⁵⁶ Here we consider that the flexibilities were not granted in 2019 to isolate the full-effect of these flexibilities compared to a scenario where none of them would be attributed.



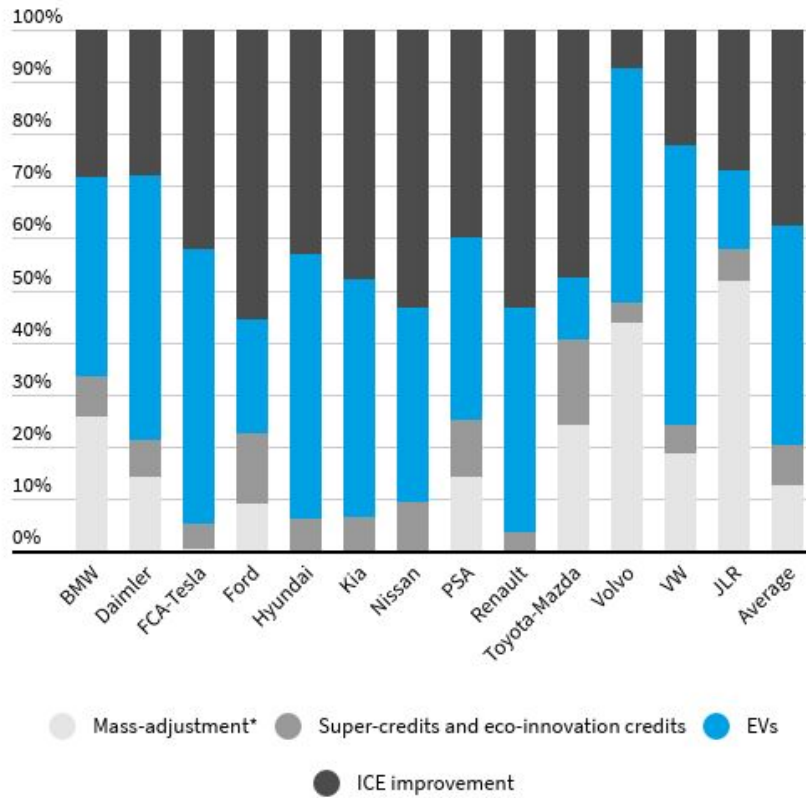
* The mass-adjustment doesn't benefit to JLR which benefits from a higher derogation target. The (negative) contribution of the mass-adjustment to carmakers with a target below 95g/km is set at zero.

Other flexibilities include super-credits, eco-innovation credits and 95% phase-in of sales.

Source: T&E modelling of carmakers compliance with the EU car CO2 targets. Partly based on analysis of car registration data over the first half of 2020 (from JATO Dynamics).

Figure 24: How carmakers close the 2020 compliance gap (vs. 2019)

In 2021, contribution of flexibilities (excluding mass-adjustment) to close the compliance gap of 2019 is much lower than in 2020 given that close to all carmakers have used up all their super-credits in 2020 and can't benefit anymore from the 95% phase-in. Indeed both the eco-innovation credits and the remaining super-credits account for 8% of the gap closure in 2021 (2.7 g/km). Importantly, the increase in EV sales is projected to close around half of the gap (48% or 15 g/km) on average while ICE improvements -including an increase in sales of hybrids- close the remaining 43% (13 g/km). When the mass-adjustment and the NEDC-WLTP uplift are taken into account, the flexibilities account for a fifth (7 g/km) of the gap closed, and contribution of EVs decreases to 42% (see Figure 25).



* The mass-adjustment doesn't benefit to JLR which benefits from a higher derogation target. The (negative) contribution of the mass-adjustment to carmakers with a target below 95g/km is set at zero. The mass-adjustment also includes the OEM-specific effect of the NEDC-WLTP uplift (based on a target of 95 g/km NEDC with a 21% uplift here).
Source: T&E modelling of carmakers compliance with the EU car CO2 targets. Partly based on analysis of car registration data over the first half of 2020 (from JATO Dynamics).

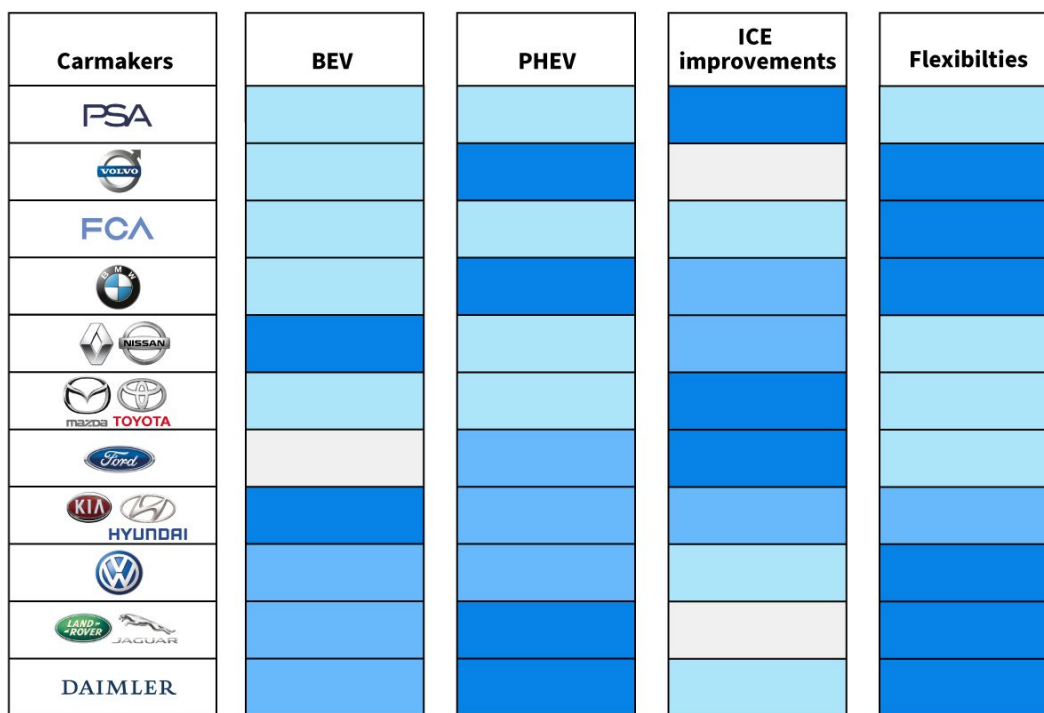
Figure 25: How carmakers close the 2021 compliance gap (vs. 2019)

5. Overview of individual OEM compliance strategies

With different product portfolios, customer base and strategic choices, automotive companies all have a different approach to comply with the EU CO₂ regulation. In this section we investigate in more depth how each individual carmaker will comply with the targets.

The table below summarises OEM's compliance strategies (method is summarised below).

Carmakers compliance strategy for 2020



Strategical importance: Lowest to highest



Figure 26: OEM compliance strategy for 2020

Method:

- BEV: *Highest* when the average BEV share of sales over 2020 is above 8%, *Medium* when above 4%, and *Low* when above 0%
- PHEV: *Highest* when the average PHEV share of sales over 2020 is above 8%, *Medium* when above 4%, and *Low* when above 0%
- ICE improvement: *Highest* when the overall ICE improvement observed during the first half of the year (vs. 2019) is higher than 7% compared to 2019, *Medium* when higher than 5% and *Low* when between 0% and 5%.
- Flexibilities: Include the following flexibilities: super-credit, eco-innovation credits, 95% phase-in and mass-adjustment. *Highest* when flexibilities contribute to more than 50% of the gap closing, *Medium* when it contributes to more than 40%, and *Low* when less than 40%.

BMW

Over the first half of 2020, BMW - which also includes Mini - is already compliant with its target thanks to a strategy relying chiefly on PHEVs (the gap of 0.3g/km is assumed to be within the margin of error). From early 2020, BMW offered PHEV versions of the 2-, 3-, 5-, and 7-series, as well as the SUVs X1 and X5 and the Mini Countryman. The most popular models are the 3-series, the 5-series and the X1. The carmaker has been one of the most outspoken on PHEVs. On top of the 9.1% PHEV sales reached in the first half of 2020, BMW also has sold 3.5% BEVs with two models: the Mini and the i3. BMW is expected to increase slightly its sales of EVs in the second half of the year and reach 14% over the full year 2020 (10% PHEV and 4% BEV).

In 2021 BMW is expected to continue ramping up the volumes of PHEV sales, and will bring to market three new BEV models which are the iX3, iNext and i4. The contribution of BEVs in the EV split remains unchanged with 14% PHEVs and 6% BEVs. Hence the CO₂ compliance in 2021 will also depend to a large extent on further increasing PHEV sales.

BMW's improvement of conventional cars (ICE and HEV), is slightly below the average with about 4% improvement in 2020 and in 2021, chiefly thanks to increasing HEV sales.

Daimler

Daimler is amongst the laggard carmakers and has to make the most effort during the second half of the year to close the 9 g/km compliance gap, or face fines. In terms of compliance strategy, we expect Daimler to use all three: BEVs, PHEVs and HEV/ICE-improvement in order to comply.

As of mid-2020, Daimler does not have enough EV sales to be compliant (7% PHEV and 3% BEV) but the EV sales are expected to increase in the second half of 2020 and in 2021 in order to help

the carmaker close the current gap (in July alone Daimler sold 16% EV⁵⁷). Daimler is expected to continue selling about twice as much PHEVs as BEVs in 2020 and 2021 thanks to a wide range of PHEVs. The most prominent models being the E-Class, C-Class, A-Class and GLC and to a lesser extent the GLA (2021 only). Mercedes is the only brand offering some of their PHEVs with a diesel engine. On the BEV side, the EQC SUV which has not sold well so far is expected to ramp up over the second half of 2020, along with the introduction of two new compact SUVs: the EQA and the EQB, and a full-size luxury sedan, the EQS, in 2021. The Smart brand has been converted into a purely electric brand (in joint-venture with the Chinese Geely) from January. Together, BEVs and PHEVs would account for 14% in 2020 and 20% in 2021.

However, increasing EV sales alone will not be sufficient for Daimler to comply given its wide gap to close. ICEs (including HEV) only improved by 1% from 2019 to the first half of 2020 which puts it amongst the worst carmakers in regard to the conventional CO₂ reductions (after JLR and Volvo). However, this also leaves much room for untapped ICE improvement potential, in particular hybridisation. Mercedes sales of mild hybrids will continue increasing and would at least double from the 8% in the first half of 2020. This would contribute to a moderate CO₂ reduction spread over a wide range of models. T&E modelling suggests Daimler could reduce ICE+HEV emissions by 4% in 2020 (compared to 2019), and 5% in 2021 (compared to 2020) via increased mild hybrid sales.

