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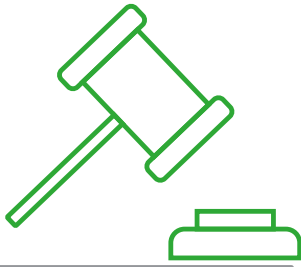
**Cutting CO₂ emissions
from passenger cars**

Towards a greener future for the
European automotive industry

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Executive summary

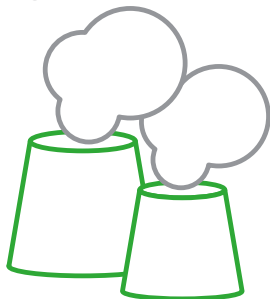
Combining publicly accessible IHS production and sales data and emission values from the European Environmental Authority, this study by Deloitte forecasts sales, emissions and CO₂ compliance in the European Union from 2020 until 2026. The key findings are as follows:



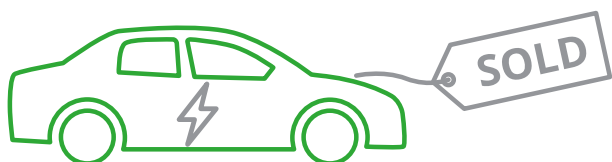
Stricter European CO₂ emission legislation might cause severe penalty payments and reputation loss – major threat to the automotive industry as half of **car manufacturers are facing penalty payments of 0.4bn€ in 2020 and 3.3bn€ in 2021.**

CO₂ emissions, on average, 23% higher under WLTP –

complexity and pressure for OEMs increase with change in reporting of CO₂ emissions according to WLTP test procedure in 2021.



Electric and hybrid vehicles as the biggest CO₂ lever – OEMs must shift their portfolio from conventional to more electric and hybrid vehicles.

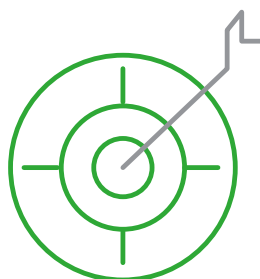


Steady increase in demand and supply for electric and hybrid engines – more than **one third of newly registered passenger cars in the EU will be electric or hybrid vehicles by 2026.**



SUV trend continues – OEMs bet on electrification with **over-proportional growth in hybrid and electric engines in SUVs** compared to smaller car types.

Emission target met at the European level in 2020 – while application of **flexibilities as super-credits and phase-in helps to avert 7.3bn€ in penalty payments**, a hard Brexit results in 27m€ additional penalty payments for 5 OEMs.



Stricter CO₂ legislation in the EU from 2020 onward

European fuel economy and emission target force OEMs to initiate technical and portfolio measures as quickly as possible.

The new emission target of 95 g CO₂/km set by the European Union from 2020 onward¹ confront many car manufacturers with major challenges, as significant penalty payments and reputation damage might occur. In 2019, for instance, Deloitte's model forecasts that car manufacturers sold new cars with an average of 108 g CO₂/km in the EU². To reach the EU CO₂ target of 95 g in 2020, and avert considerable penalties in the future, it is crucial for OEMs to initiate technical and portfolio measures as quickly as possible. One of the most important levers for reducing fleet emissions is a port-

folio shift from conventional (ICE) to electric and hybrid vehicles (BEV and PHEV)³. The regulatory environment and growing customer demand for electric and hybrid vehicles thus explain OEMs' increasing market launches of low-emissions models in the future.

Time will tell, however, if the measures taken by the OEMs will be enough, particularly in light of the additional reductions of 15 percent in 2025 and 37.5 percent in 2030 in European emission target⁴.

Stricter European CO₂ emission legislation threatens to burden the automotive industry with billions in penalty payments as well as reputation damage – the biggest CO₂ lever for OEMs is a portfolio shift from conventional to electric and hybrid vehicles.

