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The new EU regulation on CO_2 emissions from cars and how it impacts carbon targets in Germany's transport sector

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1. Results in brief

In the following, we consider the European Commission's recent legislative proposal[1] for new CO_2 emissions standards for cars, along with two possible variations on the proposal. Our analysis highlights the importance of these standards in meeting Germany's transport sector targets and in furthering the roll-out of low and zero-emissions vehicles.

1. By themselves, the EU Commission's proposed fleet targets for the period from 2021 to 2030 would only serve to reduce car CO_2 emissions in Germany by 3.5 million tonnes in comparison with the reference scenario. In order to meet the transport sector targets in Germany's Climate Action Plan 2050, it would then be necessary to ensure further emissions reductions of 44.7 million tonnes of CO_2. In the absence of any additional measures, there will be around 3.4 million electric vehicles (BEVs and PHEVs) on the road in 2030.

2. More ambitious fleet targets at the EU level could potentially save up to 20 million tonnes of CO_2, which would significantly reduce Germany's transport sector shortfall. In light of foreseeable technological developments, such an ambitious reformulation of the regulation would also be feasible. Among many vehicle manufacturers, production targets for zero-emissions vehicles already exceed those of the present Commission proposal. Such an approach would make it possible to increase the number of electric vehicles on the road to 11 million by 2030 and to reduce *real* CO_2 emissions for conventional cars from 179 to 108 g/km. This would correspond to a vehicle fuel efficiency of 4.4 litres per 100 km.

3. Should the Commission proposal remain unchanged, however, it will be necessary to implement a range of significant national measures to meet Germany's sectoral targets. These may involve raising mineral oil tax rates, undertaking a robust reform of existing vehicle and company car taxation policies, and levying a usage-based toll on both new car fleets and existing vehicles. Introducing such measures would require a political consensus that is currently lacking. Also, it also cannot be ruled out that local authorities to introduce their own measures to regulate car traffic independently of federal legislation. This situation will likely be replicated among other EU member states, some of which have already advocated for a more ambitious regulatory framework at the Commission. Drivers and above all vehicle manufacturers therefore risk being faced with a confusing array of legislation that stands in the way of a unified internal market. The lack of a reliable, long-term political regulatory framework could be highly detrimental to car manufacturers' product planning processes.

4. The negotiation process on the Commission's proposal is expected to continue throughout 2018. Germany's binding 2030 climate targets require the federal government, in consort with other EU member states, to push for more ambitious fleet target regulations. This will be essential if Germany is to retain any hope of meeting its transport sector targets and its broader goal of a 55 per cent reduction in overall greenhouse emissions by 2030.

[1] Cf. EU KOM (2017a).

2. Germany's transport sector targets and the role of car emission standards

Germany's federal government first set distinct sectoral targets for greenhouse gas reductions in its Climate Action Plan 2050, which was adopted at the end of 2016. The plan provides for transport sector emissions reductions of between 40 and 42 per cent against 1990 levels by 2030, at which point emissions should be between 95 and 98 million tonnes. In comparison with greenhouse gas emissions in the 1990 base year as well as current emissions levels (2016: 166.2 million t),[2] this will require a reduction of almost 70 million tonnes of CO_2 in the space of 13 years – despite the fact that in the far longer period since 1990, net emissions have risen slightly rather than fallen. Against this backdrop, the need for effective emissions reductions policies in the transport sector is clear.

The extent of the challenge is laid bare by the official forecasts for greenhouse gas emissions, which Germany, like all other EU member states,[3] is required to provide every two years. The most recent "Projection Report" was submitted to the EU Commission in April 2017.[4] It reveals that, if no further political measures are implemented beyond those currently in place, transport sector emissions will only fall by 15 million tonnes against 1990 levels by 2030. This "with measures scenario" (WMS) constitutes the report's reference scenario. Even in the "with additional measures scenario" (WAMS), the expected emissions reductions of 26 million tonnes by 2030 fall far short of what is really needed.

The Projection Report (PR) assumes that the additional reductions of around 11 million tonnes by 2030 in the WAMS will be achieved solely by means of the renewal of the European Commission's CO_2 Regulation for cars and light commercial vehicles (LCVs).[5] At the time of the report's publication, however, the Commission's proposal for future fleet targets was not yet known.