The carmaker could also fall back on using one of the flexibilities to comply like creating a new pool with one of the over-compliant carmakers (e.g. Volvo, FCA-Tesla, PSA, BMW or Renault) in order to ease the compliance effort (pools can be declared until the end of the year). For example, in the hypothetical situation where Daimler forms a pool with Volvo (Geely is a stakeholder in both companies), they would only need to sell a combined 16% EVs to be compliant, whereas they would sell 18% on average if they had to comply separately (and Volvo would be over compliant). In this type of situation, the sales of EVs are lower because the additional electric cars sold by the carmakers which is overcompliant (Volvo in this example) and used-up by the second carmakers (here Daimler) to close their gap without increasing the electric car sales. As a result the total number of EV sold EU wide would be reduced by around 2% in this example (close to 20,000 units).⁵⁸

As a last resort, Daimler could choose to limit the sales of the highest emitting vehicles by shifting them to lower emitting variants or to PHEVs and BEVs. T&E estimates that if Daimler were to cut the sales of the 1% of vehicles that emit the most (close to 300 g/km on average), the average CO₂

⁵⁷ ICCT (2020). Market monitor: European passenger car registrations, January–July 2020. [Link](#)

⁵⁸ Over the whole market, this decrease in EV sales would reduce the EU market share by 0.2 percentage points in this situation.

emissions would drop by 1.6 g/km. If Daimler were to shift the sales of its top three sales-weighted high emission models to PHEVs - the Mercedes G-class, GLE and AMG GT, its CO₂ emissions would reduce by 10 g/km (or 8%). This increases to 22 g/km if the models are zero emission (or 17%). The three models considered here make up 8% of Daimler's sales in H1 2020 (+6% only for the GLE, i.e. 15,600 units).

According to the European Electric Car Report⁵⁹, in July and August Daimler has been closing the gap and has registered more EVs than Tesla in Western Europe so far this year.

FCA-Tesla

The FCA-Tesla pool is expected to overcomply both in 2020 and 2021, thanks to Tesla's electric car sales. FCA has been a clear laggard for electrification due to underinvestment and thus fully relies on its pooling agreement with Tesla to comply. Without Tesla we calculate that FCA would miss the target by 17 g/km (10 g/km from the Tesla BEVs and 7 g/km thanks to the super-credits). In the scenario where FCA registers about 600,000 cars in 2020⁶⁰, the total fine would have been one billion euros.

Fiat will introduce an electric version of its flagship 500 model towards the end of 2020, but the sales are only expected to really take off in 2021 (around 1% of sales in 2020 and 4% in 2021). This model will meet the existing strong competition in the electric city car segment with the Renault Zoe, Peugeot e-208 and electric Mini. This is the only BEV offered by FCA in 2020 and 2021. For PHEVs, Jeep will start selling the Compass and Renegade PHEV models in 2020, but the sales are only expected to ramp up in 2021. This would amount to about 3% PHEV sales in 2020 and 6% in 2021.

Over the first half of 2020, Tesla represented 13% of the combined FCA-Tesla sales which is enough for FCA-Tesla to comply. In 2021, Tesla will start selling BEVs produced in Europe with the production of the Model Y in the new Berlin factory (official date 1st July 2021). In the meantime, given that Model 3 faces growing competition on the European market and that Model Y would only be delivered in large volumes in 2022, we expect Tesla's sales to stay around 13% of the pool's sales (around 80,000 units in 2020 and 100,000 in 2021).

FCA's average CO₂ emissions will also be reduced thanks to the sales of mild hybrid versions of the Fiat 500 and Fiat Panda in 2020 and of the Jeep Compass and Renegade in 2021. Nonetheless,

⁵⁹ Schmidt Matthias, The European Electric Car Report. [Link](#)

⁶⁰ High estimate given that FCA registered 235,000 cars in H1 2020 and we assume that sales in H2 would be 29% higher than in H1.

over the period 2019-2021, FCA has a relatively low ICE+HEV improvement (7% over the two years versus 10% on average).

In the medium term, the planned merger between FCA and PSA will ease FCA's CO₂ compliance and the new group would likely no longer need the pooling agreement with Tesla.

Ford

Ford is a clear laggard with regards to mobility - it currently has only two models, the Kuga PHEV and Explorer PHEV- and has only sold 3% PHEVs in the first half of 2020. Aside from the Kuga, Ford's compliance thus mostly relies on ICE improvement and mild hybrids as a short term strategy while it ramps up its EV production.

Ford improved the emissions of its ICEs+HEVs from 2019 to 2020 by a staggering 16%, notably thanks to a high level of hybrid sales (12%, mainly the Ford Puma) but also due to stalling progress over the previous years, allowing the carmaker to benefit from a lot of untapped efficiency gains.

The remaining gap of 1.4 g/km for 2020 is likely to be closed by selling 5% PHEVs and 13% hybrids over the full year. In 2021, Ford will launch the Mach-E BEV SUV, which will bring additional competition to the Tesla Model Y in the D-SUV segment and further help the carmaker reach its targets.

In 2019 Ford and Volkswagen Group have announced a partnership on electrification and automation. Ford will become the first other automaker to have access to Volkswagen's electric vehicle architecture and Modular Electric Toolkit (MEB) platform to deliver a high-volume zero-emission vehicles in Europe starting in 2023⁶¹. It expects to deliver more than 600,000 European vehicles using the MEB architecture over six years which will aid the carmaker's compliance post-2020.

Sales of Kuga PHEV have started off very rapidly in the second half of 2020 and according to some experts, the model could end the year as the top selling PHEV⁶².

⁶¹ Ford Media, June 2020, Ford, Volkswagen sign agreements for joint projects on commercial vehicles, EVs, autonomous driving. [Link](#)

⁶² Schmidt Matthias, The European Electric Car Report. [Link](#)

Hyundai-Kia

Hyundai and Kia have not announced the formation of a pool to this date, but are part of the same parent group. Their compliance strategy is very similar and we can reasonably analyse their compliance strategy together. Battery-electrification is their chief compliance strategy, aided by mild hybridisation of ICE.

Both carmakers have high sales of EVs in Europe accounting together for 11.5% EVs, and both have a strong focus on BEVs, with the Ioniq, Kona, e-Soul and e-Niro accounting for 7.7%. The BEV sales place them in a strong position on the EU EV market, but they still face a high gap because their mass-adjusted target is comparatively strict at 94 g/km (vs. 96g/km on average, only PSA and Renault have a lower target)⁶³.

Thanks to the European regulation, Hyundai-Kia had to ship many more EVs to Europe rather than focusing on their domestic market. From January to July 2020, the EV share in South Korea was only 2% (four times lower than in Europe)⁶⁴ and Kona EV's sales were down 45% year on year in its home country. This is another salient illustration of the effectiveness of the CO₂ targets. Hyundai now has a factory in the Czech Republic where it is building the Kona EV for European buyers which could help the carmaker deliver more vehicles.

No further BEVs are planned by 2021 and PHEV sales rely on the sales of the Ceed and Xceed models, plus the Sportage and Tucson later in 2021. We expect Hyundai-Kia's EV sales to increase in the second half of the year to reach 14% over the full year (10% for BEVs) and 17% in 2021 (11% BEVs).

Hyundai-Kia is expected to perform well on mild hybrids as they could reach close to half of their European production in 2021, only second behind Jaguar-Land Rover.

PSA

Despite being late to enter the EV market, the PSA Group is already compliant in the first half of the year and is the only carmaker to significantly over-comply (about 3 g/km). The reason why it can over-comply with their 2020 target despite the low EV shares lies in their ICE strategy. Fuel efficiency of its engines improved significantly in the last year as it decreased by 8% since 2019 (only Ford has done better due to poor performance in 2019). This can also be explained by the

⁶³ From H1 2020 data, Hyundai's gap is much higher than Kia's (7 g/km vs. 3g/km) which is mainly due to the fact that the average emissions of Hyundai's ICEs is 5g/km higher than for Kia.

⁶⁴ CleanTechnica, August 2020, *Tesla Model 3 & Hyundai Kona EV Have 54% Of South Korean EV Market*. [Link](#)

replacement of less efficient GM engines on the Opel brand with more efficient PSA ones enabling the group to streamline the use of the same platform for all powertrains and reap far reaching benefits from the high investments on the engine improvement.

PSA EV sales have reached 6% in the first half of 2020 (3.7% BEVs and 2.6% PHEVs) mainly thanks to the first serious generation of PSA BEVs arriving late 2019 with the Peugeot e208, its SUV variant the e2008, its Opel variant the Corsa-e and the DS 3 Crossback⁶⁵. No new models are expected in 2020, but 2021 would see the arrival of the e-C4 and Mokka-e BEVs. On the PHEV side, the carmaker offers the 508, 3008, DS7 Crossback and Grandland X and two models are expected to come to the market by 2021: the C5 Aircross in the second half of 2020 and the 308 in 2021. PSA is one of the only OEMs (together with Ford, Toyota-Mazda and JLR) that does not use up all their super-credits in 2020 (about 3 g/km left).

In 2021, PSA is expected to sell about 10% EV, which will consume the remaining super-credits. Thanks to the high WLTP-NEDC uplift⁶⁶ and remaining super-credits, the carmaker pool is over-compliant by more than 6 g/km in 2021. Indeed, PSA has the highest WLTP-NEDC uplift (28%), which means that even though PSA has the lowest target in 2020, its WLTP-correlated target for 2021 is slightly above the average of 119 g/km (WLTP). For a carmaker that sells lighter cars than the other pools this is an advantage⁶⁷. This high WLTP-NEDC uplift gives more room for the carmaker to reduce this gap in 2021 and lower even more the ICE emissions than what has been modelled here. In late 2021, PSA could even introduce the Peugeot e-1008, a new mini-SUV BEV below the e-2008 model.

In short, PSA's compliance strategy is a combination of modest electrification and better ICE performance in 2020 and 2021. Importantly, the group can reach their target comfortably thanks to the WLTP-NEDC uplift. It is possible that PSA could form a pool with carmakers that are further away from the target in 2021.⁶⁸

⁶⁵ The previous Opel Ampera-e (copy of the GM Volt and Bolt) has barely been sold seriously in Europe and the iOn and C-zero were also based on very early EV technology.

⁶⁶ PSA has the highest WLTP-NEDC uplift amongst the carmaker pools (28% vs. an average of 21%). If this uplift is reduced in 2021, could be in a situation of a carmaker gaming the regulation.