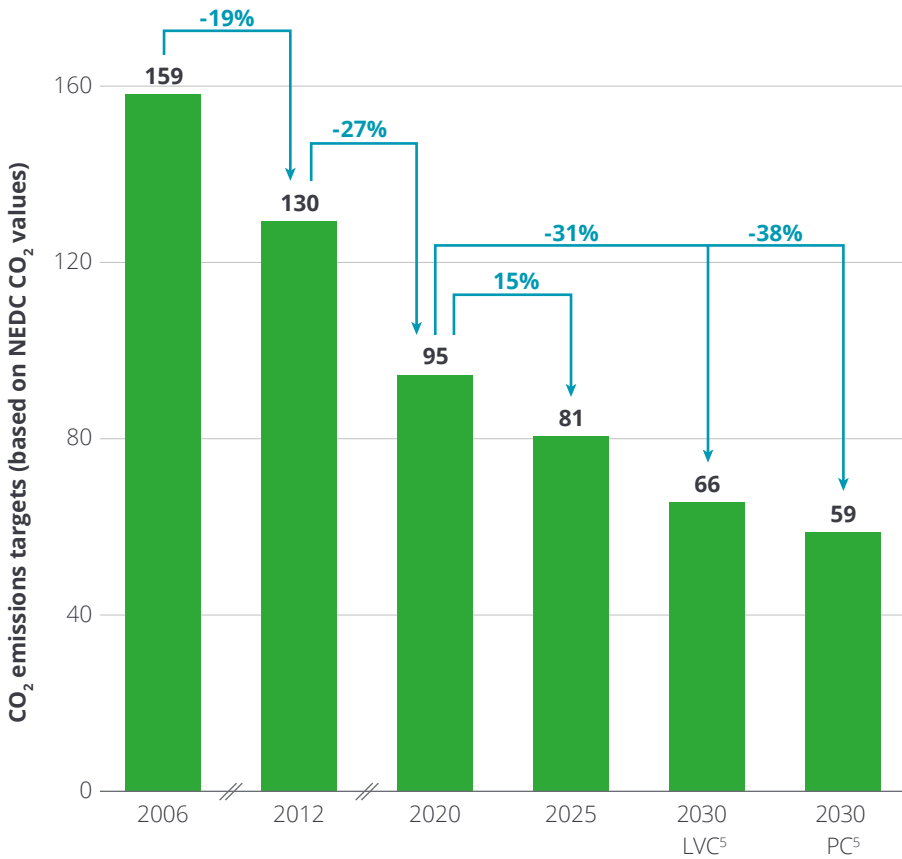
¹ Regulation (EC) No. 443/2009 and Regulation (EU) 2019/631.

² Calculations in this study are based on the EU 27 member states and Iceland and Norway (EU27+2), if not otherwise stated.

³ ICE = internal combustion engine; BEV = battery electric vehicle; PHEV = plug-in hybrid electric vehicle.

⁴ Regulation (EU) 2019/631.

Fig. 1 - Development of the European emission target from 2006 to 2030



Sources: Regulation (EC) No 443/2009, Regulation (EU) 2019/631.

⁵ LCV = new light commercial vehicle; PC = new passenger car.



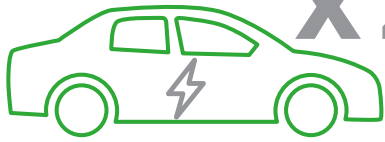
Fleet weight must be considered to calculate a car manufacturer's specific emission target – special regulations amplify the positive impact of low-emissions cars

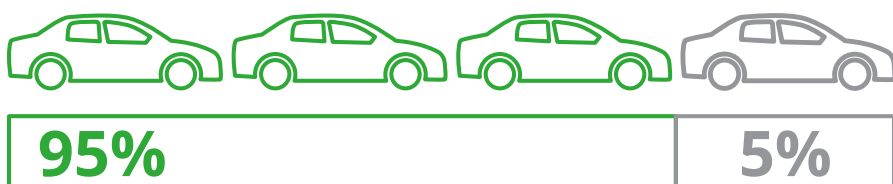
An OEM's specific emission target from 2020 onward is based on the following formula, which accounts for the OEM's specific average fleet weight (m) and the difference in comparison to the European reference weight (m_{ref})⁶:

$$\text{Specific CO}_2 \text{ emission target} = 95 + 0.0333 (m - m_{ref}).$$

Additionally, the EU allows certain special regulations (flexibilities), which reduce the CO₂ emissions taken into account by the EU Commission:

