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Automotive

Pathways to decarbonization

Drivers for transformation

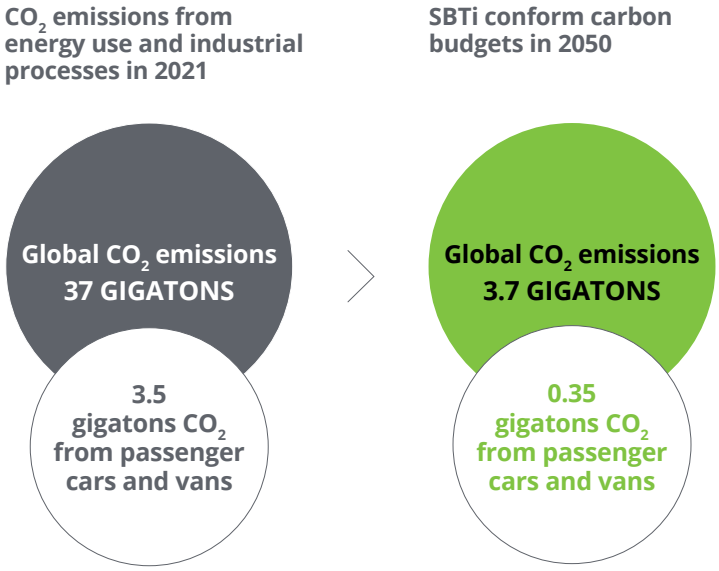
The need to act on climate change

The automotive sector is a cornerstone of mobility systems worldwide, as well as a key pillar of the global economy. However, it is also a major contributor to climate change. In 2020 alone, passenger cars and vans caused 3.5 gigatons of CO_2, almost one tenth of global CO_2 emissions.[1,2] This includes tailpipe emissions only, thereby excluding additional emission sources along the value chain such as parts and vehicle production.

To avoid the most catastrophic impacts of global warming by limiting average temperature increase to 1.5°C, all sectors would be required to substantially reduce emissions to achieve net-zero, starting from now (see Figure 1). In contrast to other sectors, a key hurdle for car manufacturers is that compliance with the Science Based Targets initiative (SBTi) requires not only reductions of Scope 1 and 2, but also Scope 3 emissions.

Over the past few decades, substantial improvements in the fuel efficiency of vehicles have been made by car makers. However, the growing prevalence of larger and heavier cars, mainly SUVs, and engine sizes counteracted these efficiency gains—and no amount of efficiency improvements will lead to net-zero emissions. Together with increased vehicle ownership, these factors led to a steady increase of the sector's CO_2 emissions by an average of 1% per year between 2010 and 2021.[3]

To effectively curb tailpipe emissions, governments around the globe therefore have implemented policies promoting and enabling the shift to electric vehicles (EVs).



Consistent with a Science Based Target (SBT), the automotive sector needs to reduce Scope 1,2 and 3 emissions by 90% by 2050. SBTs are emission reduction pathways in line with climate science to reach net-zero emissions, ensuring that global warming is limited to 1.5°C.

Figure 1: Total CO_2 emissions and contribution from the passenger car sector

[1] IEA, World Energy Outlook 2022, October 2022.
[2] IEA, Cars and Vans Tracking Report, September 2022.
[3] *See reference in footnote 1*

