CRASHING THE CLIMATE

HOW THE CAR INDUSTRY IS DRIVING THE CLIMATE CRISIS

#ClimateEmergency

GREENPEACE


"RIGHT NOW, WE ARE FACING A
MAN-MADE DISASTER OF GLOBAL SCALE.
OUR GREATEST THREAT IN THOUSANDS OF YEARS.
CLIMATE CHANGE.
IF WE DON'T TAKE ACTION THE COLLAPSE OF OUR
CIVILISATIONS AND THE EXTINCTION OF MUCH OF
THE NATURAL WORLD IS ON THE HORIZON."
—Sir David Attenborough, COP24, December 2018

BERLIN AT RUSH HOUR

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Greenpeace is an independent global campaigning network of independent organisations that acts to change attitudes and behaviour, to protect and conserve the environment and to promote peace.

For more information contact:
South Korea contact: press.kr@greenpeace.org
Germany contact: presse@greenpeace.de

Authors: Benjamin Stephan, Insung Lee, Jiseok Kim

Editor: Caroline Roberts
Design: Jayne Worth

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Greenpeace East Asia, Seoul office
6F Cheongryong bldg 257
Hangang-daero, Yongsan-gu
Seoul, South Korea (04322)

Greenpeace Germany
Hongkongstr. 10
20457 Hamburg

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EXECUTIVE SUMMARY

For some decades, car manufacturers have claimed to understand the grave threat posed by climate change. They have displayed many alternative greener vehicles at motor shows, attracting much positive media coverage. Their advertising stresses their huge concern for our wellbeing and safety, especially that of our children. However, their business decisions tell a very different story.

This report looks at the climate impacts of the world's 12 largest car manufacturers, providing new calculations that show the carbon footprint for which they were responsible in 2017 and 2018.[1] It demonstrates how they have repeatedly failed to respond appropriately to the climate emergency, and reviews the lack of progress made across five major markets: the US, the EU, China, Japan, and South Korea. It sets out Greenpeace's demands for the industry to change radically or be consigned to history.

It has been been nearly four years since the signing of the Paris Agreement, and the transition to a climate-friendly transport system emerged as an important priority. Carmakers must phase-out diesel and petrol cars including hybrids urgently, with an end to new sales by 2028.[2] This will also bring other benefits, such as less traffic congestion and improved air quality. But the car industry's inaction is robbing us of that greener, cleaner and more survivable future.[3]

This transformation can't happen overnight. But we need a firm commitment from the industry's largest players to phase-out internal combustion engines (ICEs) by implementing an action plan including a concrete timeframe. Car manufacturers continually refuse to do this. They lobby against robust climate-related regulation, fail to scale up production of zero emission vehicles effectively, and continuously promote the individual use and ownership of cars. Therefore, it is crucial that policymakers worldwide put in place regulations that secure rapid phase-out of diesel and petrol cars and offer alternative means of transport for the public.

As this report shows, improvements in fuel efficiency and updates to hybrid vehicles are no longer adequate solutions to the climate crisis. Instead they delay the fundamental change that is needed. And the current surge in SUV sales poses a further serious threat to our climate.

How manufacturers transform their business model is rapidly becoming the central question. If car companies fail to transition and diversify, they will be history. Those surviving in the future will be the ones producing smaller, lighter, and more energy-efficient electric vehicles. These vehicles will be designed and marketed to reduce individual use and ownership of cars, and built to be linked into smart grids powered by 100% renewable energy.

Greenpeace has been challenging car companies to take proportionate action on climate change since the early 1990s.[4] In this report, we show that, despite sustained warnings and growing scientific understanding of the gravity of the climate crisis, the car industry is still doing too little. The transition must start right now — before it is too late.

1. The annual carbon footprint of a carmaker is the sum of the lifecycle GHG emissions of the cars it sells in a given year. The lifecycle emissions comprise production, tailpipe, upstream, and recycling emissions. The lifecycle emissions comprise production, tailpipe, upstream, and recycling emissions.
2. See details on page 4
3. Freedom to Breathe: Rethinking urban transport, Greenpeace, 2018 https://storage.googleapis.com/planet4-international-stateless/2018/01/1b96c158-air_pollution-transport_report-2018.pdf
4. Action at car show, Greenpeace archives, 12 September 1991 https://media.greenpeace.org/archive/Action-at-Car-Show-in-Frankfurt-27MZIF3EBRY.html

KEY FINDINGS

- **The car industry's 2018 carbon footprint equals 9% of total annual global greenhouse gas (GHG) emissions.** In total, the 12 manufacturers[5] analysed in this report are responsible for 4.3 gigatons (Gt) CO_2e. Extrapolating from this, the entire industry with the 86 million cars it sold in 2018,[6] is estimated to be responsible for a combined carbon footprint of 4.8 Gt CO_2e, equal to 9% of total global GHG emissions.[7] The combined footprint exceeds the total annual GHG emissions of the entire European Union (4.1 Gt CO_2e).[8] (see chapter 3)

- **The top five emitters, VW (582m tons CO_2e), Renault Nissan (577m tons CO_2e), Toyota (562m tons CO_2e), General Motors (530m tons CO_2e), Hyundai-Kia (401m tons CO_2e),** were responsible for 55% of the industry's carbon footprint. (see chapter 3)
    - **Volkswagen was the biggest climate culprit among carmakers in 2017 and 2018.** Its 2018 carbon footprint was 582m tons of CO_2e, exceeding the total annual GHG emissions of Australia (535m tons CO_2e).[9]
    - **German manufacturers VW, Daimler and BMW had a combined carbon footprint of 878m tons CO_2e in 2018,** exceeding the 2018 GHG emissions of Germany (866m tons CO_2e).[10]
    - **Ford, General Motors and Fiat-Chrysler-Automobiles had the largest carbon footprint per vehicle.** This is no surprise as particularly in the US, their sales have been dominated by large SUVs and pickup trucks.
    - **Hyundai-Kia's plan to aggressively increase the proportion of SUVs in its product portfolio will inevitably lead to higher GHG emissions.** It has not announced a full, or even partial, ICE phase-out plan in any market. (see chapter 4)

5. The resulting carbon footprint covers the car branch of these corporates. Some of the companies also have subsidiaries that are for example producing trucks and buses (e.g. VW and Daimler). The climate impact of that part of their business has not been considered in this analysis.
6. Global car market remains stable during 2018, as continuous demand for SUVs offsets decline in sales of Compact cars and MPVs, JATO, 21 February 2019 https://www.jato.com/global-car-market-remains-stable-during-2018-as-continuous-demand-for-suvs-offsets-decline-in-sales-of-compact-cars-and-mpvs/
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TABLE 1: CAR COMPANIES 2018 CARBON FOOTPRINTS

CAR MANUFACTURER	GHG EMISSIONS IN MILLION TONS	MILLION VEHICLES SOLD	AVERAGE LIFETIME GHG EMISSIONS PER VEHICLE IN TONS
VW Group	582	10.8	53.8
Renault-Nissan Alliance	577	10.3	55.7
Toyota	562	10.4	53.8
General Motors	530	8.6	61.3
Hyundai-Kia	401	7.4	54.0
Ford Motor Corp	346	5.6	61.4
F.C.A	305	4.8	63.1
Honda	283	5.2	54.1
PSA Group (incl Opel)	201	4.1	49.2
Suzuki	164	3.3	49.6
Daimler AG	161	2.7	58.7
BMW AG	136	2.5	54.4

- **There is a need to improve the availability of manufacturers' emissions data.** Carmakers, and a number of governments, need to improve their transparency about fleet emissions data. Comparable information about production emissions is almost non-existent. Detailed data should be made available to the public so progress can be tracked more easily and more precise assessments made about future transport emissions. The industry's lack of transparency is a significant threat to our climate and to long-term sustainability. (see chapter 3 and 7)
- **Manufacturers are failing to transition and there is a lack of investment in solutions.** Of the 12 manufacturers evaluated, only one had set a timeframe to phase out ICE globally. All 12 companies have either no plans or insufficient plans for a transition compatible with the 1.5°C target. (see chapter 4)
- **The gap between official test results and on-road CO2 emissions distorts reality and threatens the climate.** Test results that significantly overestimate a car's fuel efficiency and underestimate CO2 emissions harm the climate and deceive customers, who end up spending more on fuel. The supposed reduction in CO2 emissions looks much less impressive when real-world emissions are being considered. It remains to be seen whether the World-wide Harmonised Light Vehicle Test Procedure (WLTP) will bring the improvement needed. (see chapter 4 and 5)
- **Progress in fuel efficiency has stalled or even reversed.** Improvements in average CO2 emissions from new cars sold in the US, the EU, China, Japan, and South Korea, which account for over 70% of the total global market, have stalled or even reversed. This shows that ICE technology has to be phased out as it cannot achieve the necessary emissions reductions. (see chapter 5)

- **Hybrids and plug-in hybrids are not solutions.** ICE hybrid vehicles, both conventional and plug-in, block the rapid deployment of real alternatives. Conventional ICE hybrids rely entirely on ICE engines for power so they cannot achieve the emission reductions needed. Plug-in hybrids can also produce significant CO2 emissions if not operated in an optimal manner, with mainly short trips. Particularly in Europe, the gap between real-world and test emissions for plug-in hybrids is significantly larger than it is for ICE cars. (see chapter 5)
- **SUVs are making a difficult transition impossible.** Sales of SUVs, have increased more than fourfold over the past 10 years, from 8% in 2008 to 32% in 2018 in Europe. In the US, SUVs have reached 69% of market share. Due to their higher weight and less aerodynamic body, CO2 emissions for SUVs are significantly higher than for similar non-SUV vehicles. An increase in sales of SUVs is one of the key reasons for stalled progress in CO2 emissions reduction. (see chapter 6)
- **Companies must phase out ICE urgently and take action to move beyond producing ever more cars.** Climate change, and rapid innovation in the transport sector, mean we will need fewer cars in the future. To survive, car manufacturers must find alternatives to ever-increasing car production. Rather than continually promoting the purchase and individual use of cars, they must develop and provide innovative transport solutions that help reduce ownership. These could include car-sharing and ride-pooling services to complement public transport. (see chapter 7)

WHY DOES GREENPEACE DEMAND CAR COMPANIES PHASE-OUT INTERNAL COMBUSTION ENGINE CARS NO LATER THAN 2028?

The German Aerospace Center (DLR) study on car transport, commissioned by Greenpeace Belgium, concluded that to achieve a 66% likelihood of keeping global warming below 1.5°C, diesel and petrol cars must be rapidly phased out in Europe with an end to new sales by 2025, and hybrids by 2028. Similar global modelling for decarbonising passenger road transport in line with the 1.5°C limit does not exist yet, but the European phase-out date provides a good benchmark for car companies.

Car manufacturers must act substantively and globally on this issue. It is not good enough to only phase out diesel alone, or to do so in just one region. Nor is it acceptable to dump high-pollution cars into other markets, when they are phased-out in another. The DLR target date for Europe must be applied by the car industry globally, with ICE, including hybrids, phased-out no later than 2028.

GREENPEACE DEMANDS AND RECOMMENDATIONS FOR THE CAR INDUSTRY

GOAL: ALIGN THE CAR INDUSTRY'S BUSINESS MODEL WITH 1.5°C TARGET

ACTION STEPS

Priority 1: Phase out all ICEs, including conventional hybrids, with news sales ending by 2028 at the latest.

A. Disclose detailed annual reporting of GHG emissions, which includes brand-level CO2 fleet emissions on global and regional car sales, product-level LCA data of every model, and supply chain emissions via its website in a publicly available format.
B. Set a company-wide target to phase-out diesel and petrol cars, including hybrids, across all markets. Establish a clear strategy and concrete roadmap for a 100% EV (battery and fuel cell) transition.
C. Work with employees, labour unions and other relevant third parties to minimise the impact of the transition on the workforce, including providing necessary reskilling and reallocation packages.
D. Advocate regional, national and global policies that align with the Paris Agreement's 1.5 °C target, such as strengthening CO2 regulation, government ICE phase-out plans, and renewable energy procurement.

Priority 2: Build small, energy efficient EVs and do so in a sustainable manner

A. Prioritise producing small, light EVs.
B. Implement standards that minimise and prevent the social and environmental impacts of EVs and EV battery production.

- Advocate for a renewable energy power grid (EV charging and manufacturing).
    - Procure 100% renewable electricity in all production plants across all regions.
    - Work with the supply chain so they move to deploying 100% renewable energy and reduce GHG emissions.
- Establish procurement standards for battery supply so resources are used in a way that is environmentally responsible, efficient and respectful of human rights.
    - Establish transparent supply chains and best practice social and environmental standards in mining and processing raw materials for batteries.
    - Increase investment in research and development in battery technology to find sustainable alternatives to the current materials used such as cobalt and lithium.
    - Increase durability, longevity, reparability, energy efficiency, reuse and recyclability of batteries to minimise the use of virgin materials.

Priority 3: Move beyond producing more cars

A. Promote alternative business models that lead to reducing the individual use and ownership of cars.
B. Invest in mobility solutions that can reduce traffic growth.
C. Provide services that complements public transport, such as car-sharing or ride-pooling service.

CHAPTER 1: INTRODUCTION

"Some people, some companies, some decision-makers in particular, have known exactly what priceless values they have been sacrificing to continue making unimaginable amounts of money... and I think many of you here today belong to that group of people." Greta Thunberg, Davos, January 2019[11]

The latest Special Report on Global Warming of 1.5°C by the Intergovernmental Panel on Climate Change (IPCC) stresses the urgent need for "rapid, far-reaching, and unprecedented changes in all aspects of society."[12] To limit global warming to 1.5°C and ensure a more sustainable and equitable society, scientists say that the international community needs to reduce global GHG emissions by 45% by 2030. It's a massive challenge, but we can't afford to fail.

For some decades, car manufacturers have claimed to understand the grave threat posed by climate change. They have displayed many alternative greener vehicles at motor shows, attracting much positive media coverage. Their advertising stresses their huge concern for our wellbeing and safety, especially that of our children. However, their business decisions tell a very different story.

This report looks at the climate impacts of 12 of the world's leading car manufacturers providing new calculations showing the carbon footprint for which they were responsible in 2017 and 2018. It demonstrates how they have repeatedly failed to respond appropriately to the climate emergency, and reviews the lack of progress made across five major markets: the USA, the EU, China, Japan, and South Korea. It sets out our demands for the industry to change radically or be consigned to history.