Fig. 2 - Special flexibilities for car manufactures

 **x 2** **Super-credits:** vehicles emitting less than 50 gCO₂/km are counted 2x in 2020, 1.67x in 2021 and 1.33x in 2022 (cap of 7.5gCO₂/km in the period 2020–2022 for each manufacturer).



Phase-in: only 95% of each manufacturer's newly registered passenger cars in 2020 are taken into account.



Eco-innovations: savings of maximum 7 g CO₂/km per year achieved through use of innovative technologies or a combination of such are considered.

If car manufacturers exceed the specific yearly emission target, they must pay 95 € per excess gram multiplied by the number of newly registered passenger cars in the current calendar year.

Additional pressure due to higher CO₂ values under WLTP regulations

Complexity increases with the transition in reporting from NEDC to WLTP⁷ values in 2021 – CO₂ emissions forecasted to be 23 percent higher based on WLTP test procedure

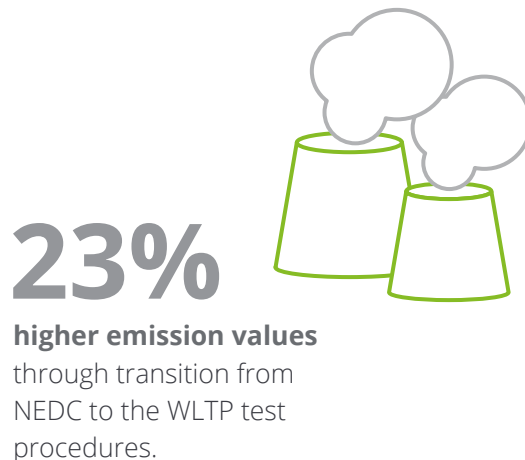
The necessity to shift OEMs' portfolios from conventional to electric and hybrid vehicles becomes even more important through the transition from the regulatory test procedure New European Driving Cycle (NEDC) to the Worldwide Harmonized Light Vehicles Test Procedure (WLTP). As the new procedure is based on more realistic driving conditions and considers equipment variants and weight classes, the WLTP is supposed to provide more realistic emission and fuel consumption values. Deloitte's model forecasts that the CO₂ emissions from new passenger cars over all OEMs will increase by around 23 percent due to the change in the regulatory test procedure⁸.

To enable a smooth transition to the new regulatory procedure, a methodology was put into place to correlate existing NEDC and new WLTP emission values during the phasing-in period from September 2017

until the end of 2020. At the beginning of 2021, OEMs must convert their specific NEDC-based emission target into a corresponding WLTP-based target⁹.

With forecasted higher CO₂ values of 23 percent under the WLTP, the pressure on OEMs to restructure their portfolio with a large share of low-emissions models increases considerably.

Fig. 3 – Difference between NEDC and WLTP test procedures



⁷ NEDC = New European Driving Cycle; WLTP = Worldwide Harmonized Light Vehicles Test Procedure.

⁸ For a detailed description of the model, please refer to the appendix.

⁹ Regulation (EU) 2019/631.

At the beginning of 2021, OEMs must convert their specific NEDC-based emission target into a corresponding WLTP-based target. Higher emission values are more than likely.

Growth of the electric and hybrid vehicle market

By 2026, more than one third of newly registered passenger cars in the EU will be electric or hybrid vehicles.

