Is Europe on track towards net zero mobility?

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Working Paper 2024.07

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european trade union institute

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Cite this working paper: Pardi T. (2024) Is Europe on track towards net zero mobility? Working Paper 2024.07, ETUI.

Brussels, 2024
©Publisher: ETUI aisbl, Brussels

Print: ETUI Printshop, Brussels

D/2024/10.574/12
ISSN: 1994-4446 (print version)
ISSN: 1994-4454 (electronic version)

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Contents

Abstract

The purpose of this paper is to explore whether the 'Fit for 55' update of the European Union's CO_2 regulation is up to the task of fixing its past mistakes and putting Europe on course to reach net zero mobility by 2050, while also dealing with the new set of challenges that arises with the accelerated process of electrification.

The paper's analysis indicates that it is not up to such a task. There is an urgent need to rectify the 'Fit for 55' update, and, more generally, the trajectory taken by the electrification path in Europe. There are, however, a few, key and relatively straightforward measures that could steer the production and sale of new cars in Europe towards a more sustainable, inclusive and efficient path. These include the phasing-out of the weight-based standards regime and its replacement with one geared rather better to energy efficiency; and to integrate lifecycle analysis into the regulatory regime so as to ensure that a car's full carbon footprint is taken properly into account. These measures together should steer the production and sales of new cars in Europe in the right direction: towards greener, more energy efficient, affordable, electric cars that are made in Europe. The paper concludes that systems of support need to be fundamentally reconfigured if electromobility systems are to be shaped more in the direction of affordability.

Introduction

In February 2022 the European Union took the ground-breaking decision to ban the sale of Internal Combustion Engine Vehicles (ICEVs), including plug-in hybrids (PHEVs), from 2035 via the 'Fit for 55' update of the CO_2 regulation for cars and vans. 'Fit for 55' stands for the need to reduce CO_2 emissions in Europe by at least 55% by 2030 compared to 1990 in order to keep the 100% reduction target for 2050 on track. Carbon neutrality by 2050 is the condition for fulfilling the Paris Agreement and keeping global warming below a rise of 2°C.

Transport is the only sector in Europe whose emissions have increased since 1990 rather than decreased. Fuel consumption by cars represents 57% of the CO_2 emitted in 2021 by the transport sector and CO_2 emissions from cars have increased by more than one-fifth since 1990. This is why the 'Fit for 55' package has been particularly demanding for the automotive sector. It is not a matter of keeping the sector on the right path towards decarbonisation, as is the case for the other main emitting sectors. For road transport emissions, a radical course correction is necessary to address the cumulative failures of both EU regulators and carmakers to bring down CO_2 emissions during the past thirty years.

This paper seeks to explore whether the 'Fit for 55' update of the CO_2 regulation is up to the task of fixing its past mistakes and putting Europe on course to reach net zero mobility by 2050, while also dealing with the new set of challenges that arises with the accelerated process of electrification. The point is not to question the necessity of the fast-track electrification of individual mobility, and neither does the paper argue for a longer time-span for the combustion engine or see synthetic fuels as a viable alternative. It does, however, argue that, without policy changes, the current pathway towards electromobility is not sustainable and will not deliver the decarbonisation targets.

Three challenges will be the focus of attention.

First, the banning of ICEVs in 2035 will have, as a direct consequence, the almost complete phasing out in slightly more than ten years of a core European industrial sector specialised in the manufacturing of conventional powertrains and transmissions that currently accounts for 30-40% of the 2.4 million workers directly employed in automotive manufacturing. Even in the most optimistic scenario of a complete production in Europe of the batteries and electric powertrains needed for 100% electric vehicle (EV) sales in 2035, the net loss of employment in the automotive sector will still amount to several hundred thousand jobs, highly concentrated in a few regions and countries (STRATEGY& 2021).

Second, EVs are currently much more expensive than ICEVs with an average gap of 10,000-15,000 euros for similar models. When we compare the price of the average EV with that of the average ICEV actually sold in Europe in 2022, the gap becomes even bigger, at more than 30,000 euros (Bibra et al. 2022), because most of the EVs currently being sold are priced in the high range. This gap raises the crucial problem of affordability that was highlighted in the European Commission's impact study for the 'Fit for 55' update as the main hurdle towards 100% sales of EVs (European Commission 2021). The risk is also one of generating increasingly unequal access to individual mobility since only a small minority of wealthy households, mainly in northern Europe, has access to these vehicles so far, even as second-hand cars.

Third, with the internal combustion powertrain, the European automotive industry benefited from a technical and regulatory protectionism. The combined effect of the most demanding technical regulation for homologating vehicles[1] and the most demanding CO_2 standards for the sale of new cars meant that only very specific powertrains manufactured in Europe, and in particular diesel powertrains, would satisfy these norms. Foreign OEMs had either to buy these powertrains from European OEMs and suppliers, or develop and manufacture them in Europe with European suppliers. Both solutions have limited the direct imports of cars and, more generally, the capacity of foreign OEMs to capture market share.

With battery electric vehicles (BEVs), this scenario is inverted: pure electric OEMs in the US (Tesla) and the New Energy Vehicle manufacturers in China (BYD, SAIC, Geely, Chery, Dongfeng, etc.) enjoy a competitive advantage over European OEMs and do not face constraints in importing and/or producing cars in Europe. Since the beginning of the accelerated electrification of European sales in 2020, their market share has doubled every year and will soon become a significant threat to the survival of European OEMs.

To discuss how the 'Fit for 55' update addresses past regulatory failures and deals with this new set of challenges, the paper is organised as follows.

The first section traces the genealogy of the 'Fit for 55' update, highlighting a key component missing from its design: the abandonment of the weight-based CO_2 standards that have largely contributed to making European cars heavier, more powerful and more expensive in the last twenty years, when the need to reduce CO_2 emissions should have required the opposite (Pardi 2021, 2022).

1. This is the process by which vehicles sold in Europe (including imported ones) must be approved for sale according to a list of mandatory environmental, safety and security standards that concern the dimensions, the functions and the performances of the vehicles (see also: https://www.acea.auto/fact/type-approval/).

The second section summarises the past and present implications of this regulatory 'upmarket drift', focusing on three in particular: environmental – the failure to reduce CO_2 emissions; economic – the distortion of competition between generalist and premium OEMs that has favoured the manufacturers of the heaviest and most polluting cars; and social – the increasing exclusion of the middle and working classes, in particular in southern European countries and central and eastern ones, from access to new cars and the most up-to-date models.

The third section analyses the combined consequences of this pre-existing upmarket drift and the fast-accelerated process of electrification triggered by 'Fit for 55', especially concerning these three implications raised by the electrification of the European automotive industry. It shows that upmarket drift risks compromising the purpose of electrification, creating barriers to its diffusion, amplifying its negative economic and social outcomes and reducing its environmental benefits.

The conclusion suggests some urgent policy measures to address these risks and avoid the reproduction of past failures and mistakes.

1. The 'Fit for 55' ban on ICEVs: from the Dieselgate scandal to the pro-electric coalition

The genealogy of the 'Fit for 55' update to the CO_2 regulation proposed by the Commission in March 2021 and adopted by the Council in March 2023 can be traced back to the Dieselgate scandal that erupted seven years earlier. In September 2015, Volkswagen was found guilty by the US Environmental Protection Agency of having used a cheating device for homologating its new diesel models for the US market. It soon became evident that this was not an isolated case: all carmakers were using more or less legal and illegal devices to 'optimise' the emissions of air pollutants and CO_2 during homologation tests. The International Council on Clean Transportation (ICCT), the non-governmental organisation (NGO) which had uncovered the cheating device, found that EURO 6 diesel cars homologated in Europe between 2011 and 2015 emitted, in real drive conditions, on average five times more air pollutants (NOX) and 30% more CO_2 than in homologation tests (Baldino et al. 2017). The ICCT also found that the 'optimisation rate' for CO_2 emissions – a technical term that describes the discrepancy between the emissions recorded in homologation tests and the real drive ones recorded by consumers or tested independently –continued to increase: from an average of 8% in 2001 to 39% for models homologated in 2015 (Tietge et al. 2019).

In other words, the 18% reduction in CO_2 achieved by the European automotive industry during this period in order to meet the 2015 target of 130g CO_2/km set by the EU CO_2 regulation introduced in 2009 was, in fact, mostly the result of this optimisation: in real drive conditions the reduction was one of only 3%.

After Dieselgate, the preservation of diesel technology as the main solution developed by the European automotive industry to decarbonise new car sales became an impossible uphill battle. With diesel sales declining and loopholes for optimisation eliminated in 2017, the average CO_2 emissions of European new car sales increased and, by 2019, it was 27g higher than the 95g CO_2/km target set for 2020. The European automotive industry had to increase the market share of EVs significantly just to meet the CO_2 target and avoid the penalties that, in 2020, would have amounted to 83 billion euros. The leap in market share of EVs, from 3% to 11% in 2020, reflected this survival strategy. However, it did not yet mark a conversion towards an accelerated electrification process and the phasing out of the internal combustion engine.

Two years previously, the 2017 initial proposal of the European Commission to update the CO_2 regulation and set new reduction targets for 2025 and 2030 was still in line with previous policy and preserved technological neutrality with no clear preference for BEVs. The 15% and 30% CO_2 reduction targets it proposed for 2025 and 2030 meant that a mild electrification via hybrids (HEVs) and PHEVs, coupled with a modest market share for BEVs, would have been enough to keep the European automotive industry on track. In commenting on the draft, Hass and Sander stated that 'it had the VDA[2]'s influence written all over it' (2019: 19).

