

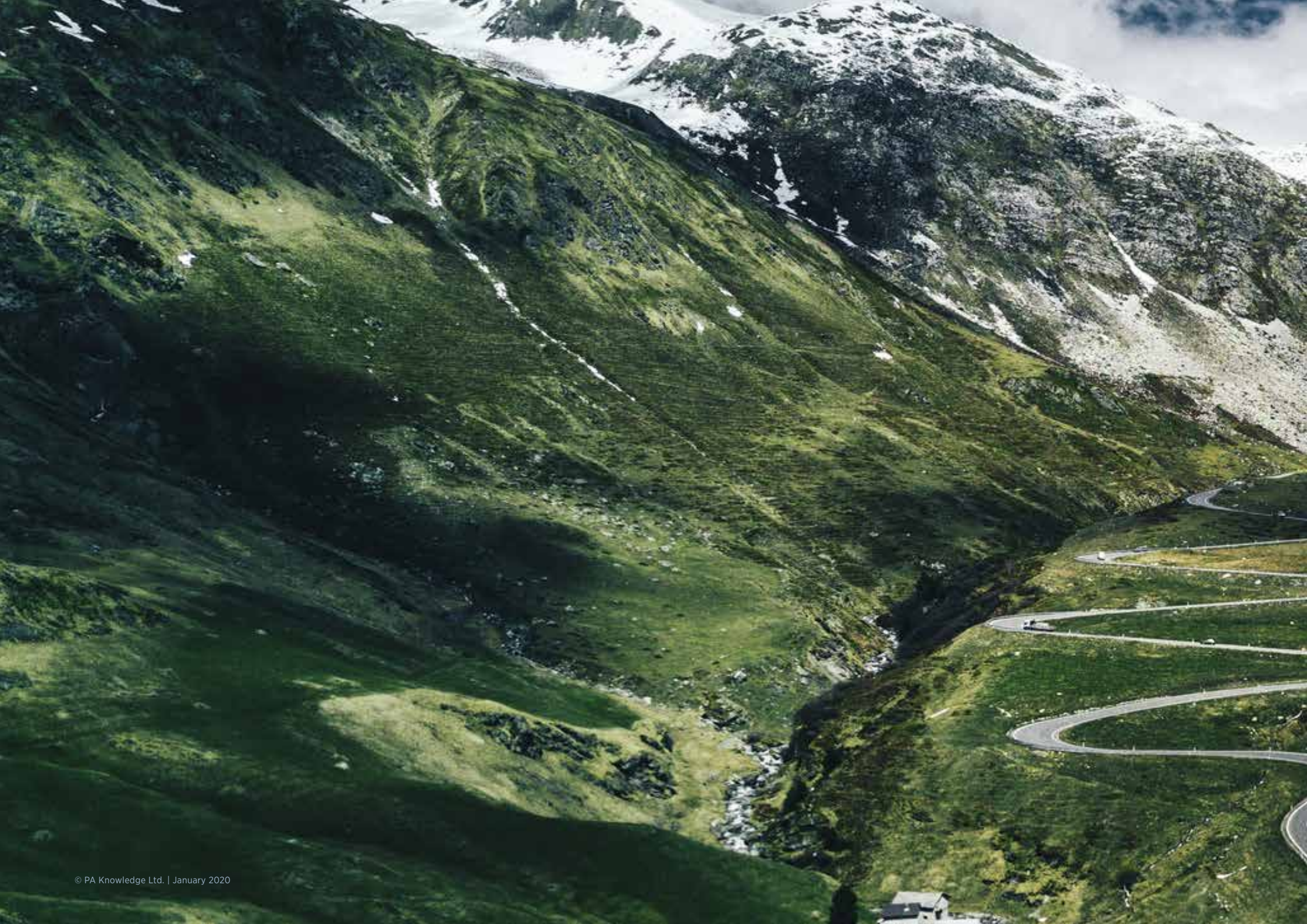


**CO<sub>2</sub> EMISSIONS  
ARE INCREASING.  
CAR MAKERS  
MUST ACT**

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**How Europe's automotive industry can  
meet tough CO<sub>2</sub> emissions targets**

**Bringing Ingenuity to Life**  
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## CAR MAKERS CAN SEIZE OPPORTUNITIES IN OUR COMPLEX WORLD

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Car manufacturers are going through tough times. Growing public concern about climate change is increasing regulatory action and changing customer attitudes. More governments are setting net zero carbon targets. And, although innovative technologies are appearing at an unprecedented rate, it's unclear which will win in the long-term. At the same time, the wider economic and political situation is uncertain – some are predicting a global downturn and Britain's future with Europe is still undefined.

Despite this fast-paced and unpredictable environment, all car makers must focus on the European Union's 2021 CO<sub>2</sub> emissions targets or risk significant fines. But, after four years of steady progress, we've found emissions increased across the board in 2018, and all manufacturers are now set to miss their 2021 targets.

Our proprietary analysis shows this is because there's a strong demand for high-powered vehicles, as well as SUVs and heavier cars. People are also choosing petrol cars following the diesel emissions scandal. And, at the same time, manufacturers are struggling to get low-emission options into showrooms at an attractive price.

With this recent step backwards, **our study now shows Europe's 13 top manufacturers are facing more than €14.5bn in fines**, with some companies seeing penalties high enough to have a material impact on their profitability and reputation.

## THERE ARE REASONS TO BE OPTIMISTIC

Yet, while this short-term outlook is challenging, we know there's opportunity in this complexity. There are solutions and reasons to be optimistic about the future. By unlocking human ingenuity, the car industry can innovate to cut emissions.

Our work across the automotive sector, combined with our deep experience working towards the global sustainability agenda, has highlighted opportunities for car makers to seize a competitive advantage.

By acting now to reduce their average CO<sub>2</sub> emissions, they can protect their reputation and win customers. And that means taking actions like:

- discounting electric and plug-in hybrid vehicles to boost their sales
- taking high-polluting vehicles off the market
- developing service schemes that increase low-emission vehicle use
- investing in accelerating innovative technologies to market as a standard option
- exploring mergers with other car makers and the supply chain to manage costs
- developing open platforms, like Volkswagen's MEB platform, to make electric tech more available.

But we know car makers can't create a low-emission future alone – governments must help. They must carefully consider how to reinvest the fines they levy to boost sustainability-related innovation. And they need to create a Europe-wide roadmap to ensure the continent's automotive industry can continue to compete in a global market.

There will be more change and disruption ahead, but by seizing the opportunities we see in the market, adaptable car makers will meet their CO<sub>2</sub> targets and further ambitions to achieve net zero carbon, and be well set to cope with changes in the wider world.



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## FOUR STEPS FORWARD, ONE STEP BACK

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EU CO<sub>2</sub> emissions regulations are still the most stringent in the world. Each car maker has a specific target to ensure that, by 2021, cars in Europe will emit less than 95 grams of CO<sub>2</sub> per kilometre on average. Going over the individual limits will incur a fine of €95 for every excess gram of CO<sub>2</sub> multiplied by the number of cars the manufacturer sells in 2020. In contrast, the US have targets of 125g/km by 2020, Japan's target is 122g/km and China is aiming for 117g/km.

However, looking further ahead, China's plans to phase out vehicles with combustion engines by 2050 could bring dramatic change as the largest automobile market will only be open to emission-free vehicles.