It has been nearly four years since the signing of the Paris Agreement, and the transition to a climate-friendly transport system emerged as an important priority. Carmakers must phase out all cars with an ICE urgently. This will also bring other benefits, such as less traffic congestion and improved air quality. But the car industry's inaction is robbing us of that greener, cleaner and more survivable future.[13]

11. Greta Thunberg's speech at Davos shows that if anyone is going to save the world, it's Generation Z, The Independent, 25 January 2019 https://www.independent.co.uk/voices/davos-greta-thunberg-climate-change-global-warming-a8746536.html

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CHAPTER 2: HOW TRANSPORT IS THREATENING OUR CLIMATE

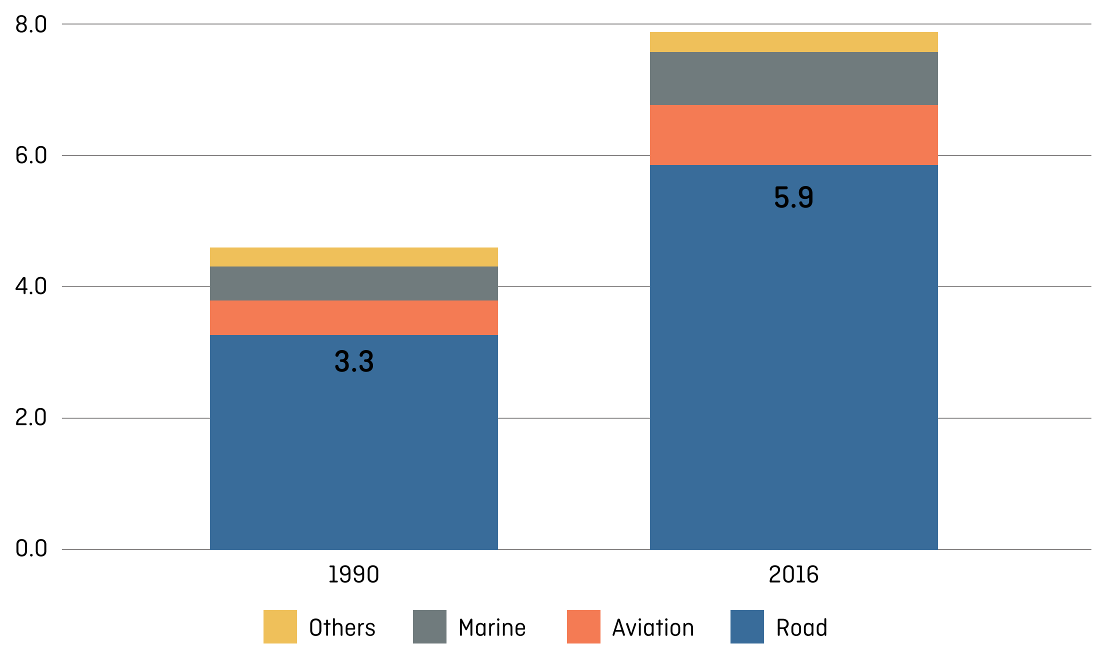
ROAD TRANSPORT IN THE GLOBAL CONTEXT

According to the International Energy Agency (IEA), CO2 emissions from the global transport sector were around 8 gigatons (Gt) — a quarter of the total in 2016.[14] Road transport, which consists of cars, trucks and buses, accounted for 74% of global transport CO2 emissions, and 18% of total global CO2 emissions in 2016.[15]

The most recent publicly available data from the IEA (released in 2018) shows that transport emissions grew by 2% in 2016, a similar amount to previous years.[16] Calculations[17] by the Global Carbon Project (GCP) released in December 2018 suggest that the trend has continued, with cars, trucks and planes being part of the reason emissions continued to rise globally in 2018.[18]

The scale of emissions and the speed of their growth means it's critical that road transport emissions are tackled without delay. According to the latest statistics from the IEA, CO2 emissions from road transport increased by 71% between 1990 and 2016.[19]

FIGURE 1: GLOBAL TRANSPORT CO2 EMISSIONS BY TRANSPORT TYPE (UNIT: GT CO2)



Source:CO2 Emissions Statistics: CO2 emissions from fuel combustion 2018 overview, International Energy Agency, 2018[20]

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18. Cars and coal help drive 'strong' CO2 rise in 2018, BBC, 5 December 2018, https://www.bbc.co.uk/news/science-environment-46447459
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20. Ibid.

TRANSPORT EMISSIONS BY COUNTRY/REGION

Transport emissions, and the proportion of overall emissions they represent, tend to be higher in countries where car culture is most entrenched. Emissions from transport have become the biggest source of CO2 emissions in the US[21] and some EU member states, such as the United Kingdom.[22]

This report focuses on five of the biggest car markets in the world, which are also home to all the major global carmakers.

UNITED STATES

- Transport as a percent of total country emissions: 29%[23]
- Cars (sedans, SUVs and pickup trucks) account for around 59% of transport GHG emissions.[24]
- Transport emissions per capita is 5.39t-CO2, which is nearly five times higher than the G20 average of 1.13tCo2/capita.[25]

EUROPE

- Transport as a percent of total emissions: 24%[26]
- 73% of GHG emissions from road transport come from cars and vans.[27]
- GHG emissions from the transport sector have increased over the last three years, while average CO2 emissions of new passenger cars increased for the first time in 2017.[28]

CHINA

- Transport as a percent of total country emissions: 9%[29]
- Transport emissions account for a relatively small percentage of total emissions. However, the scale and growth rate in the past five years was up to 21%, the second-highest growth rate among G20 countries.[30]
- In 2018, 28 million cars were sold in China, most powered by petrol or diesel engines.[31] According to Germany's nonprofit Center for Solar Energy and Hydrogen Research Baden-Württemberg (ZSW), 1.2 million of the cars sold in 2018 were EVs and plug-in hybrid electric vehicles (PHEVs).[32]

SOUTH KOREA

- Transport as a percent of total country emissions: 16%[33]
- Road transport accounted for around 90% of transportation GHG emissions.[34]
- The emissions from transport have increased over the last three years by 2.3% annually.[35] Transport emissions per capita are 2.04t-CO2, nearly twice the G20 average of 1.13tCo2/capita.[36]

JAPAN

- Transport as a percent of total country emissions: 19%[37]
- Emissions from road transport, largely cars, trucks and buses, account for around 87% of transport sector emissions, and about half of these emissions were produced by private cars.[38]

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CHAPTER 3: THE CAR INDUSTRY'S CARBON FOOTPRINT

This report provides new calculations for the industry's carbon footprint, using data from 2017 and 2018 for the 12 largest car manufacturers.

HOW ANNUAL CARBON FOOTPRINTS ARE CALCULATED

The annual carbon footprint of a carmaker is the sum of the lifecycle GHG emissions of the cars it sells in a given year. The lifecycle emissions of a car are made up of:

- The GHG emissions caused through the production of the car
- The tailpipe emissions caused by fuel consumption during its life
- The emissions caused through supplying this fuel
- The emissions caused through recycling at the end of its life.

Not all of the emissions occur in the production year, but putting these cars on the road means their future emissions have been locked into the system.[39]

TABLE 2: GHG EMISSIONS OVER THE LIFETIME OF AN AVERAGE VW GROUP CAR[40]

PRODUCTION		USE PHASE		END OF LIFE	OVERALL
Supply chain	Production	Fuel supply	Fuel consumption	Recycling	
5.7t CO_2e	0.8t CO_2e	5.5t CO_2e	29.0t CO_2e	2.7t CO_2e	43.7t CO_2e[41]

CARBON EMISSIONS DURING PRODUCTION AND RECYCLING

Production carbon emissions are mainly determined by the amount and type of materials used — the bigger the car the higher the emissions. The Institut für Energie und Umweltforschung (IFEU) estimates that production and recycling emissions are 6t carbon dioxide equivalent (CO_2e)[42] for a petrol-fuelled subcompact car, 7.1t CO_2e for a compact car, and 9.9t CO_2e for a premium vehicle.[43] Data availability is limited as lifecycle assessments are done by manufacturers for individual models but not published systematically. Manufacturers rarely provide average numbers for their entire production. A recent exception has been VW, which provides data for carbon emissions over the lifetime of an average VW Group car (see table 4). According to VW estimates, 6.5t of CO_2e are emitted during the production of an average VW group car — 15 % of the emissions it will cause over its lifetime. Most of this comes from the supply chain, with only 12% emitted by the VW Group directly. Recycling adds another 2.7t CO_2e bringing production and recycling emissions for an average VW group car to 9.2t CO_2e.

39. The carbon footprint as it has been calculated here differs from the 2018 emissions of all the cars on the road from a specific manufacturer in that year. Estimates of this are much more difficult to make as data on how many cars from a specific manufacturer are on the road and which fleet emissions they have is not available. The total of that calculation would likely be higher as the carbon footprint calculated in this report because fleet emissions have improved over the years. But most importantly what we analyse here focuses on the problems car manufacturers create with their current sales.
40. Keynotes ID. INSIGHTS Sustainable E-Mobility, Volkswagen Newsroom, 15 February 2019, p5 https:/www.volkswagen-newsroom.com/de/publikationen/weitere/keynotes-id-insights-sustainable-e-mobility-169
41. VW calculates the emissions during the use phase of their vehicles based on results from official cycles test. Cycle test results however significantly underestimate on-road emissions (see chapter 4). We adjusted for that difference in our carbon footprint calculation. As a result, VW's average lifetime emissions per vehicle increase by 23%.
42. A variety of greenhouse gases with varying global warming potential are emitted during the production of a car. To be able to give a single value for all , gases other than CO2 are converted into CO2 equivalents.
43. IFEU as cited in Ökobilanz gängiger Antriebstechniken, ADAC, 2019, https://www.adac.de/infotestrat/umwelt-und-innovation/abgas/oekobilanz/default.aspx?ComponentId=317354&SourcePageId=47733

In addition to vehicle size, the share of renewable energy used for production and the overall energy and carbon efficiency of parts of the production process determine how much GHG is emitted. Some manufacturers have set renewable energy goals for their factories. But as inhouse emissions only account for a small proportion of overall production emissions, and an even smaller fraction of lifecycle emissions for fleets dominated by ICE vehicles, these goals have little effect on their footprints.

TABLE 3: CARBON FOOTPRINT DURING PRODUCTION: BATTERY ELECTRIC VEHICLES (BEV) VS COMPARABLE ICE MODELS

SUBCOMPACT ICE	6t CO_2e
SUBCOMPACT BEV (eg Renault Zoe)	6t + 3.2t for a 22kw/h battery = 9.2t CO_2e
	5t + 9.2t for a 41 kw/h battery = 15.2t CO_2e
PREMIUM ICE	9.9t CO_2e
PREMIUM BEV (eg TESLA MODEL S “LONG RANGE”)	9.9t + 14.5t for a 100kw/h battery = 24.4t CO_2e

BATTERY ELECTRIC VEHICLES AND PRODUCTION EMISSIONS

BEVs have a larger carbon footprint during production than comparable ICE vehicles. (See table 4) According to IFEU apart from the battery, the production footprint of a BEV is roughly similar to an ICE vehicle. But battery production is energy intensive (80% of production emissions of a battery) and process emissions (20% of production emissions) also occur, driving up production emissions significantly.[44] Process emissions stem from the chemical reactions during a production process, such as the reduction of iron ore to steel in a conventional blast furnace. Think tanks Agora Verkerswende and IFEU estimate that during current battery production an average of 145kg of CO2e occurs per kw/h of battery capacity, although there is potential to reduce this significantly.[45] Therefore, a 100 kw/h battery, as included in a Tesla Model S “Long Range”, adds 14.5t of CO_2e emissions,[46] more than doubling the production footprint compared to a similar ICE model. Hence, to limit GHG emissions when transitioning to large scale BEV production two aspects become crucial: a fully renewable energy supply for the production process, and a focus on lighter vehicles that require smaller batteries.

For detailed demands on how manufacturers need to make BEV’s climate-friendly see chapter 7.

44. Klimabilanz von Elektroautos. Einflussfaktoren und Verbesserungspotenzial., Agora Verkehrswende, 2019, p. 45, https://www.agora-verkehrswende.de/filead-min/Projekte/2018/Klimabilanz_von_Elektroautos/Agora-Verkehrswende_22_Klimabilanz-von-Elektroautos_WEB.pdf
45. Ibid., p42.
46. The Tesla Model S “Long Range” is used to illustrate this as it is a popular model with a large battery. As Tesla is in the process of switching to 100% renewable electricity supply in its battery factory, the carbon footprint of their 100 kw/h batteries can be expected to be lower than IFEU’s estimate of the industry average. Tesla Gigafactory To Be Powered 100% By “Tesla Solar” By End Of 2019, Clean Technica, 27 August 2018 https://cleantechnica.com/2018/08/27/tesla-gigafactory-to-be-powered-100-by-tesla-solar-by-end-of-2019/

TAILPIPE CARBON EMISSIONS

Tailpipe emissions make up the vast majority of a car's lifecycle carbon emissions. Emissions are largely determined by the type of engine, fuel efficiency, and distance driven over its lifetime. The latter can vary drastically — estimates about the average distance range from 190,000 to 230,000km.[47][48]

ICE cars and hybrids produce tailpipe carbon emissions, whilst BEVs or a fuel cell electric vehicles do not. If a car is fuelled by renewable electricity,[49] or hydrogen produced through electrolysis powered by renewable electricity,[50] the car can be operated with no fuel-related carbon emissions.

Fuel efficiency is mainly determined by a car's weight and the power of its engine. Both weight and engine power have increased over the years, cancelling out efficiency gains made in engine technology. The fuel efficiency of an individual car is also affected by whether it's most often used in urban areas or on highways, and how fast it's driven. With plug-in hybrids, usage patterns (including how often the car is charged) have an even bigger effect on fuel efficiency than in the case of conventional ICE cars (see chapter 5).

EMISSIONS CAUSED BY FUEL SUPPLY

Supply, or 'upstream' fuel emissions — sometimes also referred to as well-to-tank emissions — stem from oil exploration, refining of diesel and petrol, and its distribution. For Europe, analysts estimate average upstream emissions to be 14g of CO2e per megajoule (MJ) for petrol and 15g of CO2e per MJ for diesel.[51] For petrol, this translates into 452g CO2e per litre, an additional 19.4% over the 2,330g CO2 released from the combustion of a litre of petrol. For diesel, this translates into upstream emissions of 561g CO2e per litre, an additional 21.3% over the 2,640g of CO2 released from the combustion of a litre of diesel.

To sum up, apart from the distance a car is driven, design decisions made by car manufacturers are the main factors that determine how much GHGs vehicles emit during their lifecycle. Manufacturers can choose to promote small, efficient cars or large SUVs; to build cars around 300 horsepower diesel engines or efficient electric engines. However, most of the cars they are marketing are not climate-friendly. SUVs are becoming more common (see chapter 6) and engine sizes are increasing, while electric alternatives are scarce.

47. John L. Sullivan et al., Life Cycle Inventory of a Generic U.S. Family Sedan Overview of Results USCAR AMP Project, JSTOR, 1998, pp. 1909-1923 https://www.jstor.org/stable/44741137?seq=1#page_scan_tab_contents
48. Maarten Messagie et al., A Range-Based Vehicle Life Cycle Assessment Incorporating Variability in the Environmental Assessment of Different Vehicle Technologies and Fuels, MDPI, 2014 https://www.mdpi.com/1996-1073/7/3/1467/htm
49. While individuals and fleet operators might power their BEVs with 100% renewable electricity, this is not yet the norm. But research from the International Council on Clean Transportation (ICCT) for Europe has shown that even when taking the standard electricity mix and production into account, BEVs are already are more climate friendly in most member states than comparable petrol or diesel cars. Effects of battery manufacturing on electric vehicle life-cycle greenhouse gas emissions, The ICCT Briefing, February 2018 https://theicct.org/sites/default/files/publications/EV-life-cycle-GHG_ICCT-Briefing_09022018_vF.pdf
50. Today most of the hydrogen is not yet produced through electrolysis but through steam reforming of fossil methane. As long as they are powered with fossil hydrogen, fuel cell electric vehicles cannot provide the needed emissions reductions.
51. Edwards et al., WELL-TO-TANK Report Version 4.a, European Commission, 2014, p.84 www.publications.jrc.ec.europa.eu/repository/bitstream/JRC85326/wtt_report_v4a_april2014_pubsy.pdf

THE FINDINGS: HOW CAR COMPANIES ARE CRASHING THE CLIMATE

In 2018, VW was the biggest climate culprit among the world's carmakers with a carbon footprint of 582m tons CO_2e resulting from the cars it produced in 2018 and the emissions caused by them over their lifetime. Renault-Nissan (577m tons CO_2e) and Toyota (562m tons CO_2e) came close. For comparison, the carbon footprints caused by these carmakers are greater than the total annual GHG emissions of Australia (535m tons CO_2e).[52 53] GM's footprint (530m tons CO_2e) exceeds that of the United Kingdom (465m tons CO_2e) and even Hyundai-Kia's footprint (401m tons CO_2e), the fifth largest, still exceeds the total annual emissions of Poland (379m tons CO_2e). German manufacturers VW, Daimler and BMW had a combined carbon footprint of 878m tons in 2018, exceeding the 2018 GHG emissions of Germany (866m tons CO_2e).[54]

In total, the 12 manufacturers analysed here are responsible for 4.3 gigatons (Gt) of CO_2e. Extrapolating from this, the entire industry with the 86 million cars it sold in 2018[55] is estimated to be responsible for a combined carbon footprint of 4.8 Gt CO_2e, equal to 9% of total annual global GHG emissions including emissions from land-use change.[56 57] For comparison, the US, the world's second largest carbon emitter after China, put 5.7 Gt CO_2e into the atmosphere, while the EU emitted 4.1 Gt CO_2e.