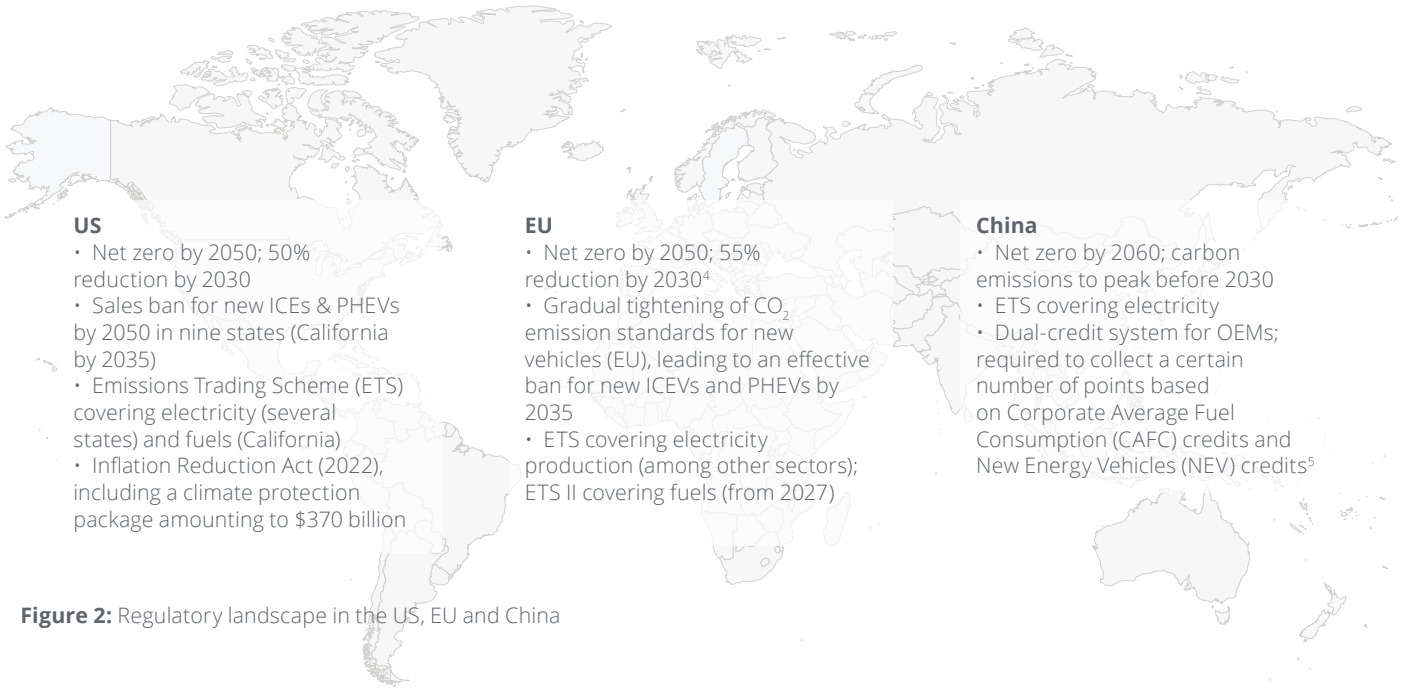


Figure 2: Regulatory landscape in the US, EU and China

A strong regulatory push for EVs

2022 was the first year that the overarching political framework for achieving the National Determined Contributions (NDCs) of the Paris Agreement had been tightened worldwide. However, climate ambitions vary widely across countries.

Europe has taken the global lead in the efforts to reduce greenhouse gas emissions (see figure 2). The main initiative affecting the automotive industry are strict tailpipe emission targets for new vehicles. The European Union has legislated that original equipment manufacturers (OEMs) are required to reduce average emissions by 55% by 2030 and by 100% by 2035 (compared to 2020). This effectively restricts original equipment manufacturers (OEMs) to selling battery electric vehicles (BEVs) and fuel cell electric vehicles (FCEVs) from 2035 onwards. In Norway, one of the leading EV markets, BEVs already represented 80% of new car sales in 2022 and the country has set the target to achieve 100% by 2025 at the latest.[6]

In the US, so far only ten states plan to phase out vehicles with combustion engines (ICEVs) by 2050 (at the latest).[7] China has for several years promoted the market uptake of EVs. Similar to the US, however, there is no clarity on what extent new sales of ICEVs may be phased out in the future. Nevertheless, China has the strongest growing EV market.[8]

Redirection of capital flows

International climate treaties, strict national sector targets, and shifting market dynamics have started to threaten the profitability of business models based on conventional car production. In turn, it seems increasingly difficult for OEMs and suppliers to gain access to capital at competitive costs if they cannot demonstrate their ability to decarbonize their products and operations.

Changing customers' attitudes on sustainable mobility

While customers today are still hesitant to fully embrace sustainable mobility options, this may change in the future with increasing awareness for climate issues. A no-regret option for automotive players is therefore to move fast towards the net-zero goal as well as to extend their product portfolio by offering shared mobility solutions. Otherwise, there is a risk that customers may shift their preferences towards other modes of transport if the automotive industry is missing out on demonstrating their ability to transform fast.

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[4] European Commission, Proposal for a Regulation of the European Parliament and of the Council amending Regulation (EU) 2019/631 as regards strengthening the CO_2 emission performance standards for new passenger cars and new light commercial vehicles in line with the Union's increased climate ambition, 2022.
[5] Ministry of Industry and Information Technology of the People's Republic of China, Passenger car enterprise average fuel consumption and new energy vehicle credit parallel management method, 2021.
[6] Norwegian Ministry of Transport, Report to the Storting (white paper) National Transport Plan 2022–2033, June 2021.
[7] ICCT, Growing momentum: global overview of government targets for phasing out sales of new internal combustion engine vehicles, accessed January 12, 2023.
[8] Canalys, Global EV sales up 63% in H1 2022, with 57% of vehicles sold in Mainland China, August 2022.