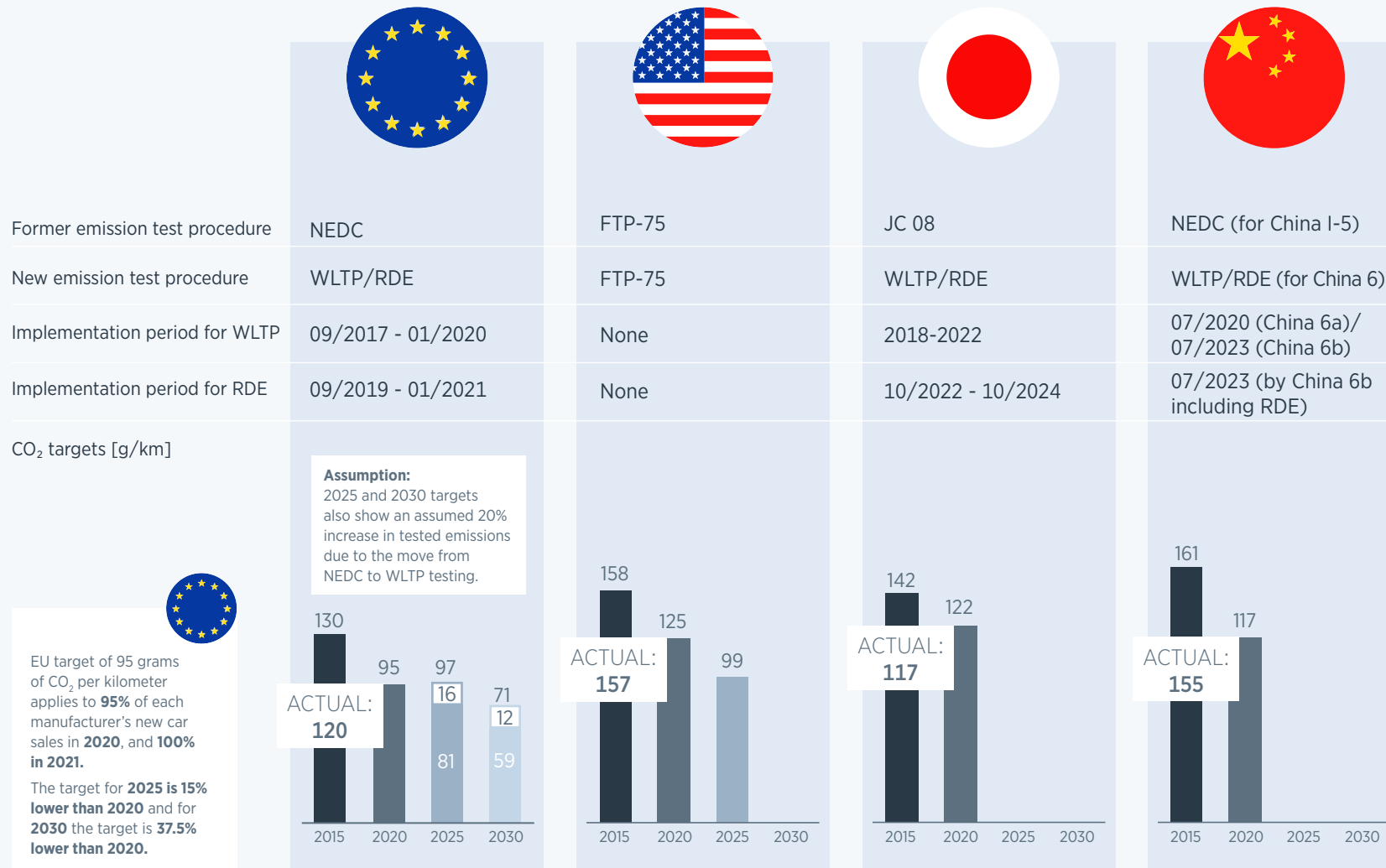


Figure 1. CO<sub>2</sub> guidelines in Europe are the toughest in international comparison

Source - **ICCT numbers** for CO<sub>2</sub> values per car type NEDC calculated (USA, China, Japan) and EU 2025/30 Sources for the assumed 20% increase in emissions from NEDC to WLTP:

1. **European Commission Report 2017** "From NEDC to WLTP: effect on the type-approval CO<sub>2</sub> emissions of light-duty vehicles"
2. **VDA 12/2016** "Position zu Umstellung von CO<sub>2</sub> basierten Steuer-/Incentive- Systemen auf WLTP"
3. **ICCT 01/2018** "The European Commission regulatory proposal for post-2020 CO<sub>2</sub> targets for cars and vans: A summary and evaluation"
4. **PA Simulation 2019 based on baseline sold car mix 2021** and adjustments in conjunction with European Commission Report (1)

## A BUMP IN THE ROAD

This is the fifth year we've assessed the 13 leading car makers' performance against the 2021 targets. And after substantial progress towards those goals in recent years, this year's analysis shows car makers have taken a step backwards.

It's an unexpected bump in the road, with our earlier forecasts predicting continued progress. This difference reflects a change in manufacturers' portfolios caused by increased demand for SUVs and large cars, fewer people buying diesel cars and manufacturers not getting low-emission alternatives into show rooms.

In addition, an increase in integrated electronic systems and accessories are having a small negative impact on fuel efficiency due to the added weight and energy use.

These factors combined to increase CO<sub>2</sub> emissions between 2017 and 2018, which in turn has given us a less optimistic view of manufacturers' future performance.

RANK <sup>1</sup>	CAR MAKER	ACTUAL DATA (g CO <sub>2</sub> /km)				FORECAST DATA			FORECAST 2021 PENALTY (IN MILLIONS OF EUROS)
		2016 <sup>2/3</sup>	2017 <sup>2/4</sup>	2018 <sup>2/4</sup>	2021 TARGET	2021 <sup>2/5</sup>	DEVIATION <sup>5</sup>		
1	Toyota	105.5	103.1	100.9	94.9	95.1	0.2	18	
2	PSA	110.4	111.9	113.9	91.6	95.6	4.0	938	
3	Renault-Nissan-Mitsubishi	111.2	111.7	108.2	92.9	97.8	4.9	1,057	
4	Hyundai-Kia	124.7	121.5	118.9	93.4	101.1	7.7	797	
5	Volkswagen	120.4	121.5	121.1	96.6	109.3	12.7	4,504	
6	BMW	122.9	121.5	123.6	102.5	110.1	7.6	754	
7	Ford	120	120.8	122.7	96.6	112.8	16.2	1,456	
8	Daimler	125.3	127.0	130.4	103.1	114.1	11.0	997	
9	Honda	126.5	127.2	126.8	94.0	119.2	25.2	322	
10	Fiat-Chrysler (FCA)	120	119.9	125.4	92.8	119.8	27.0	2,461	
11	Volvo	121.5	124.4	129.5	108.5	121	12.5	382	
12	Mazda	127.7	130.8	134.8	94.9	123.6	28.7	877	
13	Jaguar-Land-Rover	150	151.7	151.5	130.6	135	4.4	93	

&gt;14,655

Figure 2. CO<sub>2</sub> emissions and fines forecast for leading car makers in Europe<sup>1</sup> Rank on 2021 forecast<sup>2</sup> Based on NEDC<sup>3</sup> Based on data from ICCT<sup>4</sup> Based on data from EEA<sup>5</sup> Based on actual data until 2018 and PA forecast estimation

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We now expect all manufacturers to miss their target and face significant fines. In the case of Volkswagen, these could be as high as €4.5 billion due to its high sales volume. Even those that were previously on track to meet their targets, such as Renault-Nissan-Mitsubishi and Volvo, look set to fall short. This means the scale of fines for many will be enough to affect their profitability.

CAR MAKER	DEVIATION	PENALTY (in million €)	PENALTY (in % of EBIT 2018)
Mazda	28.7	877	115.7%
Fiat-Chrysler (FCA)	27.0	2,461	49.5%
Honda	25.2	322	5.5%
Ford	16.2	1,456	39.0%
Volkswagen	12.7	4,504	32.4%
Volvo	12.5	382	27.6%
Daimler	11.0	997	9.0%
Hyundai-Kia	7.7	797	28.9%
BMW	7.6	754	8.3%
Renault-Nissan-Mitsubishi	4.9	1,057	12.4%
Jaguar-Land-Rover	4.4	93	404.3%
PSA	4.0	938	21.3%
Toyota	0.2	18	0.1%

Figure 3. Mazda is furthest from its emissions target, while Toyota has fallen behind its target for the first time



## HOW TO CUT CO<sub>2</sub> EMISSIONS FOR 2021 AND BEYOND

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While all manufacturers have continued to focus on increasing their portfolio of low-emission vehicles, they vary in the speed with which they've been able to do so. Typically, when developing technologies, the approach is to launch them as a premium product and then cascade them into the broader market, allowing time for transformation of the portfolio.

But our analysis shows that manufacturers would need to sell more than 2.5 million extra battery electric vehicles (BEV) to meet their targets. Based on the sales volume in 2018, that would need an increase of 1,280 per cent by 2021. And while some have investigated pooling portfolios to incorporate more electric cars, such as the FCA-Tesla agreement, the lack of available alternative vehicles means it won't be enough.

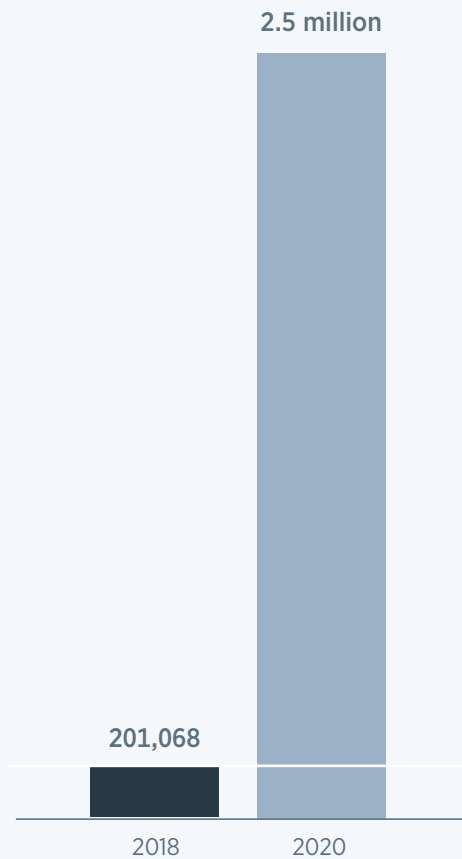


Figure 4. Additional BEV sales needed across Europe to meet 2021 targets

Selling so many BEVs in such a short time is practically impossible due to production capacity constraints. Volkswagen's new production line for the ID3, for example, is capable of making 100,000 units in 2020. There would need to be 26 such production lines across the manufacturers to meet the 2021 targets.