Compared to 2017, the carbon footprint of the industry shrank by only 1% in 2018. This corresponds to a similar drop in the combined sales of these 12 manufacturers. Ford's sales fell by 10%, resulting in a similar decrease in its carbon footprint. For other manufacturers, such as Hyundai-Kia, Daimler and BMW, modest improvements in average fleet emissions were cancelled out by rising sales. With 7%, General Motors (GM) saw a significant spike in its average fleet emissions, mainly due to selling Opel and Vauxhall, brands with smaller, more fuel-efficient models relative to the rest of GM's portfolio, to Groupe Peugeot Société Anonyme (PSA).

US manufacturers Ford, GM and Fiat-Chrysler-Automobiles (FCA) have the highest per-vehicle carbon footprint. This comes as no surprise as SUVs and pickup trucks dominate sales in the US more than anywhere else in the world. In 2018, the top-selling car models in the US were the Ford F-Series, the Chevrolet Silverado (General Motors) and the Dodge RAM (FCA), all three of them giant, gas-guzzling pickups.[58] The high share of SUV and pickup sales drive up overall fleet emissions in the US, and the fleet emissions of manufacturers whose US sales make up a large portion of their overall production.

[52] Global Annex-I map, UNFCCC 2019, https://di.unfccc.int/global_map
[53] Apart from GHG emissions data for Germany, for which 2018 data was available, all country GHG data is from 2017, the most recent year for which country data has been published by the UNFCCC.
[54] Klimabilanz 2018: 4,5 Prozent weniger Treibhausgasemissionen, Umweltbundesamt, 2019, https://www.umweltbundesamt.de/presse/pressemitteilungen/klimabilanz-2018-45-prozent-weniger
[55] Global car market remains stable during 2018, as continuous demand for SUVs offsets decline in sales of Compact cars and MPVs, JATO, 21 February 2019 https://www.jato.com/global-car-market-remains-stable-during-2018-as-continuous-demand-for-suvs-offsets-decline-in-sales-of-compact-cars-and-mpvs
[56] Emissions Gap report 2018, UNEP, published on 5 December 2018 https://www.ipcc.ch/site/assets/uploads/2018/12/UNEP-1.pdf
[57] These are total global greenhouse gas emissions of 2017, the most recent year data is available for.
[58] USA best selling cars in 2018, Focus2Move, 18 January 2019 https://focus2move.com/usa-best-selling-cars-2018/

TABLE 4: CAR COMPANIES 2018 CARBON FOOTPRINTS

CAR MANUFACTURER	EMISSIONS IN MILLION TONS OF CO_2E	VEHICLES SOLD	AVERAGE LIFETIME EMISSIONS PER VEHICLE IN TONS OF CO_2E	AVERAGE FLEET EMISSIONS CO2 IN G/KM
VW Group	582	10.8	53.8	192.7
Renault-Nissan Alliance	577	10.3	55.7	196.6
Toyota	562	10.4	53.8	180.8
General Motors	530	8.6	61.3	217.9
Hyundai-Kia	401	7.4	54.0	186.3
Ford Motor Corp	346	5.6	61.4	210.6
F.C.A	305	4.8	63.1	220.5
Honda	283	5.2	54.1	185.0
PSA Group (incl Opel)	201	4.1	49.2	176.3
Suzuki	164	3.3	49.6	168.8
Daimler AG	161	2.7	58.7	212.0
BMW AG	136	2.5	54.4	192.3
Top 12 car manufacturers	4246	76.0	55.9	195.0
Car industry	4807	86	Share of global GHG emissions	9%

TABLE 5: CAR COMPANIES 2017 CARBON FOOTPRINTS

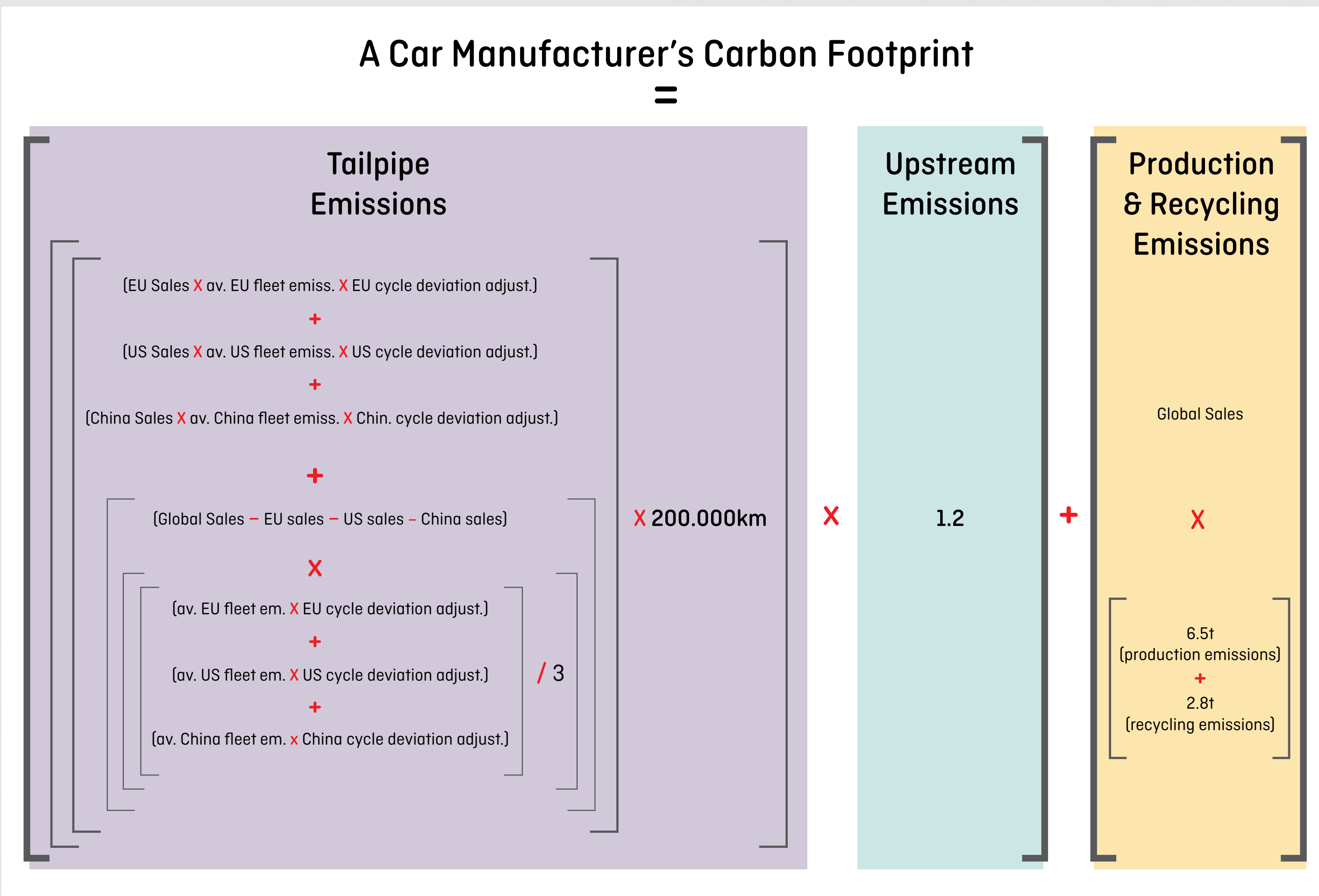
CAR MANUFACTURER	EMISSIONS IN MILLION TONS OF CO_2E	VEHICLES SOLD	AVERAGE LIFETIME EMISSIONS PER VEHICLE IN TONS OF CO_2E	AVERAGE FLEET EMISSIONS CO2 IN G/KM
VW Group	575	10.6	54.3	191.6
Renault-Nissan Alliance	571	10.3	55.7	196.9
Toyota	569	10.3	55.2	185.9
General Motors (incl Opel)	540	9.0	60.0	203.8
Hyundai-Kia	399	7.3	54.6	188.6
Ford Motor Corp	385	6.3	61.3	211.4
F.C.A	308	4.8	63.7	223.1
Honda	289	5.3	54.8	187.4
PSA Group	210	4.2	49.5	176.5
Suzuki	159	3.2	50.0	170.5
Daimler AG	158	2.7	58.3	212.4
BMW AG	133	2.5	54.1	193.7
Top 12 car manufacturers	4296	76.5	56.2	195.1
Car industry	4857	86.4	Share of global GHG emissions	9.1%

How we calculated carmakers' carbon footprints

Calculating car manufacturers' carbon footprints is not without challenges. Apart from a few exceptions, they have not been transparent or given much detail about their impact on the climate. In some cases they probably don't even have a good overview themselves.

The calculation (see figure 2) was done using the following data: fleet emissions data in China, the EU and the US; sales data for these three markets; global sales data; data on production emissions. We used government data where possible, other data sources where necessary and worked with proxies when comparable data was not available. Apart from a few exceptions, car manufacturers are not transparent about their own emissions data or give much detail about their impact on the climate. This is something that must change moving forward.

FIGURE 2: CARBON FOOTPRINT CALCULATION



Emissions data for the US market was provided by the Environmental Protection Agency (EPA), which provides timelines for the manufacturers from 1975 to 2018.[59] In the case of the EU and China, official sources provided emissions and sales data for each model sold on the respective markets, from which we needed to compute the manufacturers' fleet averages.[60]

CO2 emissions data is based on the standardised test cycles that manufacturers must use to certify each model. Countries use different test cycles and these vary in their ability to model the fuel efficiency and CO2 emissions of the cars on the road. The New European Driving Cycle (NEDC) used in Europe[61] and China significantly underestimates a car's carbon emissions under real-world conditions. However, the EPA's test cycle used in the US is accurate (even overestimating emissions by 1%), so we needed to correct for these deviations to get comparable figures. We used the average deviations identified by the International Energy Agency (IEA) and the International Council on Clean Transportation (ICCT) for the cars sold in these three markets as a correction factor: EU +39%, China +37%, USA -1%.[62] To account for sales in markets beyond China, the EU and the US, for which emissions data was not available, the average of each manufacturer's available fleet emissions data was used as a proxy. Upstream emissions have a linear relationship to the amount of fuel consumed and hence the tailpipe emissions. Based on the estimates by Edwards et al.,[63] we assumed a 20% increase over tailpipe emissions.

Sales data for this analysis comes from Focus2move.com (for global sales) and Carsalesbase.com (for sales in key markets). The sales of the 12 car companies covered accounted for 88% of global car sales in 2018.

The emissions data available for 2018 for the 12 manufacturers covers 60% of their global sales. This varies from manufacturer to manufacturer, between 78% (VW) and 19% (Suzuki) of sales. The median for data availability is 67%. As the Japanese government does not publish fleet emissions data for the Japanese market, data availability for Japanese manufacturers, with a high share of their global sales in Japan, is scant. As Suzuki additionally sells many vehicles in India for which no data is available, data availability for Suzuki is the lowest. The Korean government only disclosed group specific data for 2017 for five domestic groups and has not disclosed any data for 2018. To ensure comparability, specific data for the Korean market had to be excluded limiting availability of fleet emissions data for Hyundai-Kia to only 47% of their global sales.

Comparable data on production and recycling emissions is even harder to find than for fuel consumption and tailpipe emissions. As there was not enough data available to make precise distinctions between manufacturers, we used 6.5 tons of CO_2e as a proxy for production and 2.7 tons of CO_2e as a proxy for recycling. These correspond to the figures provided by the VW Group, a useful proxy as it combines both volume and premium brands. This comes with a caveat: production emissions from manufacturers that focus on the premium segment, such as Daimler and BMW, or that have a high share of SUVs and pickup trucks, tend to be slightly underrepresented, while the production emissions of manufacturers that sell fewer SUVs or premium cars are slightly overrepresented.

The resulting carbon footprint covers the car branch of these corporates. Some of the companies also have subsidiaries that are for example producing trucks and buses (e.g. VW and Daimler). The climate impact of that part of their business has not been considered in this analysis.

59. 2018 EPA Automotive Trends Report Supplemental Table K: Estimated Real-World Fuel Economy Data Stratified by Manufacturer and Vehicle Type, EPA, 2019 https://www.epa.gov/sites/production/files/2019-06/420r19002-supp-table-k-v2.xlsx
60. Monitoring of CO2 emissions from passenger cars - Data 2018 - Provisional data, EEA, 2019 http://ftp.eea.europa.eu/www/co2/CO2_passenger_cars_v17_csv.zip
61. From September 2018, the NEDC will be replaced in the EU by the Worldwide Harmonized Light Vehicles Test Procedure (WLTP). WLTP is expected to reduce the gap between test results and average real-life emissions. However, as in 2018 vehicles certified according to WLTP only made up 29% of sales and the rest had still been certified according to the NEDC, used the IEA's and ICCT's estimates 2017. CO2 emissions from new passenger cars in the European Union: Car manufacturers' performance in 2018, ICCT, 2019 https://theicct.org/sites/default/files/publications/ICCT_CO2_emissions_pv_EU_2018_20190806.pdf
62. Fuel economy in major car markets: Technology and policy drivers, 2005-2017, IEA and ICCT, 2019, p. 76-80 https://theicct.org/sites/default/files/publications/GFEI_WP19_Final_V3_Web.pdf
63. Edwards et al., WELL-TO-TANK Report Version 4.a, European Commission, 2014, p. 84 http://publications.jrc.ec.europa.eu/repository/bitstream/JRC85326/wtt_report_v4a_april2014_pubsy.pdf

CHAPTER 4: HOW THE CAR INDUSTRY IS FAILING TO RESPOND TO THE CLIMATE CRISIS

> **"Preventing irreversible climate disruption is the race of our lives and for our lives [...] We need rapid and deep change in how we do business, generate power, build cities and feed the world. And – having endured what is possibly the hottest month in recorded history – we need action now."**
> **—UN Secretary-General António Guterres, 1 Aug 2019**[64]

In 2014, the IPCC[65] set out how GHG emissions from passenger and freight transport could be reduced through avoiding unnecessary journeys; switching to greener modes of travel, such as cycling and public transport; improvements that lower the energy intensity of vehicles and engines; switching to lower carbon fuels, such as electricity from renewable sources.

But these changes are not happening fast enough and, five years on, global emissions from this sector are growing, not falling.[66][67] We are heading for a catastrophe and all the while the car industry is still failing to plan for a phasing-out of ICE cars, lobbying against strong climate regulation, failing to market battery electric vehicles sufficiently or shared vehicles at all.

FAILURE TO SPEED UP TRANSITION

Given the urgent need to achieve the 1.5°C global warming target, Greenpeace believes car manufacturers must step up to the challenge. The priority is to phase-out diesel and petrol cars. A Greenpeace commissioned study by the German Aerospace Centre in 2018 found that to achieve the target, the European passenger car sector needs to phase-out the sale of fossil-fuelled cars, including conventional hybrids, with the last ICE cars coming off the production lines in 2028.[68] While there are no comparable assessments for other regions, the European date provides a good benchmark for companies. The impacts of climate change are already devastating lives, and we must leave the ICE behind within the next decade.

There must also be a large reduction in cars on the road and a greater uptake of greener modes of transport. These changes will mean that the only car manufacturers surviving into the future will be those that can make this transition and diversify their business quickly.[69] However, there appears to be little will among carmakers to change and take urgent action.