⁶⁷ Average mass in 2019, according to EEA registration data, the three pools with the lighter cars are: PSA at 1,284 kg, Renault at 1,300 kg and FCA-Tesla at 1,317kg. The carmaker Fiat alone however sells lighter cars than the PSA Group (1,191 kg).

⁶⁸ PSA also recently unveiled two new, dedicated electric-car architectures, including the eVMP to cater for C- and D-segment EVs which will benefit both PSA and FCA under their new merged company Stellantis. Forbes, July 2020, Traditional European EV Players Under Threat From Surging Peugeot. [Link](#)

Renault-Nissan

As part of the Renault-Nissan-Mitsubishi⁶⁹ Alliance, Renault and Nissan have very similar compliance strategies relying on an early move on battery electrification and are expected to close the gap of less than 2 g/km remaining in the second half of the year. Together, they are expected to reach 12% BEV sales in the first half of 2020 (and 2% PHEV sales) thanks to two flagship electric cars that have been amongst the earliest EVs on the market; the Renault Zoe (best selling BEV model in H1 2020 with 35 thousand units) and the Nissan Leaf. During the first half of 2020, around half of the Renault Zoes were sold in France.

In 2021, both carmakers are expected to reach 14% EVs (11% BEV) with Renault starting to sell mass-market PHEVs such as the Captur, Kadjar and Megane (Renault PHEV sales are expected to ramp up from about 500 units in the first half of 2020 to 15,000-20,000 units in the second half of the year), while Nissan starts selling the Qashqai PHEV and BEV version Ariya in addition to the Leaf. The Renault Twingo, which is available from summer 2020, would bring an additional BEV to the portfolio of the Renault-Nissan Alliance as well as the Dacia BEV based on the Renault Kwid. Hybrid production is also expected to increase from 2020 to 2021 with the new Renault Clio hybrid further helping the carmakers to comply.

Renault's compliance strategy relies almost entirely on the Zoe in 2020 as the carmaker is only expected to sell a limited number of Twingo BEVs and Capture and Megane PHEVs. Based on compliance modelling and the IHS Markit light duty production forecast, T&E expects Renault to sell about 100,000 Zoe in 2020 - or a tenth of the entire EU EV sales fleet in that year - and the same volume in 2021. This is about 80% of Renault's forecasted EV sales for 2020 and half of their EVs in 2021. We calculate that without the Zoe, Renault would increase its average CO₂ emissions by 15 g/km in 2020, which would make the carmaker miss its target by a very large margin (12 g/km or 13%). Out of the 15 g/km, 5.4 g/km are 'lost' from the lower effect of the super-credits. This very important difference also comes from the fact that without the Zoe Renault only obtains 2 g/km from super-credits. In this situation, the total EU average CO₂ would increase by 1.6 g/km, which shows the great importance that one single BEV model can have on the market.

Toyota-Mazda

The Toyota-Mazda pool is the only group that focuses its compliance strategy solely on hybrids. Toyota-Mazda easily reaches the targets by maintaining around 55% hybrid sales in 2020 and

⁶⁹ Mitsubishi compliance strategy is not presented in this report given that the carmaker is expected to leave the European market (see link below) but it could be underlined that for the moment Mitsubishi's compliance strategy relies exclusively on high PHEV sales (Outlander) with 25% in the first half of the year. European Autonews, August 2020, *Mitsubishi to halt Outlander, ASX shipments to Europe, source says*. [Link](#)

2021 and slowly starting to offer new BEVs and PHEVs. Toyota-Mazda pool offered the Prius PHEV in the first half of 2020 in relatively low numbers (0.2% of sales) and will add the RAV4 PHEV, Mazda MX-30 BEV and Lexus UX BEV in its EV portfolio in the second half of the year 2020

Toyota-Mazda compliance strategy is a good example of what the compliance strategy of EU carmakers would have looked like absent the breakthrough in electric vehicle technology. It is also the clearest proof that any difficulties EU carmakers may now be facing cannot be explained by a lack of affordable fuel efficiency technologies but by poor planning or indeed carmakers hope that EU regulators would again delay or scrap the targets as Donald Trump did in the US.

For the post-2020 CO₂ targets, Toyota has little flexibility with the hybridisations strategy given that the carmaker has already pushed their sales of hybrids to a significant extent that the full hybridisation of the sales will not be sufficient to hit the 2025 target. It will thus also have to significantly ramp up the sales of EV to reach to 2025 which they have been negatively advertising in the past years⁷⁰.

Volvo

Volvo's compliance strategy relies entirely on high sales of plug-in hybrids which have already reached 23% of the sales in the first half of 2020, placing the manufacturer as the leader for EV share of sales. PHEV models offered by the carmaker are the following: V60, V90, Polestar 1 and SUVs XC40, XC60 and XC90. Thanks to this Volvo is already compliant in the first half of the year 2020.

Polestar, which is the electric car performance brand of Volvo, has started delivering the Polestar 2 in August 2020. The Polestar 2 is the first BEV from the auto company and competes directly with Tesla's Model 3. It is assumed that deliveries would account for 10,000 units in 2020. The Polestar 2, together with the new XC40 BEV expected in the second half of the year, BEVs could account for 2% of the sales in 2020 and 6% of the sales in 2021 while the share of PHEVs would stay fairly constant in 2020 and 2021 (around 24%). With BEVs and PHEVs together, Volvo would reach 26% EV sales in 2020 and 30% in 2021.

Volvo is also the carmaker with the heaviest vehicles and thus has the most lenient target of 111 g/km, which makes the target all the more easy to reach. In our compliance modelling, it is the only carmaker which doesn't improve ICE efficiency from 2019 to 2020 (+1% gCO₂/km), although we assume ICE improvements from 2020 to 2021 to be in line with the market average as Volvo can easily fit mild hybrid or other cost-effective technologies.

⁷⁰ Electrek, February 2019, *Toyota produces shameful anti-electric vehicle ad to sell Corolla hybrid*. [Link](#)

Volvo's compliance strategy which focuses on PHEVs, benefits from a very generous treatment towards reaching the targets (see PHEV are 'fake EVs' in section 4.5). If their PHEV sales were accounted for in a realistic way under WLTP emission test, then their efforts would have to be much higher. For example if the PHEVs emissions from Volvo would be double of what they are double (88 g/km instead of 44 g/km), then the average emissions would increase by around 16 g/km (9 g/km from emission increase and an additional estimated 7 g/km from the loss of super-credits).

Volkswagen Group

In the near term, the Volkswagen Group's compliance strategy is relatively balanced between BEVs, PHEVs and mild hybrids; although in the medium and long term, the world's largest carmaker places a strong bet on BEVs with the launch of the dedicated MEB platform in 2020.

The Volkswagen Group needs to significantly improve its CO₂ performance during the second half of the year to close the compliance gap of 5 gCO₂/km (third worst after Daimler and JLR). The main strategy to close this gap now relies on the EV models produced on the MEB platform. The long-awaited I.D.3 -Volkswagen's flagship Golf-sized BEV- is expected to be delivered in high volumes starting in autumn 2020 alongside similar models from its sister brands (Skoda Enyaq and Cupra el-Born) and the SUV version, the ID.4. The carmaker is expected to go from 7% EV sales in the first half of 2020 (4% BEV and 3% PHEV) to 10% in full 2020 (6% BEV and 4% PHEV). This places the group at the same level as the market average for EV sales but offers a comfortable **market leader position for the volume of EV sales with more than 250,000 units**. Importantly the carmaker has reported that it plans to rely on internal company fleet sales of EVs as an additional compliance help and plans to reach 92 gCO₂/km with 35% EV and hybrids⁷¹ internally.

The I.D.3 is an important part of the carmaker's compliance, however the mass production of the vehicle has been hampered by difficulties over the car's software. To compensate this and meet the growing demand, the carmaker has announced it will increase the production of the eGolf in Dresden until Christmas (after which the production line will be converted to the production of the ID.3 in January⁷²).

In 2021, EV sales continue to increase with the ramp-up of the MEB-based models along with new models like the ID.5, the Q4 e-tron, and many PHEVs derived from successful ICE models like the Passat, Octavia, Golf, Leon, A6, Cayenne and Tiguan. This allows the group to beat the market

⁷¹ Ralf Brandstätter (CEO of Volkswagen brand), LinkedIn post from September 2020. [Link](#)

⁷² Electrive, August 2020. BMW expands i3 production while VW looks to the e-Golf. [Link](#)

average and reach 17% (10% BEV and 7% PHEV), and allows Volkswagen to land right on its 2021 target. The Volkswagen Group strengthens its leading position for volume of EV sales with more than half a million EV units in 2021, or 30% of the expected EV market.

The group's ICE+HEV average is expected to improve by 4% between 2019 and 2020 and again a further 4% the following year mainly thanks to increasing sales of mild hybrids (notably the Golf hybrid).

Modular Electric Toolkit (MEB) platform

Volkswagen Group's strategy to become a leading electric car manufacturer relies on its electric vehicle architecture and Modular Electric Toolkit (MEB) platform. MEB is the lower cost mainstream vehicle platform which is the basic building block for 50 different models Volkswagen Group promises by 2025. The MEB platform is operated under five plants in Europe (four in Germany and one in the Czech Republic). Volkswagen is licencing the platform to other carmakers to share the risks and amortise costs, in the hope that the MEB-based chassis becomes the industry standard allowing Volkswagen to dominate the aftermarket⁷³. At least 6 models will be produced in 2020/21, amounting to 350,000 BEVs.

We calculate that without the ID.3 and other MEB-based vehicles⁷⁴, the Volkswagen Group's average emissions increase by around 6 g/km in 2020 and 11 g/km in 2021, making the carmaker miss its target by a large margin⁷⁵. Out of the 6 g/km, 2 g/km are 'lost' from the lower effect of the super-credits (for 2021, it is assumed the group has used-up all super-credits in 2020). Without these BEVs, Europe's BEV share would drop by close to 2 percentage points (from 8% to 6%) in 2021 (0.7pp in 2020) and the average EU CO₂ emissions would increase by 1.5 g/km in 2020 and 3 g/km in 2021.

Pooling with SAIC (MG Motors)

⁷³ The vehicles built on the electric chassis are also expected to be profitable by 2021 at the latest. One person familiar with the strategy said VW has cut the number of hours needed to build cars on the platform dramatically, achieving savings of 35 per cent in production costs. Financial Times, January 2019, *Volkswagen's plan to kill off Tesla*. [Link](#)

⁷⁴ ID.3, ID.4, ID.5, Seat el-Born, Skoda Enyaq and Audi Q4 e-tron.