This time, however, the Commission faced strong opposition from the European Parliament: a coalition of 19 Member States led by France, Italy and Spain pushed for higher targets for CO_2 reduction (20% in 2025 and 40% in 2030) and the creation of compulsory quotas for zero and low emission vehicles (20% in 2025 and 35% in 2030). The VDA and the European Automobile Manufacturers' Association (ACEA) announced that this 'could spell the end of the European automotive industry' (Haas and Sander 2019: 20). After a marathon negotiation between the Commission, Parliament and the Council, the final result was a compromise that hardened the terms of the Commission proposal for 2030 (a 37.5% reduction target rather than 30%), but kept the principle of technological neutrality intact.

It was already clear that the power balance between the status quo coalition and the pro-electric coalition was shifting.

Environmental NGOs like Transport & Environment and the ICCT had successfully established a narrative in which electrification appeared as the only way forward: the right technology that could fix the failures of the wrong technological choices of the past (T&E 2018). The status quo coalition had also been weakened and fractured by the consequences of the Dieselgate scandal. Volkswagen had distanced itself from ACEA, moving towards a pro-electric position for both tactical and strategic reasons: cleaning its image after Dieselgate and aligning Europe with the fast electrification already at work in China, its main and most profitable market. Volvo, under Chinese ownership since 2010 when Geely bought it from Ford, also shifted to a pro-electric position, taking the lead in the Platform for Electromobility, a lobbying organisation created in 2015 that also included Renault and several US pro-electric companies like Ford, Uber and Tesla.

When in 2019 the European Commission launched the Green Deal, with the objective of engaging Member States in binding targets to reach carbon neutrality by 2050, the ground was fertile for tilting the balance in favour of an accelerated process of electrification. The 'Fit for 55' package launched in 2021 had the automotive sector in the spotlight from the beginning, not only because it had got completely off-track in terms of CO_2 reduction but also because it had, with electrification, a relatively straightforward solution

2. VDA is the employers' association of the German automotive industry and has been identified as the most influential lobbyist in shaping previous CO_2 regulations in 2009 (Klüver 2013) and 2013 (Nowack and Sternkopf 2015).

to move back on track by 2030. There were still, however, some important hurdles to get the European Parliament on board: the question of employment, raised in particular by CLEPA, the European Association of Automotive Suppliers, whose members are the most exposed to an accelerated phasing out of the ICE sector (Strategy& 2021); the question of affordability, raised by ACEA, which was an important source of concern for southern European Member States as well as central and eastern European ones (ACEA 2020); and the question of putting an end to the principle of technological neutrality with the proposed 2035 ban on ICEVs. The latter was expressly at odds with German ordo-liberal principles of European governance in which the market is supposed to select technologies and not the state.

The pro-electric coalition launched a series of studies to provide evidence that an accelerated electrification by 2030-35 would: create more jobs for the broad automotive ecosystem than it would destroy in the ICE sector (BCG 2021); achieve cost parity between BEVs and ICEVs by 2026 (T&E and BloombergNEF 2021); and see BEVs eventually become much cheaper than ICEVs (in terms of total cost of ownership) due to their lower maintenance and fuel costs (elementenergy 2021). Furthermore, alternative technologies (green hydrogen, plug-in hybrids, synthetic fuels, biofuels, etc.) were shown either as less economically viable (T&E 2021b) or as less environmentally efficient (Bieker 2021).

The main hurdle, however, remained the potential opposition from the German interest coalition, and in particular from BMW, Daimler and their main German suppliers, that wanted to preserve ICE technology by relying on the development of synthetic fuels. The behind the scenes compromise that explains why Germany eventually endorsed 'Fit for 55' at both Parliament and Council levels is not to be found in the new regulation but in what has been left out of the update and from most of the debates that surrounded its adoption.

From interviews with negotiators and lobbyists of the pro-electric coalition in Brussels,[3] it is clear that the price to pay for consenting to the 2035 ban on ICEVs was to leave untouched the weight-based standards that the German coalition had managed to squeeze into the CO_2 regulation back in 2009. As shown in a previous report for the European Trade Union Institute (Pardi 2022), weight-based standards favour the manufacturers of heavier cars and have contributed to moving the European automotive industry in the wrong direction by making the average European car significantly heavier and more powerful. By keeping weight-based standards, the 'Fit for 55' update therefore failed to address one of the main causes of the past failures of the CO_2 regulation: upmarket drift and its environmental, economic and social consequences. The next section looks back over the last 15 years of CO_2 regulation and how weight-based adjustment became its integral part.

3. In 2023, we interviewed four representatives of environmental NGOs and four representatives of automotive lobbies (ACEA, CLEPA).

2. Upmarket drift: regulatory causes and socioeconomic consequences

As described in detail in that previous ETUI publication (Pardi 2022), the first voluntary CO_2 targets negotiated by the Commission with ACEA in 1998 were not weight-based. By 2005, however, it had become clear that the targets would not be achieved, but the problem only concerned the manufacturers of heavier cars- that is, the premium brands (Audi, BMW, Daimler and Volvo) and Volkswagen – while the European generalist brands (Peugeot, Citroen, Fiat, Renault) were on track, with Ford and Opel lagging slightly behind.

On average, a 10% increase in weight leads to a 7% increase in fuel consumption (IEA 2019). Furthermore, heavier cars need more powerful engines that also lead to higher fuel consumption: on average, a 10% increase in engine power leads to a 5% increase in fuel consumption (ICCT 2017; Tietge et al. 2019). This trend highlights the fundamental contradiction between, on the one hand, upmarket drift – towards more expensive, more powerful and heavier cars – and, on the other, the reduction of CO_2 emissions. It also shows that upmarket drift preexisted the introduction of weight-based standards.

One of the main causes of upmarket drift had been another key European regulation: the 'whole vehicle type approval' introduced in 1992 to harmonise the technical parameters for homologating new vehicles for the Single Market. The European Union, already under strong influence from the VDA (Haas and Sander 2019), had decided to harmonise these parameters (safety, depollution, noise, etc.) with the highest standards of northern European countries, in particular Sweden and Germany, its technical regulatory strategy thereby adding weight, power and cost to the average European car. The CO_2 regulation should have put a stop to the inflation of such norms and shifted the trend towards having lighter, less powerful and cheaper cars. But this was seen as a major threat to the German premium model based on upmarket drift, and Germany therefore lent all its weight on shaping the regulation in a way that would not harm the premium model (Nowack and Sternkopf 2015; Rohfritsch and Batho 2016). The introduction of weight-based CO_2 standards was the short-term answer to this threat by giving more time to the manufacturers of heavier vehicles to comply with the regulation. As Transport & Environment had already highlighted at the time:

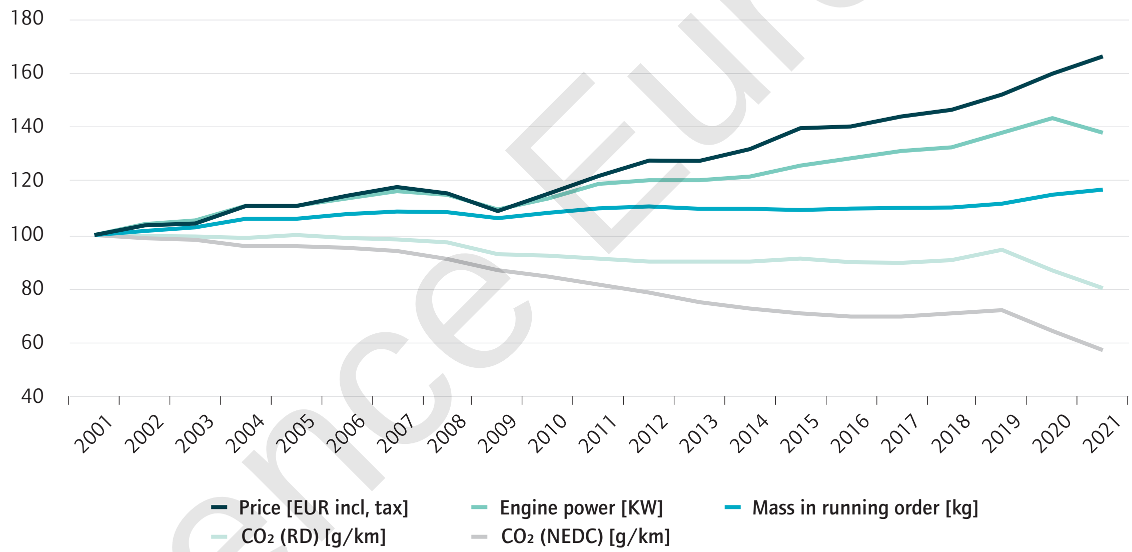
> Weight-based CO_2 standards for cars are a very bad idea for the following reason: they punish positive action. (T&E 2007)

The Commission, by giving in to German pressure, institutionalised a CO_2 regulation that not only allowed the manufacturers of the most polluting cars to have less demanding targets but which also, more importantly, hindered the others, in particular the French and Italian generalist brands, in developing alternative strategies based on lighter cars.

2.1 The environmental, social and economic consequences of regulatory upmarket drift

Figure 1 below illustrates some of the consequences for new car sales of regulatory upmarket drift.

Figure 1 The upmarket drift of the average new car (EU, 2001-21)



Note: CO_2 real drive data is based on Tietge et al. (2019) up to 2018 and on SprintMonitor data by brand for 2018-2021.
Source: ICCT (pocketbook data); EEA data – author treatment.

The 10% of mass and the 26% of engine power that were added to the average new car sold in the Single Market between 2001 and 2015 were equivalent to a 21% increase in CO_2 emissions. During the same period, the automotive industry was supposed to reduce CO_2 emissions by 20% in order to meet the 2015 target of 130g CO_2/km (as measured by the NEDC homologation test[4]) whereas, to compensate for this extra mass and extra engine power, it was a 41% reduction that was actually required.