This highlights the need for a different approach to getting low-emission technology into mass-market cars more quickly, but few car makers have found the right path. They lack a clear strategy around the required technology, marketing and partnerships.

Key areas to focus on to overcome this include:

- refocusing product research and development onto innovations for low-emission engines
- cooperating with other manufacturers, such as co-developing and sharing platforms or jointly funding R&D centres
- optimising portfolios to reduce the number of variants within car segments and increase the share of low-emission vehicles
- creating open technology such as higher-density batteries and connected services that improve efficiency
- developing the charging infrastructure for a fully-electric future – such as Tesla's super charger – to push sales of electric vehicles
- optimising intelligent driving systems to boost fuel efficiency, particularly in urban environments.

## LOW-EMISSION TECHNOLOGY WILL HELP MEET TARGETS BEYOND 2021

While it's unlikely any innovative technology could make it to mass market in time to affect the 2021 targets, it could transform manufacturers' approaches to the EU's 2025 and 2030 CO<sub>2</sub> goals.

These will require average new-vehicle CO<sub>2</sub> emissions to fall 15 per cent by 2025 and 37.5 per cent by 2030, compared to 2021 targets. Emissions will also be measured using the new WLTP testing regime, which our analysis suggests will add approximately 20 per cent to recorded CO<sub>2</sub> emissions. With such tough targets on the horizon, there's a clear need to continue working towards the mass adoption of low-emission technology.

The question is, how can manufacturers meet these even tougher targets when most are a way off meeting the 2021 goals?

In our view, there are four actions to focus on:

- increase sales of low- and no-emission cars (BEV, PHEV, HEV or fuel-cell)
- extend the battery-powered range of hybrid and plug-in hybrid vehicles beyond 100km, so people can use them in battery mode more regularly
- optimise current intelligent driving tech to further reduce emissions
- limit the sale of high-powered engine cars.

While the immediate outlook isn't great for Europe's car makers, we believe technology presents opportunities. Most of these opportunities are clear when looking at long-term actions to tackle the 2025 and 2030 targets, but some still exist in getting closer to the 2021 targets.

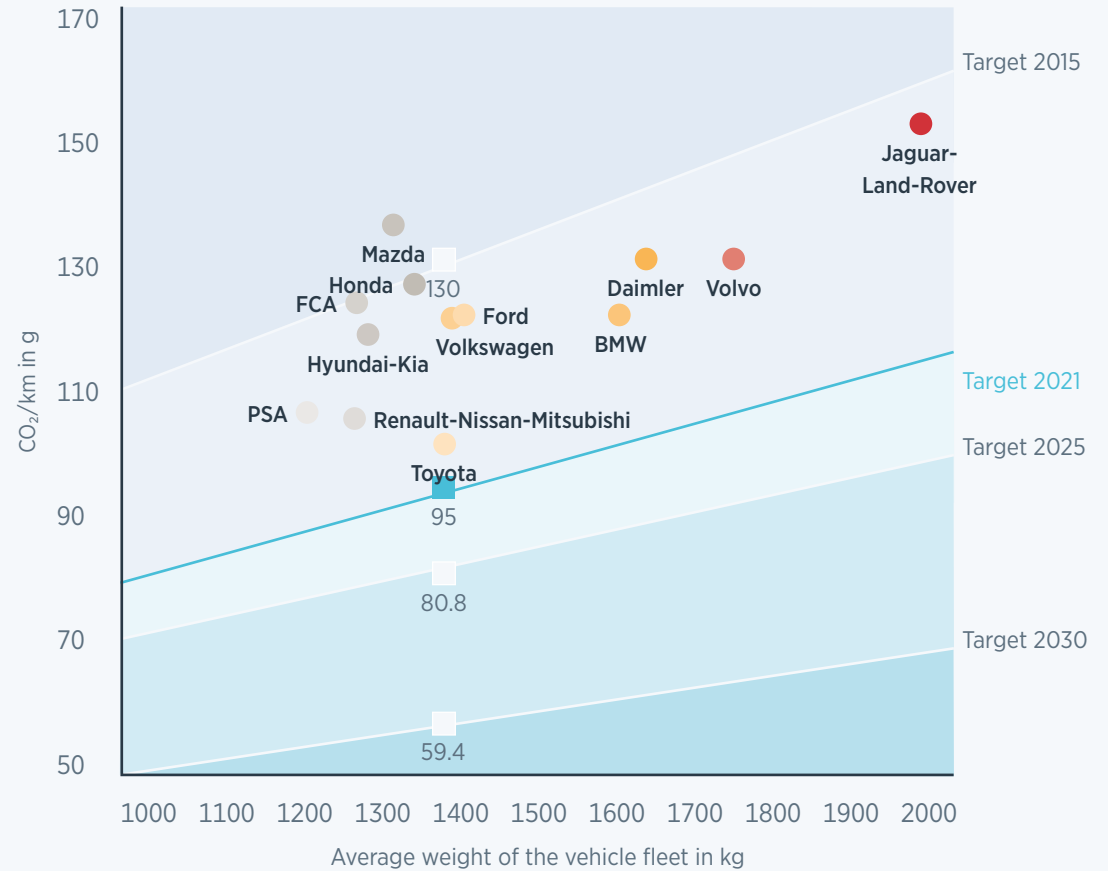


Figure 5. Actual 2018 emissions levels vs EU targets

CAR MAKER	2018 <sup>1/3</sup>	2021 TARGET	2021 FORECAST <sup>1/4</sup>	2025 TARGET <sup>5</sup>
PSA	113.9	91.6	95.6	77.4
Renault-Nissan-Mitsubishi	108.2	92.9	97.8	78.6
Fiat-Chrysler (FCA)	125.4	92.8	119.8	78.6
Hyundai-Kia	118.9	93.4	101.1	79.2
Mazda	134.8	94.9	123.6	79.3
Honda	126.8	94.0	119.2	79.8
Toyota	100.9	94.9	95.1	80.7
Ford	122.7	96.6	112.8	82.4
Volkswagen	121.1	96.6	109.3	82.4
BMW	123.6	102.5	110.1	88.1
Daimler	130.4	103.1	114.1	88.8
Volvo	129.5	108.5	121.0	94.3
Jaguar-Land-Rover	151.5	130.6	135.0	96.3

<sup>1</sup> Based on NEDC;  
<sup>2</sup> Based on data from ICCT;  
<sup>3</sup> Based on data from EEA;  
<sup>4</sup> Based on actual data until 2018 and PA forecast estimation;  
<sup>5</sup> Based on 2018 numbers, without weight adjustment, NEDC values

Figure 6. Projected targets for each manufacturer in 2025

## SHORT-TERM OPPORTUNITIES

Manufacturers should look closely at how they can encourage sales of low-emission vehicles. That will include reviewing pricing and promotions to create opportunities to reduce fines by increasing sales of EVs and PHEVs. There's also a case for limiting the sale of cars with bigger engines by taking selected models out of the portfolio.

Other options could include developing service packages through car subscription schemes, where a fleet management or subsidiary company owns the vehicles, to increase the use of low-emission options. This is a customer-driven 'transport-as-a-service' trend across Europe, where we're seeing people increasingly rent and use cars when they need them, rather than buy them.

If a manufacturer launched such a scheme with just its electric vehicles, it would force the market to better prepare for BEVs and PHEVs by installing more charging infrastructure. In turn, this would encourage standardisation of cables and connectors as well as fast charging systems. And together, this would make people more ready to invest in using fully-electric vehicles.

## LONG-TERM OPPORTUNITIES

Looking to the longer term, there are several actions manufacturers should take:

### Quickly transition to innovative technology

While the disruption and uncertainty caused by technological change have been difficult for the industry, technology has real potential to reduce emissions and costs. PHEVs and BEVs are continuously evolving, with substantial gains in range and efficiency made each year. At the same time, innovations like e-compressors, laser ignition and continuously variable valve duration (CVVD) can increase engine power and reduce fuel consumption in combustion engines. And fuel cells have long held promise for a convenient, zero-emission future, if manufacturers can overcome the technical hurdles.

To make a difference in meeting targets over the next five years, it's critical to reduce the time it takes to get these technical solutions to market. That means avoiding the slow process of launching 'premium' features that cascade through the portfolio over decades. Instead, car makers should take an agile approach to test and launch options – such as range extension for PHEV and HEV – to the mass market, refining based on cost efficiency and real user feedback.

This will also need manufacturers to examine their entire manufacturing process to understand how to handle faster developments and shorter lifecycles. Done systematically, this examination could uncover bonus benefits such as cost reductions or ways to make the production of cars more environmentally friendly.