⁷⁵ T&E expects Volkswagen to sell 70,000 to 80,000 MEB-based BEVs in 2020 and between 210,000 and 250,000 units in 2021 (depending on the speed of the recovery). ID.3 alone could account for 50,000 units in 2020 and 90,000 units in 2021. This is around 40% of Volkswagen Group's forecasted BEV sales for 2020 and two thirds of 2021 BEV sales (or around a quarter of the group's EV sales in 2020 and 40% in 2021). The upper assumption has been used in the example here. Financial Times, July 2020, *VW's electric ID.3 model draws flood of orders from new customers*. [Link](#)

It was announced in mid-September 2020 that Volkswagen Group will pool with the Chinese auto manufacturer SAIC Motor and its subsidiary MG Motor. Both automakers have run a joint venture together in China (SAIC Volkswagen) since 1984 and currently cooperate on building MEB models at a dedicated factory in Anting. This agreement will allow Volkswagen Group to benefit from the sales of the MG ZS, a small BEV SUV that is offered in markets such as the UK, Norway and Netherlands⁷⁶ as well as the MG5 compact station wagon⁷⁷.

MG Motors sold 9,100 cars in H1 2020 at an average of 72 g/km (NEDC) with 40% of its EEA sales BEVs (3,600 units). Although the inclusion of MG Motors in the scope increases the number of BEVs sold by the Volkswagen Group by 8%, the total volume increase is not significant, less than 1% (0.8%). Overall this has a limited impact on the Group's compliance over the first half of the year as it brings down the CO₂ emissions by 0.3 g/km (from 115.6 to 115.3, or a 0.3% decrease). However, as part of the agreement that was just agreed with Volkswagen, we could see MG ZS sales ramp up over the second half of the year to ease Volkswagen's compliance (the model is expect to launch "soon" on the German, Spanish and Italian markets⁷⁸).

However, the picture changes significantly for the expected UK-only car CO₂ regulation from 2021. 84% of MG Motor's registrations were in the UK during the first half of 2020 (7,700 units, including 2,200 BEVs). Volkswagen Group's emissions in the UK are the highest amongst all EEA countries (122.4 g/km NEDC) and the inclusion of MG Motor sales (at an average of 89 g/km) increases the overall volume by 5% and thus decreases the average CO₂ emissions by 1.7 g/km (or 1.4%). With Brexit looming, the pool makes sense for Volkswagen to ease their target in the UK but also provides the carmaker with an additional safety net in the case of a second COVID19 lockdown.

Jaguar-Land Rover

Jaguar-Land-Rover benefits from a derogation, which the UK fiercely fought for when it was still an EU member, that allows the carmaker to have a much higher target of 132 g/km (based on a CO₂ reduction of 45% compared to its 2007 level of 240g/km). Nonetheless, it is the carmaker which has the biggest gap to close during the second half of the year (13 g/km). To achieve this JLR is expected to rely chiefly on PHEV sales and flexibilities.

As regards PHEVs, JLR already offers the Range Rover and Range Rover Sport models but will significantly increase the supply in the second half of the year with six new models: Evoque, Velar

⁷⁶

⁷⁷ H1 2020 MG 5 sales: 2,200 in the UK, 800 in Norway, 300 in the Netherlands, and less than 100 in France, Belgium and Austria

⁷⁸ Instant, September 2020, MG will be launched in Germany in European expansion. [Link](#)

F-Pace, E-Pace, Defender and Discovery. The BEV portfolio is currently limited to the I-Pace and would widen to the J-Pace and XJ in 2021. If sold in sufficient numbers, JLR would comply by selling 15% EVs in 2020 (6% BEV, 9% PHEV) and 18% EV in 2021 (6% BEV and 12% PHEV).⁷⁹

On top of benefiting from a derogation that allows to sell higher emitting vehicles than what the mass-adjusted target would, the carmaker is expected to be -together with Daimler- the highest beneficiary from the three main flexibilities in 2020 (95% phase-in, super-credits and eco-innovation). Their total contribution would amount to more than 16gCO₂/km on average.

JLR ICE (including HEV) emissions have actually increased by 1% from 2019 to the first half of 2020. This means there is a strong level of untapped potential for JLR to reduce emissions from ICEs and HEVs in the second half of the year, especially by shifting a higher portion of the diesels to HEVs.⁸⁰ As a last resort JLR could choose to achieve this by cutting the sales of the highest emitting vehicles, or shift the sales of the highest emitting vehicles to lower emitting vehicle types and segments.

⁷⁹ IHS Markit assumes slightly lower levels of EVs production (13% in 2020 and 17% in 2021), which means that JLR could have to prioritise more sales of EVs over ICE.

⁸⁰ As a result JLR could reduce ICE+HEV emissions by 4% in 2020 compared to 2019 but this would require the carmaker to reduce the emissions of these vehicles by 8% in the second half of the year compared to the first half. In 2021 ICE+HEV improvement is at 5%.

6. Conclusion

6.1 EU car CO₂ standards: modern day industrial policy

After years of stagnating (even worsening) CO₂ performance and sluggish sales of electric cars, early 2020 has marked the beginning of the new era in Europe, the Age of an Electric Car. Driven by the entry into force of 2020/21 Car CO₂ emission standards, European automotive industry invested over EUR 60 billion⁸¹ in 2019 alone - reversing the trend with China - in order to bring over a hundred new plug-in models to the European market. As this report shows the consumer demand followed, with plug-in sales surging to over 8% of new car sales in the first half of 2020 despite the COVID19 pandemic. Europe even saw its electric car sales eclipse China in the first quarter of 2020⁸². This means the EU car CO₂ standards are working and are driving the transformation of the EU car industry.

Soaring sales have been observed since January 2020, long before the post-COVID19 stimuli in Germany or France helped continue the momentum. Electrification is now the industrial strategy of many carmakers, including the VW Group, the Renault-Nissan-Mitsubishi Alliance, BMW and Hyundai-Kia. Starting as one of Europe's climate regulations, the 2020/21 **EU vehicle CO₂ emission standards are the modern day example of an excellent industrial policy** that pushes the car industry - albeit at the last minute - to invest and supply future-proof emissions-free technologies in Europe. Today's investments are tomorrow's jobs, and we already see dozens of battery gigafactories launching in Europe to be close to the growing electric vehicle market.

It is becoming clear that carmakers will be able to comply with the 2020/21 CO₂ standards. The PSA Group, Volvo, the FCA-Tesla pool and BMW are already compliant based on the H1 2020 sales data, while Renault, Nissan, the Toyota-Mazda pool and Ford have a mere 2 g/km gap left. One of the two laggards as of H1 2020, Daimler, has since been rapidly accelerating the sales of plug-ins and hybrids and is expected to comply by the end of the year. MEB-based models will also help the VW Group close the gap. With the compliance being likely, Europe will see its **electric car sales** reach a sizable **10% by the end of 2020** (compared to only 3% in 2019), and an even more impressive **15% share in 2021**. As plug-in cars enter the mass market, it is also clear that efforts must accelerate to roll-out seamless slow and fast charging across Europe and to transform diesel-based supply chains and skill sets.

Importantly, the impressive electric car sales observed in the first half of this year mask many failures to cut vehicle CO₂ emissions to date as well as strong demand (something that

⁸¹ Transport & Environment (2020). Can electric cars beat the COVID crunch? [Link](#)

⁸² Bloomberg, April 2020, *Europe beats China in electric vehicle sales, study shows*. [Link](#)

automakers have said was not the case for years). Since no CO₂ reduction from new cars beyond 2015 was required in 2016-2019 (following the early achievement of the 2015 target in 2013), the fuel efficiency of the millions of new cars sold in those years was deteriorating. This has meant that the new passenger car CO₂ emissions actually increased for three years in a row in 2017, 2018 and 2019. Waiting for 2020 to introduce clean technologies, carmakers instead profited from lucrative but high emitting SUVs, the addiction that is today the second largest contributor⁸³ to the rise in CO₂ emissions globally. Thousands of premium cars with CO₂ emissions above 200g/km have already been sold in 2020, including Mercedes G-CLASS, Ford Mustang, Porsche sport cars, Jeep Wrangler, Land Rover Defender and Audi Q8. Last but not least, around half of the plug-in sales today are plug-in hybrid cars that often emit up to 3 times more CO₂ in real-world driving than the lab tests show, so these must be phased out in the 2020s in favour of full electric emissions-free models.

Crucially, the pace of CO₂ reductions is far too slow to reach zero emissions transport by 2050 and meet the goals of the European Green Deal, which promises a path towards zero emissions mobility from 2025. For the entire car fleet to be zero emission in 2050, the **last new car with any CO₂ emitting engine must be sold no later than 2035**⁸⁴. This means that not only diesel and petrol cars, but gas-powered and (plug-in) hybrid models need to be phased-out. Such transformation towards zero emissions mobility will require enormous effort, support and resources. As private capital is drying up and the recession settles, public funding is imperative to fill the gap and ensure investments continue. These should support future-proof zero emission technologies including direct electrification, batteries and green hydrogen. Poignantly named, the **Next Generation EU** recovery programme is a good start, but to be successful it should **resist opportunistic calls to spend money on old generation fossil technologies** such as natural gas, oil or diesel.

6.2 BUT: EV market stagnation likely after 2022

The expected plug-in sales in 2020/21 underline the **inadequacy and weakness of the 2025 and 2030 car CO₂ targets** set recently, and there is a real danger that the supply of electric cars will stagnate or even dry up from 2022 onwards. Sales of electric cars are booming in 2020 and 2021 and reach 15% in Europe but would taper off after 2022 under the current car CO₂ standards.

The current car CO₂ regulation sets a 15% CO₂ reduction in 2025 and 37.5% in 2030 versus a baseline of around 115 g/km WLTP in 2021 which would translate into the EU fleet-wide target (ie.