3. The Commission proposal

In the meantime, the EU Commission has published its legislative proposal, which consists of two key elements:

- Firstly, it updates the existing CO_2 emissions targets for new cars and LCVs for the period from 2021 to 2030. In the following, we shall only consider the regulations pertaining to cars. The proposal provides for CO_2 emissions reductions for new car fleets of 15 per cent by 2025 and 30 per cent by 2030 against the existing 2021 fleet target (95 g CO_2/km). The fact that the Commission is now stipulating percentage reduction rates rather than absolute target values for 2025 and 2030 is due to its adoption of a new driving cycle as the basis for future emissions assessments. It is widely acknowledged that the new Worldwide Harmonized Light Vehicle Test Procedures (abbreviated WLTP) generate higher emissions values than the previous New European Driving Cycle (NEDC) and better reflects vehicle emissions in real-life scenarios. The initial WLTP values that will be assigned to individual manufacturers will nonetheless only be available after 2021.
- Secondly, the proposal contains an incentive mechanism to boost sales of zero and low-emissions vehicles. Manufacturers whose total sales consist of over 15 per cent of such vehicles in 2025 and over 30 per cent in 2030 will be issued with credits that can be offset against their emission reductions targets. The proposal does not provide for a corresponding penalty clause.[6]

2 UBA (2017).
3 EU (2013).
4 Bundesregierung (2017).
5 These two vehicle types are responsible for around two thirds of all greenhouse gas emissions in the transport sector.
6 Cf. EU KOM (2017a).

The Commission proposal raises the following questions:

- What effect would its implementation have on real car CO_2 emissions?
- How would it impact emissions reductions in the German transport sector as a whole?
- What contribution would it make to meeting Germany's transport sector targets of 95 to 98 million tonnes of CO_2 emissions in 2030?[7]

3.1 The Commission proposal and real car CO_2 emissions

Before examining the impact of the Commission proposal, it is first of all necessary to define the basis for our assessment. Since the percentage reduction stipulated in the Commission proposal relates to an as yet unknown value, we shall assume a conversion factor of 1.25 between the NEDC and the WLTP.[8] This means that the 2021 car emissions target of 95 g/km in the NEDC will be 119 g/ km in the WLTP. Converted into WLTP values, the Commission's average emissions targets for all new cars would then be 101 g CO_2/km in 2025 and 83 g CO_2/km in 2030 in the WLTP.

Despite the fact that the Commission proposal provides for the monitoring of real-world emissions, it can nonetheless be assumed that real emissions levels will be significantly higher. Here we assume a deviation of 31 per cent for 2030.[9]

3.2 Emissions reductions across the transport sector

In order to assess how the proposal will impact emissions in the German transport sector as a whole up to 2030, we first require a clearly defined reference scenario (see Table 1). This is a scenario on which emissions targets are frozen at 2021 levels and no longer updated. The scenario employed here is the 2017 Projection Report's "with measures scenario" (WMS), on which a quasi-autonomous development, influenced by factors such as population decline, petrol price fluctuations, and existing legislation will see transport sector CO_2 emissions fall by 14.6 million tonnes against 1990 levels in 2030, to a total of 148.7 million tonnes.

The premises of the Projection Report should nonetheless be regularly reassessed. On the basis of new cost estimates for emissions reductions technologies, we can assume additional reductions of 2.5 million tonnes beyond those predicted in the WMS. The difference between the reference scenario emissions of 146.2 million tonnes and Germany's sectoral goal of 98 to 95 million tonnes would then still be around 50 million tonnes.

Although it is highly likely that these updated figures will better reflect future developments, the reference scenario is still beset by a high degree of uncertainty. Slower rates of population decline or falling energy and fuel prices, for example, could result in higher emissions levels.

3.3 Germany's sectoral targets

By itself, the implementation of the Commission proposal would result in additional emissions reductions of only 3.5 million tonnes in 2030.[10] On this basis, Germany would then fall short of the upper end of its 2030 reductions target by 44.7 million tonnes.

In its own background studies, the EU Commission arrives at a more optimistic appraisal of the

[7] Our modelling is based on the TEMPS new registration model, developed by the Öko-Institut. This model also underlies the modelling in the federal government's 2017 Report on National Greenhouse Gas Projections (Projection Report)". It is outlined in the Appendix to this study.

[8] For a detailed consideration, see Kasten; Blanck (2017), p. 12.

[9] Cf. Miller (2016). It is possible that the deviation may be even greater. The estimate of 31 per cent is based on calculations by the ICCT, which take account of the presently known variability of the WLTP. Real fuel consumption today is on average 42 per cent higher than the consumption recorded by vehicle manufacturers in the NEDC.

[10] For an explanation of the methodology on which our calculations are based, see the Appendix.

proposal's impact. It assumes that its car-specific targets will be sufficient to reach the European climate target of -30% for the "non-ETS" (Emissions Trading System) sector. This sector brings together transport, agriculture, and waste management.