Decarbonization challenges

OEMs and suppliers in the driver seat

The goal for the automotive industry seems to be clear: to be compliant with the 1.5 °C temperature goal, it is necessary to decarbonize their entire value chain, which will likely be built around EVs.

Current decarbonization discussions are mainly driven by regulation, however, car makers (OEMs, supplier, dealerships, etc.) need to take the "driver seat" by being part of the solution. The industry has responded to this as demonstrated by their ambitious near-term targets; nevertheless, long-term targets have not been set yet (according to their SBTi commitments[9]). For example, in some cases OEMs already partly plan to phase out ICEVs production ahead of regulatory requirements.

However, to put targets into practice has proven difficult as the industry faces multiple external and internal challenges (Figure 3). The transformation is not only requiring high investment costs for ramping up EV capacity, but a net-zero business model is still not competitive due to higher technology costs that cannot be passed on to consumers.

The challenge to decarbonizing the global vehicle fleet

What is left unspoken: Even though CO_2 emissions from new sales of vehicles have started to decline with increasing EV shares, the global fleet of 1.2-1.6 billion cars[10] consists predominantly of ICEVs (around 98.5%)[11] and will continue to for some time to come. This clearly impacts the overarching target to reduce emissions according to the 1.5 °C path. In fact, today's climate policies target new sales—except for some instruments that increase operational costs of petrol and diesel cars (such as CO_2 taxes on fuels).

Furthermore, the inconsistency of global regulatory frameworks requires tailored business models, technological responses, and decarbonization strategies for different regional contexts. The automotive ecosystem is already complex, and, in the future, there will likely be even more actors involved. As a result, cross-sectoral collaboration and joint activities, mainly with the power sector, but also basic materials production and recycling, may increase. A successful transformation depends, therefore, also on the progress of other sectors in providing green solutions at scale. As a result of these challenges, the majority of automotive companies find it still difficult to establish a stringent sustainability strategy.

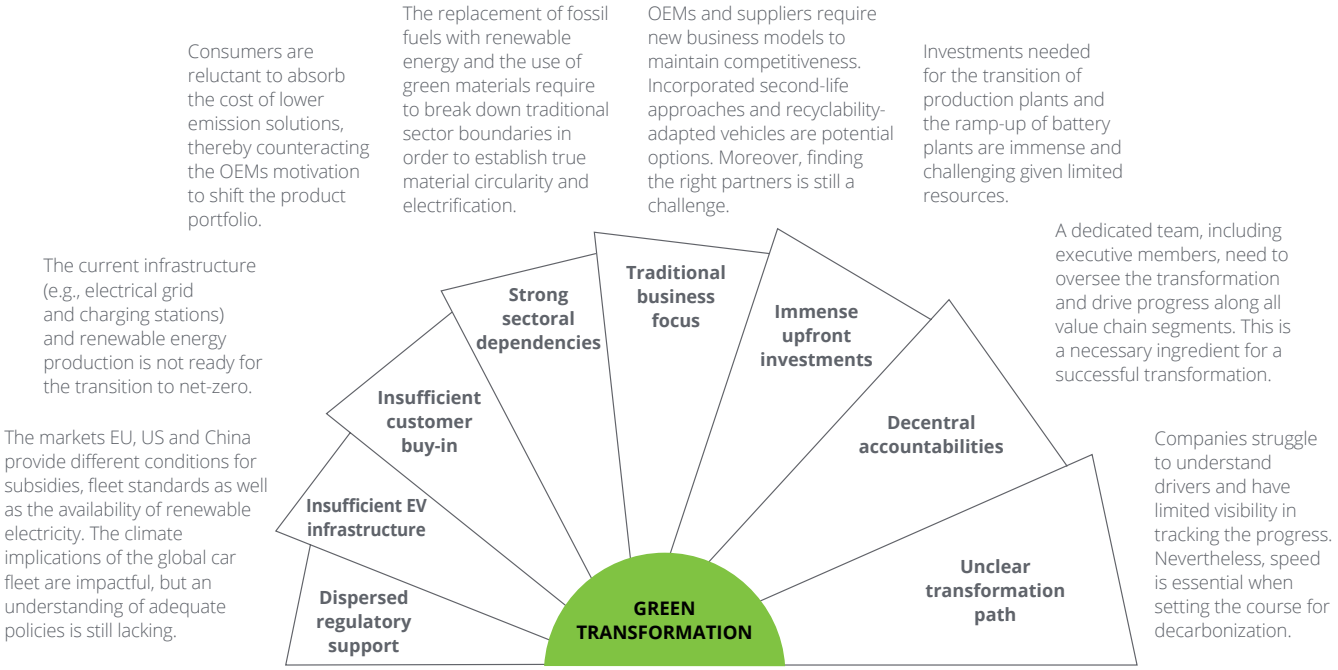

Figure 3: Net zero challenges of automotive players

[9] Science Based Targets, Companies taking action - Science Based Targets, accessed December 2022.
[10] German Environment Agency, Marktdaten: Mobilität, March 2022.
[11] BloombergNEF, Electric Vehicle Outlook Report 2022, June 2022.