⁸³ IEA (2019). Growing preference for SUVs challenges emissions reductions in passenger car market. [Link](#)

⁸⁴ Transport & Environment (2018). Roadmap to decarbonise cars. [Link](#)

before mass-adjustment) of **98 g/km in 2025** and **72 g/km in 2030** (WLTP). No targets are currently set for after 2030, but the sales of electric cars would have to increase sharply to reach the commitments of the Paris Climate Agreement. The road transport sector needs to be zero emission in 2050 and - given the average retirement age of light-duty vehicles of around 15 years - all new cars and vans must thus be zero emissions no later than 2035.⁸⁵

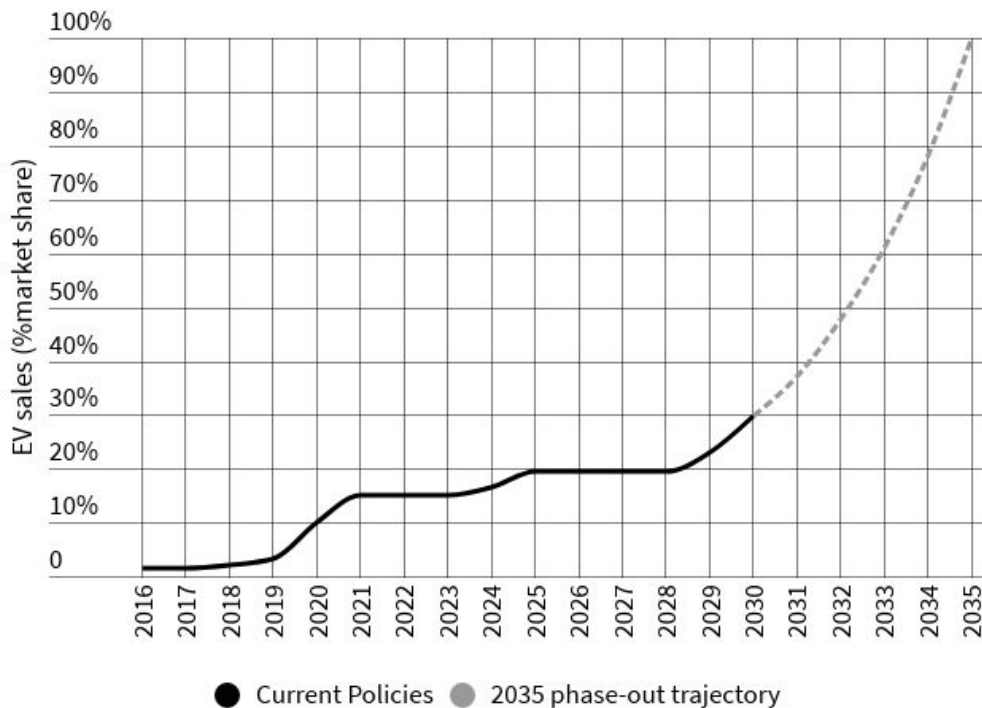
Under the current regulation, an average of around 20% EV sales would be sufficient to meet the target in 2025 and 30% in 2030⁸⁶, see Figure 27. In this scenario, the European EV market would grow by only 7% annually on average between 2021 and 2025, and another 9% between 2025 and 2030 - just as the electric cars reach price parity with conventional models and can accelerate much faster. Then it would have to surge to an annual increase of 27% between 2030 and 2035 to reach a Green Deal comparative scenario⁸⁷.

The 2025 sales **benchmark** for zero and low emission cars is only 15%, likely to be overachieved by some carmakers years earlier. Overshooting this benchmark by more than 5% allows carmakers to reduce their 2025 CO₂ target by up to 5%. This full 5% bonus on the CO₂ target would be reached if a carmaker sells around 25% plug-ins or 20% BEV in 2025 (thus reaching a 20% ZLEV share). This is a likely scenario given the current market trends, meaning that some carmakers will need to **reduce CO₂ emissions by a mere 11% over 2025-2029**. Selling 25% EVs in 2025 also means that the emissions from internal combustion engine cars could even increase by 1% per year, which is a drastic set back on the regulation.

⁸⁵ Joint letter from September 2020. *Subject: Call on the European Commission President to set an EU-wide end date for sales of internal combustion engine cars and vans by 2035.* [Link](#)

⁸⁶ Main assumptions: annual ICE improvement of 1.5% between 2021 and 2025 and 1% between 2025 and 2030, BEV/PHEV split: 60%/40% in 2025 and 65%/35% in 2030. No contribution of the ZLEV bonus, 4 g/km of eco-innovation credits in 2025 and 5 g/km in 2030.

⁸⁷ For comparison between 2019 and 2021, the EV market share more than doubled every year (+110% annual growth).



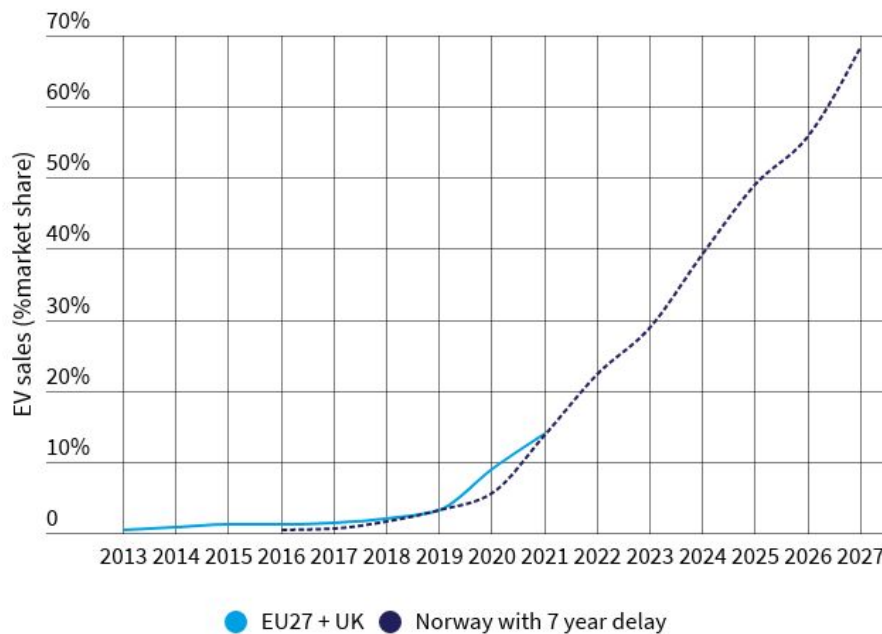
Current Policies trajectory is based on the current CO2 emissions reduction targets of **-15% in 2025 and -37.5% in 2030.**



Figure 27: European EV sales under the current car CO₂ regulation

If the current regulation remains, the electric car surge ends in 2021 and tapers off until 2029, meaning little progress required up to 2030 and undermining efforts to ramp up mobility just as electric models become affordable and the transition to zero emissions mobility must accelerate. The current regulatory trend for the adoption of electric cars is not in line with typical **technology adoption curves** (s-curves) which reflect the speed of new technology adoption. During the 2020s, electric cars will gradually become cheaper to buy than their ICE equivalents, at which point the sales of electric cars would quickly replace those of their polluting counterparts. Moreover given the climate urgency and the need for rapid climate action in the transport sector, early action is preferable to delaying action to the next decade. In the light of this a cost-effective, ambitious and climate-compatible trajectory needs to be set.

Norway has reached 3% EV sales in 2012, which is 7 years before the EU has reached the same level (in 2019). Two years after having reached the 3% market share, Norway was selling around 14% EVs, which is also what we expect the EU to achieve in 2021, or two years after having reached 3%. Given that from 2016 to 2021 the EU seems to be following the same EV uptake path as Norway, we could extrapolate this trend later in the 2020s by translating the Norwegian EV sales onto the EU market with a seven year delay. As a result, if the EU was to continue following the same trend as Norway, the EU market would reach 50% EV sales in 2025 and 70% in 2027 (see Figure 28).



EU EV market share for 2020 and 2021 is forecasted based on T&E modelling of carmakers compliance with the car CO2 emissions targets.



Figure 28: EU and Norway EV sales compared

The current design of the car regulation, whereby targets kick-in in five year intervals with no emission reductions required in between, is suboptimal from the climate point of view. This leads to a situation where carmakers are way off target until the last minute, and their profit strategy to date meant that the per km emissions actually increased prior to the entry into force of the

regulation. A much more effective design would be to set **annual CO₂ reduction targets per OEM** based on the 2030 trajectory as is the case in the United States or China. 3-year averaging or banking & borrowing credits can be introduced for flexibility. T&E's back-of-the-envelope calculation shows that solely by **setting an intermediate target between 2025 and 2030 would result in a cumulative CO₂ saving from new car sales of 5-8% by 2030**; an important contribution to raising the EU's overall 2030 ambition.

The EU should strengthen the car CO₂ targets in 2025-2030 to increase the supply of electric vehicles across Europe, their adoption by consumers and accelerate the transition to emobility in line with cost-effective technology uptake in the 2020s. **The revised CO₂ standards should set more ambitious annual targets from 2025 onwards to achieve 100% zero emission sales in 2035.**

6.3 What else is needed for a smooth uptake of EVs

EU car CO₂ standards are highly important but by far not the only mechanism needed to bring our mobility system to zero emissions. Many other measures across the field of fiscal, spatial and infrastructure policies are needed to bring about a coherent change. The following points focus on a number of them, with detailed recommendations available in other T&E publications.

High-mileage fleets

Electrifying public and corporate fleets is already cost effective today. Often doing more than 20,000 km a year, company cars, delivery vehicles, taxi and ride-hailing services base their vehicle choice on the total cost of ownership basis, not purchase price. They are also often leased. Such fleets can electrify fully by the late 2020s, creating a pool of affordable second hand plug-in cars to benefit the wider population.

The European Commission should set separate **zero emission vehicle (ZEV) mandates for large corporate and public fleets** as done in California. Any entity with a fleet of over 20 vehicles should be required to **go zero emission no later than 2030**. The EU Clean Vehicles Directive should be amended and expanded to include targets on private fleets.

Charging infrastructure

Ubiquitous and seamless charging is crucial to enable emobility, so increasing penetration of electric cars should go hand in hand with more and better roll-out of charging points. Priority should be given to private and public parking places in buildings (workplace and residential) with the aim to have them pre-fitted with cables by 2035, and business premises such as shops and

restaurants. Charging hubs should develop in cities to enable fleets, taxi's and shared e-cars to top up without difficulty, while the entire EU road network should be sufficiently covered by 2025.

In September 2020, the European Commission has released a communication putting forward seven flagships⁸⁸ on which member states should focus in their recovery and resilience plan investments to ensure a successful green recovery. Accelerating the deployment of charging infrastructure is one of the flagships whereby the Commission aims to build one million public charging points in 2025 (out of the three million needed by 2030). Member states should take note of this flagship and put forward ambitious plans for infrastructure deployment in line with the expected electric car stock in 2025 and 2030 (aligned with higher post-2020 car and van CO₂ standards).

The Alternative Fuels Infrastructure Directive (AFID) should be urgently reviewed - no later than early 2021 - and turned into a **Zero Emissions Infrastructure Regulation** setting mandatory requirements on national governments and commercial properties alike. For more T&E's recommendations on the revision of AFID, see T&E's RechargeEU report⁸⁹.

The revision of the AFID should set in legislation the European Commission's ambition to reach one million public chargers in 2025 and three million in 2030 by placing **binding targets at Member State level** on the number of public chargers. Such country targets should be based on several country-specific parameters like the expected volume of EV sales, the access to home and work charging and the average distance driven. Some flexibility can be granted to Member States by allowing (ultra)-fast to count for more than one.