### **Cooperate with other manufacturers**

Mergers and consolidation between both car makers and suppliers could help reduce costs and manage the complexity of production in this new world. While the FCA merger with Renault proposed in summer 2019 didn't get off the ground, the December announcement that FCA and PSA are merging shows these kinds of developments are high on the agenda. R&D costs can fall dramatically if companies can come together to adapt and improve each other's technologies, platforms and systems. The new FCA-PSA group, which will be the fourth largest car maker in the world, will show how much this can impact total CO<sub>2</sub> emissions.

Equally, while pooling hasn't lived up to its promises, alliances and greater collaboration have real potential to reduce overall emissions by increasing investment and the speed of new developments.

### **Develop open platforms**

As people get increased choice, proprietary technology is making less of an impact in the sales process. This creates an opportunity to share open platforms, reducing R&D costs while creating new revenue streams and improving sustainability across the sector.

This is already happening, with Volkswagen announcing it's open to sharing its new MEB platform for electric vehicles and is cooperating with Ford. This could reduce costs for all those involved and lead to standardisation across manufacturers, speeding the adoption of technology. Such an approach to sharing could be particularly important if we don't see a reduction in the cost of batteries as it would offer a way to share risk between companies.

### **Improve communications with customers**

As car use risks becoming demonised for its impact on the environment, it's crucial for manufacturers to focus their marketing and communications strategies on their low-emissions offerings. By refocusing the brand around sustainability, it's possible to protect the future reputation while increasing sales of low-emission vehicles today.

## GOVERNMENTS NEED TO ACT TOO

While much of the burden of developing more sustainable mobility lies with manufacturers, governments also have a role to play. The public is demanding they continue their focus on emissions, but governments will have to balance actions against the scale of fines and the resulting effect on the profitability of key players in the economy. This could open further discussions with the industry about the regulatory action that will drive meaningful, sustainable results.

One part of this will be careful thought around how to reinvest any fines in a way that supports innovation across Europe, possibly using a new European Innovation Programme. This could drive the development of low-emission innovations, like connectivity that synchronises inner-city traffic to optimise its flow, high-density battery technology or fast, wireless charging solutions.

Recharging electric vehicles is still a challenge – as long as it's taking more than five minutes, there's a risk of overloading the system by putting more electric cars on the streets. So, governments need to focus on supporting the development and installation of fast-charging infrastructure. Connecting this infrastructure to a central system will also be key as it would let drivers easily find their nearest available charging point.

Such a system could even include a way to reserve time at charging stations based on parameters like traffic, speed, weather and destination. This would open the door to smart and connected driving that optimises trip management.

All this will also need a broader perspective, a willingness to look beyond Europe and understand that the real competition will be with China and the USA. In that environment, cooperation and careful, clever collaborative investment in R&D will be the best way to optimise costs and succeed in a more competitive global market. This should lead to a Europe-wide strategic roadmap focused on strengthening the automotive and mobility industry.





## ACT NOW TO MITIGATE 2021 FINES AND START ANSWERING THE 2025 CHALLENGE

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Car manufacturers are facing profound challenges. The 2021 emissions targets are the most urgent of these but they're just one of many factors that are demanding car makers adapt.

In response, manufacturers will need to be agile and flexible in developing technology. Just being big won't be enough. They need to be smarter and work with governments, competitors and customers. And they will need to do this quickly or face fines running into the tens of billions by 2025.

We'll also see further reductions in targets for CO<sub>2</sub> and other emissions, as well as a trend towards the circular economy. These will create new challenges for the industry to address. Learning from the current situation, technology planning, openness to the latest trends and proactive interaction between industry and regulators will be key.

All this will cost money. And as apps and services become more important, manufacturers will need a new mindset. This will cause short-term pain, but there's every reason to be positive. Those that can adapt and substantially reduce emissions will play a vital role in building a positive human future in a technology-driven world while winning customer trust and loyalty.

## OUR ANALYSIS IN DETAIL

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We based our analysis of Europe-wide CO<sub>2</sub> emissions on assessments of each of the region's 13 largest car makers, as well as the performance of individual countries. What follows is a detailed view of each manufacturer's emissions performance and potential future, plus an overview of country performance.

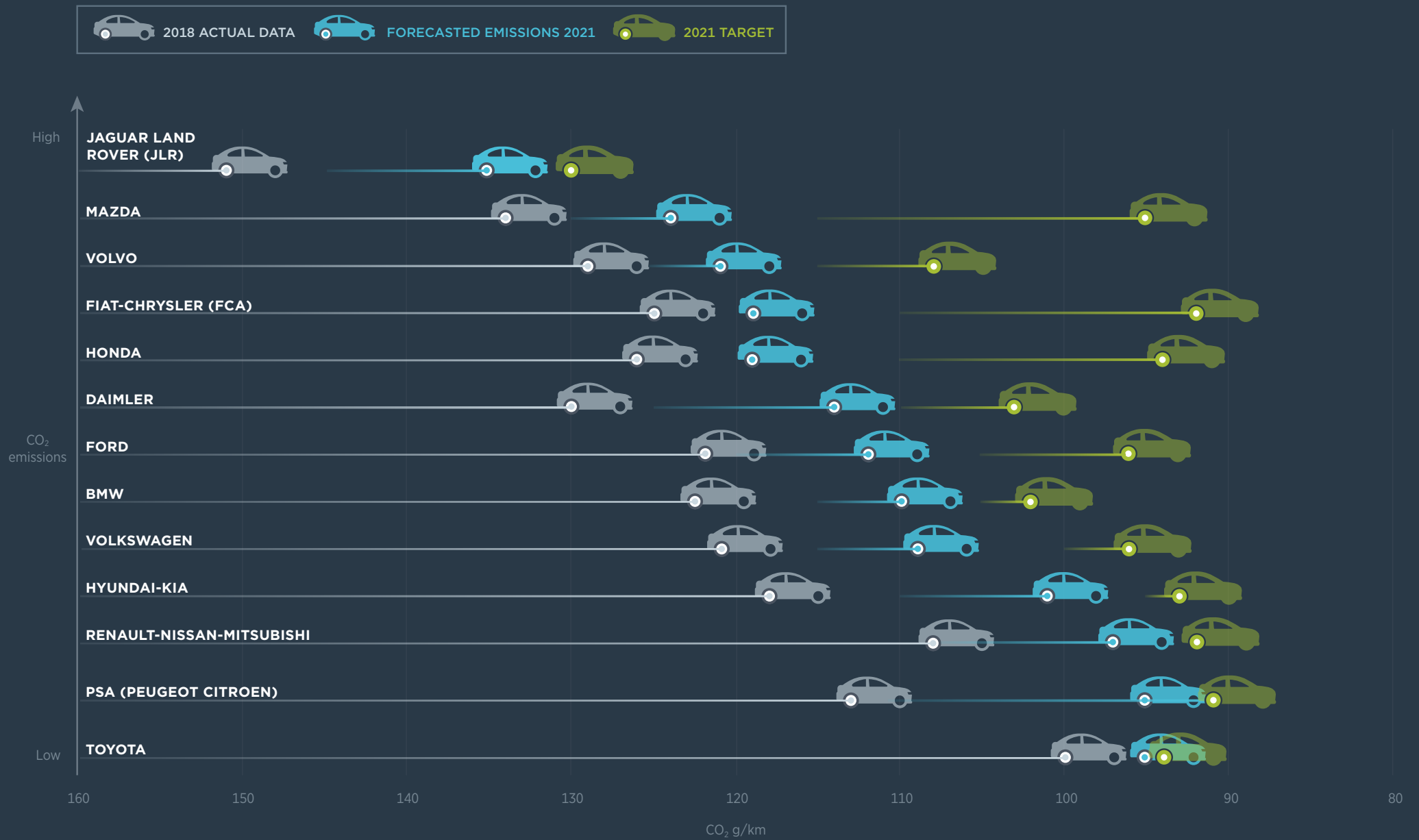


Figure 7. CO<sub>2</sub> emission reduction over time against 2018 actual data and 2021 targets

## TOYOTA MOTOR CORPORATION

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Toyota is the global leader in hybrid technology. And in the European market, it has two brands: Toyota and Lexus.

Our forecast shows its CO<sub>2</sub> emissions falling from 100.9g/km today to 95.1g/km in 2021, just above its 94.9g/km target. While it won't face significant fines, its performance has worsened since last year when we predicted it would easily meet its target. We expect sales of plug-in hybrid electric vehicles (PHEV) and hybrid electric vehicles (HEV) to make up more than 71 per cent of its portfolio in Europe by 2021.

Toyota's hybrid strategy means it will come close to meeting its 2021 target and the hybrid market looks set to grow further as vehicles become more affordable. But Toyota still lacks zero-emission options such as battery electric vehicles (BEV), which it will need if it's to meet the 2025 targets. While Toyota is investing in these innovative technologies, and in fuel cell systems, there's a long road between development and mass market. The new Mirai II, with its competitive pricing, could open the door for new fuel cell technology as the Toyota Prius did for the hybrid.