Sharp increase in plug-in hybrids and electric cars in the EU predicted – reaching nearly 5 million in sales and a market share of 34 percent in 2026

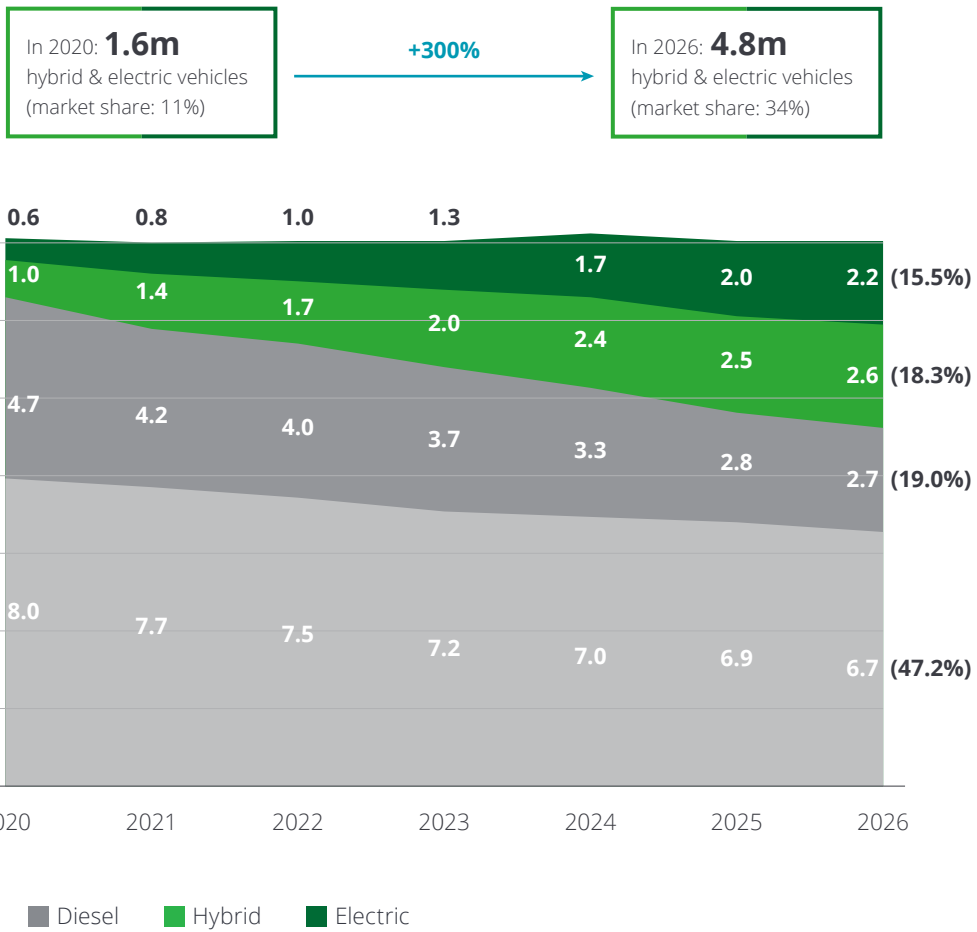
Based on the results of Deloitte's model, which combines IHS sales and production data¹⁰, supply and demand for electric and hybrid engines are steadily increasing.

Around 5 million hybrid and electric vehicles are forecasted to be sold by 2026, reaching a market share of 34 percent compared to only 11 percent in 2020.

While sales of conventional engine types decrease, the number of electric and hybrid models increase sharply and is predicted to reach a share of 80 percent in OEMs' product portfolio. Additionally, Deloitte forecasts a continuous downward trend in horsepower from an average of 135 hp in 2020 to 126 hp in 2026.

Registrations of plug-in hybrids and electric cars are expected to treble from 1.6 million in 2020 to 4.8 mio in 2026.