The above Member State targets should be complemented by additional metrics and requirements for the TEN-T Core and Comprehensive network and at the level of urban areas to ensure the infrastructure develops smoothly and in line with the local needs. But such additional measures alone (i.e. without the country targets) are not sufficient to ensure that the overall number of public chargers is in line with the EU Green Deal ambition because it fails to provide the necessary certainty to future EV buyers and to the emobility industry as a whole, notably for the various actors in the charging infrastructure supply chain and services.

Taxes

⁸⁸ European Commission, September 2020, NextGenerationEU: Commission presents next steps for €672.5 billion Recovery and Resilience Facility in 2021 Annual Sustainable Growth Strategy. [Link](#)

⁸⁹ Transport & Environment (2020). RechargeEU: How many charge points will EU countries need in 2030. [Link](#)

Taxation largely sits with national governments and is a powerful tool to push the EV market. On the consumer side, outdated vehicle taxes should be replaced with **bonus-malus CO₂ taxation** whereby higher taxes on the polluting vehicles support the bonuses given for the purchase of electric cars. This is a fiscally sustainable way to support the growing sales of plug-ins while at the same time shift the behavior of consumers away from high CO₂ emitting models.

Corporate fleets and company cars are the prime market to electrify and are fiscally driven. Member states should follow the example of countries such as the UK and set **low or zero benefit-in-kind taxes for zero emissions company cars**, while providing VAT reductions to employers who offer those to their employees.

Cities

Cities are at the forefront of climate action and especially post-COVID, the resolve of city dwellers⁹⁰ to have pollution-free streets and ban polluting vehicles has strengthened. There are simply too many privately-owned cars clogging cities today, which - when not stuck in traffic jams - are parked unused for more than 90% of the day.⁹¹ Most mobility in cities should be done on foot, by bike, in public transport such as electric buses or trams or by other new mobility services such as e-scooters. Instead of everyone owning a car, fleets of electric cars should be shared and electrified ride-hailing and car sharing services filling the gaps. The remainder of private cars which cannot be replaced by active, public or shared mobility should be zero emissions. Cities should redesign their centres and streets to take space away from cars and make it available for people and for zero emission mobility services. Cities should **ban any car with CO₂ or pollutant emissions from circulation on their territory no later than 2030**.

EU and national recovery plans

Last but not least, the new **Next Generation EU recovery package** should enable both governments and companies to **fast track transition to zero emissions**. No public money should be spent on the old economy be it gas, oil or diesel - and EU and national programmes should target incentives for companies and people to purchase zero emissions solutions, infrastructure roll-out and investments into scaling up batteries manufacturing, motors and electronics production and car production lines upgrades.

So while the electric car is finally entering the mainstream in Europe, there is a lot to do to deliver the Green Deal and zero emissions mobility promised by the European and national politicians

⁹⁰ Transport & Environment (2020). No going back: European public opinion on air pollution in the Covid-19 era. [Link](#)

⁹¹ Transport & Environment (2017). Does sharing cars really reduce car use? [Link](#)

alike. Charging infrastructure must be rolled out faster at work, home and across business premises, while vehicles taxes designed smartly to accelerate electrification and penalise those that buy gas guzzlers. Supply chains and European workforce should be supported - not least by the new Next Generation EU budget - to make sure everyone is part of the zero emissions mobility transition. Europe cannot afford to leave anyone behind in the fossil age as it **enters the new Emobility Era.**

7. Annexes

7.1 Further methodology

Filling the gaps

In the database, about nine cars sold out of ten include the information on the New European Drive Cycle (NEDC) CO₂ value of the car registered, which leaves about one model out of ten which doesn't include an NEDC CO₂ value. To overcome this, T&E has calculated the average manufacturer brand (not pool)-specific gap between NEDC and WLTP (Worldwide harmonized Light vehicles Test Procedure) CO₂ emission values and has applied this gap to the existing WLTP value to estimate the corresponding NEDC value. When the gap is not available (only for small OEMs that are not very relevant here, e.g. Cadillac, Dodge, Aston Martin etc), then the average CO₂ of the specific subcategory (segment, body type and drivetrain) of the OEM pool was applied (only allows to cover an additional 1.6% of the data). As a result 98% of the registrations in the database have both an NEDC and WLTP value.

Super-credit

The calculation for the total value of super-credits is iterated to account for the difference in EV sales between the full year 2020 and the first half of the year. The share of PHEVs below 50g/km is 87% and the average NEDC CO₂ of PHEVs under 50 g/km is 38 g/km vs. 42 g/km on average for all PHEVs whereas PHEVs above 50g/km are on average 67 g/km. All of JLR's PHEV were above 50 g/km during the first half of 2020 (average 69 g/km).

Registrations and CO₂ data may be retrospectively updated by some of the national type approval authorities which could change the current CO₂ values obtained for the first semester of 2020. Therefore discrepancies can be observed between our dataset and official registration data when published mid-2021.

7.2 Manufacturer pools

For this report, the definition of pools according to the European Commission, "M1 pooling list", version of 5th of June applies. The 13 main brands or pools considered in this report are: Volkswagen Group (Audi, Porsche, SEAT, Škoda, VW), PSA (Citroën, DS Automobiles, Opel, Peugeot, Vauxhall), Renault (Dacia, Renault), FCA-Tesla (Alfa Romeo, Fiat, Jeep, Lancia, Tesla), BMW (BMW, Mini),

Toyota-Mazda (Lexus, Mazda, Toyota), Daimler (Mercedes-Benz, Smart), Volvo (Volvo and Polestar)⁹², Jaguar-Land-Rover (Jaguar and Land Rover), Ford, Hyundai, Kia and Nissan.

Mitsubishi is not considered given its intention to leave the European market and Honda and Suzuki were not considered their rather limited volumes (32 thousand and 73.7 thousand units respectively over the first half of the year).

The deadline to notify the Commission of a pool for 2020 is the 31st of December of that year. But the likelihood of another pool materializing seems low because no OEM is likely to over-achieve the targets.

According to the EEA, a niche derogation target can be asked by car manufacturers with annual EU sales between 10,000 and 300,000 vehicles. In this case, the target is a reduction of 45% compared to the 2007 fleet CO₂ average. Four OEMs are using this derogation for 2020/1: Jaguar-Land Rover, Mazda, Subaru and Suzuki⁹³. Mazda only applied for 2018 and is now forming a pool with Toyota.

7.3 Data tables

⁹² Not part of the June 4th M1 pooling list but assumed to form a pool for 2020 and 2021. Carmakers are allowed to form pools until the 31th of December to notify a pooling agreement (31th of October for open pools)

⁹³ Circabc, European Commission. C(2016) 3770 final. [Link](#)

OEM	2019			2020			2021		
	BEV	PHEV	EV	BEV	PHEV	EV	BEV	PHEV	EV
BMW	3%	6%	9%	4%	10%	14%	6%	14%	20%
Daimler	2%	2%	3%	5%	9%	14%	7%	13%	20%
FCA-Tesla	13%	0%	13%	13%	2%	16%	17%	6%	23%
Ford	0%	0%	0%	0%	5%	5%	2%	6%	8%
Hyundai	5%	1%	6%	12%	2%	14%	13%	5%	18%
Kia	3%	3%	6%	7%	6%	14%	9%	8%	17%
Nissan	9%	0%	9%	12%	0%	12%	13%	2%	15%
PSA	0%	0%	0%	4%	3%	6%	6%	5%	10%
Renault	3%	0%	3%	9%	3%	12%	10%	4%	14%
Toyota-Mazda	0%	0%	0%	1%	1%	2%	1%	2%	3%
Volvo	0%	10%	10%	2%	24%	26%	6%	24%	30%
VW	1%	1%	2%	6%	4%	10%	10%	7%	17%
JLR	5%	5%	10%	6%	9%	15%	6%	12%	18%
Average	2%	1%	3%	6%	5%	10%	8%	7%	15%

Scope: European Economic Area (EEA), same as the EU car CO2 regulation

Source: Historic EEA data for 2019 and T&E in-house modelling of OEMs compliance for 2020 and 2021, partly based on registration data from the first half of 2020 (JATO Dynamics)

Figures may not match because of rounding

Figure 29: EV share of sales per OEM from 2019 to 2021

OEM	NEDC (g/km)	WLTP (g/km)	BEV (%)	PHEV (%)	HEV (%)
BMW	118	142	4%	9%	3%
Daimler	129	147	3%	7%	8%
FCA-Tesla	107	128	13%	0%	6%
Ford	108	131	0%	3%	12%
Honda	121	145	1%	0%	23%
Hyundai	114	130	9%	2%	13%
Kia	110	127	7%	6%	10%
Mitsubishi	110	134	0%	25%	0%
Nissan	109	129	10%	0%	0%
PSA	96	124	4%	3%	0%
Renault	104	121	8%	0%	0%
Toyota-Mazda	100	129	0%	0%	55%
Volvo	120	149	0%	23%	12%
VW	116	140	4%	3%	0%
JLR	159	179	5%	5%	23%
Total	111	134	5%	4%	8%

Scope: European Economic Area (EEA), same as EU car CO2 regulation

Source: T&E analysis of passenger car registration data from JATO Dynamics

HEV includes full and mild hybrids

Figure 30: OEM CO₂ emissions and EV sales, 1st half of 2020

Carmakers' compliance status after the first half of 2020

OEM	NEDC	Flexibilities	Status	Target	Gap
BMW	118	14.4	103	103	0
Daimler	129	16.0	113	104	9
FCA-Tesla	107	12.4	94	95	-1
Ford	108	8.3	100	98	2
Hyundai	114	12.0	102	95	7
Kia	110	12.1	98	96	3
Nissan	109	11.5	97	96	2
PSA	96	6.8	90	93	-3
Renault	104	9.8	95	93	1
Toyota-Mazda	100	4.4	96	95	1
Volvo	120	11.5	109	111	-2
VW	116	11.7	104	99	5
JLR	159	14.9	145	132	13
Total	111	10.6	100	98	2

Scope: European Economic Area (EEA), same as EU car CO2 regulation

Source: T&E analysis of passenger car registration data from JATO Dynamics
 HEV includes full and mild hybrids. Flexibilities include super-credits, eco-innovation credits and 95% phase-in of sales.