## PSA GROUP

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France's PSA Group is the second-largest manufacturer in Europe. Its brands are: Peugeot, Citroen, DS and Opel/Vauxhall.

We forecast that its CO<sub>2</sub> emissions will fall from 113.9g/km today to 95.6g in 2021, 4g short of its 91.6g/km target. This would lead to fines of €938 million. This shortfall is partly due to an increase in emissions seen in 2018.

PSA's new platforms, CME and EMP2, give them more flexibility in their production lines, enabling them to manufacture petrol, diesel or electric vehicles from the same facility. This will help them ramp up production and adapt to changes in technology. And with the FCA merger, there should be further benefits from scaling technologies across the new PSA-FCA range.

The Group has made progress in the electrification of its portfolio and aims to only offer fully-electric (PHEV & BEV) models by 2025, with the first on sale from 2020. By the end of 2020, all brands will have one BEV car available. We expect PHEV and BEV to make up 10 per cent of its sales in Europe by 2021.

Its focus on small and compact cars, and increased PHEV adoption, means we expect to see stable emissions reductions.

## RENAULT-NISSAN-MITSUBISHI ALLIANCE

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In Europe, the Renault-Nissan-Mitsubishi (RNM) Alliance has four low-cost and mainstream brands (Renault, Nissan, Dacia and Mitsubishi) and one emerging premium brand (Infiniti).

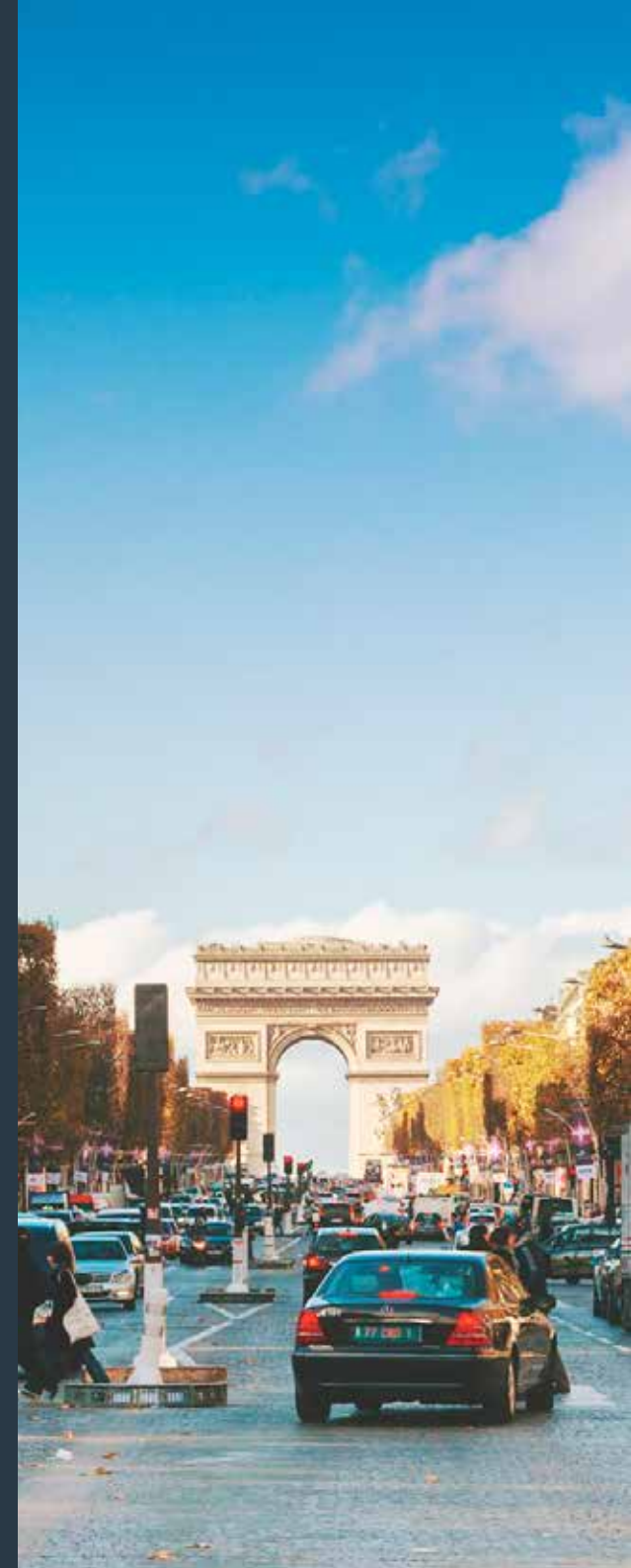
Our analysis shows that its CO<sub>2</sub> emissions will fall from 108.2g/km today to 97.8g/km in 2021, missing its 92.9g/km target and incurring fines of more than €1 billion. That's because, while emissions declined in 2018, the trajectory is slower than previously forecast.

The Alliance has made huge investments in electrification, research and development, and its production system in recent years. This has let it increase production volumes in its current plants and prepare new facilities to produce EVs. The key questions are whether the products will be ready in time and have the right pricing structure.

But RNM's experience in PHEV, gained from the Outlander PHEV, should help it move the technology into other products. We expect PHEV and BEV to make up more than 11 per cent of RNM sales in Europe by 2021.

The Alliance's strategy is to remain the global leader in affordable mass market EVs by launching new models in 2020 and having ten fully electric models by 2022. Sticking to the mainstream and low-cost segments of the market means battery prices will be critical to this strategy, although a rental model might boost BEV sales in 2021.

The challenge for RNM in 2020 is to get new low-emission vehicles in showrooms and available for customers to order.



# HYUNDAI MOTOR GROUP

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The Hyundai Motor Group is the largest South Korean automotive manufacturer and has two mainstream brands: Hyundai and Kia.

Our forecast shows its CO<sub>2</sub> emissions will drop from 118.9g/km today to 101.1g/km in 2021, meaning the company will struggle to reach its 93.4g/km target. This will lead to fines of €797 million. Despite some progress in 2018, emissions aren't coming down fast enough.

Hyundai has transformed itself into an innovative leader with a broad portfolio that includes petrol, diesel, PHEV and BEV drive trains. In addition, Hyundai is still pioneering the development and sale of fuel cell electric vehicle (FCEV) technology, offering fuel cell cars to customers in Europe today.

With plans for 38 new low-emission car models by 2025, Hyundai's EVs should account for about 10 per cent of all European car sales by then. In the shorter term, we expect PHEV and BEV to make up more than 15 per cent of its sales by 2021.

A core question for Hyundai's future success will be which technology they choose to adopt for the long-term.

## VOLKSWAGEN AG

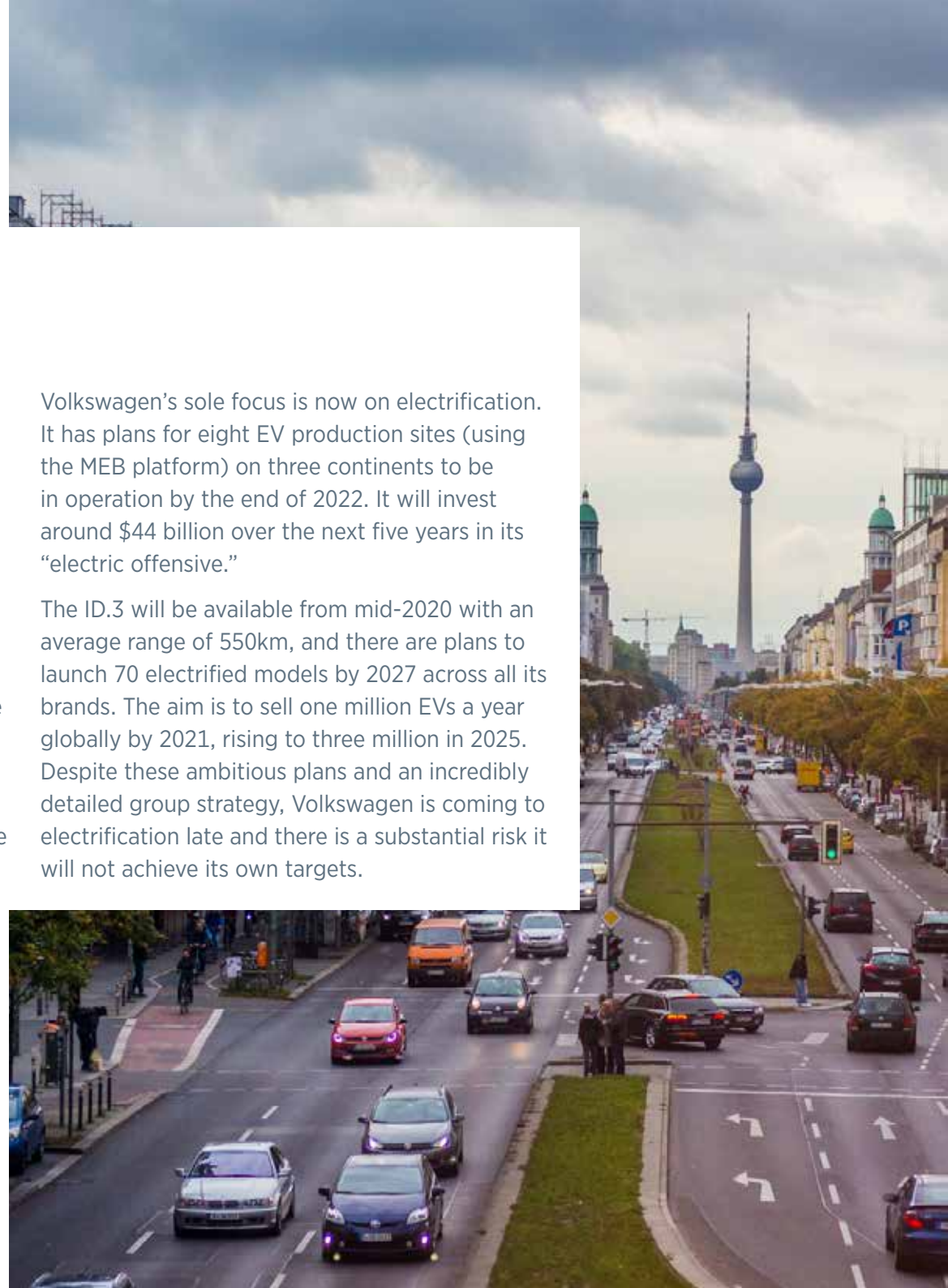
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Volkswagen is the largest car manufacturer in the world. In Europe, it runs Volkswagen, Audi, Škoda, Seat, Porsche, Bugatti, Bentley and Lamborghini. Bentley and Lamborghini have specific EU targets, so we excluded them from our Volkswagen analysis.