4. New European Driving Cycle; i.e. the basis for the test of fuel economy and emissions that all cars must go through before going on sale. This was replaced in 2017 by the World Harmonised Light Vehicle Test (WLTP) procedure.

Part of this upmarket drift was driven by the process of the dieselisation of new car sales as the main technological solution to reduce overall CO_2 emissions: diesel powertrains delivered on average a 27-37% fuel economy over petrol ones (IEA 2019: 46), but they were heavier (by 50 kg on average (T&E 2017), more expensive (9-21%) and emitted a much greater level of air pollutants (Tietge et al. 2019). Even with diesels' market share growing from 36% to 52% between 2001 and 2015, and with the market share of direct petrol injection cars growing from less than 1% to 40% (a technology that delivers a 7% reduction in CO_2 emissions), the total CO_2 reduction was not enough to compensate for upmarket drift.

Ultimately, the industry delivered, in real drive conditions,[5] only a 9% decrease in CO_2 emissions between 2001 and 2015, half what had been demanded, which is why the optimisation of homologation tests via dedicated devices was 'required' to eliminate the gap and fulfil the target.

Following Dieselgate and the collapse in diesel sales, the average new car sold in 2019 emitted only 5% less CO_2 emissions in real drive conditions than in 2001, while being 12% heavier, 38% more powerful and 52% more expensive: an utter technological and regulatory failure.

This paradoxical outcome was also driven by another direct consequence of upmarket drift. The European generalist brands were forced by regulatory pressure and weight-based standards to follow the premium brands upmarket. As their traditional compact cars sold in the A and B segments had to integrate more expensive premium technologies to comply with both sets of regulation, they moved away from their customer base and lost market share along the way. Only Volkswagen, the most expensive European generalist brand (an average purchase price of 33,500 euros in 2021 compared with 25,700 euros for the generalist group), was able to preserve its market share. The other generalist brands saw their market share halved on average (a drop of 47% between 2001 and 2021). During the same period, the premium brands increased their market share by 43%.

Not surprisingly, almost all the employment loss in the European automotive industry during the last twenty years (2000-20) occurred in those countries where the generalist brands locate their manufacturing: France (down by 87,000); Italy (30,000); and Spain (116,000).

In other words, the EU CO_2 regulation had favoured the sales of the heaviest and most polluting cars manufactured by the premium brands to the detriment of the lightest and less polluting cars manufactured by the generalist brands.

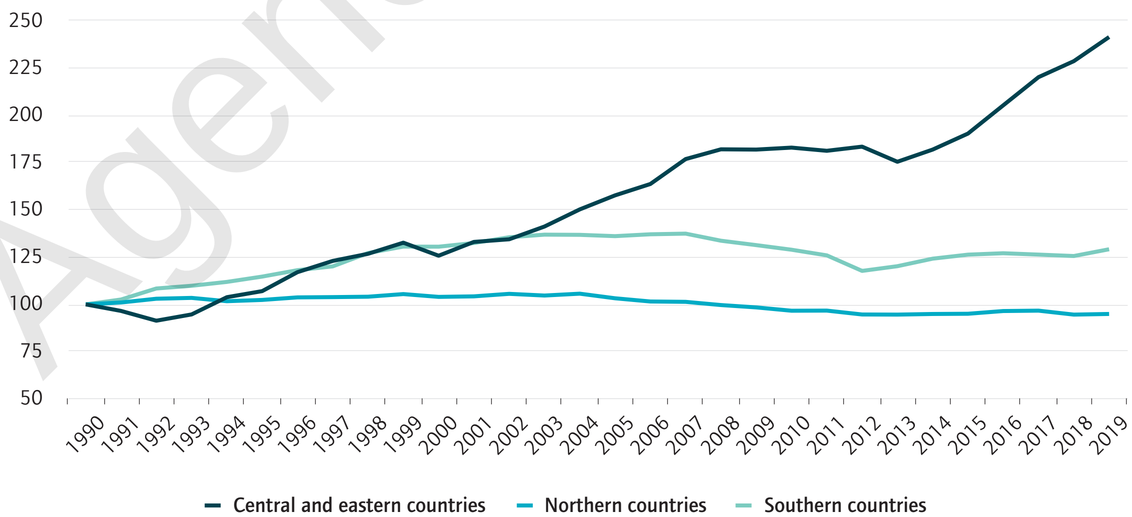
5. Real drive data is provided either from different consumer databases where consumers report how much fuel they use for driving their cars or from tests in real drive conditions carried out on several different models by NGOs or independent laboratories/universities. For a comprehensive list of these databases and tests see Tietge et al. (2019).

Also, by making cars more expensive (the average price of new cars grew in Europe by 66% between 2001 and 2021 against a general inflation rate in the euro area of 38%), upmarket drift made new cars in general a much less effective solution to decarbonising the car fleet. Between 2000 and 2021, the European car fleet grew by 36% (from 186 to 253 million vehicles) while new car sales declined by 23% (from 13 to 10 million). As a result, the rate of fleet renewal fell from 6.9 to 3.8%. The lower the fleet renewal rate, the longer it takes to decarbonise the fleet: 15 years in 2000, 26 years in 2021.

Furthermore, behind this European average there is a growing divide between northern countries and southern, alongside central and eastern European, ones. In northern Europe, the number of years required to renew the whole car fleet grew 'only' from 13 to 20; in southern Europe, where purchasing power is lower, it grew from 13 to 29; and in central and eastern Europe, it grew from 31 to 48. The result of these divergent dynamics is an increasingly polarised access to recent cars: 67% of the car fleet of less than two years, and 65% of the car fleet of less than 10 years, is located in northern European countries; in contrast, 74% of the car fleet older than 20 years is located in southern and eastern European countries (where cars older than 30 years can represent up to 30% of the car fleet (Pardi 2018)).[6]

It is precisely in those countries that have the least access to recent models that CO_2 emissions from cars have increased the most during the last thirty years: +241% in central and east European countries and +47% in southern European ones, compared with a drop of 4% in northern Europe (Figure 2).

Figure 2 **Greenhouse gases from fuel combustion (cars), EU27**



Source: EEA.

6. Source: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Passenger_cars_in_the_EU

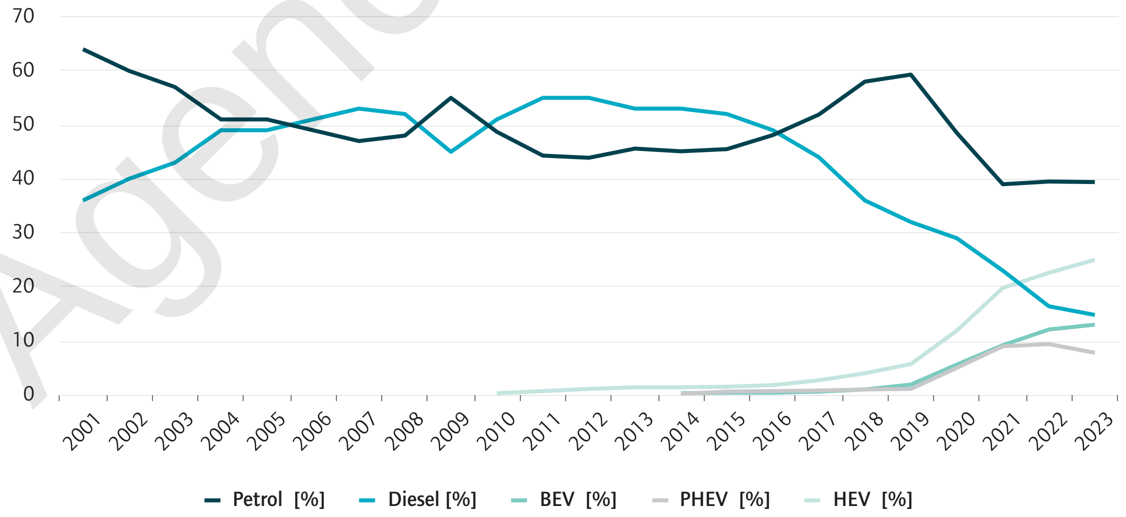
Since upmarket drift is increasing with electrification, as the next section demonstrates, this means that access to new cars becomes even more difficult in these countries, leaving them without viable solutions to decarbonise their car fleets and meet the 'Fit for 55' targets.

3. When electrification meets upmarket drift

The 'Fit for 55' update of the CO_2 regulation has raised the ambition by lifting the reduction target for 2030 from 37.5% to 55% (on 2021 emissions) and banning all ICEV (including HEV and PHEV) new car sales in the EU from 2035.[7] This will result in a dramatic acceleration of electrification in the coming years.

Between 2019 and 2021, the shares of EVs in new car sales increased rapidly – from 2% to 9% for BEVs and from 1% to 9% for PHEVs – in order to meet the 2021 target of 95g CO_2/km in the context of collapsing diesel sales (Figure 3). Yet, most of the consequences of the 'Fit for 55' update will be felt between 2025 (when the intermediate CO_2 target is 77g) and 2030, with the final target of 43g at the commencement of the phasing out of ICEVs in 2035.[8] Such a scenario is also supported in that most European carmakers have already announced that they will stop selling ICEVs in Europe in 2030.

Figure 3 **Shares of EU sales of new cars by type of powertrain (2001-23)**



Source: ACEA.

7. Despite an exception made for e-fuels that deliver a 100% CO_2 reduction, a move pushed by Germany.
8. To avoid confusion, NEDC values continue to be used in this paper for 2025 and 2030, applying a conversion rate from the WLTP values. The official targets, however, are expressed in terms of WLTP: 93.6g CO_2/km in 2025 and 49.5g CO_2/km in 2030.