Call for action

Establishing a decarbonized value chain

Decarbonization should be actioned across all industries. A combination of a fast EV ramp-up, the use of renewable energy along the entire value chain, and the establishment of circular materiality are necessary ingredients for a 1.5 °C temperature compliant pathway (Figure 4).

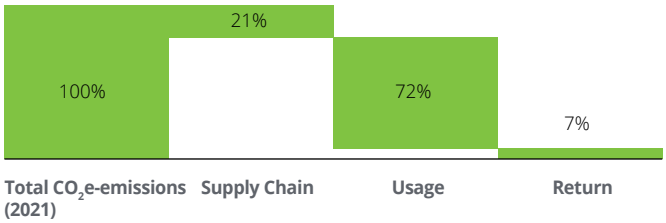

Figure 4: An illustrative OEM example of today's life cycle emissions*

*Assuming a share of >90% ICEVs of OEMs sales

As can be seen, most emissions are caused during the usage phase and capture tailpipe emissions as well as emissions from fuel/electricity production. The supply chain phase includes vehicle production, including raw materials extraction and processing (e.g., steel, aluminum, and polymers) and component and part production (e.g., electric components and batteries). It also captures related logistics activities. During the return phase, greenhouse gas emissions are caused from scrappage and recycling activities.

Decarbonization levers

There is a wide range of levers to be pulled for decarbonization – addressing all areas of the value chain (Figure 5). In fact, the task is to anchor sustainability in all divisions, from administration and purchasing to development and production, and even distribution and sales and aftersales. This will be enabled by reporting structures aligning climate and financial reporting to understand the emission footprint and the potential to address decarbonization.

The task is to adopt circular business models and transition production plants as well as the usage to clean energy. There is a need to extend and collaborate beyond the owned value chain by seeking to involve suppliers and customers to join forces in order to help achieve net-zero emissions by 2050.

A blueprint for changing the industry

With so many different fields of action, one main task is to prioritize and define them as part of a holistic plan for implementation. A successful strategy depends on how the (uncertain) future of the automotive ecosystem will play out. This depends also on external factors and how these develop over the coming years and decades, such as consumer preferences, macroeconomic and geopolitical factors, regulations, but also the pathways of closely interrelated sectors.

Vice versa, the transformation of the auto sector will have wide-reaching impacts at the regional and national level as specific industry branches will be heavily affected, with repercussions to the entire economy. It is therefore opportune to develop an industry blueprint for decarbonization based on scenario analysis, closely examining the future.

Product portfolio alternatives

Portfolio adjustments with steady shift from ICEVs to EVs

Shift to smaller vehicle models to reduce material input and to generate efficiencies due to less fuel and electricity consumption in the usage phase

Green energy and electricity

Production is powered by electricity from renewable sources and biogas for e.g. heating processes

Energy supply is secured by green energy contracts or self-generation (e.g. solar panels)

Inbound and outbound logistics is based on low carbon transportation modes

Low carbon materials & eco-design

Low carbon version of main materials and parts, including extraction, preparation, and parts processing at the supplier facilities

Less material input or the use of alternative lightweight materials to reduce the vehicle weight

Green power for transition phase

Switch from fossil fuels to cleaner and/ or carbon neutral fuels (e.g. e-fuels for existing fleet)

Secondary materials recycling

Increase of secondary (recycled) materials rate in sourcing with a focus on the main materials aluminum, steel, polymer, electronics and battery

End of life

Closed-loop recycling of end-of-life vehicles and replacement of virgin material in material sourcing and production

Multi-life approaches as for example second-life business models for batteries

New business models

Offsetting residual emissions by new business models

Building or contracting for direct capture and storage for leftover emissions

Abatement strategies: Various offset mechanisms including nature-based solutions

Figure 5: The automotive industry's levers to reach net zero

Authors

Harald Proff
Partner | Global Automotive Leader
hproff@deloitte.de

Bernhard Lorentz
Partner | Global Consulting Sustainability & Climate Strategy Leader
blorentz@deloitte.de

Cathleen Gutglück
Senior Manager | Climate Lead Risk Advisory
cgutglueck@deloitte.de

Corina Cruceru-Weisbrod
Manager | Supply Chain Network Operations
ccruceru@deloitte.de

Deloitte.