While some companies have announced moves towards electrification, these moves will not transform the industry within the required timescale (see chapter 5). For example, at the end of 2018 Volkswagen publicly announced it will bring its last ICE platform to market in 2026 and phase out ICE production by 2040.[70] In 2019, Daimler announced it would be carbon neutral by 2039, but without giving a date by which it would phase out ICEs.[71] Other corporate announcements are limited to partial plans to expand EV models, including hybrids, by the mid-2020s, or stop selling diesel vehicles in some markets.

64. Opening remarks at press encounter at UN Headquarters, United Nations Secretary-General, 1 August 2019 https://www.un.org/sg/en/content/sg/speeches/2019-08-01/remarks-press-encounter-un-headquarters
65. Paraphrasing Climate Change 2014 Mitigation of Climate Change Working Group III Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Chapter 8: Transport, IPCC, p. 603 https://www.ipcc.ch/site/assets/uploads/2018/02/ipcc_wg3_ar5_full.pdf
66. Cars and coal help drive 'strong' CO2 rise in 2018, BBC, 5 December 2018 https://www.bbc.co.uk/news/science-environment-46447459
67. Global Carbon Budget 2018, Earth System Science Data, 5 December 2018, https://www.earth-syst-sci-data.net/10/2141/2018/
68. Development of the car fleet in EU28+2 to achieve the Paris Agreement target to limit global warming to 1.5°C, Greenpeace, 20 September 2018 http://www.greenpeace.org/archive-belgium/Global/belgium/report/2018/20180907_GP_EUCarFleet_1.5.pdf
69. See Chapter 6 for more detail on what the industry must do.
70. Dr. Herbert Diess, Leading the Transformation, Volkswagen, 2019 https://www.volkswagenag.com/presence/investorrelation/publications/presentations/2019/03_march/1_CMD_Diess.pdf
71. "Ambition2039": Our path to sustainable mobility, Daimler website https://media.daimler.com/marsMediaSite/en/instance/ko/Ambition2039-Our-path-to-sustainable-mobility.xhtml?oid=43348842

TABLE 6: TOP 12 CAR COMPANIES' ICE PHASE-OUT PLANS

2019 SALES RANK	NAME	PUBLIC COMMITMENT TO A GLOBAL PHASE OUT OF THE ICE	NOTE
1	VW Group	Will stop selling fossil fuel cars by 2040.[72]	Start of production of last ICE-platform in 2026. Carbon neutral by 2050, including vehicle and manufacturing supply chain.
2	Toyota Group	X	Diesel phase-out only in Europe by 2019. Plan to have zero CO2 emissions in vehicle lifecycle by 2050.[73]
3	Renault-Nissan Alliance	X	Nissan: plans to stop diesel for passenger cars at each model's renewal in Europe. Limit diesel sales to commercial vehicles in Japan and US [74] Renault: reduce by 50% its diesel offer by 2022. [75]
4	General Motors	X	Committed to "all electric future" without a date for ICE phase-out.[76]
5	Hyundai-Kia	X	
6	Ford Group	X	
7	Honda Motor	X	
8	FCA	X	Diesel phase-out in its passenger cars sold only in the EMEA (Europe, Middle East, Africa) market by 2021 (light commercials will remain diesel).[77]
9	PSA Group	X	No new diesel engine to be developed.[78]
10	Daimler AG	X	Carbon neutral by 2039, in vehicles and factories.[79]
11	BMW AG	X	
12	Suzuki	X	(Maruti Suzuki India) — phase-out diesel by April 2020.[80]

By way of comparison, a number of national governments including the UK, France, and the Netherlands, have announced ICE phase-out plans with dates.[81] Although these announcements have rarely been backed up by legally binding regulations and are often too late, it has given a strong market signal that there is no future for fossil fuel vehicles.

72. Christoph Rauwald, Oliver Sachgau, VW Says the Next Generation of Combustion Cars Will Be Its Last, Bloomberg, 4 December 2018 https://www.bloomberg.com/news/articles/2018-12-04/vw-says-the-next-generation-of-combustion-cars-will-be-its-last
73. What is the Toyota Environmental Challenge 2050?, Toyota website, 29 May 2019 https://blog.toyota.co.uk/toyota-environmental-challenge-2050
74. Nissan will abandon diesel cars in Europe, Le Point, 7 May 2018 https://www.lepoint.fr/automobile/securite/nissan-va-delaisser-les-voitures-diesel-en-europe-07-05-2018-2216448_657.php
75. Clémentine Maligorne, Isabelle de Foucaud, Diesel, electric: where is Renault today?, Le Figaro, 6 October 2017 www.lefigaro.fr/economie/le-scan-eco/dessous-chiffres/2017/10/06/29006-20171006ARTFIG00249-diesel-electrique-o-en-est-renault-aujourd-hui.php
76. Alex Davis, General Motors Is Going All Electric, Wired, 10 July 2017 https://www.wired.com/story/general-motors-electric-cars-plan-gm/
77. FCA Capital Markets Day, FCA, 1 June 2018 https://www.fcagroup.com/en-US/investors/Pages/capital_markets_day_2018.aspx
78. Florian Chopin, End of diesel: the PSA Group program, l'Auto-Journal, 28 September 2018 https://news.autojournal.fr/news/1531522/Diesel-PSA-Stratégie-Electrique-Hybride
79. David Keating, Mercedes-Benz Will Make Entire Car Fleet Carbon-Neutral by 2039, Forbes, 13 May 2019 https://www.forbes.com/sites/davekeating/2019/05/13/mercedes-benz-will-make-entire-car-fleet-carbon-neutral-by-2039/#4bd1642f4bd4
80. Maruti's decision to phase out diesel by April 2020 may hasten the end of the road for the fuel, Business Today, 25 April 2019 https://www.businesstoday.in/sectors/auto/maruti-decision-to-phase-out-diesel-by-april-2020-may-hasten-the-end-of-the-road-for-the-fuel/story/340488.html
81. Greenpeace map to track ICE phase-out, car access restrictions into cities and specific cars bans within city limits. https://www.greenpeace.org/international/act/clean-air-now/

LOBBYING AND DUPLICITY

The car industry has a long history of fighting government regulation. It has a track record of lobbying against everything from seat belts to airbags, claiming that these safety features will raise car prices and lead to the mass layoff of workers.[82] In recent years, manufacturers have used these same arguments to oppose climate regulations.

In Europe, the European Automobile Manufacturers Association (ACEA) has long argued against strengthened CO2 emission standards. For example, on 10 December 2018, ACEA put out a press release calling provisions by the European Parliament aimed at achieving the targets in the Paris UNFCCC climate agreement "extremely aggressive", and again used the "affordability" argument.[83]

In the US, the 12-member Alliance of Automobile Manufacturers (AAM) is reported to have spent millions of dollars[84] since the election of President Trump in an effort to dismantle policy progress on US vehicle efficiency and greenhouse gas emissions. [85] Moreover, the AAM have been accused of spreading disinformation.[86] The Corporate Average Fuel Economy (CAFE) standards, which were strengthened significantly under President Obama, are now under review by the Trump administration, and are threatened with significant weakening.

While the Trump administration wants to roll back these rules, California and 13 other states are resisting the changes, potentially dividing the US car market in two.[87] Concerned about facing two different standards, four major manufacturers (Ford, Honda, VW and BMW) entered into a voluntary agreement with California directly,[88] agreeing to a slightly looser standard than the original Obama rule: 51 miles per gallon by 2026 (instead of the Obama standard of 54.5 mpg by 2025).

Research by Influence Map shows a pattern of car companies saying one thing in public but another in backroom political lobbying.[89] In representations to the US Environmental Protection Agency (EPA), Ford said regarding the greenhouse gas emissions standards "The Proposed Determination should be withdrawn…", [90] whereas in 2018 Chairman Bill Ford publicly enthused about Ford's supposed commitment to electrification.[91] Meanwhile, Toyota told the US government the greenhouse gas emissions standards "are not appropriate"[92] and yet on the Toyota website's sustainability page it claims to be "… working on initiatives that contribute to the sustainable development of society and the earth through all its business activities in cooperation with global society."[93]

Duplicity on environmental standards was again evident in the diesel emissions testing scandal, known as "dieselgate". This began in 2015 when the Volkswagen Group was forced to admit it had installed illegal software in diesel engines to cheat anti-pollution tests.[94] It means far more harmful nitrogen dioxide (NO2) emissions, which can cause serious health problems, have been pumped into the air than was thought. The scandal has spread across the industry and Daimler, Nissan, Fiat Chrysler, Mazda, Suzuki, Yamaha, Mitsubishi, Renault and Volvo have all become embroiled in the emissions testing fiasco.[95] Recently a criminal investigation into Ford's emissions certification process was opened by the US Justice Department.[96]

82. Time for a U-Turn Automakers' History of Intransigence and an Opportunity for Change, Union of Concerned Scientists, December 2017, https://www.ucsusa.org/sites/default/files/attach/2017/12/cv-fuel-efficiency-intransigience-full_0.pdf
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85. Trump administration freezing fuel efficiency penalties, Reuters, 13 July 2019 https://www.reuters.com/article/us-autos-emissions/trump-administration-freezing-fuel-efficiency-penalties-idUSKCN1U801U
86. Dave Cooke, Automakers Turn to Climate Deniers in Quest to Lower Fuel Economy Regulations, Union of Concerned Scientists, 19 March 2018 https://blog.ucsusa.org/dave-cooke/automakers-turn-to-climate-deniers-in-quest-to-lower-fuel-economy-regulations
87. Trump's Rollback of Auto Pollution Rules Shows Signs of Disarray, New York Times, 20 August 2019, https://www.nytimes.com/2019/08/20/climate/trump-auto-emissions-rollback-disarray.html
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DISTORTED NUMBERS: TEST RESULTS VERSUS ON-ROAD EMISSIONS

Over the past two decades, we have also witnessed an increasing gap between test cycle results and on-road emissions. According to the ICCT, in the EU the gap between real world emissions and NEDC test cycle results grew from 8% in 2001 to 39% in 2017.[97] The incentive to optimise cars for these roller bench tests grew when the test results became the basis for mandatory climate-related regulation. The IEA and ICCT estimate that the deviation from real world results in China, where the NEDC test has also been used, to be 34%. In Japan, deviation between real world results and the JC08 test cycle is estimated to be 46%. In the US, the Corporate average fuel economy (CAFE) standard offers results that on average are estimated to be 34% lower.[98] Standards such as the NEDC, which are outdated and inappropriate for today's car models, have made it easy to produce results that are lower than on-road results. To address this, a new test, the Worldwide Harmonised Light Vehicle Test Procedure (WLTP), has been developed and is being implemented in Europe with a planned roll-out to other markets. However, first analysis by the ICCT indicates that a substantial gap still remains.[99]

The gap between test results and on-road fuel-efficiency and emissions is a disaster for the climate. It also deceives customers, who end up spending more on fuel. It is unclear to what extent whether these deviations stem solely from cycle optimisation within legal boundaries or if manufacturers have at some point used illegal measures to lower their official CO2 emissions. After news of dieselgate broke, VW flagged to German authorities that it might also have manipulated CO2 emissions in more than 660,000 cars across Europe.[100] An investigation conducted by German transport authority, the KBA, did not find any irregularities in the tested VW models but found models from other manufacturers whose test results they could not reproduce.[101] Their colleagues at the US EPA however came to a different conclusion. They found software in VW cars that manipulated their behavior on the roller bench and hence lowered fuel consumption and CO2 emissions during the cycle tests. As a consequence VW now has to compensate 98,000 car owners in the US.[102]

97. Tieetge et al., From Laboratory to Road: A 2018 update of official and "real-world" fuel consumption and CO2 values for passenger cars in Europe, ICCT, 2018, p.(i) https://theicct.org/sites/default/files/publications/Lab_to_Road_2018_fv_20190110.pdf
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MARKETING FAILURE

Research carried out in 2018 by Transport & Environment shows that the car industry is not doing enough to encourage sales of battery electric vehicles (BEVs).[103] It highlighted a lack of spending on advertising, limited choice of models, lack of availability in showrooms and long waiting times. While car manufacturers blame insufficient charging infrastructure and incentives, the report shows that they could have done significantly more to meet their own goals for BEV uptake.

The research,[104] which used European data from leading marketing analytics company Ebiquity, found that "Whilst around 30% of British, French and German consumers say they would consider buying an electric car, just 1.5% of advertising spend was on zero-emission models and 1.4% on plug-in hybrid models in the EU's largest car markets: Germany, France, UK, Italy, and Spain. Across the EU, advertising spend is likely to be significantly lower than this percentage as little promotion of zero-emission models is likely out of the major new car markets."

At the same time, advertisement spending for SUVs is skyrocketing. Research conducted by Greenpeace Germany on the German car market shows that in 2018 manufacturers spent more on advertising for SUVs than on any other segment.[105] Despite the lack of publicly available data to assess manufacturers' marketing decisions and expenditure on SUVs in other car markets, car commercials and statements by CEOs show that SUVs are being heavily promoted. For example, Chung Eui-sung, a senior vice president of Hyundai and Kia Motors, has ordered the company to focus on research and development and sales of SUVs rather than traditional sedans. The company plans to increase the proportion of SUVs among new cars released to 90% next year, up from 60% this year.[106]

103. Carmakers STILL failing to hit their own goals for sales of electric cars, Transport & Environment, June 2018 https://www.transportenvironment.org/sites/te/files/2018_06_EV_announcements_report.pdf
104. Ibid.
105. Ein dickes Problem. Wie SUVs und Geländewagen das Klima und unsere Städte ruinieren, Greenpeace Germany, 2019 https://www.greenpeace.de/sites/www.greenpeace.de/files/publications/s02571_gp_report_suv_09_2019_es.pdf
106. Maeil Broadcasting Network, 22 August 2019, https://www.mk.co.kr/news/business/view/2019/08/654032/?utm_source=naver&utm_medium=newsstand

CHAPTER 5: FUEL EFFICIENCY AND HYBRIDS — BAND-AID SOLUTIONS

THE LIMITATIONS OF FUEL EFFICIENCY IMPROVEMENTS

For decades, carmakers have promised to improve the fuel efficiency of the ICE and reduce CO2 emissions to fight climate change — a good move as the amount of CO2 emitted is directly proportional to the amount of fuel combusted. Unfortunately, improvements in average CO2 emissions from new cars sold in the five markets covered by this report have stalled or even reversed. And these markets account for over 70% of the total global market.[107]

While some national governments and the EU have introduced and strengthened CO2 emissions targets for 2030,[108] the reductions are nowhere close to stay within the the 1.5°C limit. As DLR research for Europe demonstrates, this will require ICE cars, including ICE hybrids, to be phased-out from sales by 2028.[109]

Here follows an overview of carmakers' failure so far, and what they need to do to achieve zero tailpipe CO2 emissions by 2028.