The Commission's background studies nonetheless also assume that, alongside the car-specific targets, other measures will contribute to meeting its climate goals. Some of these are far-reaching, such as a proposed EU-wide internalisation of the external effects of the transport sector. The Commission also assumes that biofuels will play an increasingly important role.[11]

According to the calculations on which this paper is based, the emissions reductions that would result from the Commission proposal would be lower even than those predicted in the Projection Report's "with additional measures scenario" (WAMS) as an effect of the renewed fleet targets. In the latter scenario, the regulations in force from 2020/21 would result in 11 million tonnes of additional emissions reductions by 2030 in comparison with the WMS.[12]

4. The alternative proposals: Pro Climate and Pro Climate Plus

The key question that needs to be addressed is: How high do the fleet emission targets need to be in order to make a significant contribution to reducing the shortfall in CO_2 reductions? In order to respond to this question, we shall model two variations on the Commission proposal.[13]

Table 1: The remaining shortfall from Germany's transport sector emissions targets after implementation of the Commission proposal (greenhouse gas emissions as per the CAP 2050 in millions of tonnes of CO_{2e})

Transport sector emissions in Germany	Reduction	GHG emissions in MT CO_{2e}
Emissions (1990)		163.3
Emissions in the Projection Report reference scenario (MMS) (2030)	14.6	148.7
Emissions in the new reference scenario (2030)	2.5	146.2
Emissions after implementation of the Commission proposal (2030)	3.5	142.7
Further reductions required to reach the 2030 target	**44.7**	**98**

Authors' own illustration

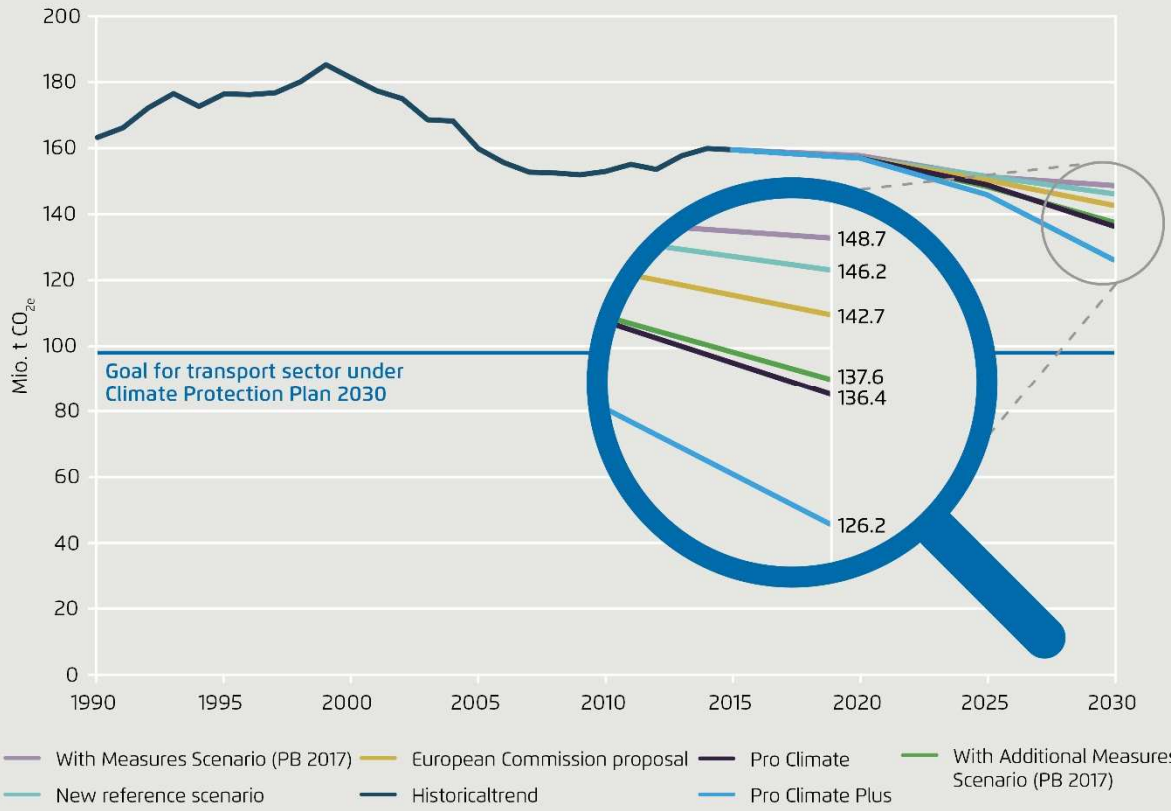
[11] EU KOM (2017b), p. 108, n. 184.

[12] A significant difference between the Commission proposal and the WAMS remains even when we adjust for the fact that they are based on two different reference scenarios. The reductions in the Commission proposal were calculated in relation to the 'new reference scenario,' on which emissions are predicted to be 2.5 million tonnes (MT) lower than in the Projection Report's reference scenario. In relation to the latter, then, the reductions in the Commission proposal would amount to (-3.5) MT + (-2.5) MT = -6MT. This remains well below the -11 million tonnes estimated in the WAMS.

[13] In the following, we shall only be concerned with car emissions targets. Since LCVs account for less than five per cent of all road-based CO_2 emissions in Germany, the corresponding reductions would have little effect on the figures for the transport sector as a whole.