We forecast Volkswagen's CO<sub>2</sub> emissions will drop from 121.1g/km to 109.3g in 2021, missing its 96.6g/km target and having to pay fines of €4.5 billion, the highest of any manufacturer. The market trend towards SUVs with bigger engines and higher CO<sub>2</sub> emissions has been a problem for Volkswagen and we expect PHEV and BEV to make up around 10 per cent of its sales in Europe by 2021.

Volkswagen's sole focus is now on electrification. It has plans for eight EV production sites (using the MEB platform) on three continents to be in operation by the end of 2022. It will invest around \$44 billion over the next five years in its "electric offensive."

The ID.3 will be available from mid-2020 with an average range of 550km, and there are plans to launch 70 electrified models by 2027 across all its brands. The aim is to sell one million EVs a year globally by 2021, rising to three million in 2025. Despite these ambitious plans and an incredibly detailed group strategy, Volkswagen is coming to electrification late and there is a substantial risk it will not achieve its own targets.



# BMW GROUP

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BMW Group is a German automotive manufacturer with three premium brands: BMW, Mini and Rolls-Royce.

Our forecast shows its CO<sub>2</sub> emissions will drop from 123.6g/km today to 110.1g/km in 2021, missing the target of 102.5g/km and incurring fines of €754 million. The Group saw a slight increase in emissions in 2018, which has made it even harder for it to meet its target.

BMW's strategy is to build on its electrified portfolio to get PHEV or BEV in almost every market segment. A BEV three door-mini will be on sale from 2020, a fully-electric iX3 SUV will also launch in 2020-21 and the fully electric iNEXT sedan will come in 2021. We expect PHEV and BEV to account for more than 15 per cent of BMW sales in Europe by 2021.

By accelerating their e-mobility strategy, BMW plans to launch 25 electrified models (12 all-electric and 13 PHEVs) and have 15-25 per cent electrified vehicles by 2023. This is two years earlier than previously planned. It's also moving away from diesel vehicles and presented its first fuel cell model at the IAA 2019, which shows BMW has an open mind about which technology to pursue over the next few years.

If BMW can increase sales of PHEV and BEV, it could be on track to meet its 2025 target.

## FORD OF EUROPE

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Ford of Europe is a subsidiary of Ford Motor Company and runs the Ford brand.

Our forecast shows its CO<sub>2</sub> emissions will drop from 122.7g/km today to 112.8g/km in 2021, leaving Ford short of its 96.6g/km target and facing fines of €1.4 billion. Their late adoption of electrification meant they were always unlikely to meet the target, but 2018's performance worsened the situation.

In addition to the \$11 billion investment in electrification projects between 2018 and 2022, Ford has allocated \$900 million in 2019 to produce the next generation of electric cars, with two new electric SUVs planned for 2023. We expect PHEV and BEV to account for more than four per cent of Ford sales in Europe by 2021.

This year, Ford and Volkswagen agreed a new cooperative approach to developing technology around commercial vehicles, autonomous driving and electric cars. This opens the way for Ford to buy the MEB platform from Volkswagen, giving them direct access to a ready to use platform for their new models with no development time needed. This means Volkswagen will be a supplier for the first time, with the ability to scale the MEB platform to its maximum.

## DAIMLER AG

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Daimler is a premium manufacturer that owns the Mercedes-Benz, Smart and EQ brands in Europe.

We forecast its CO<sub>2</sub> emissions will fall from 130.4g/km today to 114.1g/km in 2021 but it will still miss its 103.1g/km target and face fines of €997 million. Like other manufacturers, Daimler saw emissions increase in 2018.

Daimler's plans include the launch of a fully-electric brand, EQ, that will run in parallel with Mercedes-Benz. It will have ten fully electric vehicles by 2022 and an extended product range including wall boxes for home charging. The Mercedes-Benz portfolio is to be entirely electrified with PHEVs and mild hybrid electric vehicles (MHEVs) by 2022, with an overall electrified portfolio of about 50 models by 2022.

Electrification is one of the four cornerstones of the Daimler strategy. In recent months, they've invested in battery supply and carbon-free battery production. The challenge they face is how to accelerate sales to meet their commitments. The delay of the commercial launch of the EQ products to the end of 2019 has increased the risk that Daimler won't meet its 2021 target. However, its full electrification plan puts it in a good position to meet the 2025 targets.

## HONDA MOTOR COMPANY

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Honda Motor Company is a Japanese car manufacturer with one European brand.

We forecast that its CO<sub>2</sub> emissions should drop from 126.8g/km today to 119.2g/km in 2021 and so it will miss its 94g/km target and face fines of €322 million. We had previously forecast it would meet its targets, but the latest results reflect slowing progress in 2018 when it saw only a small decrease in emissions. We expect PHEV and BEV to make up more than five per cent of its sales in Europe by 2021.

Honda has committed to having electrified cars make up two-thirds of its European sales by 2025 and to offer an electrified option of every new model it launches in Europe. The Honda Urban EV Concept, which will be available from mid-2020, will be the first mass-produced fully electric Honda. However, its portfolio will need to adapt faster to include more PHEV and HEV if it's to meet its targets.





## FIAT CHRYSLER AUTOMOBILE

The Fiat Chrysler Automobile Group (FCA) has five brands in Europe: Fiat/Abarth, Alfa-Romeo, Lancia, Jeep and Maserati.

Our forecast shows that FCA's CO<sub>2</sub> emissions will drop from 125.4g/km today to 119.8g/km in 2021. That's a long way off its target of 92.8g/km, meaning it could see fines of €2.4 billion. While FCA was always going to struggle to meet the target, it took a significant step backwards in 2018, putting it at risk of one of the biggest fines. Our analysis suggests its pooling agreement with Tesla will have minimal impact on its ability to meet its targets, with PHEV and BEV sales making up around six per cent of its portfolio in Europe by 2021.

With the PSA merger, FCA gained access to an e-mobility platform that's ready to implement into their portfolio.

Our forecast reflects FCA's late start in the electrification transformation and portfolio of mostly combustion engines. The main challenges for FCA will be in updating and integrating the PSA platform into its portfolio to minimise fines.

If the announced electrification of all FCA brands (including Alfa Romeo, Maserati and Jeep) takes place in 2022/23, Fiat could shake up the entry-level car market while Alfa does the same for the mid-range. However, the Jeep portfolio and its related strategy still presents a risk for FCA.

## VOLVO CARS

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Volvo Cars is the only Swedish automotive manufacturer and it runs two brands in Europe: Volvo and Polestar.

We forecast that Volvo's CO<sub>2</sub> emissions will drop from 129.5g/km today to 121g/km in 2021, falling short of its 108.5g/km target and facing fines of €382 million. Significantly, its emissions were higher in 2018 than in 2017. We expect the share of PHEV and BEV will reach more than 14 per cent of its sales in Europe by 2021.

Volvo's strategy is to make most of its new models electric only and offer no diesel options from 2023 onwards. Their electrified portfolio will include MHEV, PHEV and BEV. The Polestar performance brand will only offer PHEV and BEV, and it plans to launch three electrified cars between 2020 and 2021 (Polestars 1, 2, 3).

Volvo Cars is still aiming for a quarter of its vehicles to be purely electric by 2025.