Fig. 4 – Newly registered vehicles in the EU by engine type in millions (2020–2026)



Increasing electrification of SUV models

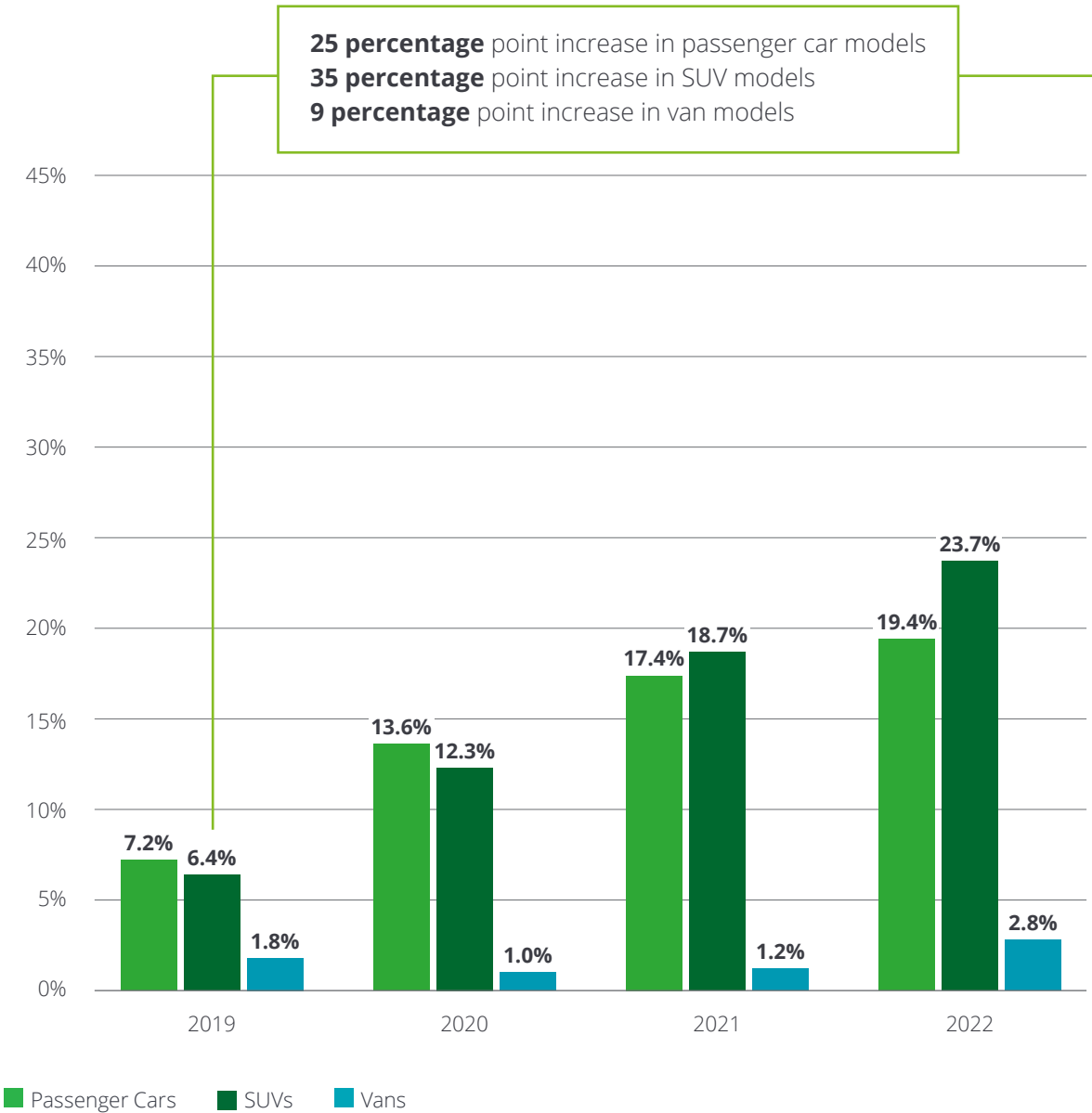
To take advantage of the continuing SUV trend, OEMs bet on electrification with over-proportional growth in hybrid and electric engines compared to smaller car types.