As emphasised above, neither the first post-Dieselgate update of 2019 nor the 2023 'Fit for 55' update have taken weight-based standards out of the CO_2 regulation. This means that electrification has been caught in regulatory upmarket drift and now contributes to making the average new car sold in Europe even heavier and pricier, and at a much faster pace than we witnessed during the dieselisation period.

Between 2010 and 2021 the average BEV and PHEV sold in Europe gained respectively 551 kg (47% of mass) and 370 kg (23%), becoming at the same time the most expensive worldwide: 48,000 euros for the former and 58,000 euros for the latter compared with 26,000 euros for the average ICEV (Pardi 2022: 27).

By comparison the average BEV sold in China in 2021 was 500 kg lighter and 19,000 euros cheaper than the equivalent in Europe. Such a comparison is useful because it shows that BEVs can be lighter and cheaper than ICEVs. In China, the regulatory framework focuses on the improvement of the energy performance of BEVs (Alochet and Midler 2019) and, since energy performance is dependent on weight, it favours the sale of lighter and cheaper vehicles. In Europe, weight-based standards incentivise the sales of the heaviest (and more expensive) EVs. For instance, the 136 kg gained by the average premium brand vehicle sold between 2019 and 2021 (a rise of 8% to a figure of 1,815 kg), due to the increasing sales of PHEVs (2,025 kg; 23% of total sales) and BEVs (2,163 kg; 7% of total sales), softened the CO_2 target of the premium group by 17g on average, representing almost one-third of the total CO_2 reduction achieved by the premium group since 2019 to meet the 2021 CO_2 target (T&E 2021a: 40). In contrast, the generalist group added 'only' 40 kg (a rise of 3% to a figure of 1,355 kg) during this period and was therefore penalised with a hardening of its CO_2 target of 2g.

Upmarket drift is embedded in the EU regulatory framework, so the faster electrification pushed by the 'Fit for 55' update both accelerates this and amplifies its negative outcomes, while making it more difficult for the EU to deal with the specific challenges raised by electrification per se. We will consider first the environmental implications of such a trend before focusing on the social and economic ones.

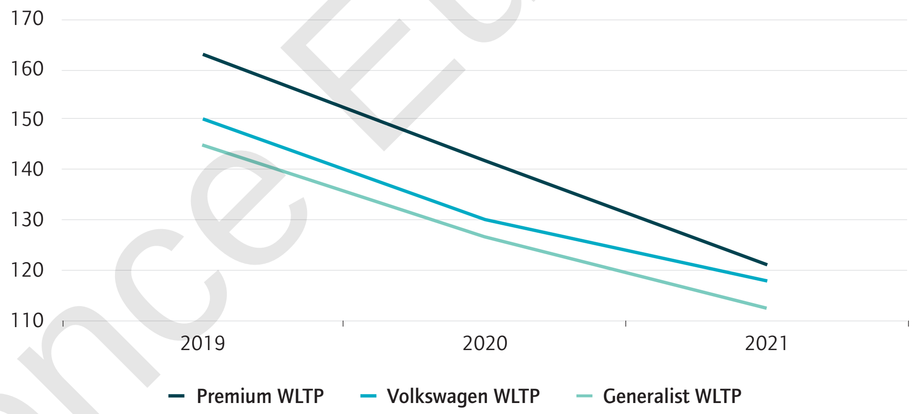
3.1 Environmental consequences: weight matters also for EVs

This section analyses in more detail the data on new car sales in Europe between 2019 and 2021 in order to assess the environmental impact of the recent acceleration of electrification combined with the phenomenon of upmarket drift. It also produces figures for the carbon footprint by brand group based on assumptions about the total car lifecycle and average usage per year.

As said previously, during this period the share of BEVs and PHEVs jumped, respectively, from 1.9% and 1.1% to 9.2% and 9%, decisively contributing to an overall reduction of the 35g CO_2/km (a drop of 23%, based on the WLTP homologation test) required to meet the 2021 target of 95g CO_2.[9]

When we consider the performances of the different groups of brands based on WLTP-measured CO_2 emissions (Figure 4), it seems that differences in weight and power do not really matter for EVs. Indeed, the group that reduced CO_2 emissions the most between 2019 and 2021 is the premium group (a drop of 26%), while the generalist group only achieved a reduction of 22% despite selling cars that were, on average, 460 kg lighter than those sold by the premium group. If the average premium car still emits more CO_2 than the generalist one (121g vs 112g), the difference now appears to be relatively small: only 9g (8%) higher despite that extra 460 kg.

Figure 4 CO_2/emissions, grammes/km (as recorded by the WLTP homologation test) by groups of brands (2019-21)



Source: EEA data, author extraction and treatment.

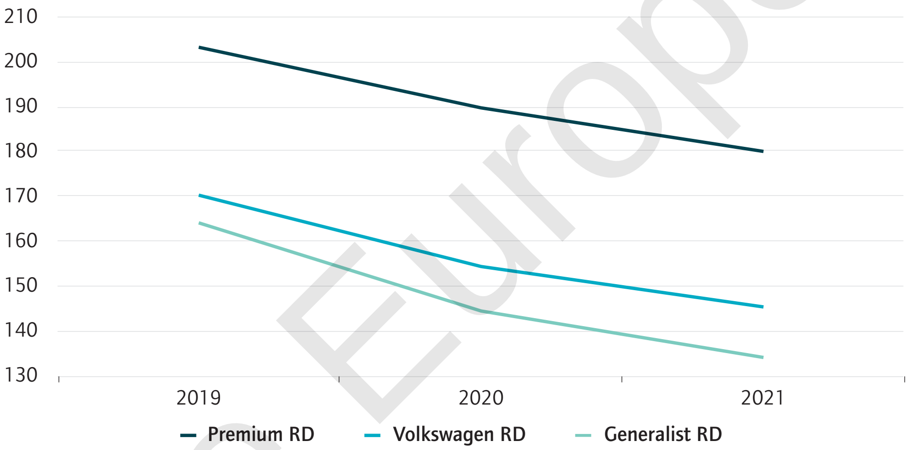
The issue here is that the WLTP test is badly equipped to measure the CO_2 emissions of electric vehicles. First, while it does measure how many watt hours per kilometre (Wh/km) an EV consumes during the test, it does not translate this into CO_2. This means that EVs are considered zero emissions vehicles when used in electric mode and that the difference in energy efficiency between heavier and lighter BEVs is not accounted for. Second, the WLTP test largely underestimates emissions from PHEVs, which represent 23% of the sales of the premium group (but only 5% of those of the generalist group), because it assumes that PHEVs are driven most of the time in electric

9. In fact, the CO_2 emissions of the average European car are still above this target in WLTP terms, at 116g CO_2 (from an average of 151g in 2019), but were translated in NEDC terms (the previous homologation test) to 91g CO_2 (also called the '21% uplift' negotiated by the Commission with the ACEA to ease the transition between the two tests).

mode, which is not the case in real drive conditions. According to several studies and consumer data, PHEVs emit, on average, four times more CO_2 in real drive conditions than in the WLTP test (Krajinska 2023).

Once we correct the data to take into account real drive (RD) emissions (see Annex on calculation methodology), the picture changes significantly.

Figure 5 CO_2/emissions, grammes/km (real drive emissions based on consumer data) by groups of brands (2019-21)



Source: EEA data, author extraction and treatment.

As we can see in Figure 5, in real drive conditions, the CO_2 reduction achieved by the premium group between 2019 and 2021 drops from a figure of 26% under WLTP to one of only 11%; while for the generalist group it drops from 22% (see Figure 4) to 18% (Figure 5). Also, the gap in 2021 between the average cars of the two groups in terms of CO_2 emissions widens: from 9g CO_2/km under WLTP to 46g in real drive conditions. Most of this increasing gap is due to the higher share of PHEVs in the sales of the premium group, but also to the higher energy consumption (an increase of 18%) of their heavier BEVs in comparison with those sold by the generalist group.

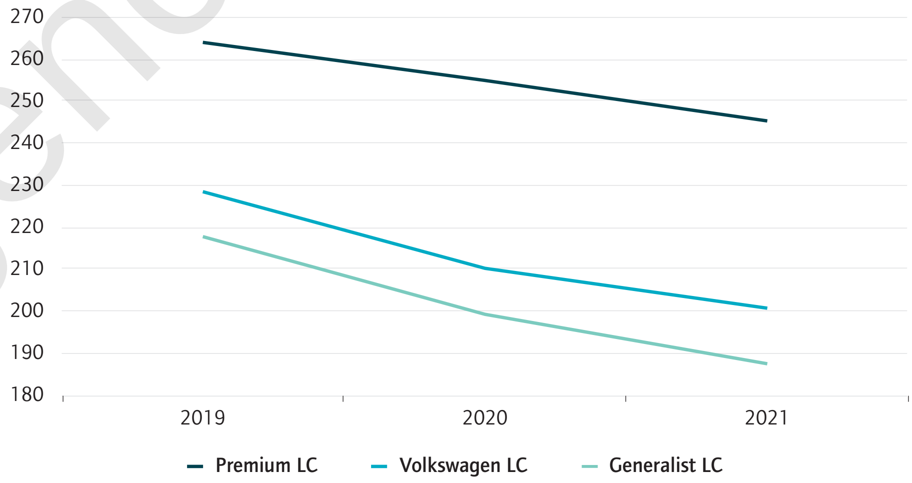
Even RD data do not capture the full environmental impact of EVs. EVs, and in particular BEVs with large batteries, require much more energy to be manufactured than equivalent ICEVs. They have, therefore, larger CO_2 footprints and it takes some years of usage, depending on the carbon intensity of the energy used, before a BEV emits cumulatively less CO_2 than an equivalent ICEV.