GHG reductions achieved by EC proposal in relation to reference case and projection report scenarios

Figure 1



Calculations by Öko-Institut

The first variation increases the Commission proposal's CO_2 reductions targets to 45 per cent by 2030 and 20 per cent by 2025. We shall call this the "Pro Climate" scenario. Average target emissions here would then be 95 g CO_2/km (WLTP) for 2025 and 65 g CO_2/km for 2030.[14] On this proposal, it is also assumed that a limit would be placed on the permissible deviation between recorded WLTP values and real CO_2 emissions, in order to prevent any further widening of the gap between test values and real emissions levels. This Pro Climate proposal would lead to reductions of around 10 MT of CO_2 by 2030. This alone would represent a significant increase over the existing Commission proposal.

The second variation raises CO_2 reduction targets for newly registered cars even further, to 50% by 2025 and 75% by 2030. This corresponds to 60 g CO_2/km by 2025 and 30 g CO_2/km by 2030. We shall call this the "Pro Climate Plus" scenario. This proposal would likewise involve limits being placed on the permissible deviation between WLTP test values and real emissions levels. These emissions targets are highly ambitious, yet in light of rapidly falling battery prices and vehicle manufacturers' announcements concerning future electric car prices and expected

[14] The intermediate 2025 target is oriented around the less ambitious end of a European Parliament proposal that provides for annual emissions reductions of 4 to 6 per cent among new registrations between 2021 and 2025. Cf. EU KOM (2017b).

Table 2: Conversion of the percentage reductions targets into WLTP values

	Reduction against 2021 levels		Average CO_2 emissions among new car fleets (in g/km im WLTP)	
	2025	**2030**	**2025**	**2030**
Commission proposal	-15%	-30%	101	83
Pro Climate	-20%	-45%	95	65
Pro Climate Plus	-50%	-75%	60	30

Authors' own illustration

sales, they are still quite conceivable.[15] Implementation of this Pro Climate Plus proposal would lead to emissions reductions of nearly 20 million tonnes. It would therefore go a long way toward meeting Germany's transport sector targets and would mean that the relevant additional measures would need to be far less severe. In sum, the Pro Climate Plus scenario and the reference scenario combined would lead to transport sector reductions of around 37 million tonnes against 1990 levels by 2030. A further 28 million tonnes[16] could potentially be saved in the goods transport sector, though this falls outside the ambit of our study.

5. Emissions targets and future electric vehicle numbers

Implementation of the Commission proposal would see the proportion of battery electric (BEV) and plug-in hybrid (PHEV) vehicles among new registrations rise to 9 per cent in 2025 and 22 per cent in 2030. In the Pro Climate scenario, these figures would increase to 14 per cent in 2025 and 40 per cent in 2030.

In the Pro Climate Plus scenario, BEVs would account for 25 per cent of new car registrations as early as 2025, and PHEVs for a further 20 per cent. In 2030, around 50 per cent of new cars would be BEVs, while just under a quarter would be conventional cars.[17]

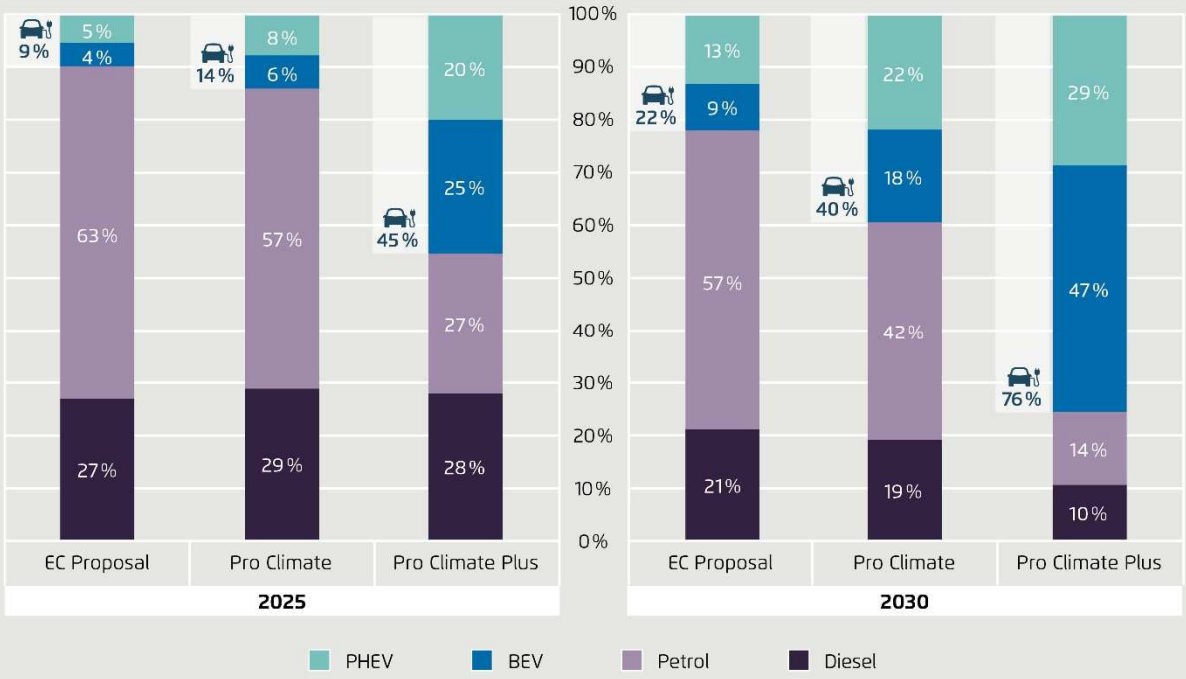
The exact distribution of new electric cars between PHEVs and BEVs will depend on factors such as the development of electric vehicle range, battery costs, consumer preferences, and infrastructural provision.