Significant growth in SUV models with low-emission engines compared to smaller car types to meet demand as well as to avoid CO₂ non-compliance of fleet portfolio

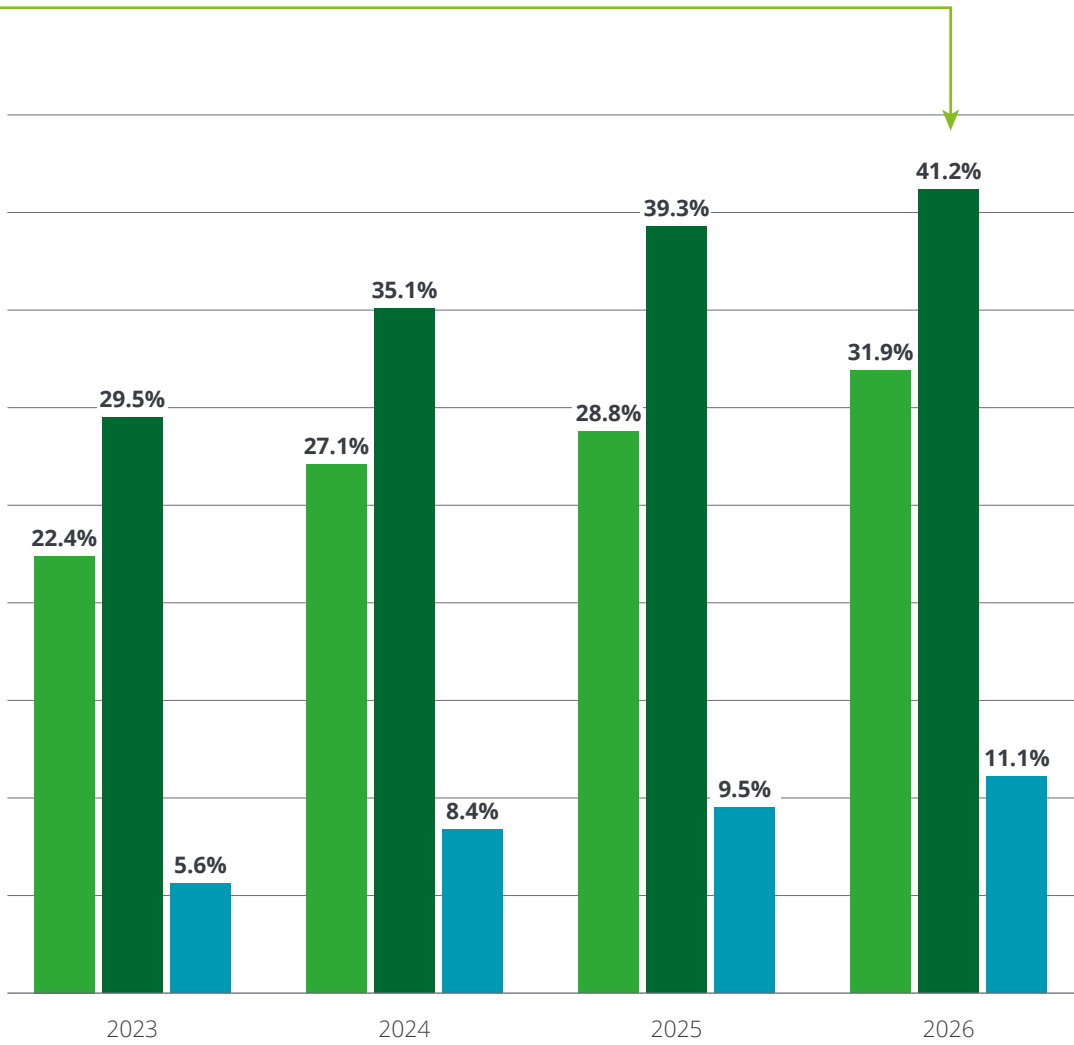
Based on Deloitte's model, sales of SUVs are forecasted to increase by 23 percent by 2026, reaching a portfolio share of more than 41 percent in 2026. Sales of SUVs will continue to increase and thereby more than 40 percent will be hybrid and electric SUV models by 2026. In comparison, only 32 percent of passenger car models and 11 percent of van models will be hybrid or electric in 2026. This growth emphasizes that OEMs will try to capitalize on the SUV trend while striving to ensure CO₂ compliance.