Lifecycle analysis (LCA) allows the integration of these CO_2 emissions in the calculation of the grammes of CO_2 emitted per km by the average car sold by our groups of brands.

There is no standard methodology available yet for LCA and, depending on the ways it is set up, the results are subject to change. The two most important parameters to be taken into account are the duration of the lifecycle – the longer a BEV is used, the less it emits per km in comparison with an ICEV; and the carbon intensity of the energy used. Despite some discrepancies due to the different ways of setting these parameters, all LCAs show that lighter BEVs emit significantly less CO_2 than heavier ones during their lifecycle. For example, the 2023 A2MAC1 and M@air study[10] shows that a Tesla Y (1,995 kg) or a VW ID4 (1,891 kg) will emit 19-20 tons of CO_2 over a lifecycle of 125,000 km when used in France, and 30 tons when used in Germany, while a Dacia Spring (970 kg) or a Renault Twingo Electric (1,170 kg) will emit 50% less. The 2023 Green NCAP study,[11] with a different energy mix (EU27 average) and a longer lifecycle (240,000 km), shows similar results: an Audi E-tron (2,242 kg) will emit 36 tons of CO_2 while a Renault Megane E-Tech (1,684 kg) or a Dacia Spring will emit respectively 26 tons (28% less) and 18 tons (50% less).

For this paper's calculations, a lifecycle has been set of 200,000 km (11,000 km per year) with energy consumption based on the average EU27 mix and a decarbonisation rate of 20% per decade, corresponding to the current reduction rate over the last ten years (2013-22). In order to perform the LCA, the Climobil tool developed by the Luxembourg Institute of Science and Technology has been used (see methodology in Annex).

Figure 6 CO_2/emissions, grammes/km (based on lifecycle analysis of 11,000 km/year and a total of 200,000 km) by brand group (2019-2021)



Source: EEA data, author extraction and treatment using Climobil tool (https://climobil.connecting-project.lu/).

10. https://maair.fr/en/lempreinte-carbone-des-voitures-electriques-les-plus-vendues-en-france-et-en-allemagne-en-2022/
11. https://www.greenncap.com/european-lca-results/

When the full lifecycle is taken into account, the reduction of CO_2 emissions achieved by the premium group between 2019 and 2021 drops to 7% while that for the generalist group falls to 14%. Also the gap between the two groups further increases, to 58g (from the 9g recorded under WLTP).

Two conclusions can be drawn from these results.

The first, which is common among LCAs, is that weight does matter, even for EVs. Heavier EVs emit more CO_2 than lighter ones in RD conditions and during their lifecycle: in 2021 the average generalist BEV (1,561 kg; LC 101g CO_2/km) emitted 24% less than the average premium BEV (2,163 kg; LC 133g CO_2/km). Also, the extremely heavy PHEVs sold in Europe emit more CO_2 than lighter ICEVs in RD conditions: this is the case for instance of the average premium petrol PHEV (2,297 kg; RD 166g CO_2/km) in comparison with the average generalist petrol car (1,234 kg; RD 139g CO_2/km).

The second conclusion is that the WLTP homologation test fails to account for these differences and favours the manufacturers of the heavier and more polluting cars (the premium group) that benefit from an optimisation rate of their CO_2 emissions (when WLTP emissions are compared with RD ones) of 48% compared with just 18% for the generalist group. This much higher optimisation also allows the premium carmakers to keep selling high polluting ICEVs: according to T&E (2021), eight of the ten most polluting ICEVs sold in 2021 (emitting more than 160g CO_2/km (WLPT)) were sold by the premium group (six) and by Volkswagen (two), with none being from the generalist group.[12]

Combined with weight-based standards, this bias in the homologation test significantly reduces the environmental benefits of electrification. Once more, it is pushing the market in the wrong direction – towards heavier and less energy efficient cars rather than lighter ones. Also, as is explained below, this makes new cars much less affordable, further reducing their capacity to decarbonise the car fleet while exacerbating the growing inequality in access to green mobility both within and between countries.

3.2 Social consequences: a growing divide between rich and poor countries and households

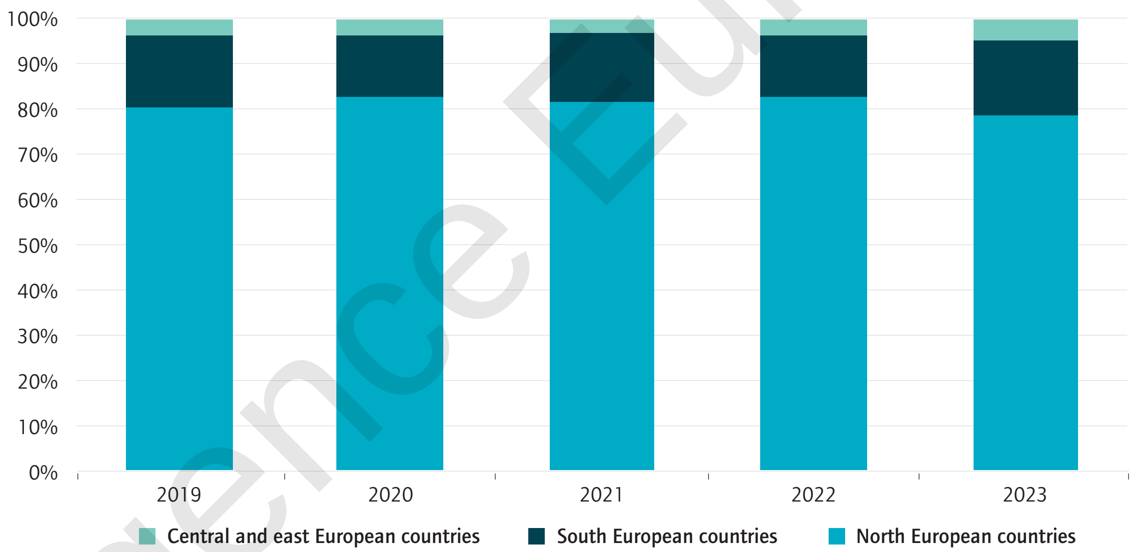
Between 2019 and 2021, the average price of a new car sold in Europe increased by 9% compared with an average Euro area inflation rate of 2.8%. This acceleration in upmarket drift was driven by electrification. The increase has been partially absorbed by the subsidies given by states to promote the uptake of EVs. In 2021, 12.5 billion euros were given to buyers of EVs, an amount that represented 3.5% of the total official price of all cars sold in

12. The other models among the top ten polluters were the Kia Sportage and the Mazda CX-5 which are outside the scope of this paper's analysis.

Europe that year. On average, each EV sold saw its owner receive 5,100 euros: 11% of the average price of a BEV (48,000 euros) and 9% of that of a PHEV (58,000 euros) (Bibra et al. 2022: 47).

These subsidies were concentrated in northern European countries: between 2019 and 2022, 82% of EV sales were located in northern European countries that represent 49% of the EU population, compared with 18% in southern European countries and central and eastern ones that, together, represent 51% of the EU population (see Figure 7). In terms of EV stocks, the divergence is even wider: 86% is concentrated in northern Europe, 13% in southern countries and just 1% in central and eastern European ones. In addition, these subsidies went mainly to the wealthier households even within northern European countries, given the extremely high prices of EVs.

Figure 7 **Share of BEV sales by groups of EU countries (2019-2023)**



Source: ACEA.

This means that the divide between wealthier and poorer countries and wealthier and poorer households in Europe is increasing when it comes to access to greener mobility. It is the reverse of this that is urgently needed to achieve the 'Fit for 55' targets.

Furthermore, despite the subsidies, the accelerated upmarket drift combined with electrification is making new cars much less affordable in general, affecting the level of sales and the car fleet renewal rate. In the period 2020-22, it was difficult to measure this impact due to the Covid-19 crisis and the global shortage of chips. In 2023, however, the market was back to almost normal conditions and, while total new car sales have been growing, these were still 13% below their 2019 level in northern Europe, 17% in central and eastern Europe and 35% in southern Europe. At these levels of sales, it will take 18 years to renew the northern European car fleet (compared with 13 years in 2000), 26 years in the southern European one (13 years in 2000) and 43 years in central and eastern Europe (31 years in 2000).

In 2023, Germany, the main EV market in Europe, was one of the first northern European countries to phase out subsidies for PHEVs that, in 2022, had provided up to 6,750 euros per car, and to reduce subsidies for BEVs from 9,000 euros per car to 6,750. The result was an immediate drop in EV sales of 32%: a reduction of 60% for PHEVs and one of 12% for BEVs. In 2024, neither will there be more public subsidies for BEVs, and sales are expected to decline further. Clearly, even in northern European countries with high purchasing power, the current process of electrification is not sustainable without public subsidy. But such subsidies are politically and socially problematic (because they benefit mostly wealthy households) and it is difficult to imagine that EU Member States can afford them for much longer (due to the increasing market share of EVs and the end of the exceptional favourable budgetary conditions generated by the Covid-19 crisis).

The social consequences of this increasing divide in accessing recent cars are already visible. As the supply of new and/or recent models shrinks, consumers tend to keep their old ICEVs longer.[13] Amongst the negative side effects of this trend are more safety risks, higher fuel costs and higher maintenance costs for those who cannot afford new cars or more recent models.