15 Volkswagen, for example, has announced that around 25 per cent of its new car sales will be accounted for by battery-driven vehicles in 2025 (cf. VW [2016]). In the same year, Mercedes-Benz and BMW expect electric vehicles to make up between 15 and 25% of their total sales (cf. BMW Group [2017], Daimler [2017]). For 2030 target values of up to 50% battery electric vehicles are being mentioned.

16 Emissions in the new reference scenario: 146.2 MT – 20 MT = 126.2 MT. This is around 28 million tonnes short of the upper end of Germany's transport sector target.

17 It is nevertheless important to note that while electric vehicles are in themselves emissions-free, they depend on electricity whose generation still produces emissions. To this extent, then, emissions are simply shifted from the transport sector to the energy sector – and will continue to be until the latter is fully decarbonised.

Breakdown of vehicle types for cars newly registered in Germany in 2025 and 2030 Figure 2



Calculations by Öko-Institut

A further deciding factor will be the extent to which manufacturers take advantage of the Commission's proposed incentives for zero and low emissions vehicles. The actual proportion of BEVs in 2025 may then be higher or lower than our predictions in the different scenarios.

The number of electric vehicles on the road in 2030 is also set to vary significantly in our three scenarios, and can therefore be seen to depend largely on the fleet emissions targets. In the Commission proposal scenario, the total number of electric cars on the road in Germany will be 3.4 million. In the Pro Climate scenario, there will be 5 million such vehicles – almost twice the number in the reference scenario. By far the highest number of electric cars will be seen in the Pro Climate Plus scenario, at almost 11 million.[18]

Eleven million alternative powertrain vehicles corresponds to roughly the number of vehicles that other, more extensive decarbonisation scenarios have suggested are required to reach Germany's transport sector climate targets.[19]

6. Increasing the efficiency of conventional powertrain vehicles

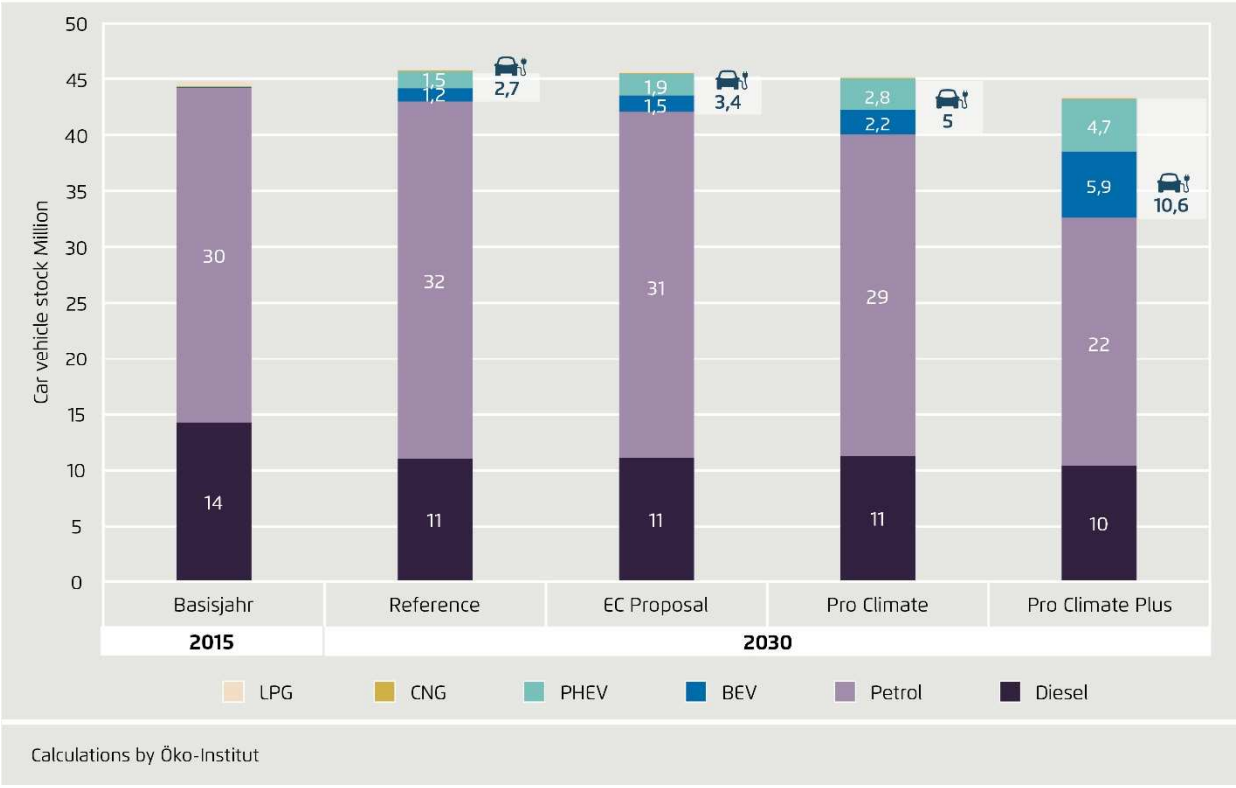
In addition to increasing the proportion of electric vehicles on the road, the proposed regulation will also help to raise the efficiency of conventional vehicles. Figure 4 shows CO_2 emissions for newly registered cars in Germany up to 2030 in the different scenarios.