# MAZDA MOTOR CORPORATION

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The Mazda Motor Corporation is a midsize Japanese car manufacturer with a single mainstream brand.

Our forecast is that its CO<sub>2</sub> emissions will drop from 134.8g/km today to 123.6g/km in 2021, missing its 94.9g/km target by some margin and incurring fines of €877 million. That's partly down to a poor 2018, which saw emissions climb 4g.

Mazda is investing in electrification through a strategic partnership with Toyota. It's also introduced its SkyActiv technology to make petrol and diesel cars more efficient. But it's still not enough, with the Mazda 3 Skyactiv-x M hybrid emitting around 102g CO<sub>2</sub>/km.

Cooperation with Toyota, especially with access to their hybrid technology patents, opens the door for further CO<sub>2</sub> reductions in the future. From 2020 onwards, the first Mazda BEV should be available with a range of approximately 300 kilometres. Mazda could also be agile enough to switch from an all combustion engine approach to a widely electrified portfolio and be able to meet future regulations. In the short-term, however, we expect its PHEV and BEV sales to account for around two per cent of its portfolio in Europe by 2021.

## JAGUAR LAND ROVER LTD

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Owned by India's Tata Motors, Jaguar Land Rover Ltd (JLR) has two premium brands: Jaguar and Land Rover.

As it sells fewer than 300,000 cars a year, JLR has a higher emissions target of 130.6g/km. Our forecast shows its CO<sub>2</sub> emissions should drop from 151.5g/km today to 135g/km in 2021, leaving it with relatively low fines of €93 million.

JLR plans to launch every new model with an electrified option from 2020. To achieve this, it announced further investment in electrification in the UK, with its Wolverhampton Engine Manufacturing Centre producing electric drive trains and a new battery assembly centre coming to Warwickshire.

It launched its first mass-produced BEV, the i-Pace, in 2019. This was the first electrified SUV among established brands. We expect PHEV and BEV sales to take a 13 per cent share of JLR's portfolio in Europe by 2021.

Despite its higher emissions target, JLR needs to focus on electrification and efficiency to avoid fines. The company could also be affected by Brexit and, if sales increase above the 300,000-car limit, the targets will move far out of reach.



## CO<sub>2</sub> EMISSIONS BY COUNTRY

While several countries have seen a slight increase in EV sales, all except Norway and the Netherlands saw a worsening in their overall CO<sub>2</sub> emissions performance. Norway also continues to be comfortably ahead of the rest in terms of both EV sales and CO<sub>2</sub> emissions. But nine European countries plan to ban combustion engines from 2030, with others to follow in 2040, affecting 47 per cent of cars sold.

Norway has reduced emissions from 83.7g CO<sub>2</sub>/km in 2017 to 72.4g CO<sub>2</sub>/km in 2018. Sales of electric vehicles continue to rise and accounted for 31.2 per cent of new car sales in 2018. The Netherlands were the second-best performer, but a long way behind, with emissions of 106g CO<sub>2</sub>/km and sales of fully electric vehicles making up six per cent of the total.

The UK saw a decline in emissions performance from 120.8 CO<sub>2</sub>/km to 125.1 CO<sub>2</sub>/km but an increase in electric vehicles sales to 0.7 per cent of all new registrations. Germany also saw an increase in emissions from 126.2g CO<sub>2</sub>/km to 129.1g CO<sub>2</sub>/km alongside a slight increase in electric vehicle sales (from 0.7% to 1.1%).

Switzerland is still the worst performer as emissions increased to 137.3g CO<sub>2</sub>/km from 133.2g CO<sub>2</sub>/km, although electric vehicles sales increased to 1.7 per cent of the total.

Further pressure to reduce the numbers of combustion engines on the road is coming from local governments in Germany and Italy, which are creating car free cities and charging zones. Given the public demand for action on climate change, we're sure to see more of these initiatives around Europe.

These national factors underline the need for car makers to quickly adopt innovative technology, moving on from just updating combustion engines with hybrids.

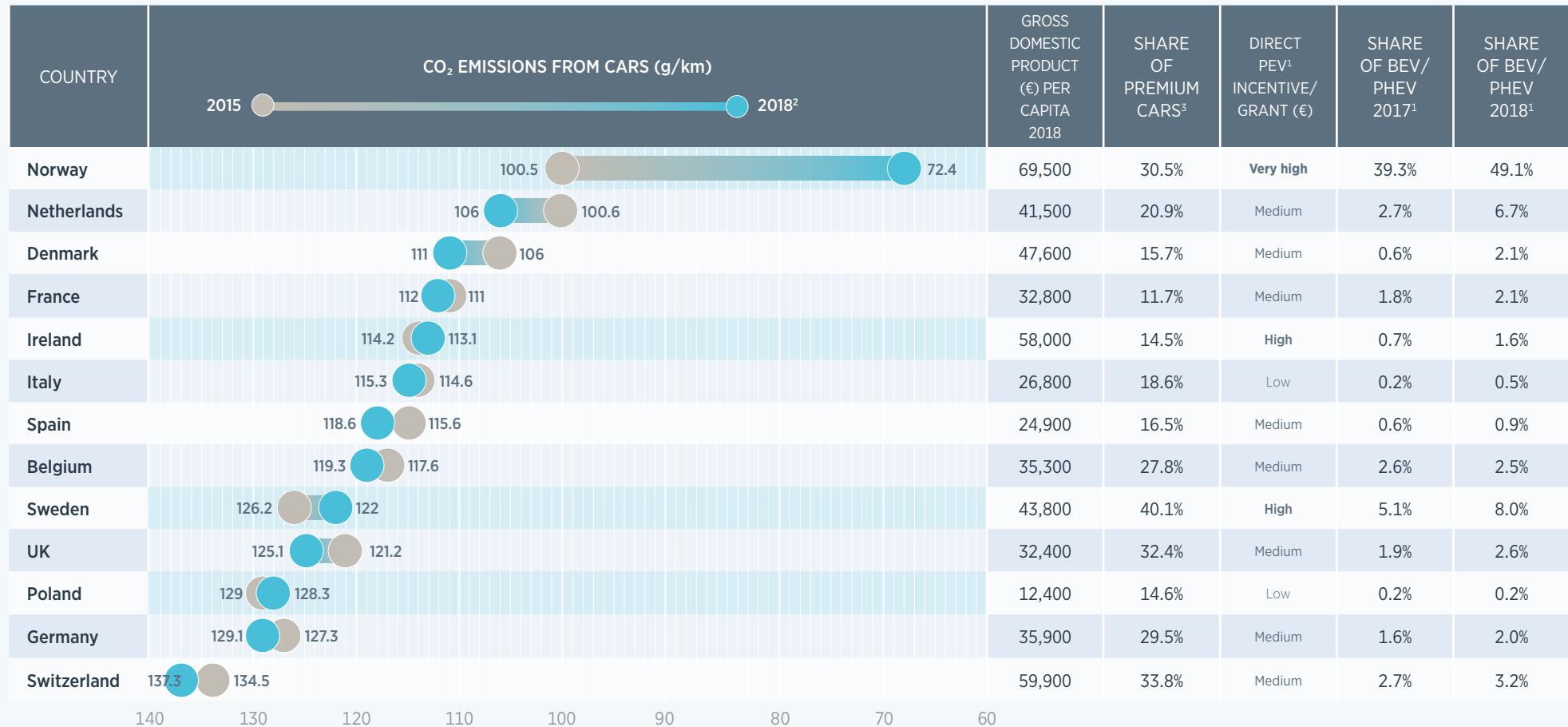


Figure 8. CO<sub>2</sub> emissions for cars in selected European countries

<sup>1</sup> PEV includes both all-electric cars (BEV) and plug-in hybrids (PHEV)

<sup>2</sup> Rank based on 2018 values

<sup>3</sup> Top best selling cars of premium brands (C,D,E segment and SUVs)

**Norway:** All new passenger cars and light vans will need to be zero-emission from 2025.

**Germany & Netherlands:** There will be a ban on new internal combustion cars from 2030.

**France, UK & Denmark:** There will be a ban on the sale of internal combustion engine cars by 2040.

Sources: Jato Dynamics (2017, 2018, 2019), Eurostat 2019, Fitch 2019, ACEA Tax guide 2019 and ACEA Statistics (2017, 2018, 2019)