But as electrification spreads amongst the richest countries and households, there will be further negative consequences for those excluded from this greener mobility. On the one hand, a growing number of large and medium-sized cities have already started to ban older cars from their roads and, eventually, only BEVs or low emissions vehicles will have access to city centres. On the other hand, even in EU Member States and cities without such measures, from 2027 (or 2028, if fuel prices are exceptionally high) all owners of ICEVs will be exposed to the effects of the European carbon market (ETS 2) for transport.

The purpose of this second carbon market, introduced with the 'Fit for 55' package in 2023, is to guarantee that Member States will keep their commitments in terms of CO_2 reduction in the transport and housing sectors. The EU will auction CO_2 emission permits, or allowances, to local fuel distributors, corresponding to the right to emit one ton of CO_2. The supply of these will diminish in time according to the 2030 EU 'Fit for 55' intermediate target (a reduction of 42% on the 2019 level) and the carbon neutrality objective of 2050. In an EU Member State where fuel consumption does not diminish fast enough, local fuel distributors will have to buy more permits. On the contrary, in a Member State where fuel consumption diminishes

13. Between 2019 and 2021 the average age of the European car increased by 4%, or 6 months (from 11.5 to 12 years) (source: ACEA).

at a faster rate, local distributors will be able to sell permits to those who need more. Depending on the interplay between diminishing supply and the overall level of demand, the price of the allowances will increase in time by a lesser or larger amount.

Up to 2030, the price for one allowance is expected to be kept below 45 euros, but after 2030 it will be for the market to decide. It has been calculated that a price of 50 euros per ton will result in an average additional annual cost of 363 euros per European household, equivalent to 0.6% of average disposable income (but up to 1% in central and eastern European countries). During this period, ETS 2 will thus work as a more or less mild tax on CO_2 for ICEV owners. Several experts have pointed out, however, that the price control mechanism does not prevent spikes above 45 euros as it is activated ex post should such spikes occur, and could prove insufficient if the decarbonisation of road transport does not progress fast enough.[14]

In any case, the main question is what will happen after 2030, when the market freely dictates the price of the allowances, in particular in those countries that cannot or would not be able to electrify their car fleets fast enough.

The example of the first ETS market, created in 2005 for reducing CO_2 emissions in the energy and heavy industry sectors, can be used here to illustrate some possible scenarios. For a long period of time, the ETS 1 price for one ton of CO_2 remained very low (around 10 euros) due to the oversupply of allowances. This was due in particular to the 2008 financial crisis, whose impact on manufacturing activities reduced the demand for energy. However, ETS 1 was reformed in 2018 so that, in the case of oversupply, surplus allowances, including future ones, are permanently cancelled (the same mechanism will apply in ETS 2). Following the further reform of ETS 1, when in 2021 the economy started to grow again in the wake of the Covid-19 crisis, demand rose back quicker and stronger than expected. Gas prices increased and energy producers started to buy more allowances anticipating the need to burn more coal to produce energy. The price of one allowance spiked in 2021 from 20 euros (for one ton of CO_2) to 81 euros, and then again from 67 euros in 2022 to 105 euros in 2023 due to the energy crisis triggered by the Russian invasion of Ukraine (a ten-fold increase by comparison with 2018).

In the case of ETS 2, similar spikes are possible. We know that the market share of EVs, and in particular of BEVs, must grow significantly to meet the 2030 CO_2 target of 49.5g (a drop of 55% on the 2021 level). At least 60% of the market will have to be fully electrified (BEVs) but, as mentioned earlier, most European car groups have already announced that, by 2030, they will only be selling BEVs so this percentage is likely to be higher. Under the associated conditions of a slow down in the fleet renewal rate, it will be almost impossible

14. See for instance: https://www.euractiv.com/section/road-transport/news/eu-carbon-market-gas-petrol-prices-could-spike-from-2027-experts-say/

to meet the CO_2 emissions reduction targets for fuel consumption in cars (a reduction of 42% between 2019 and 2030), all the more so when considering that the European car fleet keeps growing, in particular in central and eastern Europe where CO_2 emissions are also growing (see Figure 2 above).

The result of these dynamics will be a significant increase in the price of ETS 2 allowances, whose supply will be reduced by 5.38% annually from 2028. For instance, the European Consumer Organisation (BEUC) has not excluded that the price for one allowance could spike at 250 euros as early as 2030.[15] If that were the case, it would result in an average additional annual cost of 1,815 euros per European household, equivalent to 3% of average disposable income (and around 6% in central and eastern Europe) (Abrell et al. 2022; Platteau 2023).

Also, this price increase will not be homogenously spread across Europe. As mentioned earlier, countries where CO_2 emissions are diminishing the least will be those with the highest price increase because their fuel distributors will have to buy more allowances. The consequences could therefore be dramatic for southern European countries and central and eastern ones: rapidly ageing car fleets, growing CO_2 emissions and fast rising fuel prices with no viable solutions to reduce them.

That this scenario is possible and even probable can be deduced from the EU's decision to allocate 25% of the revenues generated by the sale of ETS 2 allowances to a newly created Social Climate Fund to support vulnerable households and small businesses to cope with fuel price increases. The other 75% will go to Member States that will have to use it to finance social climate measures, notably to facilitate access to electric cars (although only 25% of this amount could be used to reduce the impact of price increases). The money will be redistributed progressively so that those countries that are the most vulnerable to fuel price increases will receive a higher share of the SCF. However, the total amount available has been capped at 59 billion euros for the period between 2027 and 2032, when the SCF will be discontinued. Such an amount corresponds to 8.4 billion euros available annually to 27 countries. By way of comparison, the policies put in place in France alone to reduce the impact of energy price increases between 2021 and 2023 amounted to 85 billion euros.[16] Furthermore, the ETS 2 mechanism will first raise the price of fuel for consumers and only after that can national governments intervene to address such increases. How efficiently they will do it and with what delays remains to be seen.

To summarise, if European Member States are on the right track to decarbonise road transport, then ETS 2 will have a limited impact on fuel prices but, thanks to its redistributive effect via the SCF, it will do something

15. A recent survey of modelling based on European CO_2 emissions targets suggest a range of price between 175 euros and 300 euros for ETS 2 allowances from 2030 (Abrell et al. 2022).

16. Source: https://www.vie-publique.fr/en-bref/290156-aides-la-consommation-denergie-un-cout-estime-85-milliards-deuro to help laggards catch up. This is the rationale behind its implementation. However, if accelerated electrification coupled with regulatory upmarket drift proves socially unsustainable, in particular in southern European countries, as well as central and eastern European ones where CO_2 emissions from cars have increased the most in the last 30 years, then ETS 2 will lead to sharp increases in fuel prices while its redistributive effects will not be sufficient to address the social and political consequences of such a development.

3.3 Economic consequences: fast growing imports and declining market shares for generalist carmakers

Between 2019 and 2023, European brands lost market share of 3 percentage points to foreign brands (from 76% to 73%). The main cause of this loss was that, with the progress of electrification, Europe's lower market share in BEV sales became more apparent.

In 2023, the market share of European brands in BEV sales was 63% (in contrast to a total sales figure of 73%). This is not surprising: as mentioned in the Introduction, European brands had a competitive advantage in ICEV, in particular in diesel powertrains and in compact petrol injected powertrains, both of which were required to meet the CO_2 targets set by the European Commission. This advantage played an important protective role in the process of trade liberalisation for automotive products pursued by the EU since the late 1990s.

In contrast, in the BEV market, European carmakers suffer a double competitive disadvantage against BEV manufacturers such as Tesla and many Chinese carmakers. On the one hand, these new companies have a cost and technological lead in BEVs: they started earlier to the mass production of BEVs, are more vertically integrated in the battery value chain and have higher economies of scale, better cost structures, proportionally much higher capital evaluation and easier access to capital for investment. On the other hand, European carmakers are handicapped in this race towards electrification because they must simultaneously phase out the production of ICEVs while building up the production of BEVs in a very short period of time.

The Chinese BEV market, currently the biggest and most competitive in the world (3,606,680 units over the first eight months of 2023), is dominated by independent Chinese carmakers. Their total market share is 72%, with Tesla having 17% and the European brands capturing just 4% of BEV sales (Inovev n.d.).

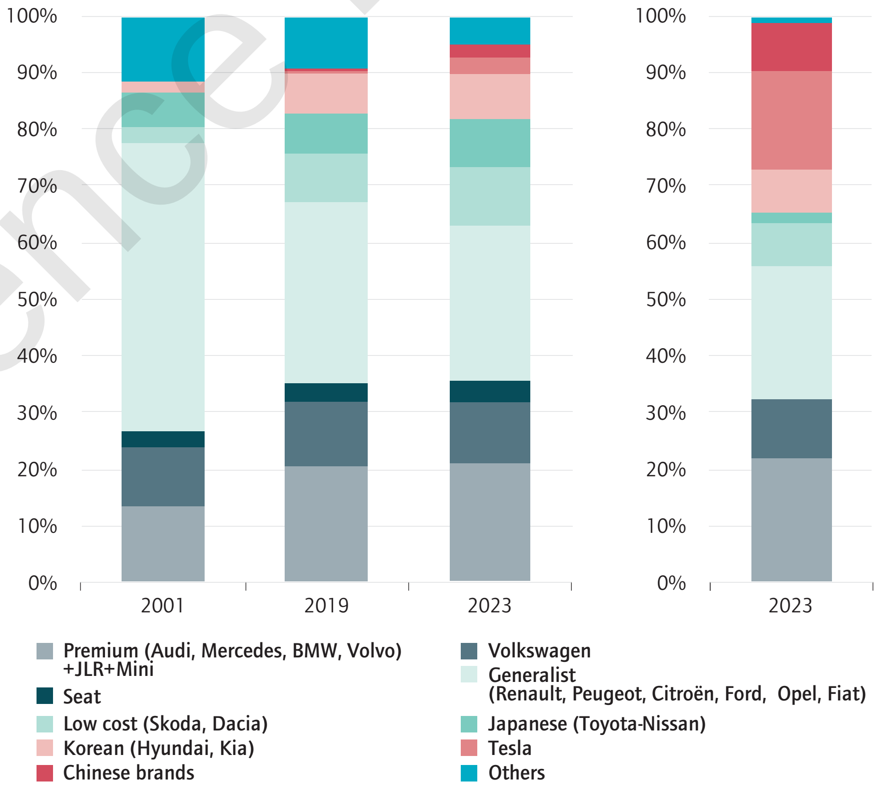
It is also important that Chinese brands have only just started to penetrate the European market where two brands, MG (SAIC) and Polestar (Geely), represent more than half of total Chinese sales on the basis of only five models sold, although more than fifty models from Chinese brands were imported by Europe in 2023. SAIC and BYD have already announced plans to manufacture BEVs in Europe, anticipating a steady growth of sales (in

December 2023, BYD announced it would establish its BEV manufacturing plant in Hungary). In the meantime, China has already become the primary exporter of cars to Europe (521,881 cars in 2022 (source: ACEA)), ahead of Korea and Japan.