In the reference scenario, there will be no further improvement in the efficiency of new cars after

[18] Small differences in the total number of cars on the road may result from changes in demand in response to electric vehicle price fluctuations.

[19] Cf. ifeu (2017); Agora Energiewende (2017).

Car vehicle stock in Germany in 2030 Figure 3



Calculations by Öko-Institut

2021.[20] In both of our variations on the Commission proposal, however, real annual efficiency improvements of between 1% and 3% are expected for conventional cars from 2021 to 2030. In the Pro Climate Plus scenario, the fuel efficiency of a typical car is set to improve by 2030 to 4.4 litres/100km (weighted average for diesel/petrol).

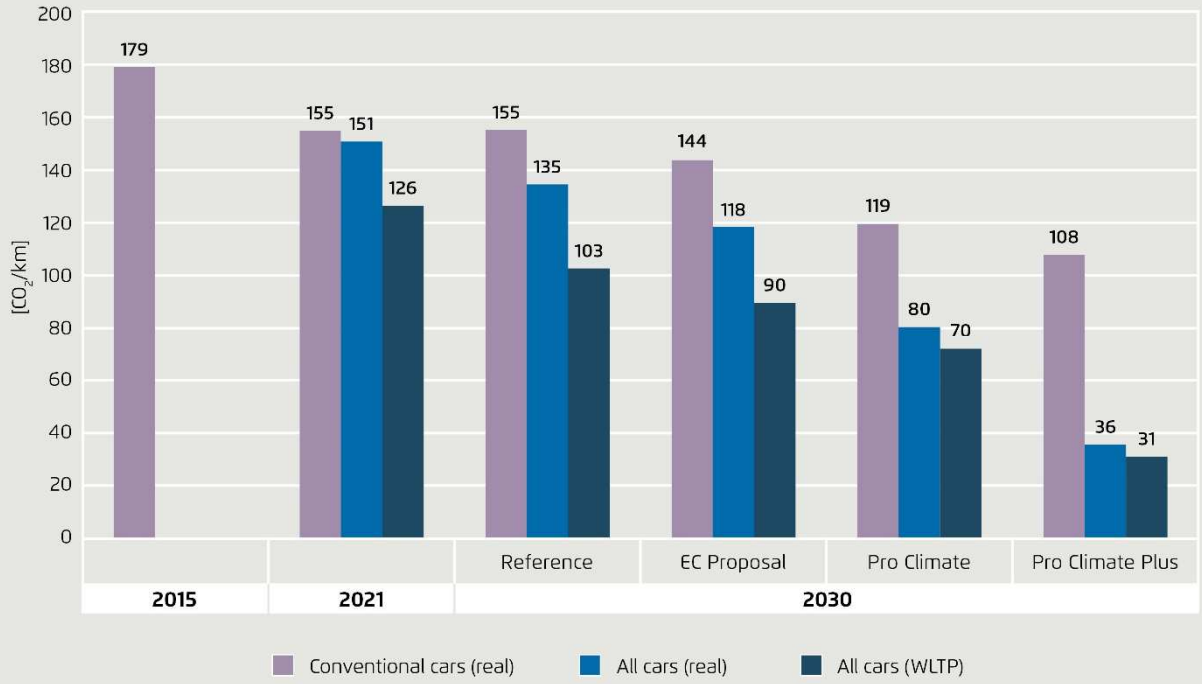
Emissions reductions for all cars combined (including electric vehicles), will be significantly higher than those for conventional cars alone in the period from 2021 to 2030. On account of the growing proportion of electric vehicles, average fleet CO_2 emissions are set to fall to 135 g/km on the reference scenario, 80 g/km on the Pro Climate scenario, and to 36 g/km on the Pro Climate Plus scenario (all real-world emissions).