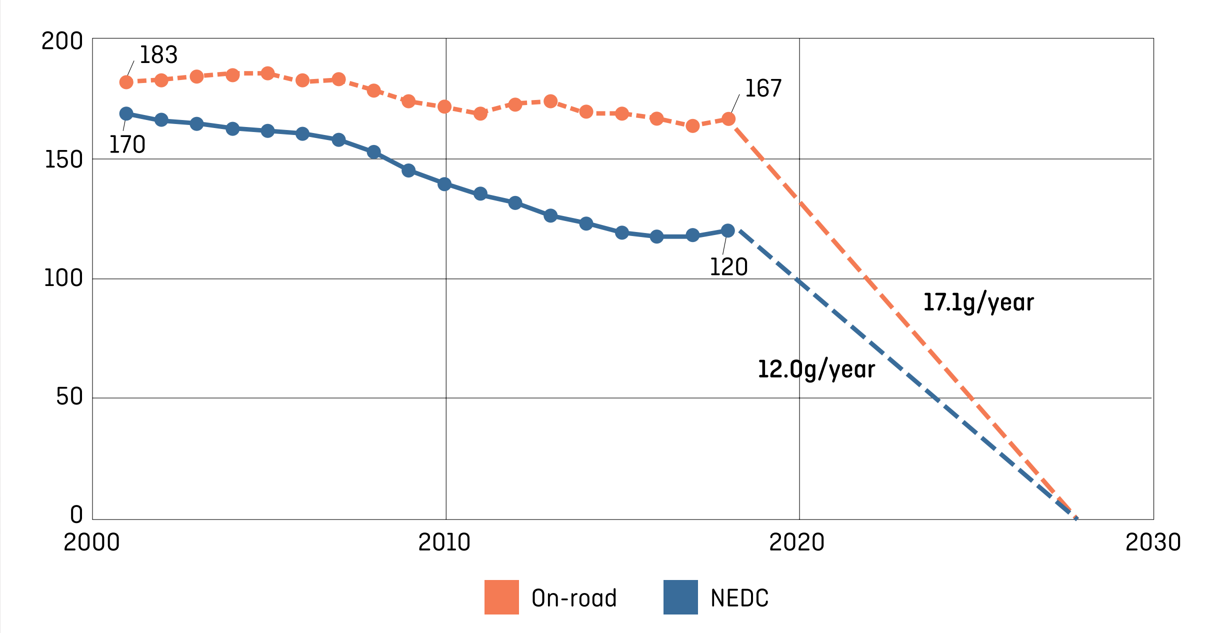
EU28

Average CO2 emissions per km from passenger cars in the 28 European Union countries decreased between 2001 and 2016. However, progress in CO2 emission reductions has slowed significantly since 2015 and reversed over the last two years.

According to provisional passenger car CO2 fleet data for 2018, average CO2 emissions from new cars registered in the EU is 120.4g/km. That is a 50g/km decrease compared to 2001. Compared to 2017, emissions increased by 2g/km.[110] It is important to note that the discrepancy between certified CO2 emissions based on the NEDC test and on-road CO2 emissions has increased from 8% in 2001 to 39% in 2017.[111] Adjusting for this, (see chapter 3) reductions between 2001 and 2018 shrink to a mere 16g/km.

107. Global car market remains stable during 2018, as continuous demand for SUVs offsets decline in sales of Compact cars and MPVs, JATO, 21 February 2019 https://www.jato.com/global-car-market-remains-stable-during-2018-as-continuous-demand-for-suvs-offsets-decline-in-sales-of-compact-cars-and-mpvs/
108. CO2 emission standards for cars and vans: Council confirms agreement on stricter limits, Council of the EU press release, 16 January 2019 https://www.consilium.europa.eu/en/press/press-releases/2019/01/16/co2-emission-standards-for-cars-and-vans-council-confirms-agreement-on-stricter-limits/
109. Development of the car fleet in EU28+2 to achieve the Paris Agreement target to limit global warming to 1.5°C, Institute of Vehicle Concepts, 20. September 2018 https://storage.googleapis.com/planet4-italy-stateless/2018/11/4a22ffe3-4a22ffe3-development-of-the-car-fleet-in-eu28_2-to-achieve-the-paris-agreement-target_dlr.pdf
110. Average CO2 emissions from new cars and new vans increased in 2018, European Environment Agency, 24 June 2019 https://www.eea.europa.eu/highlights/average-co2-emissions-from-new
111. From Laboratory to Road International: A Comparison of Official and Real-world Fuel Consumption and CO2 Values for Passenger Cars in Europe, The United States, China, and Japan, ICCT, 10 January 2019 https://theicct.org/publications/laboratory-road-2018-update

FIGURE 3: EU28 AVERAGE CO2 EMISSION FROM PASSENGER CARS, NEDC VS ON-ROAD (UNIT: G/KM)



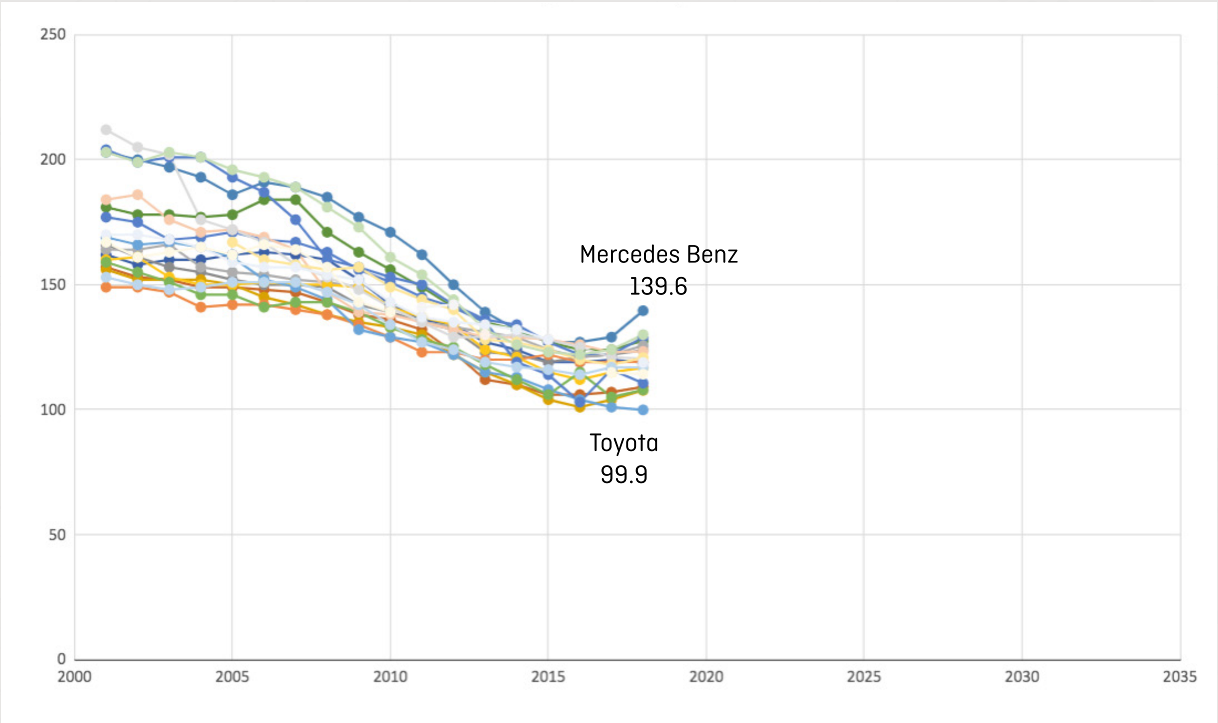
Source: Average CO2 emissions from passenger cars, European Environment Agency [112] [113]

[112] Average CO2 emissions from passenger cars, European Environment Agency, 12 April 2018
https://www.eea.europa.eu/data-and-maps/daviz/averaeg-co2-emissions-from-passenger-cars-1#tab-chart_2_filters=%7B%22rowFilters%22%3A%7B%7D%3B%22columnFilters%22%3A%7B%22columnfilter_Filter%22%3A%5B%22EU-28%20average%22%5D%7D%7D
[113] Average CO2 emissions from new cars and new vans increased in 2018, European Environment Agency, 24 June 2019
https://www.eea.europa.eu/highlights/average-co2-emissions-from-new

Official fleet average CO2 emissions ranged from 133g/km (Mercedes Benz) to 102g/km (Toyota) in 2018.[114] According to the statistics published by the ICCT and market analyst JATO, most if not all of the brands have shown an upward trend in CO2 emissions since 2016. Many factors have contributed to this trend, including an increase in sales of SUVs, which are heavier and less fuel efficient.[115]

From 2020 onwards the EU's average CO2 fleet emission target is 95g/km, which will be further reduced by 37.5% until 2030. While this is far from what is needed to stay within the 1.5°C limit, some manufacturers have been reluctant to adopt their strategies even to meet this target, risking fines which could cost them billions of euros.[116]

FIGURE 4: AVERAGE CO2 EMISSION (G/KM) PER BRAND AND INDUSTRY AVERAGE (UNIT: G/KM)



Source:
CO2 emissions rise to highest average since 2014, as the shift from diesel to gasoline continues, JATO[117]
European Vehicle Market Statistics Pocketbook 2018/2019, ICCT[118]

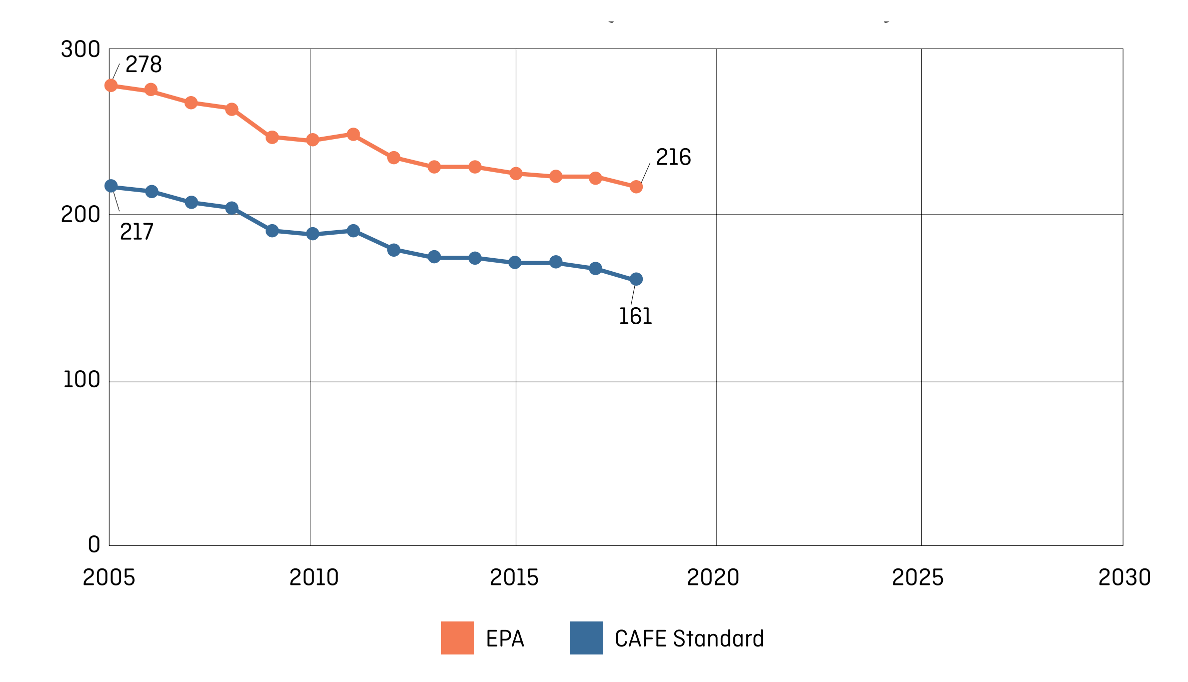
114. CO2 emissions rise to highest average since 2014, as the shift from diesel to gasoline continues, JATO, 4 March 2019 https://www.jato.com/co2-emissions-rise-to-highest-average-since-2014-as-the-shift-from-diesel-to-gasoline-continues/
115. Ibid.
116. Driving into a low emissions future - Looking beyond 2021, PA Consulting, 2018 http://www2.paconsulting.com/rs/526-HZE-833/images/PA%20CO2%202018_2019%20Report.pdf
117. CO2 emissions rise to highest average since 2014, as the shift from diesel to gasoline continues, JATO, 4 March 2019 https://www.jato.com/co2-emissions-rise-to-highest-average-since-2014-as-the-shift-from-diesel-to-gasoline-continues/
118. European vehicle market statistics, 2018/2019, ICCT, 5 December 2018 https://theicct.org/publications/european-vehicle-market-statistics-20182019

US

The situation is similar in the US. Although there has been a reduction in CO2 emissions, progress slowed between 2013 and 2016 by an average of 1g/km per year, based on official fuel efficiency data published by the National Highway Traffic Safety Administration (NHTSA) for Corporate Average Fuel Economy (CAFE) Standards, converted into CO2 emissions values.[119] Provisional NHTSA data indicates an improvement of 8g/km between 2017 and 2018.[120]

However, results from the CAFE test heavily deviate from what cars emit on the road. On average, the IEA and the ICCT estimate on-road emissions to be 34% higher.[121] While the CAFE results are used for regulatory purposes, there is a second EPA test cycle used to give customers information about the fuel efficiency of their vehicles with much more accurate results. According to the EPA CO2 fleet emissions in 2018 were 216g/km. Reducing fleet emissions to zero by 2030, for example, requires a yearly reduction of 18g/km; to achieve it by 2028 an annual reduction of 21.6g/km is required.

FIGURE 5: US FLEET AVERAGE CO2 EMISSION (UNIT: G/KM)

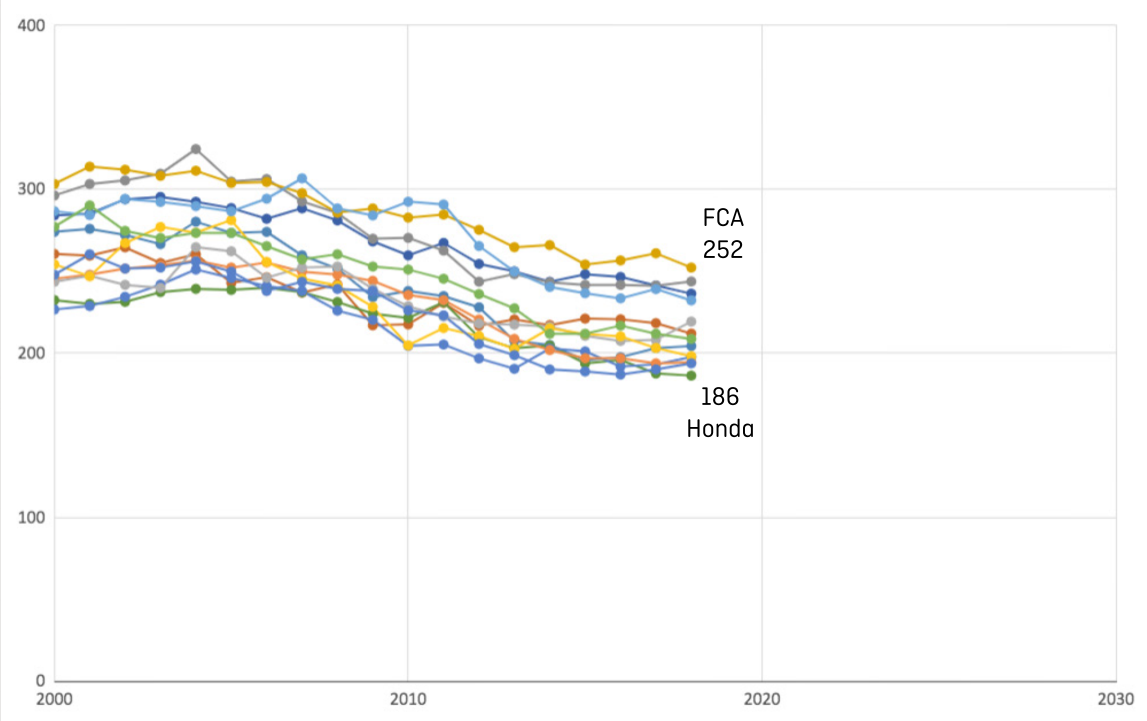


Source:
Fleet Fuel Economy Performance Report, NHTSA[122]
Automotive Trends Report, EPA [123]

[119] Manufacturer Performance, CAFE Public Information Center https://one.nhtsa.gov/cafe_pic/CAFE_PIC_Home.htm
[120] Manufacturer Projected Fuel Economy Performance Report, NHTSA CAFE, 30 April 2018 https://one.nhtsa.gov/cafe_pic/MY_2017_and_2018_Projected_Fuel_Economy_Performance_Report.pdf
[121] Fuel economy in major car markets: Technology and policy drivers, 2005-2017, IEA and ICCT, 2019, p.76-80 https://theicct.org/sites/default/files/publications/GFEI_WP19_Final_V3_Web.pdf
[122] 2004-2016 Fleet Fuel Economy Performance Report, NHTSA https://one.nhtsa.gov/cafe_pic/CAFE_PIC_fleet_LIVE.html
[123] Automotive Trends Report Supplement Table K: Estimated Real-World Fuel Economy Data Stratified by Manufacturer and Vehicle Type, EPA, https://www.epa.gov/automotive-trends/download-data-automotive-trends-report

All brands are failing to achieve the necessary reduction, with some performing particularly badly according to data published by EPA. For example, GM, Ford and FCA recorded the highest CO2 emissions among the manufacturers at 236g/km, 244g/km and 252g/km respectively in 2018. Average CO2 emissions of cars sold by Ford, Nissan-Mitsubishi, VW and Mazda actually increased between 2015 and 2018. The range of average CO2 emissions for model year 2018 varied from 252g/km to 186g/km, which makes it clear that achieving zero emissions will be impossible for all 13 brands tracked by the EPA, if they don't fundamentally change their strategy.