Figure 31: OEM compliance status, 1st half of 2020

	95% phase-in	Eco-innovation credits	Super-credits (FY 2020)	Super-credits (as of July 2020)
BMW	4.4	2.5	7.5	7.5
Daimler	6	2.5	7.5	7.5
FCA-Tesla	4.4	0.5	7.5	7.5
Ford	4.5	1.5	3.1	2.3
Hyundai	3	1.5	7.5	7.5
Kia	3.1	1.5	7.5	7.5
Nissan	2.5	1.5	7.5	7.5
PSA	1.6	0.5	4.8	4.8
Renault	2	0.5	7.5	7.4
Toyota-Mazda	2.9	1.5	1.2	0.0
Volvo	2.5	1.5	7.5	7.5
VW	4.3	1.5	7.5	5.9
JLR	4.9	2.5	6.5	7.5
Average	3.5	1.3	6.3	6.0

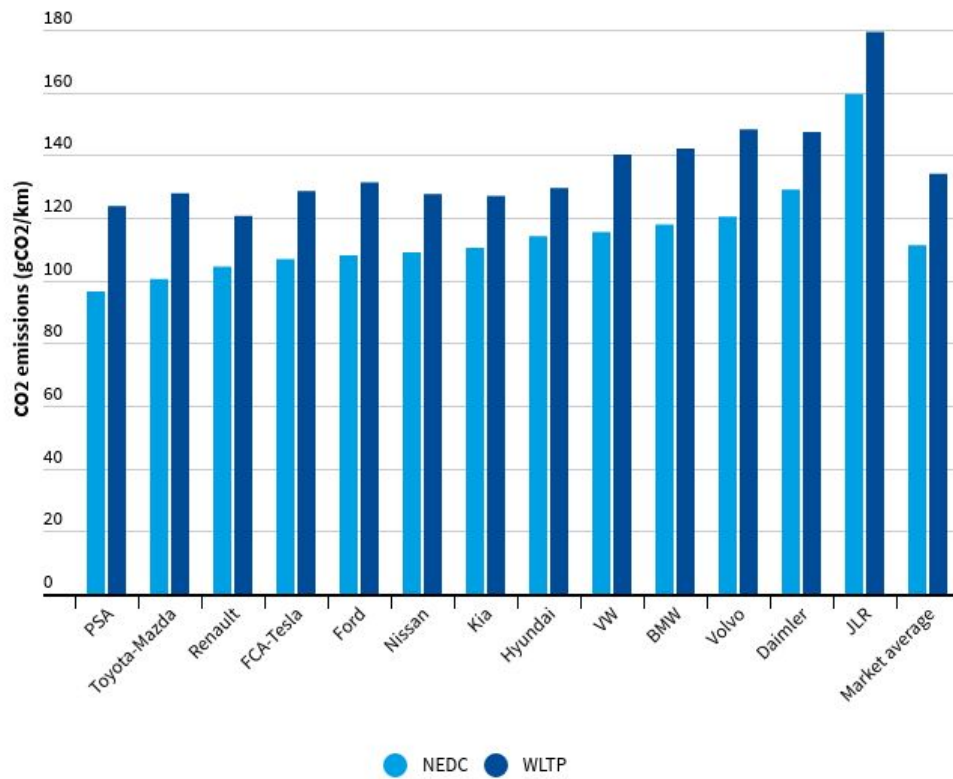
Scope: European Economic Area (EEA), same as EU car CO2 regulation

Source: T&E analysis of passenger car registration data from JATO Dynamics (95% phase-in and super-credits) and T&E assumptions based on analysis of 2019 EEA car registrations (eco-innovation credits). The 95% phase-in and the eco-innovation credits are assumed to be the same between the first half of the year and the full year 2020. Full year super-credits can vary versus the first half of the year as EV sales (and CO2 emissions) are as they are based on T&E modelling of OEM compliance over the year 2020.

Figure 32: T&E analysis and assumptions for flexibilities (2020)

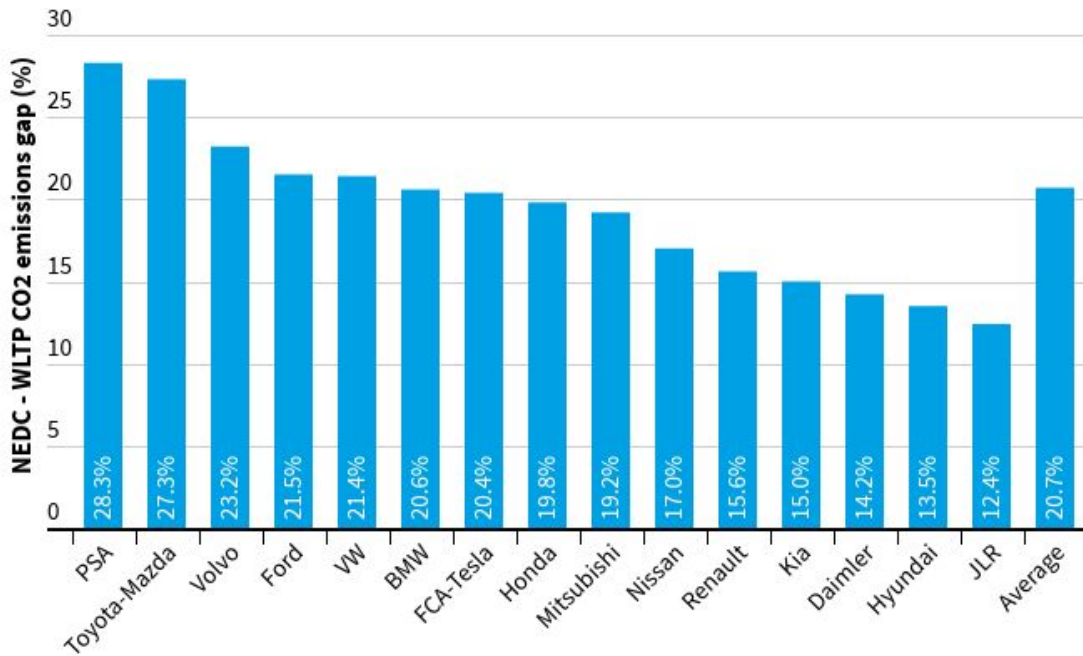
7.4 WLTP-NEDC uplift par carmaker

The two figures (31 and 32) below show how the uplift between NEDC and WLTP emissions compare over the first half of the year 2020.



Source: T&E analysis of H1 2020 passenger car registration data from JATO Dynamics.

Figure 33 - Average NEDC and WLTP emissions per OEM (H1 2020)



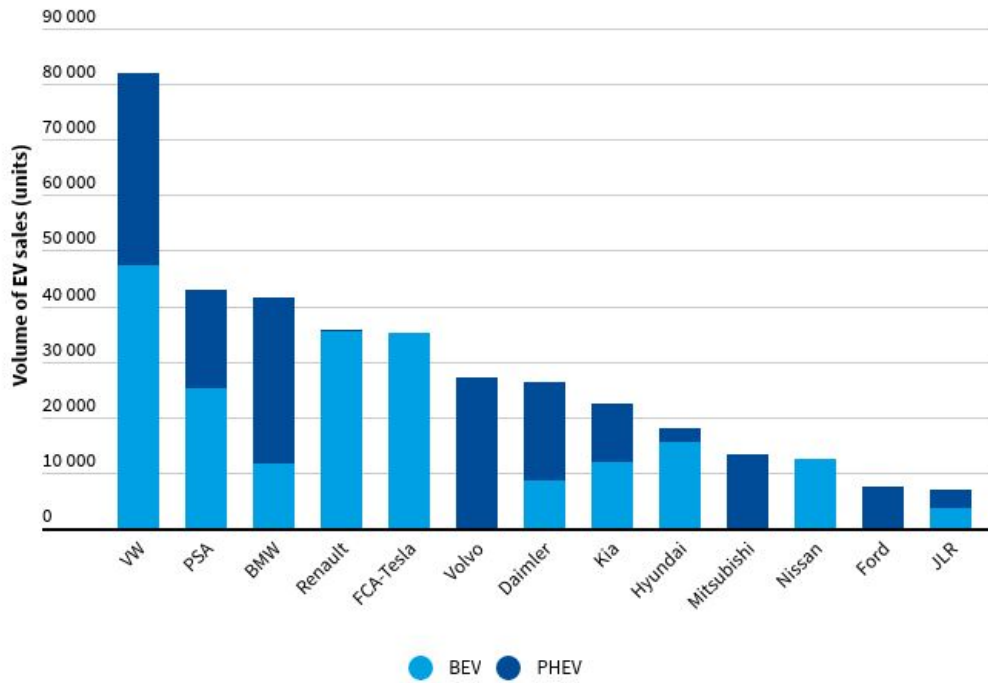
Source: T&E analysis of H1 2020 passenger car registration data from JATO Dynamics.

Figure 34 - OEM-specific NEDC-WLTP CO₂ emission gap

7.5 Others

The figures below provide additional information and analysis on the car registrations during the first half of the year 2020.

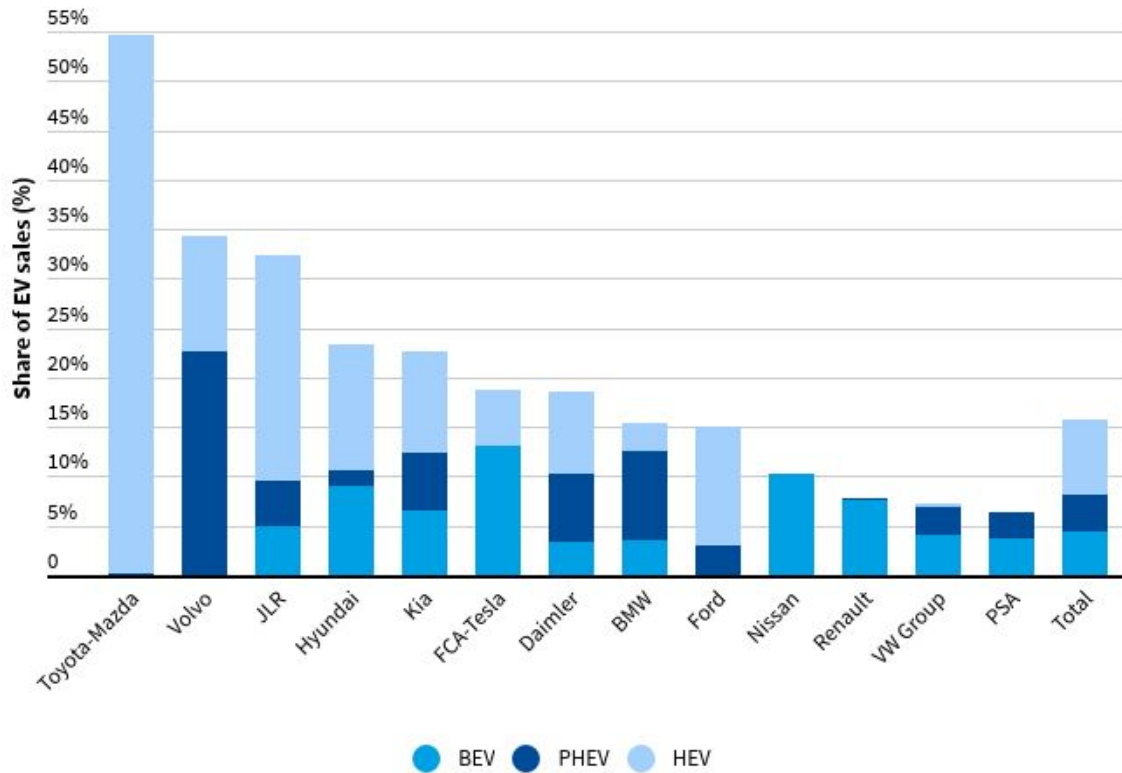
Volume of EV sales per carmaker (H1 2020)