The overall stock of cars on the road has a significant impact on emissions reductions across the transport sector. The composition and efficiency of this stock will largely be determined by the cars released on to the market between now and 2030.

In 2030, around two thirds of all vehicles on the road and over 50% of all kilometres driven in Germany will be accounted for by vehicles registered before 2024 (see Figure 5). It is therefore crucial that the updated CO_2 regulations impose binding standards as soon as possible, rather than waiting until 2030.

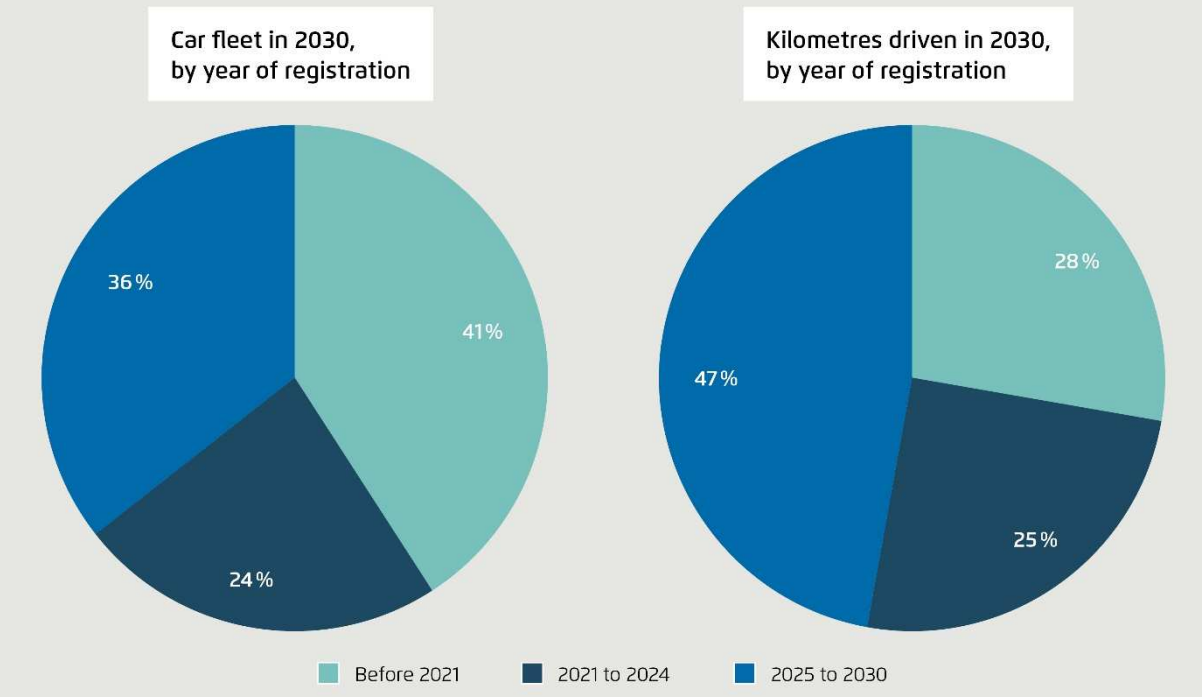
[20] The emissionreductions in the reference scenario can be accounted for by an increase in the average efficiency of all cars on the road in the period leading up to 2030. This will in part be due to the retirement of older, less efficient cars and to the growing proportion of electric vehicles.

The CO_2 emissions of newly registered cars in Germany in the various scenarios — Figure 4



Calculations by Öko-Institut without emissions from power generation

Composition of German car fleet and kilometres driven based on year of first registration — Figure 5



Calculations by Öko-Institut

7. Conclusions

The Commission's draft regulation falls a long way short of what is needed for Germany to reach its 2030 transport sector climate targets. The proposal also fails to adequately promote the burgeoning electric vehicle market. In the further negotiations around the regulation, it is therefore crucial for those involved to set more ambitious emissions targets for 2025 and 2030. In its contribution to these negotiations, Germany's federal government should take its cue from the Pro Climate scenario, at the very least.

Even within Europe, car sales markets are already subject to a range of tax regimes. Different EU member states, for instance, have adopted divergent approaches to incentivising the uptake of electric vehicles. Should the new regulation ultimately fail to make a significant contribution to meeting climate targets or adequately support the growth of the electric vehicle sector, it is only natural that some member states will rely on national legislation to promote sales of alternative powertrain vehicles and meet their own climate targets. In the foreseeable future, this would lead to an unpredictable array of regulatory frameworks within the European Economic Area and may spur the fragmentation of the internal market. This will have a detrimental effect on the capacity of car manufacturers to ensure robust, long-term product portfolio planning. In the context of fierce global competition for market dominance in the electric vehicle sector, such a fragmentation would be especially unhelpful.