FIGURE 6: AVERAGE CO2 EMISSION (G/KM) OF AUTOMOBILES SOLD IN THE US BY BRANDS (UNIT: G/KM)



Source: Automotive Trends Report, EPA[124]

Factoring in US specific upstream emissions associated with fuel production such as gasoline, diesel and electricity, the Union of Concerned Scientists, estimates that the average CO2 emissions across all brands increase to between 376g/mile (233g/km) and 443g/mile (323g/km).[125] The United States Department of Transportation Federal Highway Administration says car owners drive an average of 13,476 miles per year. This translates to CO2 emissions of 5.1 to 6.0 tons per year — a spectacular failure to achieve emission reductions necessary to meet the 1.5°C target.

The Automaker Rankings (2018) report highlights one notable exception in the US market: Tesla, a dedicated EV manufacturer. Its average CO2 emission level was 136g/mile (85g/km), when considering US specific emissions associated with electricity generation. This is 70% lower than the industry average of 443g/mile (275g/km).[126] With an increasing share of renewable electricity, this gap will grow further.

124. Automotive Trends Report Supplement Table K: Estimated Real-World Fuel Economy Data Stratified by Manufacturer and Vehicle Type, EPA, https://www.epa.gov/automotive-trends/download-data-automotive-trends-report

125. Automaker Rankings 2018: The Environmental Performance of Car Companies, The Union of Concerned Scientists, June 2018, [p.9] https://www.ucsusa.org/sites/default/files/attach/2018/06/cv-automaker-rankings-2018-report.pdf

126. Ibid.

CHINA

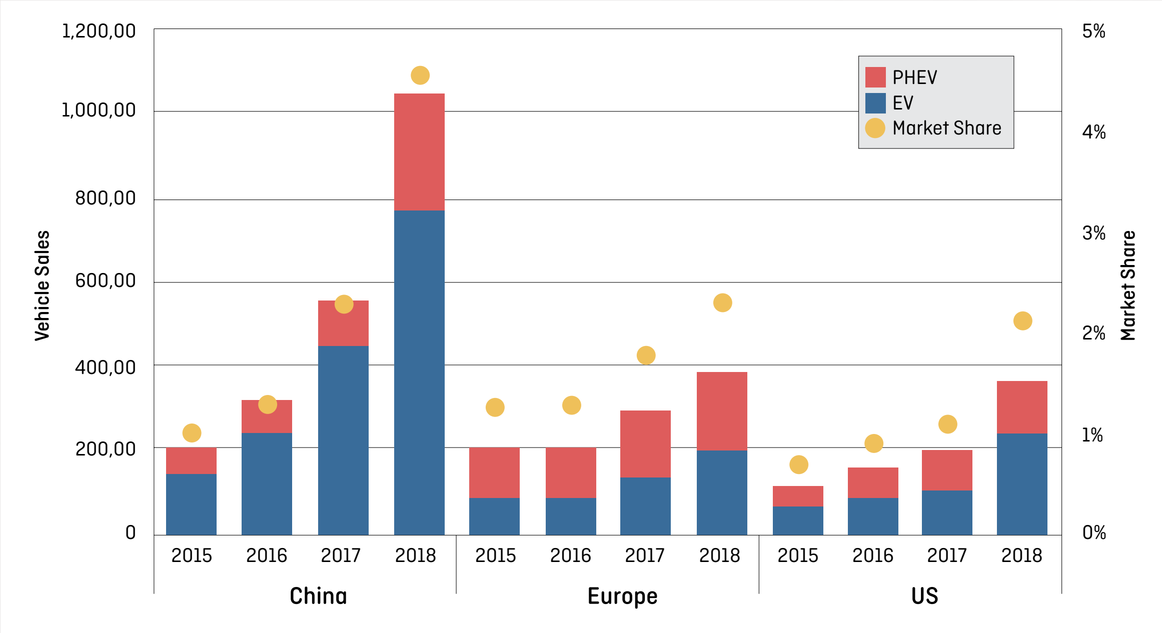
Transport GHG emissions have increased rapidly in China due to industrialisation and increased motorisation. In 1994, transport GHG emissions were 165,567Mt, accounting for 5.5% of China's total GHG emissions. By 2012, it had increased to 797,083Mt, accounting for 8.5% of total emissions.[127] [128]

Automobile sales continued to grow rapidly from 13.76m units in 2010 to 20.66m units in 2014, an increase of 50%. There was a slight reduction from 29m units in 2017 to 28m units in 2018, the first decline in two decades.

The Chinese government does not publish fleet average CO2 emissions at market or brand level. However, an ICCT report on the changes in CO2 emissions between 2010 and 2014 provides some insight into progress made by different brands. According to the report, average CO2 emissions ranged between 200g/km and 150g/km in 2010 and 180g/km and 150g/km in 2014.[129] These numbers are based on the NEDC, and according to IEA and ICCT they underestimate on-road emissions by 34%.[130] The figures show that the Chinese automobile market has been dominated by ICE vehicles and suggests that China needs to make fundamental changes to meet the challenge of achieving zero tailpipe emissions in the future.

According to a recently published report by the U.S. Department of Energy, BEVs and PHEVs accounted for 4.5% of automobiles sold in China 2018.[131] Battery electric vehicles with zero tailpipe emissions accounted for 3%, placing China ahead of the US and Europe in transition to zero tailpipe emissions. With the start of their mandatory EV quota at the beginning of 2019, it can be expected that the market share of EVs will continue to grow.

FIGURE 7: SALES OF NEW ELECTRIC & PLUG-IN VEHICLES BY COUNTRY/REGION, 2015-2018



Source: China — Data summarized by Argonne National Laboratory from Hewu WANG, Xu HAO. Data Base of Electric Vehicle Production in China, State Key Laboratory of Automotive Safety and Energy, Tsinghua University.[132]

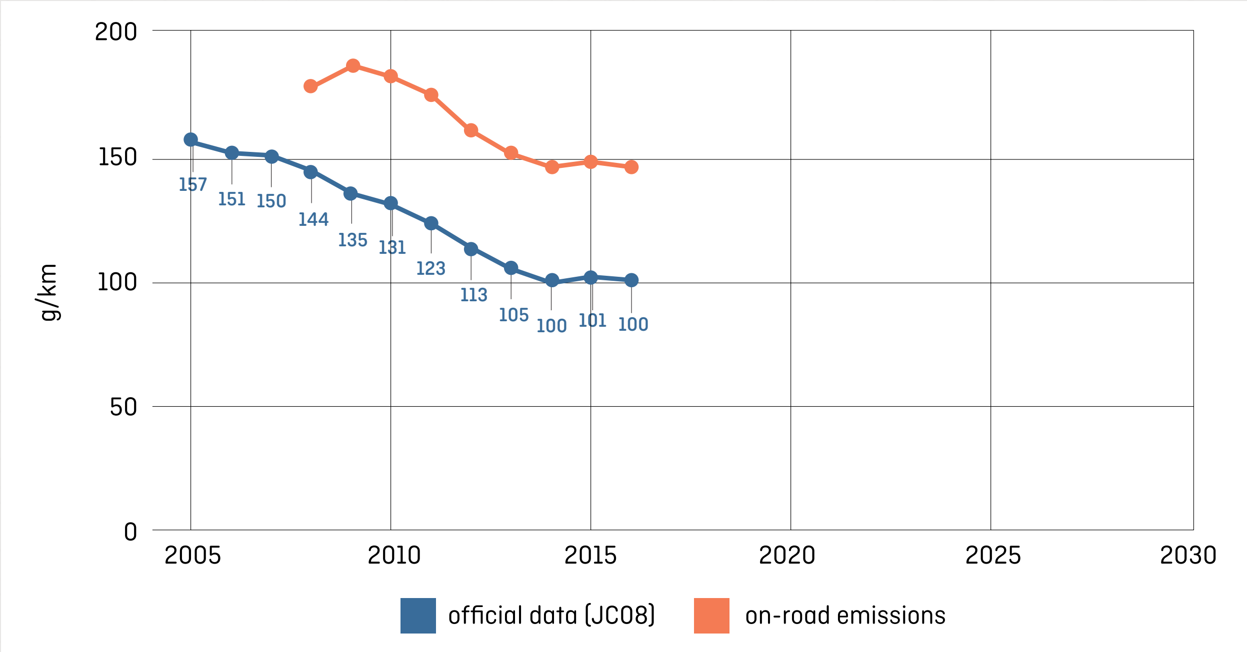
127. Emissions Summary by China, Data by Sector https://di.unfccc.int/ghg_profiles/nonAnnexOne/CHN/CHN_ghg_profile.xlsx
128. Emissions Summary for China, United Nations Framework Convention on Climate Change https://di.unfccc.int/ghg_profile_non_annex1
129. The New Passenger Car Fleet In China, 2014: Technology Assessment And Comparison, 2014 Versus 2010, ICCT, 5 March 2018 https://theicct.org/publications/new-passenger-car-fleet-china-2014-technology-assessment-and-comparison-2014-versus
130. Fuel economy in major car markets: Technology and policy drivers, 2005-2017, IEA and ICCT, 2019, p.76-80 https://theicct.org/sites/default/files/publications/GFEI_WP19_Final_V3_Web.pdf
131. FOTW #1079, April 29, 2019: More Than 1 Million Plug-in Vehicles Were Sold in China in 2018 https://www.energy.gov/eere/vehicles/articles/fotw-1079-april-29-2019-more-1-million-plug-vehicles-were-sold-china-2018
132. Ibid.

JAPAN

Total CO2 emissions from passenger cars and buses have decreased from 122 megatons (Mt) in 2005 to 107Mt in 2015, which makes Japan unique among the five key markets reviewed. During this period, the number of passenger cars in use increased from 57.1 million units in 2005 to 61.8 million units in 2015 while the number of buses in use remained largely unchanged at approximately 0.23 million units.

The reduction in CO2 emissions, despite the increase in cars, is down to a combination of factors. One is the reduction in average CO2 emissions of new passenger cars. Between 2005 and 2016 official industry average CO2 emissions were reduced by 57g/km, from 157g/km to 100g/km. However, the rate of reduction in CO2 emissions per km has slowed down since 2014, and even increased by 1g/km in 2015. The average CO2 emissions returned to 100g/km in 2016, the same level as in 2014. According to the IEA and ICCT the test cycle used in Japan on average underestimates on-road emissions by 46% in which case actual fleet emissions would be at 146g/km (see figure 7).

FIGURE 8: JAPANESE AVERAGE FLEET CO2 EMISSIONS (UNIT: G/KM)



Source:
Motor Industry of Japan 2018, Japan Automobile Manufacturers Association[133]
Real-world fuel consumption and CO2 emissions of new passenger cars in Europe, ICCT[134]

The number of ICE hybrids in use (31.5% of vehicles in 2016) was a significant factor in reducing CO2 emissions to the 2016 level. In 2016, the percentage of ICE hybrids was much lower in the EU (1.7%) and the US (2%). However, further reductions are still needed in Japan and the government has introduced a new fuel efficiency target. This can only be met if at least 20% to 30% of new vehicles sold are electric or plug-in hybrids by 2030.[135]

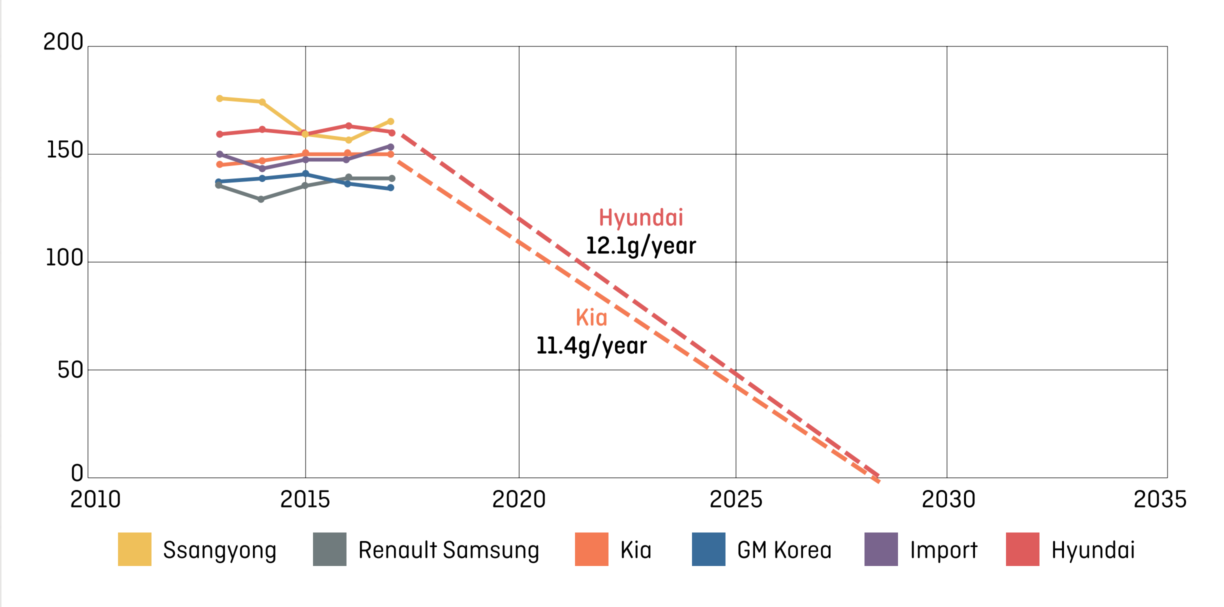
133. Motor Industry of Japan 2018, Japan Automobile Manufacturers Association, May 2018. http://www.jama-english.jp/publications/MIJ2018.pdf
134. Real-world fuel consumption and CO2 emissions of new passenger cars in Europe, ICCT, November 2017
https://theicct.org/sites/default/files/L2R17_ICCT-fact-sheet_EN_vF.pdf
135. Japan mandates cars to be 30% more fuel efficient by 2030, Nikkei Asian Review, 4 June 2019
https://asia.nikkei.com/Business/Automobile/Japan-mandates-cars-to-be-30-more-fuel-efficient-by-2030

SOUTH KOREA

GHG emissions from road transport have steadily increased, from 81Mt in 2011 to 95Mt in 2016. This is due to a number of factors, including an increase in the number of vehicles on the road from 18.4m in 2011 to 21.8m in 2016.[136]

Another factor is an increase in the average CO2 emissions of vehicles sold. According to the Korea Energy Agency, average vehicle CO2 emissions increased slightly from 149.4g/km in 2013 to 151.4g/km in 2017. Kia had the largest increase (3.2%), while average emissions of vehicles sold by import brands increased by 2.3%. Hyundai, which has the highest market share, recorded a 0.4% increase, with its average CO2 emissions at 157.6g/km 6.2g/km higher than the industry average of 151.4g/km. Overall, none of the brands made meaningful progress in reducing CO2 emissions between 2013 and 2017.