## GET IN TOUCH

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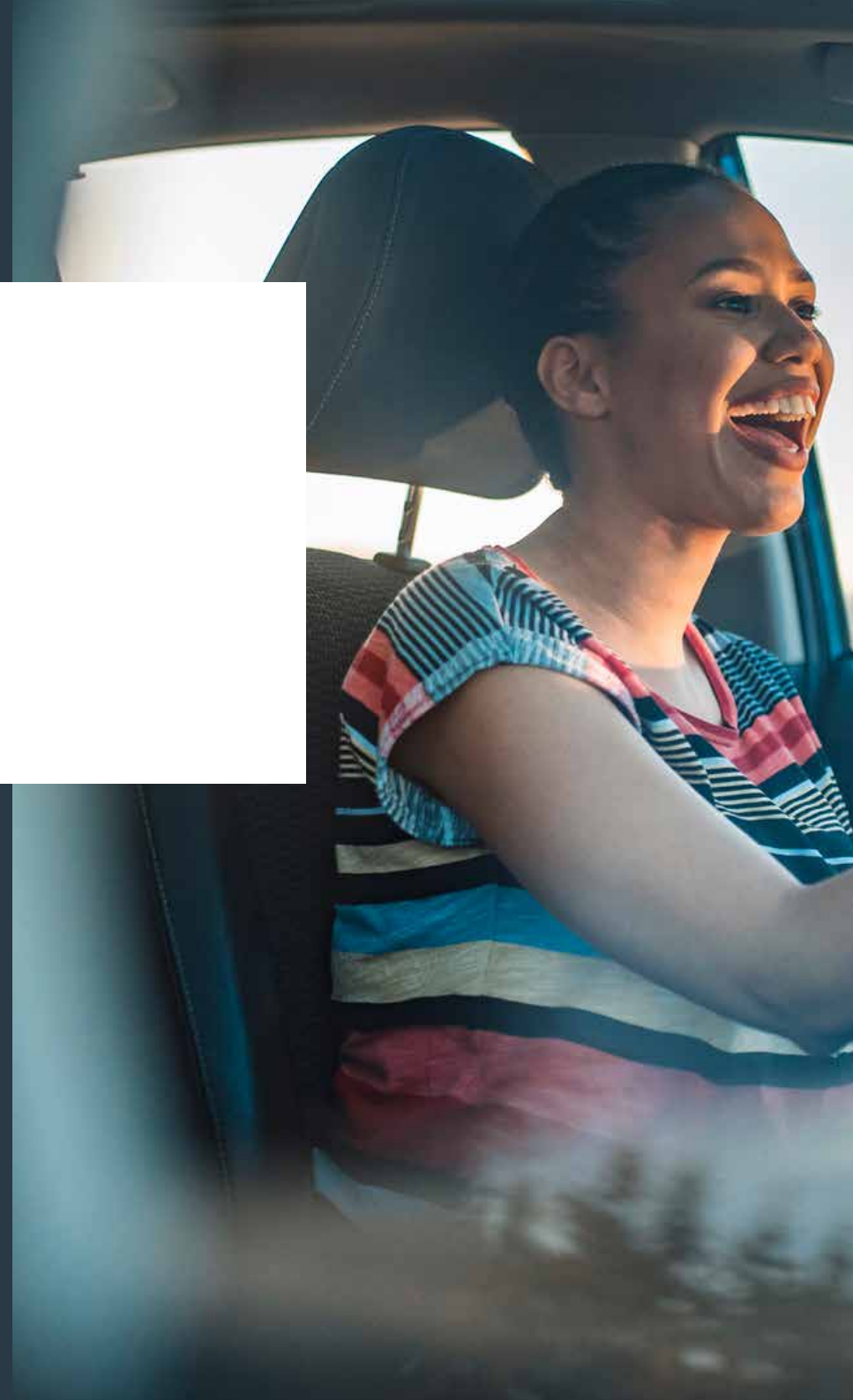


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## METHODOLOGY

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To forecast CO<sub>2</sub> emissions, targets and fines, we used a proprietary analysis based on public data and our industry expertise.

Manufacturer-specific CO<sub>2</sub> targets depend on current average fleet weight and how that differs to the previous three years. We forecast the average fleet weight of each manufacturer using a proprietary assessment of present and earlier weight trends, their ability to reduce weight and their commitment to enhancing their electrified portfolio in the coming years.

We also calculated the number of registrations of each powertrain type and car segment (city, small, compact, SUV, etc.) for each manufacturer using an extrapolation of current trends and our insights into the future focus of individual car makers.

Emissions performance reflects a segmented portfolio based on current and earlier models, as well as future trends and planned releases. We set up the segmentation to discriminate between different powertrain types and car segments to better forecast future fleet emissions. This process let us forecast the development of different powertrain technologies by each manufacturer, as well as the extent of any increase in heavy SUVs. We also included super-credits, which the EU awards to each low-emission vehicle (less than 50g CO<sub>2</sub>/km) registered.

We calculated the fines each manufacturer would need to pay using the deviation between their specific target and our forecast emissions in 2021. For each gram of CO<sub>2</sub> above the target, the EU will fine manufacturers €95 multiplied by the number of cars registered in the region.

Our 2021 forecasts are based on the NEDC test procedure as this will remain in place for the 2021 targets, even though the WLTP arrived in 2018 to give consumers more information about each new car in Europe.

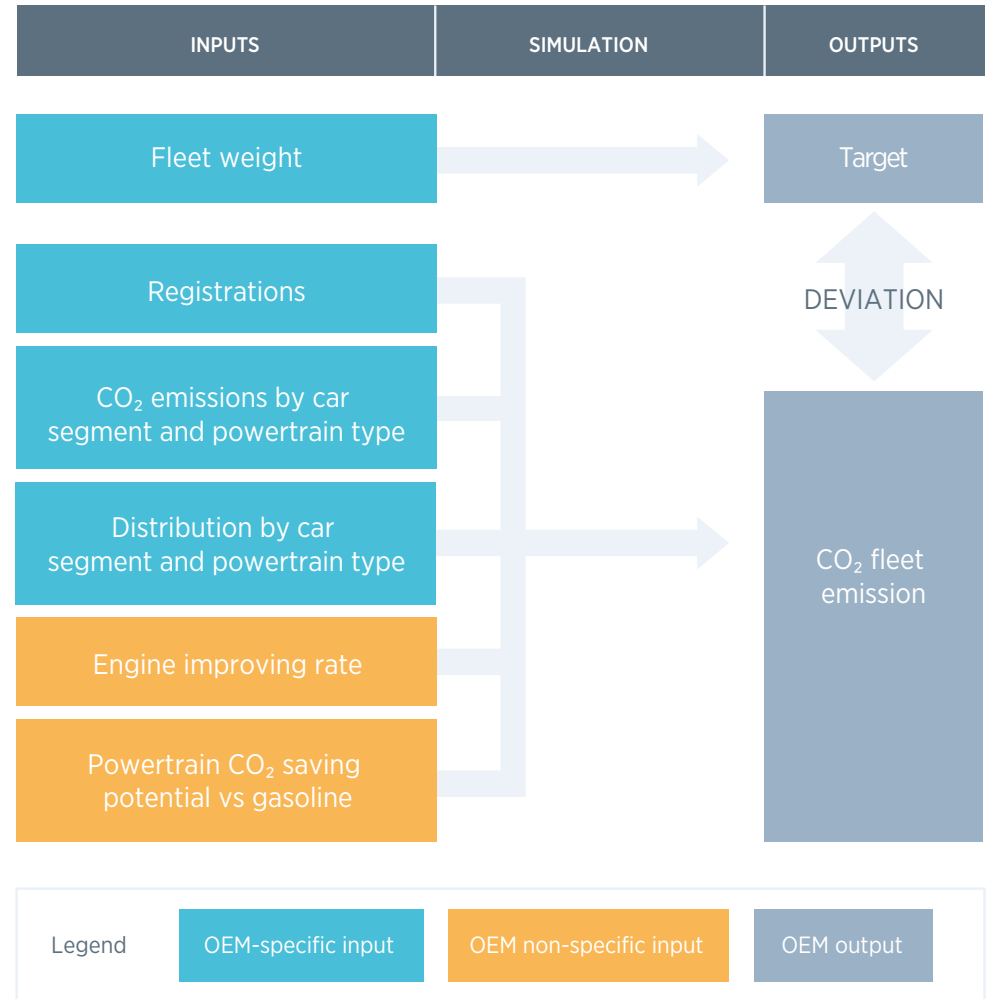


Figure 9. Our benchmarking model is based on various inputs

## TARGET CALCULATION

General rule for every car maker

CO<sub>2</sub> target: 95g/km as mean value  
adapted to fleet weight from 90 to 110g/km

If sales <300,000 units  
an exception can be granted **on demand**

CO<sub>2</sub> target: -45% from the 2007 emission level

If sales <10,000 units  
an exception can be granted **on demand**

CO<sub>2</sub> target: no general rule, targets to be discussed  
specifically between the EU and each of the requesting  
car maker

## REGULATIONS FRAMEWORK

**In 2020:** 95% of new passenger cars must  
comply with the specific limit for each car maker

**As of 2021:** 100% of new passenger cars

## AWARDED SUPER-CREDITS

Each low-emitting car (<50g/km) is counted as:

- 2 vehicles in 2020
- 1.67 vehicles in 2021
- 1.33 vehicles in 2022
- 1 vehicle from 2023 onwards

## PENALTIES

95 €/gram CO<sub>2</sub> over the target  
for **each car** registered in the EU

Figure 10. EU regulatory framework for CO<sub>2</sub> emissions in the automotive industry



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