Source: T&E modelling of carmakers' CO2 emission compliance based on passenger car registration data from the first half of 2020 (data from JATO Dynamics)

Figure 35: Volume of EV sales per carmaker (H1 2020)

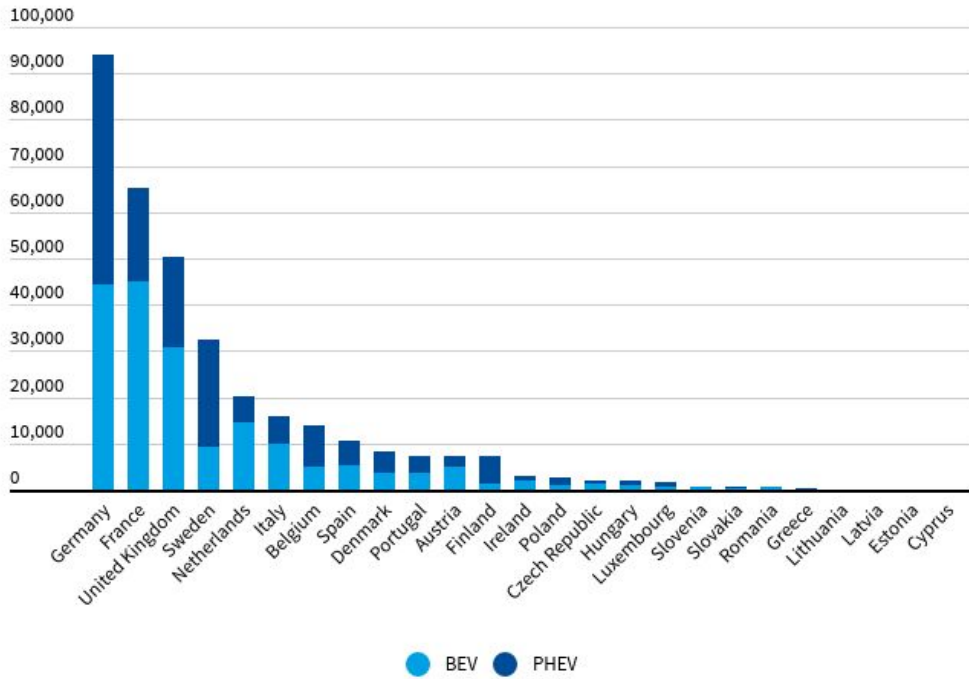
EV sales per carmaker, including hybrids (H12020)



Source: T&E analysis of H1 2020 passenger car sales data from JATO Dynamics.
Hybrids cover both mild and full hybrids

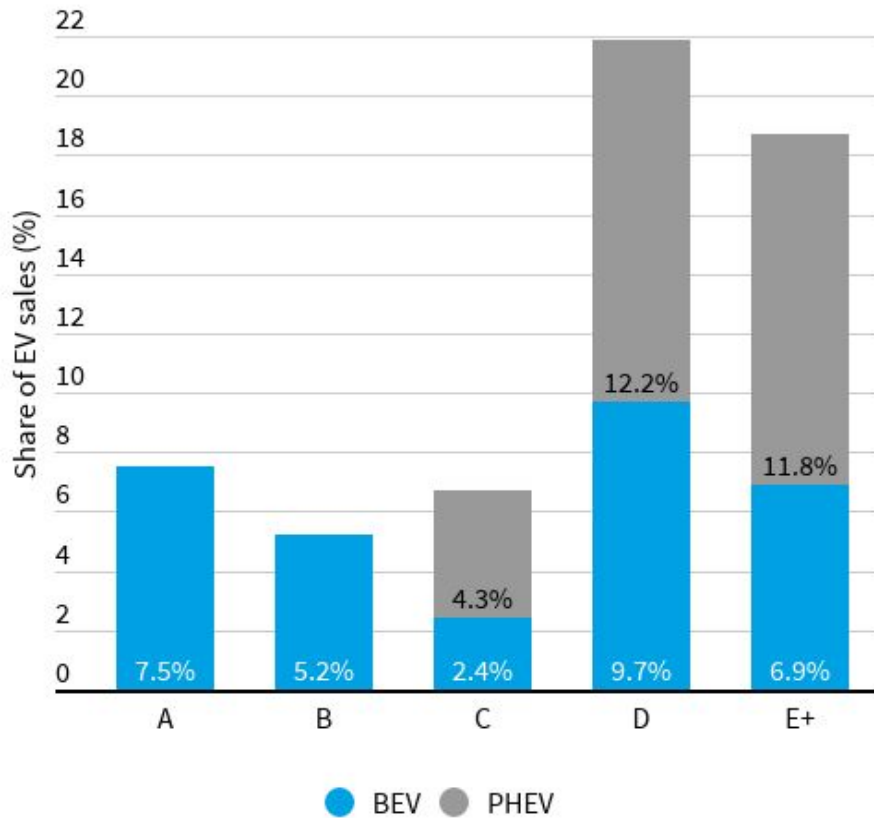
Figure 36: EV sales per carmaker, including hybrids (H12020)

Volumes of EV sales per country, EU27+ UK (H1 2020)



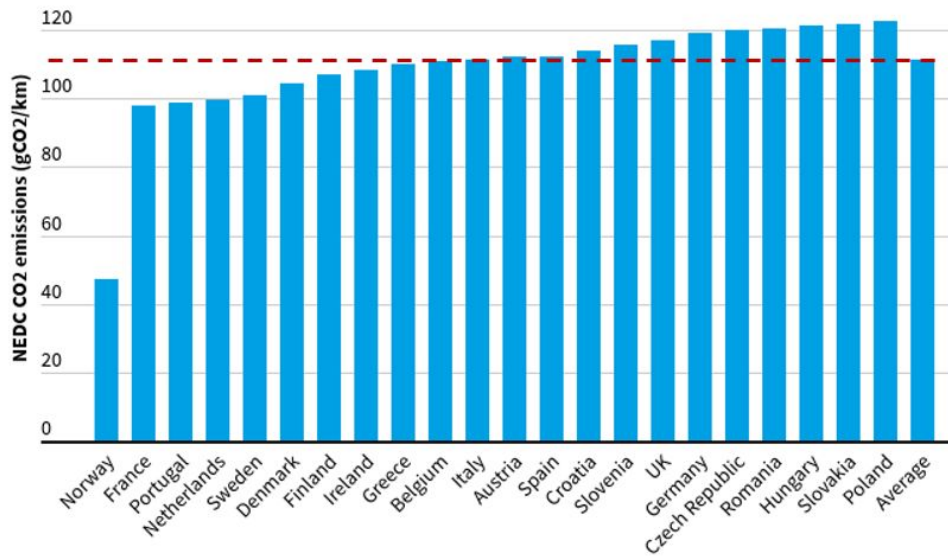
Source: T&E analysis of ACEA quarterly registration statistics

Figure 37: Volumes of EV sales per country, EU27+ UK (H1 2020)



Around 20% of the BEVs are SUVs whereas half of the PHEVs are SUVs.
 Source: T&E analysis of JATO Dynamics data on car registration in Europe in the first half of 2020

Figure 38: Share of EV per segment in the EU (H1 2020)



Source: T&E analysis of passenger car registration data from the first half of 2020 from JATO Dynamics



Figure 39: EV sales per carmaker, including hybrids (H12020)

BEV model availability in the EU, variants and small OEMs not included

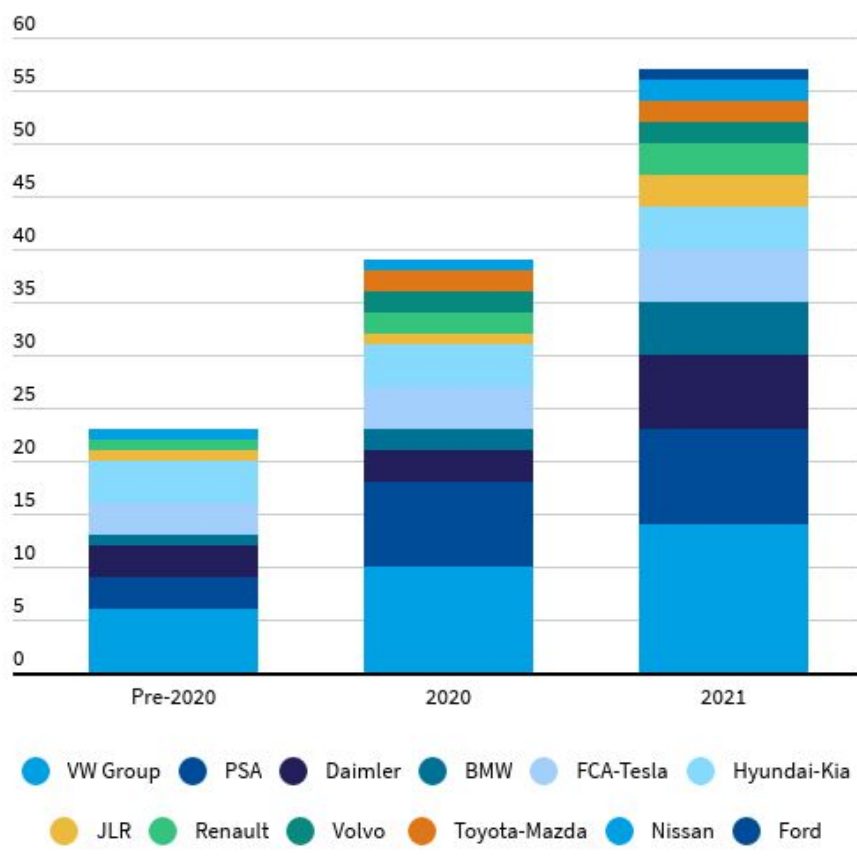


Figure 40: BEV model availability in the EU, variants and small OEMs not included