FIGURE 9: SOUTH KOREA CAR CO2 EMISSIONS BY BRANDS (UNIT: G/KM)



Source: 2018 Vehicle Fuel Economy and CO2 Emissions Data and Analyses, Korea Energy Agency[137]

136. Automobile Registration Status, STATISTICS KOREA http://www.index.go.kr/potal/main/EachDtlPageDetail.do?idx_cd=1257
137. 2018 Vehicle Fuel Economy and CO2 Emissions Data and Analyses, Korea Energy Agency http://bpms.kemco.or.kr/transport_2012/download/download.aspx?path=gbn/2018_%EC%9E%90%EB%8F%99%EC%B0%A8_%EC%97%90%EB%84%88%EC%A7%80%EC%86%8C%EB%B9%84%ED%9A%A8%EC%9C%A8_%EB%B6%84%EC%84%9D%EC%A7%91(%EC%B5%9C%EC%A2%85).pdf

THE LIMITATIONS OF ICE HYBRIDS AND ICE PLUG-IN HYBRIDS

Worsening of the climate crisis has prompted a flurry of announcements from brands about the electrification of their vehicles. These announcements include plans for hybrids combining an ICE with an electric motor and a battery. Although ICE hybrids can deliver some reduction in CO2 emissions compared to conventional ICE cars, they still burn petrol or diesel.

There are two main types of ICE hybrid: conventional hybrids that are charged on the move and plug-in hybrids, which have bigger batteries that can be repowered at charging points, extending the electric-only range of the vehicle.[138]

Many carmakers favour ICE hybrids over pure battery-electric cars because it allows them to continue manufacturing the ICE, mechanical transmission and emission treatment systems. These components require regular maintenance and replacement of parts, creating additional profits. Also, carmakers in Europe promote plug-in ICE hybrids to meet their on-paper fleet targets and avert heavy fines.

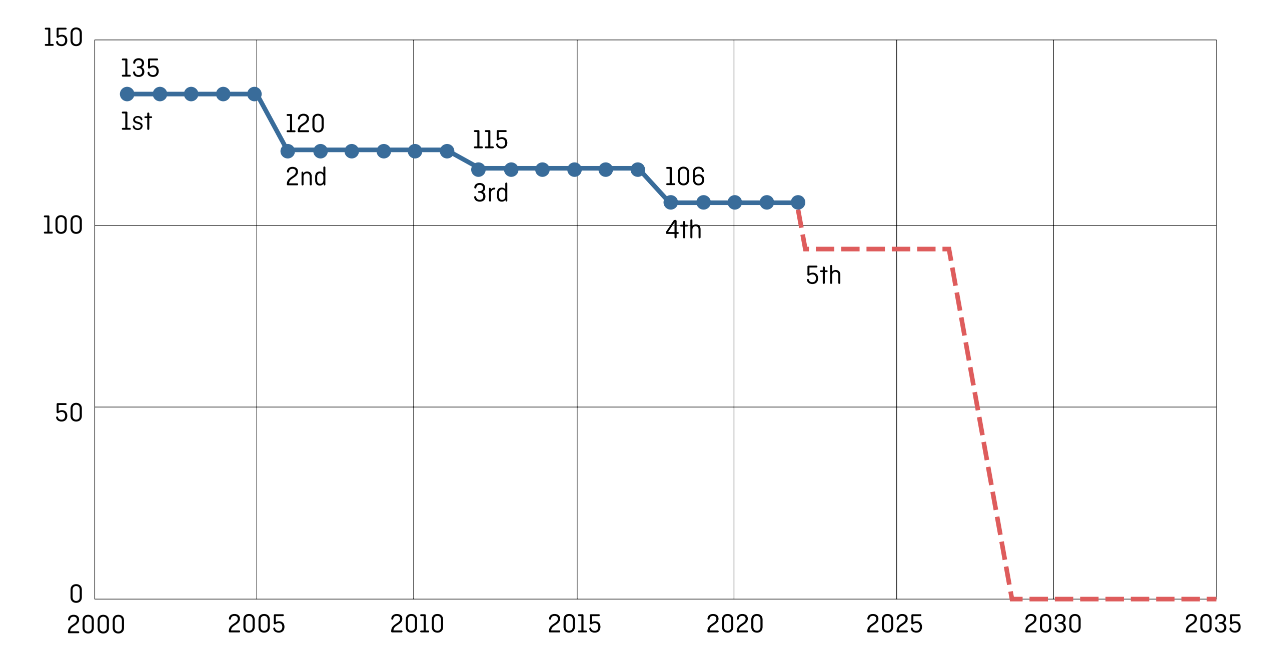
CONVENTIONAL ICE HYBRIDS

Early-adopter hybrid drivers have driven positive change because they have helped alter public perception of electric vehicles. However, the vehicles are still incompatible with the 1.5°C limit.

One example is the Toyota Prius ICE hybrid, launched in December 1997, just one day before United Nations Framework Convention on Climate Change (UNFCCC) COP 3 was held in Kyoto. It was rightfully hailed as a shining example of how CO2 emissions can be reduced. The fourth generation Prius, released in 2018, emits 106g/km (170g/mile) of CO2 (US EPA),[139] and is 22% more fuel efficient than the 2001 first generation Prius. If this trend continues, the 5th generation hybrid will be 7% to 8% more efficient than the previous model, with CO2 emissions slightly lower than 100g/km. Although every little reduction helps, the rate of reduction is too slow to stay below the 1.5°C limit.

[138] Another type, so called mild-hybrids, are not considered here as the technology resembles a classic ICE, and does not offer an electric drive mode. It only allows the ICE to be switched off when coasting, braking or stopping.
[139] Compare Side-by-Side, Fuel Economy, US Department of Energy https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=16705&id=20934&id=30919&id=41161gov/

FIGURE 10: CHANGE IN TOYOTA PRIUS CO EMISSION (1ST TO 4TH GENERATION) (UNIT: G/KM)



Source: Fuel economy, United States Environmental Protection Agency[140]

[140] Fuel economy, United States Environmental Protection Agency https://www.fueleconomy.gov/

PLUG-IN ICE HYBRIDS

Plug-in hybrids, an evolution of the hybrid-technology pioneered by the original Toyota Prius, are now being promoted by car manufacturers in various markets including Europe, Japan and the US. Carmakers offering very few fully electric models, such as BMW and Mercedes, need plug-in hybrids to meet the EU's strengthened CO2 fleet limit of 95g CO2/km, required from 2020.

However, emission reductions depend on how the car is used. To reduce emissions significantly, a plug-in hybrid must mostly make short urban trips and be charged repeatedly. If it's not used in this way, the large battery is simply dead weight to be carried while the car is mainly powered by the ICE. This cancels out efficiency gains, often to the point where plug-in hybrids cause similar or even higher CO2 emissions than comparable pure ICE cars.

Also, plug-in hybrids can only provide significant CO2 reductions if their design uses the electric components to reduce consumption rather than to increase the overall power and performance of the car. One example, Audi's Q5e, with a combined output of 367 horsepower, has 20 horsepower more than the SQ5, Audi's ICE performance version of the same model.

In Europe and the US, testing regulation allows official CO2 emissions for plug-in hybrids to be certified as far lower than on-road emissions (see chapter 3). While a systematic analysis is still lacking, tests for individual models from Germany's motorists' union, the Allgemeiner Deutscher Automobil-Club (ADAC), indicate that actual petrol or diesel consumption and corresponding CO2 emissions for plug-in hybrids were two to three times as high as manufacturers' reported test cycle results.[141] VW's plug-in hybrid Golf GTE officially consumes 1.5l of petrol per 100km (35g CO2/km) but, according to the ADAC's tests, the consumption is 3.3l 100km (77g CO2/km).[142] Others estimate that real-world consumption could even be four to five times higher if plug-in hybrids are mainly used for long-distance trips, as can be the case for company cars.[143]

As the gap between real-world and test emissions for plug-in hybrids is significantly larger than it is for ICE cars, particularly in Europe, selling more of them is the key short and mid-term strategy for carmakers aiming to meet the EU CO2 fleet targets. Another incentive is the EU supercredit rule, which allows vehicles with official emissions below 50g CO2/km to count as two vehicles in 2020, 1.67 vehicles in 2021 and 1.33 vehicles in 2022.[144] This allows manufacturers to further lower their fleet average, offsetting other gas guzzlers.

In summary, it is impossible to get to zero tailpipe emissions as long as a car includes an ICE. Reliance on ICE hybrid vehicles, both conventional and plug-in, blocks the rapid deployment of real alternatives not powered by oil. And considering the huge gap between official data and their real-world performance, this reliance is risking a further increase in CO2 emissions.

141. ADAC Ecotest 2018. https://www.adac.de/infotestrat/tests/eco-test/plugin_hybride/
142. Ibid.
143. Ekatarina Kel 2019 - Hohe Förderung, fragwürdiger Umweltnutzen. Süeddeutsche Zeitung August 6th 2019 https://www.sueddeutsche.de/auto/foerderung-pluginhybrid-oekobilanz-umweltpraemie-1.4553350
144. Consolidated version of Regulation (EC) No 443/2009 of the European Parliament and of the Council of 23 April 2009 setting emission performance standards for new passenger cars as part of the Community's integrated approach to reduce CO2 emissions from light-duty vehicles https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:02009R0443-20180517

CHAPTER 6: WHY SUVS POSE A DANGEROUS RISK TO THE CLIMATE

"We're driving more miles in bigger cars, changes that are outpacing improvements in vehicle fuel efficiency," – Rob Jackson, Stanford University and chair of the Global Carbon Project [145]

In 2018, sales of SUVs reached 29.77m — a figure that is 7% higher than in 2017.[146] In February 2018, JATO, a global supplier of automotive business intelligence, stated that the boom in SUV sales was not a fad but a continuing trend.[147] According to its statistics, in 2018 seven out of ten best-selling models were trucks or SUVs.[148] Each SUVs sold locks us into higher CO2 emissions for the whole of that vehicle's lifetime.

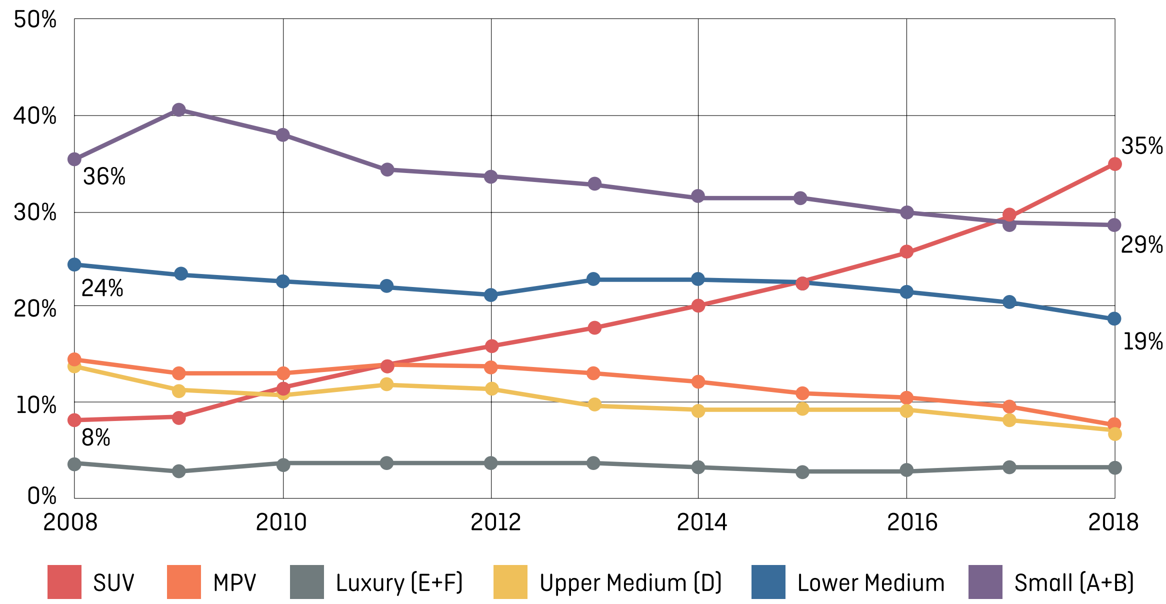
Recently released data by the European Environment Agency (EEA) on CO2 emissions from automobiles sold in 2018 highlights why SUVs are such a problem. In 2018, 4.5 million SUVs were sold in the EU28 and Iceland combined. This accounted for approximately one third of new cars sold in the EU and Iceland. According to registration data published by the European Automobile Manufacturers' Association (ACEA), this is a steep increase in market share from 8% in 2008 to 32% in 2018. EEA statistics show that the average SUV sold in 2018 emits 133g CO2/km – is 13g higher than the average petrol car sold in Europe (120g CO2/km).[149] Analysis by Greenpeace Germany shows that this difference can be even higher if one compares the on road CO2 emissions of specific SUV models with their sedan or station wagon counterparts (see table 7).

TABLE 7: CO2 EMISSIONS OF SUV MODELS WITH THEIR SEDAN/STATION WAGON COUNTERPARTS[150]

	TYPE	MODEL YEAR	WEIGHT (EMPTY)	POWER	OFFICIAL CO2 EMISSIONS IN G/KM (NEDC)	ON ROAD CO2 EMISSIONS (BASED ON DATA FROM SPRITMONITOR)	LIFETIME TAILPIPE CO2 EMISSIONS OVER 200,000 KM	LIFETIME FUEL RELATED (TAILPIPE AND UPSTREAM) GHG EMISSIONS OVER 200,000 KM
VW Golf 2.0 TDI Variant Comfortline	Station Waggon	2017 until 18	1,438kg	110kW	111g/km	159g/km	31.8t	38.2t
VW Tiguan 2.0 TDI Trendline	SUV	2016 until 18	1,568kg	110kW	123g/km	177.5g/km	35.5t	42.6t
		Difference	130kg	0kW	12g/km	18.5g/km	3.7t	4.4t
BMW 520d Touring)	Station Waggon	Since 2018	1,730kg	140kW	132g/km	182.8g/km	36.6t	43.9t
BMW X5 xDrive 25d (G05)	SUV	Since 2018	2,145kg	170kW	150g/km	222.6g/km	44.5t	53.4t
		Difference	415kg	30kW	18g/km	39.8g/km	8.0t	9.6t
Mercedes C 220 d T (S 205)	Station Waggon	2014 until 18	1,615kg	125kW	114g/km	164.3g/km	32.9t	39.4t
Mercedes GLC 220 d (X 253)	SUV	2015 until 19	1,845kg	125kW	129g/km	193.5g/km	38.7t	46.4t
		Difference	230kg	0kW	15g/km	29.2g/km	5.8t	7.0t

145. Global fossil fuel emissions have climbed upward for a second straight year, driven by growing energy use, Stanford, 5 December 2018 https://news.stanford.edu/press/view/24972
146. Global SUV boom continues in 2018 but growth moderates, JATO, 20 February 2019 https://www.jato.com/global-suv-boom-continues-in-2018-but-growth-moderates/
147. Ibid.
148. 2018 (Full Year) International: Global Top Car Brands, www.best-selling-cars.com, 23 February 2019 https://www.best-selling-cars.com/global/2018-full-year-international-global-top-car-brands/
149. Average CO2 emissions from new cars and new vans increased in 2018, European Environment Agency, 24 June 2019 https://www.eea.europa.eu/highlights/average-co2-emissions-from-new
150. Ein dickes Problem. Wie SUVs und Geländewagen das Klima und unsere Städte ruinieren, Greenpeace Germany, 2019 https://www.greenpeace.de/sites/www.greenpeace.de/files/publications/s02571_gp_report_suv_09_2019_es.pdf