Fig. 5 - Share of hybrid and electric vehicles per car type (2019-2026)



Sources: IHS Markit, Deloitte analysis.



Predicted CO₂ compliance in the EU until 2026

Emission target will be met at the European level in 2020 only due to the application of super-credits and phase-in.

7.3bn in penalty payments can be averted through the application of super-credits and phase-in in 2020

As discussed, meeting the stricter EU emissions legislation as of 2020 will be challenging. Even if the CO₂ target for the European fleet level is forecasted to be met, a detailed analysis shows that significant penalty payments are averted only by applying super-credits and phase-in in 2020. The regulation allows newly registered passenger cars with emissions of less than

50 g CO₂/km to be counted twice in 2020. Moreover, only 95 percent of the newly registered passenger cars are considered¹¹, which enables OEMs to deduct 5 percent in sales of the highest-emitting vehicles. The application of these flexibilities supports the majority of OEMs to reach their specific EU emission target in 2020, averting considerable penalty payments of 7.3bn €. However, 13 of 21 OEMs will already exhaust the maximum in super-credits (7.5 g CO₂/km) in 2020.



Fig. 6 - Average emissions and targets in g CO₂/km at the EU level (2020-2026)



Sources: IHS Markit, Deloitte analysis.



Large number of car manufacturers face significant penalty payments in 2020 and especially in 2021

Although CO₂ compliance will be reached at the European level, several car manufacturers will not achieve their individual emission target. As forecasted in Deloitte's model, 5 out of 21 car manufacturers already have to face penalty payments of overall 0.4bn € in 2020. In 2021, the situation deteriorates, as 13 out of 21 car manufacturers will already have reached the mandated maximum reduction of 7.5 g CO₂/km in super-credits in the preceding year. Without the possibility of applying additional super-credits in 2021, 10 of 21 OEMs must pay considerable penalty payments totaling 3.3bn €.

Brexit hits CO₂-non-compliant OEMs twice – threat of 27m € of additional penalty payments

With a hard Brexit becoming increasingly likely, CO₂ emissions must be assessed separately for the EU27+2 and the United Kingdom. This separate assessment of the EU27+2 and the United Kingdom will result in 27m € in additional penalty payments for 5 OEMs in comparison to a pooled assessment within EU28+2 according to Deloitte's model.

Need to introduce short-term countermeasures to reduce CO₂ emissions in 2020 and 2021

Overall, this analysis shows that in the long term, OEMs are able to shift toward greener portfolios, which will aid them in averting significant penalty payments in the future. Nevertheless, to reduce high penalty payments, within the next two years, the majority of car manufacturers must initiate additional short-term countermeasures that combine the steering dimensions profitability, volume and CO₂.

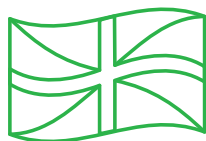
Fig. 8 - Expected penalty payments for european car industry in 2020 and 2021



13 of 21 OEMs exhaust super-credits of max. 7.5 gCO₂/km already **in 2020**.



3.3bn€ in penalty payments for 10 of 21 OEMs in 2021.



A hard **Brexit** would result in **27m€ additional penalty payments** in 2020 for 5 OEMs.

Although emission target will be met at the European level in the future, a majority of car manufacturers face penalty payments of 0.4bn € in 2020 and 3.3bn € in 2021.