Moreover, Tesla has announced that it will double its European production capacity to one million cars per year, manufacturing a second new model beside the model Y, which established itself as the best-selling car in Europe in 2023. This expansion will make the Tesla assembly factory in Berlin the largest in Europe.

If all European carmakers are suffering from the foreign offensive on BEVs, once more it is the generalist brands, which dominated the European market in the 1990s, that are those suffering the most. Figure 8 shows that their market share is not only being attacked by direct price competition from Tesla Chinese importers and Japanese/Korean brands, but it is also being further squeezed by the accelerated upmarket drift that keeps pushing the market away from their consumer base, in particular in the BEV market.

Figure 8 **Market shares of new car sales, EU27 (total market 2001-2019-2023 – left/BEV market 2023 – right)**



Sources: CCFA, Inovev.

Between 2019 and 2023, the market share of the generalist group fell from 32% to 27% (from 51% in 2001), while the Volkswagen brand and the premium group preserved or increased their market shares respectively.

In the BEV market, the generalist group is performing worse than the European average: market share is down to 22% in comparison with 26% of total sales, while Volkswagen and the premium group have similar market shares in BEV as in total sales (respectively 10% and 22%, compared to 11% and 21%). This is not surprising given the relative average prices of BEV and ICEV cars sold in Europe in 2023.

The combined impact of increasing import penetration and the further squeezing of the generalist group's sales could have disrupting consequences for several European regions where car production is clustered, in particular where the cars of the generalist brands are, in the main, manufactured (France, Italy, Spain, Poland, Slovenia).

Electrification per se, all other things being equal, is already expected to destroy a significant amount of jobs in automotive manufacturing because the production of an electric powertrain requires between 50% and 75% fewer workers than a conventional one. For instance, according to a study made by CLEPA in 2021, even if we assume that (a) all the batteries and electric powertrains required for the 100% BEV market of 2035 will be manufactured in Europe and (b) sales will recover their 2019 level, 600,000 jobs will still be lost in the automotive sector during the next ten years (Strategy& 2021).

However, with accelerated upmarket drift it is unrealistic to expect a full recovery in the new car market. In 2023, sales were 18% higher than in 2022, but still 20% below their 2019 level.

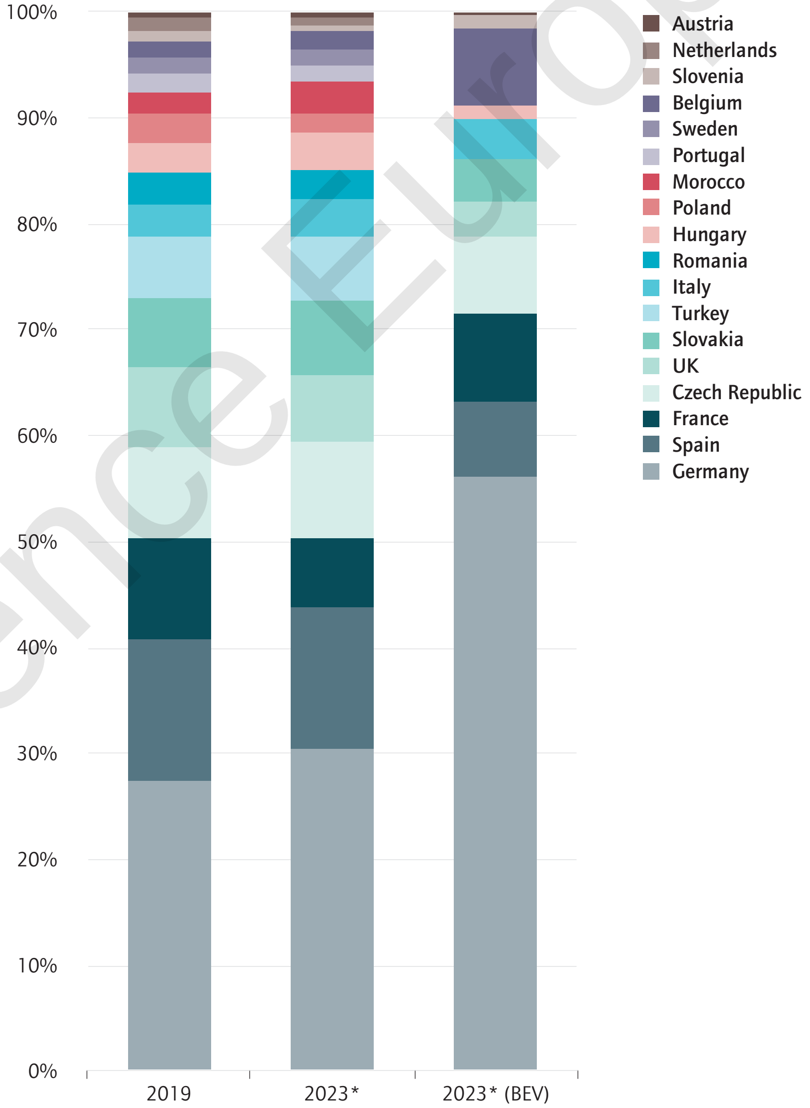
In a smaller market, the fast declining market share of the generalist group may lead rapidly to significant redundancies and factory closures. In 2022, the utilisation ratio of European production capacity in the generalist group was at a historical low of 50% (compared to 61% in VW and 65% in the premium group).[17] In other words, the generalist carmakers had twice as many factories and workers as needed. In 2023, the situation was slightly improved in some regions but the special conditions that made such a low utilisation rate bearable – no competition due to the shortage of chips and the generalised temporary unemployment measures subsidised by states in response to the Covid-19 crisis – were disappearing.

Overall, European car production in 2023 should remain at a figure 20% below that of 2019, but with important variations by country, as shown in Figure 9: from rises of 11% and 7% for Morocco (ultra-low cost offshoring from France, Romania and Spain) and Belgium (premium BEV production

17. Source: Inovev – https://www.inovev.com/index.php/en/automotivemarket-sheet?option=com_cck&course_id=14842

of Volvo and Audi); to drops of 10% in Germany (at the core of European premium sports utility vehicles and BEV production) and to ones of 63%, 45% and 41% for, respectively, Slovenia, France and Poland (fast declining generalist ICEV production not compensated in the context of a slow uptick in BEV production). As a result of these trends, France and Italy, the two main countries of the generalist carmakers, which represented in 2000 30% of European car production, are now reduced to 10%, one-third of the size of Germany alone.

Figure 9 **Car production in Europe (including UK, Turkey and Morocco) – all models (2019-23)/BEV cars only (2023) – (% of total production)**



* First nine months.
Source: ACEA, Inovev.

Conclusions

The purpose of this paper was to evaluate whether the 'Fit for 55' update of the European Commission's CO_2 regulation, which bans ICEVs from 2035, is up to the task of decarbonising road transport by 2050. The paper's analysis indicates that it is not.

The main problem with the update is that it embarks on an ultra-accelerated transition towards electrification without addressing the causes of the past failures of European CO_2 regulation. If in the course of the last twenty-five years CO_2 emissions from cars have been growing almost continually in Europe, the problem has not (only) been the technology used, but also (and mainly) that, during this period, the structural characteristics of the average new European car sold in Europe have been moving in the wrong direction. Rather than becoming lighter, less powerful and cheaper, so as to reduce CO_2 emissions and accelerate the diffusion of greener cars, the average new car has become heavier, more powerful and less affordable.

This 'upmarket drift' has, to a large extent, been driven by two key European regulations shaped by German/premium group interests: the whole vehicle type approval regime that harmonised EU technical norms for new cars with the higher technical standards of northern European countries, where cars tend to be heavier, more powerful and more expensive than in the rest of Europe; and the weight-based CO_2 standards that not only protected these heavier premium cars from effective CO_2 regulation, but also hindered the generalist carmakers from making lighter and cheaper cars to reduce CO_2 emissions.

Under these conditions, dieselisation was the only way of reducing CO_2 emissions but, coupled with upmarket drift, it proved utterly inefficient and led to the Dieselgate scandal. The 'Fit for 55' update should have been the opportunity to change the CO_2 regulation, and not only the technologies used in car manufacture, in order finally to push manufacturing in Europe in the right direction. The consequences of having missed this opportunity could compromise the EU Green Deal.

The EU Green Deal is based on three pillars: promote the most efficient process of decarbonisation; achieve a just transition that does not leave anybody behind; and protect and develop European industries. By coupling preexisting upmarket drift with an accelerated process of electrification, the 'Fit for 55' update is now producing the opposite results.