FIGURE 11: EU PASSENGER CAR MARKET SHARE BY VEHICLE TYPES



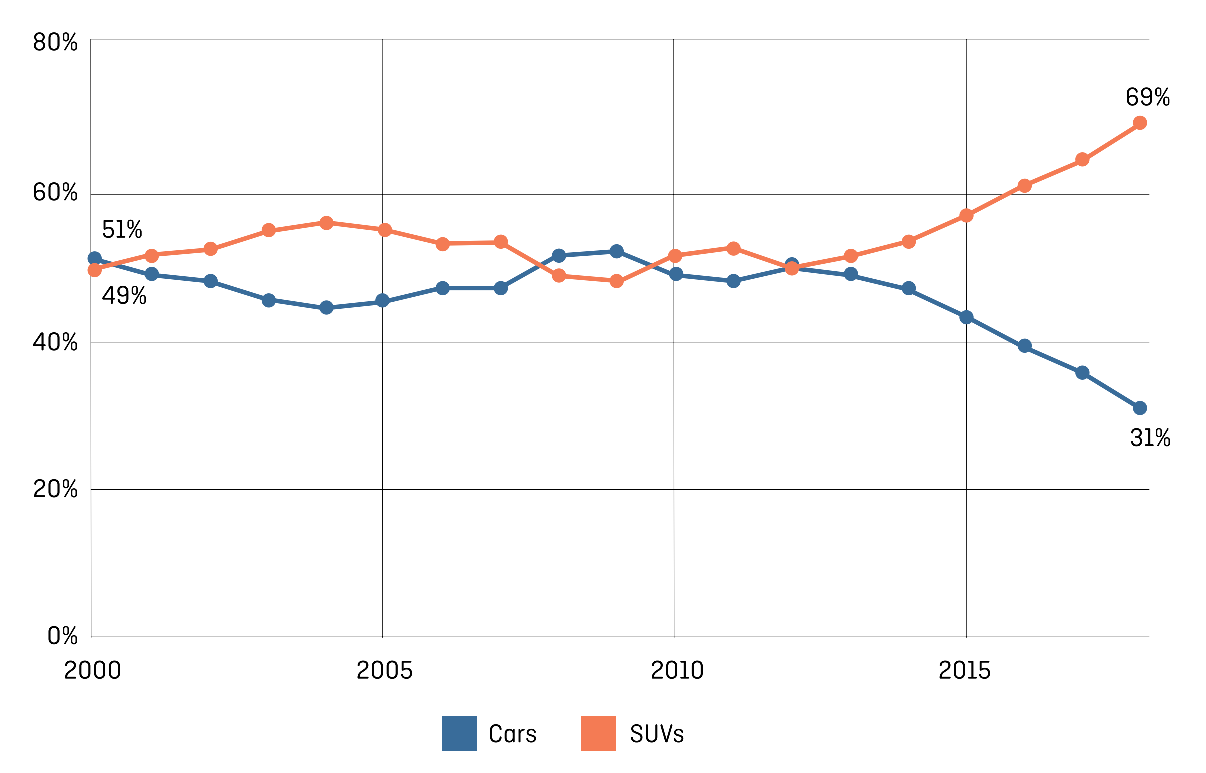
Source: Segments by Body, Country, European Automobile Manufacturers Association [151]

The additional 13g of CO2 per km from SUVs sold in the EU leads to a significant increase in CO2 emissions over their lifetime. If these cars are, on average, driven for 200,000km over the course of their lifespan, the tailpipe emissions of each SUV are on average 2.6t CO2 higher than that of an average non-SUV. As a result, the 4.5 million SUVs sold in the EU in 2018 will, over the course of their lifetime, add an additional 11.7m tons of CO2 to EU road transport emissions.

The SUV boom started much earlier in the US than in the EU and has reached an entirely different level. According to data published by US Bureau of Economic Analysis in 2018, the share of SUV in total sales almost reached 70%.[152] The market share of passenger cars (sedans), which emit less CO2, has declined to 31% in 2018 from its previously stable level of around 50%.[153]

151. Segments by Body, Country, European Automobile Manufacturers Association, https://www.acea.be/statistics/tag/category/segments-body-country
152. Light Weight Vehicle Sales: Autos and Light Trucks, US Bureau of Economic Analysis, July 2019, https://www.bea.gov/docs/gdp/auto-and-truck-seasonal-adjustment
153. Ibid.

FIGURE 12: US MARKET SHARE PERCENTAGES BY VEHICLE TYPE



Source: Light Weight Vehicle Sales: Autos and Light Trucks, US Bureau of Economic Analysis[154]

[154] Light Weight Vehicle Sales: Autos and Light Trucks, US Bureau of Economic Analysis, July 2019, **https://fred.stlouisfed.org/series/ALTSALES/**

What about electric SUVs?

Electric SUVs have similar problems because they are heavier and less aerodynamic than electric sedans. This leads to increased electricity consumption, which in turn leads to increased CO2 emissions from the production of electricity.

But even if they are powered with 100% renewable electricity, electric SUVs are a problem. To drive an electric SUV the same distance as its non-SUV counterpart requires a larger battery, which increases the production footprint of the vehicle (see chapter 2). For example, according to EPA data, electricity consumption of a Long Range Tesla Model S[155] sedan is rated at 189Wh/km while a Long Range version of the Model X SUV, which shares its main structure and powertrain, such as drivetrain/chassis with a Model S sedan, is rated at 217Wh/km – around 15% more.[156] Therefore, to drive the same distance, the Model X requires a 15% larger battery than the Model S.

While Tesla currently offers both models with only 100kWh battery options, you need to buy a Tesla Model X with a 90 kWh battery to match the range of the Model S with a 75kWh battery.[157] Based on the findings of IFEU that on average 145kg of CO_2e are emitted per kW/h during battery production, the additional battery size of 15kW/h adds 2.2t of CO_2e to the production emissions of the Model X.[158] While it's possible to significantly reduce battery production emissions — FEU believes they could be halved by 2030 — it is impossible to fully decarbonise them with current technologies. Therefore it is imperative to build light, energy-efficient vehicles, and electric SUVs are quite the opposite.

Until we fully decarbonise the electricity supply, the extra electricity needed for an SUV also causes upstream (supply) fuel emissions during electricity production. Depending where an SUV, such as the Model X is being used, this can amount to 2.9t of extra CO2 emissions over its lifetime compared to a Model S of a similar specification (see table 8).

TABLE 8: CO2 EMISSION DIFFERENCE BETWEEN TESLA MODEL S SEDAN AND MODEL X SUV, ASSUMING 200,000KM DISTANCE DRIVEN OVER ITS LIFETIME

Vehicle model	Wh/km	Lifetime electricity consumption	Lifetime CO2 upstream fuel emissions in the EU	Lifetime CO2 upstream fuel emissions in California[160]	Lifetime CO2 upstream fuel emission in Texas[161]
			(295g-CO2/kWh in 2016)[159]	(213g-CO2/kWh in 2017)	(524g-CO2/kWh in 2017)
Model S long range	189	37800kW/h	11.2t	8.1t	19.8t
Model X long range	217	43400kW/h	12.8t	9.2t	22.7t
Difference	28	5600 kW/h	1.7t	1.2t	2.9t

155. The example is not ideal, as even the Tesla Model S with a 100kW/h battery is not a sensible vehicle from an environmental point of view. We used it anyways to be able demonstrate the difference between an electric SUV and similarly specced electric sedan.
156. Electric car range and efficiency (EPA), Pushevs https://pushevs.com/electric-car-range-efficiency-epa/
157. 2017 Tesla Model X AWD - 90D vs 2017 Tesla Model S AWD - 75D on fueleconomy.gov https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=38528&id=38524
158. As Tesla is in the process of switching to 100% renewable electricity supply in its battery factory, the carbon footprint of their 100 kw/h batteries can be expected to be lower than IFEU's estimate about the industry average. Tesla Gigafactory To Be Powered 100% By "Tesla Solar" By End Of 2019, Clean Technica, 27 August 2018 https://cleantechnica.com/2018/08/27/tesla-gigafactory-to-be-powered-100-by-tesla-solar-by-end-of-2019/
159. CO2 emission intensity, European Environment Agency, 18 December 2018 https://www.eea.europa.eu/data-and-maps/daviz/co2-emission-intensity-5#tab-googlechartid_chart_11_filters=%7B%22rowFilters%22%3A%7B%7D%3B%22columnFilters%22%3A%7B%22pre_config_ugeo%22%3A%5B%22European%20Union%20(current%20composition)%22%5D%7D%7D
160. California Electricity Profile 2017, US Energy Information Administration, 8 January 2019 https://www.eia.gov/electricity/state/california/
161. Texas Electricity Profile 2017, US Energy Information Administration, 8 January 2019 https://www.eia.gov/electricity/state/texas/index.php

CHAPTER 7: STEERING IN THE RIGHT DIRECTION: GREENPEACE RECOMMENDATIONS AND DEMANDS FOR THE CAR INDUSTRY

The car industry must change radically if we are to avoid climate catastrophe. It must also be much more transparent and give details about its impact on the climate. Apart from a few exceptions, it does not systematically report brand-level CO2 fleet emission data by regions where cars are sold, or report GHG emissions during production.

In years to come, the only viable manufacturers will be those who left behind the ICE, producing smaller, lighter, more energy-efficient electric vehicles. These vehicles will be designed and marketed to reduce individual use and ownership of cars, and built to be linked into smart grids powered by 100% renewable energy.

QUESTIONS FOR CAR MANUFACTURERS

Is the company's level of ambition consistent with the decarbonisation of the transport sector needed to stay within 1.5°C total temperature change?

Has the company established a strategy and concrete plans to phase out ICEs?

Has the company established a plan to diversify its business model that leads to producing fewer cars and reducing car ownership, such as providing shared mobility services?

Does the company show clear and public support for policies that align with the Paris Agreement's target to limit global warming to less than 1.5°C, and challenge those policies that would further increase emissions?

PRIORITY 1: PHASE OUT THE INTERNAL COMBUSTION ENGINE, INCLUDING HYBRIDS NO LATER THAN 2028[162]

After 2028, all new passenger vehicles must not run on diesel, petrol, gas, or be hybrids. The sooner manufacturers start to implement this, the smaller the impact on their workforces as they will have more time to reskill and reallocate to ensure job security.

PRIORITY 2: BUILD SMALL AND ENERGY EFFICIENT ELECTRIC VEHICLES AND DO SO IN A SUSTAINABLE MANNER

When moving towards producing 100% battery and fuel cell EVs, the priority must be to produce passenger EVs that energy-efficient — hence small and light — to limit battery sizes and the impacts associated with producing them. Manufacturers have a strong responsibility to implement and enforce high social and environmental standards across their supply chain. They must also procure renewable energy and enhance resource efficiency.

PRIORITY 3: MOVE BEYOND PRODUCING EVER MORE CARS

The transport sector is being transformed, not only due to the need for decarbonisation but also due to many innovations drastically reducing the number of cars needed. For car companies to survive they have to think beyond selling ever more cars. They need to diversify business model for example by reinventing themselves as a transport provider that offers car-sharing and ride-pooling services to complement public transport enabling people's mobility in a more climate-friendly way.

162. Development of the car fleet in EU28+2 to achieve the Paris Agreement target to limit global warming to 1.5°C, Greenpeace, 20 September 2018 http://www.greenpeace.org/archive-belgium/Global/belgium/report/2018/20180907_GP_EUCarFleet_1.5.pdf

TABLE 9: GREENPEACE RECOMMENDATIONS AND DEMANDS FOR THE CAR INDUSTRY

<table>
<tr><th>GOAL</th><th>Align the car industry's business model with 1.5 °C target</th></tr>
<tr><th>ACTION</th><th>STEPS</th></tr>
<tr><td>Phase-out all ICEs, including conventional hybrids, with news sales ending by 2028 at the latest.</td><td>A. Disclose detailed annual reporting of GHG emission, which includes brand-level CO2 fleet emissions on global and regional car sales, product level LCA data of every model, and supply chain emissions via its website in a publicly available format.

B. Set a company-wide target to phase-out diesel and petrol cars, including hybrids, across all markets. And establish a clear strategy and concrete roadmap for 100% EV (battery and fuel cell) transition.

C. Work with employees, labour unions and other relevant third parties to minimise the impact of the transition on the workforce, including providing necessary reskilling and reallocation packages.

D. Advocate regional, national and global policies that align with the Paris Agreement's 1.5 °C target, such as strengthening CO2 regulation, government ICE phase-out plans, and renewable energy procurement.</td></tr>
<tr><td>Build small and energy efficient EVs and do so in a sustainable manner</td><td>A. Prioritise producing small, light electric vehicles.
B. Implement standards that minimise and prevent the social and environmental impacts of EVs and EV battery production.
• Advocate for a renewable energy power grid (EV charging and manufacturing)
    • Procure 100% renewable electricity in all production plants across all regions
    • Work with the supply chain so they move to deploying 100% renewable energy and reduce GHG emissions.
• Establish procurement standards for battery supply so resources are used in a way that is environmentally responsible, efficient and respectful of human rights.
    • Establish transparent supply chains and best practice social and environmental standards in mining and processing raw materials for batteries.
    • Increase investment in research and development in battery technology to find sustainable alternatives to the current materials used such as cobalt and lithium.
    • Increase durability, longevity, reparability, energy efficiency, reuse and recyclability of batteries to minimise the use of virgin materials.</td></tr>
<tr><td>Move beyond producing more cars</td><td>A. Promote alternative business models that lead to reducing the individual use and ownership of cars.
B. Invest in mobility solutions that can reduce traffic growth.
C. Provide services that complements public transport, such as car-sharing or ride-pooling services.</td></tr>
</table>

DEMANDS TO POLICYMAKERS

To address the climate emergency and establish an emissions plan consistent with the Paris Agreement, national and municipal governments must enact regulations now to decarbonise the transport system and provide a seamless public transport network. The transition from polluting fossil fuels to renewable energy, and car-centered mobility to alternative mobility modes is already underway in some countries, demonstrating that it's not a technological challenge but a political one.

More than 15 countries have announced plans to phase-out new petrol and diesel cars, and also, in some cases, hybrids. Although these announcements have rarely been backed up by legally binding regulations and are often too late, they are a strong signal to markets that there is no future for fossil fuel vehicles.

A study by the Ecologic Institute shows that a combination of regulatory and tax measures are the most effective way to transition from diesel and petrol to EVs — if these requirements are set at ambitious levels. Therefore policymakers must provide a binding regulatory framework to stop sales of new fossil fuel cars and hybrids, develop and implement measures that restrict car numbers, and provide alternative modes of transport.

TABLE 10: GREENPEACE RECOMMENDATIONS AND DEMANDS POLICYMAKERS

GOAL	Decarbonise the transport system to meet the 1.5 °C target
ACTION	**STEPS**
Make it clear that the internal combustion engine will be phased-out	A. Announce the phase-out plan of diesel, petrol, and hybrids with legally binding regulations and ensure regulations are ambitious and properly enforced. B. Introduce mandatory quotas for EV production and strengthen CO2 reduction targets for manufacturers, and impose high penalties for non-compliance. C. Implement public and private procurement of EVs as obligatory. D. Incentivse EV purchase to make it more affordable for people who don't yet have alternatives to cars. Focus the financial support on the purchase of small, light energy-efficient vehicles, while penalising ICE vehicles through higher purchase or road taxes. E. Supply EV charging stations powered by renewable energy through smart grids. F. Require car companies follow human rights and environmental due diligence and ensure transparency in their supply chain, particularly regarding the production of batteries.
Develop alternatives to mass car ownership	A. Develop and implement car-restricting measures (eg car-free zones, ultra-low emission zones, kilometer tolls, tax measures, etc.) B. Improve and extend the public transport system, minimising transit deserts. C. Improve and extend cycling and walking infrastructures. D. Encourage the public's transition from individual cars to more climate-friendly travel modes through provision of affordable public transport networks, subsidised bike purchase schemes, etc.

#ClimateEmergency

GREENPEACE