Implications for the industry and authorities

Fig. 9 – Long- and short-term implications for OEMs



OEMs have to combine long- and short-term measures to ensure CO₂ compliance¹² and successfully transform the automotive industry for a greener future

long-term

Technical product and portfolio measures

- Expansion of driving range for BEVs
- Optimization of time to charge

Mix shift from conventional to electric

- Further increase in BEV volume
- Support of charging infrastructure

Avoidance of delivery delays

- Timely start of production of hybrid and electric models ensured

Steering of demand through price measures

- Decreasing/increasing list prices
- Stimulation of demand with sales aids

Volume mix shifts in short-term planning

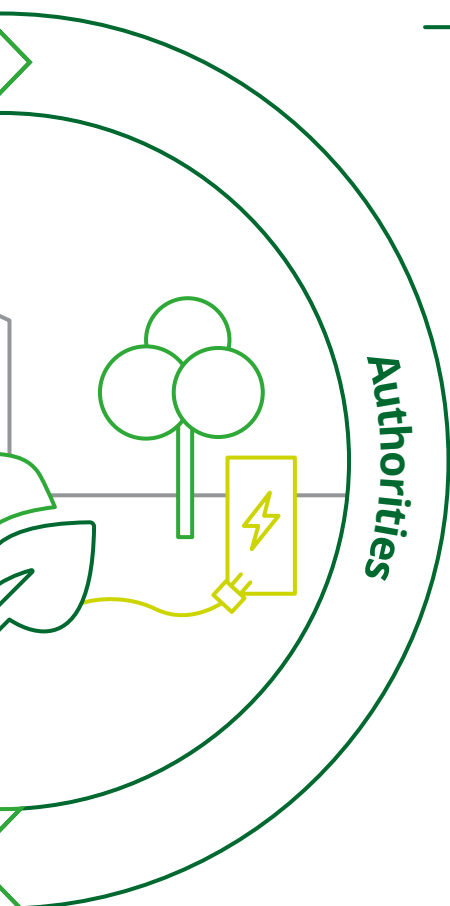
- Promotion of CO₂-compliant car models
- Optimization of equipment, tires and accessories

short-term



Authorities can support the shift to a greener portfolio

and boost the demand for electric and hybrid vehicles through investments and financial incentives¹³



long-term

Consideration of sustainability performance indicators (KPIs) in regulatory decisions

- Integration of sustainability KPIs into processes as new dimension

Holistic approach in regulating emissions

- End-to-end assessment of emissions from production to registration of passenger cars

Geopolitical standardization effort

- Standardization of emissions regulations on the European continent

Support of public charging infrastructure

- Investments in charging infrastructure, e.g., best practices, are Norway, the Netherlands or Belgium

Financial incentives for electric vehicles

- Governmental subsidies and tax exemptions, e.g., for company fleets to stimulate demand and provide compensation for higher acquisition prices

short-term

¹³ Deloitte report 2019 – “New market. New entrants. New challenges. Battery Electric Vehicles”.

Appendix

Description of the model and the data

The model calculated by Deloitte contains detailed information on each vehicle model that will be traded in the EU until 2026. The model combines IHS production and sales forecasts with European Environmental Authority information regarding the emissions of each new passenger car model by engine type and power in the EU. The model not only analyzes motorization, engine type and CO₂ emissions per vehicle but also considers corresponding production and sales forecasts until 2026. Thus, the annual CO₂ emissions and possible penalty payments for non-compliance with the EU emissions regulation can be determined for each car manufacturer applying the EU emissions regulation. As corresponding data for CO₂ emissions and weight per vehicle were not available on a yearly basis, the model assumes constant values per vehicle until 2026. If individual CO₂ emissions were not available for each vehicle, the model formed analogies based on power and weight. In addition, this model does not consider CO₂ savings achieved through eco-innovations, as this information was not publicly available. Following the EU emissions regulation, only manufacturers with more than 10,000 newly registered passenger cars in the EU in a calendar year were taken into account. Additionally, for car manufacturers that are companies within a group, weight, sales, CO₂ emissions and subsequent super-credits and phase-in were determined for the group as described in the EU regulation (Article 6, 'Pooling').





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