First, it continues to prioritise the heaviest, most polluting and least energy efficient cars even when they are electrified, biasing competition in favour of the premium manufacturers of such cars that benefit from much less demanding CO_2 targets and a much higher optimisation rate of CO_2 emissions in homologation tests than the generalist manufacturers of lighter, more energy efficient cars.

Section 3 shows how, for EVs, weight matters even more than for ICEVs. Lighter BEVs require much smaller batteries, fewer materials and much less energy when they are produced and used. Smaller BEVs allow for much smaller carbon footprints, but also for much more affordable prices. This is, for instance, the path followed by the Chinese process of electrification where the recent fast growth of micro electromobility has been driven by consumers alone, with no subsidies from the state (Alochet and Midler 2021; Zhang et al. 2024).

One of the biggest problems of the transition towards EVs in Europe is that we are electrifying the conventional multipurpose cars of the twentieth century. Consumers are still being pushed towards buying oversized, overpriced and overpowered electric cars to fulfil all their mobility needs in one vehicle. If the average European BEV sold in 2021 had a mass of 1,722 kg (2,163 kg for the premium group) – 400 kg more than the average petrol car and 500 kg more than the average Chinese BEV – it is because such a BEV has the size and the autonomy to carry the whole household over more than 500 km three times per year for summer and winter holidays while, for 99% of the remaining time, it will be driven empty with only the driver onboard. The most efficient path towards decarbonisation is the reverse: integrating lighter and cheaper BEVs with an array of public and private mobility services using digital technologies that are now widely available; in other terms, changing our mobility system, not just electrifying vehicles.

Second, by promoting heavier BEVs and PHEVs, and by disincentivising the production and sale of lighter BEVs and PHEVs in Europe, the 'Fit for 55' regulation sharply accelerates upmarket drift, making cars even more unaffordable than before. The result is that the divide that upmarket drift had already created between northern, southern, and central and eastern European countries, and between social classes, in terms of access to new, recent, greener cars, is now growing more rapidly. Those who are excluded from access to recent cars, and even more from access to electric models, are precisely those countries and social classes that are the most dependent on cars for their mobility and which have the oldest and most polluting fleets. Those who most need access to affordable electromobility to fulfil the 'Fit for 55' objective for 2030 and achieve carbon neutrality in 2050 have no possibility of doing so.

The risk is that such a social and geopolitical exclusion from the EU green transition will result in increasing political opposition to electrification which, in turn, will also be exacerbated by the forthcoming introduction, via the 'Fit for 55' package, of a carbon market for road transport. Section 3.2

reports how, starting from 2027, and without any protective regulation of the carbon price from 2030, ETS 2 will increase the price of petrol and diesel in a volatile and unpredictable way, further discriminating against the owners of ICEVs but also further threatening the political viability of the Green Deal.

Third, by accelerating the process of electrification, through the least efficient pathway, the 'Fit for 55' update exposes the European automotive industry to a perilous transition. While European carmakers will have the burden of phasing out annual industrial capacity of 15 million ICEVs in slightly more than ten years, companies like Tesla, and the several Chinese manufacturers that have already started to enter the Single Market with their cheaper BEVs, will enjoy a significant cost and technological advantage. Since the start of accelerated electrification in 2020, European brands have lost 8% of their market share and, in the BEV segment, they control just 63% of the market and face increasing competition.

In this already difficult context, it is the generalist carmakers that will face the hardest task: they have already been weakened by twenty years of upmarket drift; they will be the most exposed to the price competition imposed by the Chinese carmakers; and they will continue to lose market share as a result of the accelerated upmarket drift caused by electrification. In this case, political opposition to electrification could appear on economic grounds, as has recently been seen with the opposition to the Euro 7 norm for air pollutants first raised by Italy and the Czech Republic, and eventually endorsed by the majority of EU automotive countries, including France and Germany.

If the analysis reported in this paper is correct, there is an urgent need to rectify the 'Fit for 55' update and, more generally, the trajectory taken by the electrification path in Europe. There are, however, a few key and relatively straightforward measures that could steer the production and sale of new cars in Europe towards a more sustainable, inclusive and efficient path.

The first and most evident of these is the immediate phasing-out of weight-based CO_2 standards. This could be justified on several complementary grounds including environmental ones – promoting greener cars; social ones – promoting more affordable cars; and economic ones – promoting the European car industry.

Such a measure would, however, not be sufficient without rethinking the technical norms for cars, in particular for BEVs. Inspiration could be taken here from the technical norms for micro key-cars in Japan, where CO_2 emissions from cars diminished by 23% between 2001 and 2019 (whereas in Germany they increased during the same period by 3%), or from the technical norms for New Energy Vehicles in China. In any case, such norms should not be harmonised to the highest possible technological standards, but towards those embodied in the most affordable and efficient average car which would encourage the more rapid decarbonisation of the European car fleet.

The second measure should consist of introducing energy efficiency as the key discriminator in shaping the supply of new cars in Europe. Without weight-based standards, energy efficiency can be achieved by reducing the weight, but also by improving battery technology or the aerodynamics of BEVs. The current WLTP test could easily be updated to integrate such a measure, while it could also be established that only cars that fulfil a certain level of energy efficiency could either be homologated or allowed to receive subsidies from national governments. This is again the path taken by Chinese regulations for BEVs. In a similar way, a more realistic utility parameter for calculating PHEV emissions should be introduced. Since 2022, on-board devices in new cars have been recording real drive consumption and emissions, and this data should be used to calculate a new utility parameter for PHEVs in order to improve their design towards lower emissions vehicles.

The third measure should integrate lifecycle analysis in order to allow consumers to discriminate between new cars not only on energy efficiency but also on their carbon footprint. Such an additional measure would further push carmakers to make lighter cars, using fewer materials and less energy and to locate their production in Europe (rather than importing BEVs from China), in particular in countries where energy has a low carbon content. It is interesting to note that the new French 'eco-bonus' for the purchase or rental of BEVs will integrate a carbon footprint threshold. This measure is a much more effective way of tempering the import of BEVs from China than the current anti-subsidy investigation started by the European Commission on 4 October 2023. The latter, in the best case scenario, will slow down imports from China, but it will be a difficult process and it is unclear whether it is in the interests of Europe to start a trade war with one of its main trading partners. Market regulations based on energy efficiency and the carbon footprint will not stir up trade frictions but they would result in a more effective path towards decarbonisation.

These measures together should steer the production and sale of new cars in Europe in the right direction: towards greener, more energy efficient, affordable, electric cars that are made in Europe. But they also need to push towards a more comprehensive transformation of our mobility systems.

In order truly to reverse upmarket drift and its long-term consequences, such measures are required but they will not be sufficient. The whole system of national subsidies for both the production and sale of BEVs must be reconfigured increasingly or even exclusively to support affordable BEVs or, even better, more affordable electromobility services, with a clear priority for social groups that are the most dependent on cars and the most excluded from recent car ownership.

More generally, increasing opposition to electrification from southern European countries, as well as central and eastern European ones, and from lower income social classes, needs urgently to be addressed. In the US, the Inflation Reduction Act provides a good example of how to make the availability of the massive state aid required by electrification contingent on social clauses which protect employment, wages and labour conditions in the automotive and battery industries. Without such clauses, the Green Deal and the just transition are merely empty slogans. However, such European and national deals must also address the growing mobility (or transport) poverty created by upmarket drift. Otherwise, the gilets jaunes who have, so far, been a French exception could become a European norm.

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All links were checked on 06.03.2024.

Annex

Real drive and lifecycle calculation methodology

To calculate the real drive emissions of the different groups of brands, the following methodology has been used.

Data was extracted from the European Energy Agency database for all new cars sold between 2019 and 2021 for each of the brands. For each brand, the average new car sold is calculated by type of fuel while the data is then aggregated to calculate the average car sold by brand group. For 2019 and 2020 (when NEDC data were available), optimisation rates were applied by type of fuel and brand group on the NEDC CO_2/km values reported in the EEA database. To calculate the different optimisation rates, the following literature was relied on (T&E 2018; Tietge et al. 2019; Dornoff et al. 2020; Krajinska 2023). For 2021, the ratio between the WLTP and RD values from 2020 was calculated and applied to the 2021 WLTP values. For BEVs, the WLTP Wh/km figure was used to calculate the grammes of CO_2/km emitted based on the average carbon content of European energy (EU27) for 2019, 2020 and 2021, applying an optimisation rate of 19% based on Sprintmonitor.de data (see also literature above). The RD emissions of PHEVs only include petrol and diesel emissions, and not the energy-related emissions from electric use.

To calculate the lifecycle emissions of the different brand groups by type of vehicle, the following methodology was used. In the Climobil (https://climobil.connecting-project.lu/) database a car model was selected for each year for each brand group whose features (mass and engine power) matched as closely as possible the average vehicle sold within each type of fuel by the most sold brand in our database for each year. In the Climobil tool, the following parameters were then adjusted for each model using Gerpisa/CNRS calculations of the average values for each type of vehicle and the yearly EU average for the carbon content of the electricity mix: battery capacity (kWh); electric car range (km); carbon content electricity mix (grammes CO_2eq./kWh); NEDC penalty (per cent); ICE car curb weight (kg); and electric car curb weight (kg). We also set km/year to 11,000, a total lifecycle to 200,000 km, and the decade decarbonisation rate of the EU energy mix to 20%. The results displayed in Figure 6 are calculated with the methodology and parameters of the Climobil tool.

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D/2024/10.574/12
ISSN: 1994-4446 (print version)
ISSN: 1994-4454 (electronic version)

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