Any increase in regulatory targets will nonetheless need to be accompanied by additional measures to promote the electric vehicle sector and incentivise public uptake of alternative powertrain cars. Here it is not only crucial to expand existing charging infrastructure, for instance, but also to develop simpler methods of charging cars in family homes and workplaces. Further important steps include the expansion of wind and solar energy generation, and extensive reforms to relevant fiscal policies, such as diesel subsidies.

8. Appendix: The modelling methodology

The calculations presented above are based on a range of scenario analyses produced by the Öko-Institut. These include a reference scenario on which no additional climate protection measures are foreseen, as well as a number of scenarios with different CO_2 emissions targets for 2025 and 2030. The analyses considered the extent to which the measures provided for in each scenario would contribute to reducing transport sector CO_2 emissions in Germany by 40–42 per cent by 2030. Since emissions reductions for LCVs will only make up a small proportion of all transport sector reductions, they were not included in these calculations.

The modelling was based on the Öko-Institut's TEMPS new registration model. Under given parameters such as CO_2 emissions targets, vehicle prices, energy prices, and so on, it models the composition and efficiency of future new cars, as well as the proportion of electric vehicles among all new registrations.

In the future, higher average car efficiency levels will result in lower per km costs, which promote greater vehicle usage. This direct rebound effect of increased car efficiency was taken into account in calculating overall car CO_2 emissions. The price elasticity of car usage was estimated at -0.3. This means that for every 10 per cent reduction in per kilometre fuel costs, there is a 3 per cent increase in kilometres driven. In line with the ongoing discussions on the updating of the Renewable Energy Directive (RED II), it was also assumed that biofuels would account for 6.8 per cent of all fuel usage in 2030.

Our projections for future consumer demand were based on the predictions published by Germany's Federal Ministry for Transport and Infrastructure

(BMVI). In the latter, passenger traffic is expected to increase by 10 per cent between 2010 and 2030 and goods transport by 38 per cent.[21] The reference scenario is based on the federal government's "with measures scenario" (WMS) in its 2017 Projection Report,[22] with a number of updates. In light of current developments, it was assumed, firstly, that diesel cars would become increasingly unpopular among consumers. Secondly, recent data on the acceleration of the market for alternative powertrain vehicles (up to and including 2016) was also taken into account.[23]

The model also incorporated the latest cost curves for cars. The relevant technological data was primarily drawn from an extensive ICCT study, which constitutes the most up-to-date and transparent source of performance and cost estimates for car technologies up to 2030.[24] Where internal combustion engine vehicles and "classical" hybrids (i.e. those without a plug socket) are concerned, the ICCT study draws on detailed analyses of specific technologies, along with computer simulations of the effects of technology packages undertaken by engineering services provider FEV.[25] Where plug-in and battery electric vehicles are concerned, its estimates concerning the relevant technological and economic developments up to 2030 are based on an extensive literature review.[26]

In the updated reference scenario, CO_2 emissions are set to decline more steeply than on the Projection Report's MMS. In the latter, average CO_2 emissions for newly registered cars remain constant after 2021. On the new reference scenario employed here, an increase in average efficiency levels will continue to be seen even after 2021 as a result of the increased uptake of electric vehicles (rather than any new policy measures). CO_2 emissions for newly registered conventional cars will nonetheless remain constant in real terms. Emissions reductions in the new reference scenario will therefore be around 2.5 million tonnes higher in 2030 than in the Projection Report.

21 Intraplan; BVU (2014).

22 Despite the rather misleading description, the 'with measures scenario' is the Projection Report's reference scenario. Here, as in other studies, we consider a 'business as usual' scenario to be one that includes only those legal measures that have already been adopted.

23 KBA (o.J.).

24 Meszler et al. (2016).

25 FEV (2015).

26 Wolfram; Lutsey (2016).

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10. Abbreviations

BEV	Battery Electric Vehicle
BMVI	German Federal Ministry for Transport and Infrastructure (Bundesministerium für Verkehr und Infrastruktur)
BVU	Transport and environment consultancy "Beratergruppe Verkehr+Umwelt GmbH"
CNG	Compressed Natural Gas
EU	European Union
ICCT	International Council on Clean Transportation
ifeu	Institut für Energie- und Umweltforschung Heidelberg GmbH
Intraplan	Intraplan Consult GmbH
KBA	Federal Motor Transport Authority (Kraftfahrt-Bundesamt)
KOM	European Commission
KSP	Climate Protection Plan (Klimaschutzplan)
LPG	Liquefied Petroleum Gas
MT	Millions of tonnes
NEDC	New European Driving Cycle
Non-ETS Sector	Sectors that do not fall under the European Emissions Trading Scheme
PHEV	Plug-in Hybrid Electric Vehicle
PR	Projection Report (Projektionsbericht) of the German government
t	Tonnes
GHG	Greenhouse Gases
UBA	German Environment Ministry
VW	Volkswagen AG
WAMS	With Additional Measures Scenario
WMS	With Measures Scenario
WLTP	Worldwide Harmonized Light-Duty Vehicles Test Procedure

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