REPORT

Just Transition in the European Automotive Industry – Insights from Affected Stakeholders

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PARTNERS FOR A NEW ECONOMY

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Short Summary

Today transport contributes to about 20% of Europe's CO_2 emissions – the lion's share is caused by automobile transport. To achieve the climate goals of the Paris Agreement, a transformation of the automotive industry is therefore inevitable. The automotive industry accounts **for almost 14 million direct and indirect jobs along the value chain throughout the whole EU** and is a key economic sector in Central and Eastern Europe (CEE). These jobs will be affected by an encompassing technological and structural transition of the mobility sector that is needed to reach climate neutrality. Based on empirical evidence and 14 expert interviews, this report provides **an overview of the status quo in the sector on a European level with regards to a Just Transition and proposes policies to make it just and sustainable.**

Currently, the European transformation of the automotive industry is advanced by the **CO2-emission-regulation**, which aims toward the establishment of a zero-emission transport system in the future. Until today, no special attention has been paid to the implications of this transition for workers in the automotive industry. Nevertheless, its transformation is already in full swing: New driving technologies are emerging, paving the way towards the full electrification of cars. A **phase-out of the internal combustion engine** (ICE) in the nearby future seems to be imaginable. Despite these rushed and promising developments, it needs to be highlighted that they do not erase all the climate and environmental issues at stake. Electric cars also pose ecological challenges, like the use of raw minerals during battery production, which makes the production site even more emission-intensive than ICE cars. Regarding this challenge, a mere replacement of ICEs by battery-electric vehicles (BEV) becomes questionable, at least, as a successful way towards zero-emission transport. It looks as if **a sustainable solution requires more fundamental changes in transport as well as a total reduction of the European car fleet**. The ongoing modal shift of transport is already pointing in that direction. Through connected and digital solutions, other more ecological modes of transport are becoming more attractive. Digitalisation has the power to revolutionise the car-ownership and usage model in favour of shared solutions, possibly leading to a shrinking of the overall number of cars. In the future, the automotive industry will not only be electrified. It will also be digitalised and maybe even incorporate the fabrication of other transport products.

The developments in the automotive industry due to electrification and digitalisation require an enormous skill shift on the part of the workers. **Blue-collar jobs will shrink, while white-collar jobs are on the rise.** Overall, the effect on jobs might even be positive. Still, this does not mean that the transformation will be easy for workers. **Four gaps** need to be filled by Just Transition policies:

1. The **geographical gap**, meaning that the transformation will hit different regions differently,
2. the **skill gap**, which points to the skill differences between today's workers and tomorrow's,
3. the **time gap**, which highlights the different speeds of the transformation, leading to possible disruptions, and
4. the **attractiveness gap**, which comes up when future jobs in the green economy are seen as less attractive than the ones of the old industry.

The policy proposals brought forward to tackle these challenges take place on **four levels:**

1. **industrial policy:** the policy that supports processes of industrial transformation
2. **regional development:** the challenges differ regionally and there is no “one size fits all” solution
3. **active labour market policies and social protection schemes**
4. **stakeholder participation**

On an **industrial policy level,** it was highlighted, that there needs to be a **plan for industrial transformation** – it should not only cover the automotive industry but should be seen as a part of a broader **modal shift in transport**. This plan also includes conversion strategies for industries, modal shift policies, R&D in terms of electrification and digitalisation as well as the emphasis on local battery production, battery supply chain standards and finally the development of green energy all over Europe, as this is key to make electrification climate neutral.

On the level of **regional development**, **regional plans** have to be developed that highlight specific needs and challenges in the transition. A point of discussion remains whether European Just Transition funds should support these regional transitions. The regional plans here must prove their needs. Furthermore, the rising attractiveness of regions through the strengthening of a local and diverse economy and attractive key infrastructures is another important policy to make regions more resilient in the future.

For **active labour market policies and social protection schemes** during the transition, **reskilling** is key. There is the need for company-specific plans for the reskilling of workers, funding opportunities for training measures and frameworks to provide workers with the time needed for their reskilling, like through the reduction of working hours. For persons that cannot be reskilled within the sector cross-sectoral reskilling programs need to be set up, as well as early retirement schemes and unemployment benefits.

Stakeholder participation is key at every policy level in this transition. Through social dialogue on different levels, trust, engagement, and a willingness to commit to the transformation can be created. Trade unions also play an important role here, to **fight for better working conditions** and create attractive jobs outside the automotive industry.

This report shows that there is **a general agreement about the main challenges of a Just Transition** in the automotive industry, like the focus on reskilling. Nonetheless, there remain important **areas of discussion** concerning even the **general path which transformation might take and the future of driving technologies** as well as how to **fund the transition**, to highlight the most important points. What is needed here is a dialogue about, and an agreement on, the future vision and how the transformation of the European automotive industry is to take. This could form the basis of better direct Just Transition policies and support the change towards new transport systems and new skill profiles and the industrial structures need to realise them.

Contents

List of Figures

List of Tables

List of Abbreviations

ACEA	Association des Constructeurs Européens d'Automobiles
BEV	Battery Electric Vehicle
CAR	Centre Automotive Research
CCAM	Corporative, Connected, Automated Mobility
CEE	Central and Eastern Europe
EC	European Commission
EU	European Union
EV	Electric Vehicle
EEA	European Environment Agency
GDP	Gross Domestic Product
GGE	Greenhouse Gas Emissions
ICE	Internal Combustion Engine
ICT	Information and Communication Technology
LCA	Life Cycle Analysis
NECP	National Energy and Climate Plan
OEM	Original Equipment Manufacturer
PHEV	Plug-in Hybrid Electric Vehicle
R&D	Research and Development
RRF	Recovery and Resilience Facility
SUV	Special Utility Vehicle
ZLEV	Zero- and Low-Emission Vehicles

1 Introduction

1.1 The automotive industry in the EU

Since its rise after the Second World War, the automobile has increasingly shaped the modern European lifestyle and the infrastructure of cities. For many Europeans, the car has become the central element for their exercise of the fundamental human right to mobility. Currently, passenger cars are the main mode of transport across Europe - **more than 80% of passenger land transport is done with cars** (Geerts 2021). There are approximately 313 million vehicles in circulation on Europe's roads today (ACEA 2020).

Europe has become the world's second largest producer of motorized vehicles behind China with 20% of global vehicle production in 2019 (ACEA 2020). The automotive industry has become the key industrial player and a crucial part of European economic prosperity. **The industry's total turnover accounts for more than 7% of total European GDP** (EU Commission 2021a), and cars were a crucial export product at 8.0% of the total extra-EU trade in 2015 (Eurostat 2020). However, the automotive industry seems to have passed its peak of success, with sales dropping since 2015 to 6.3% of EU exports.

With a share of 33% of the total EU production (Lefeuvre and Guga 2019) and 57% of total EU exports of cars in 2020 (Eurostat 2020), Germany exceeds all other European countries. While Germany continues to maintain a stable share of car production and export, the power structures in the other European countries have transformed in the past years. Several Western European traditional players like France, Italy and Spain lost importance while Eastern European countries emerged as new players in the automotive industry, mainly as suppliers for the traditional Original Equipment Manufacturers (OEMs). In Czechia, Slovakia, Hungary and Romania the production has grown in the last years and the automotive industry has firmly established itself as a crucial economic sector (Lefeuvre and Guga 2019). For example, cars nowadays represent 51% of Slovakian and 12% of Czech exports (Eurostat 2020), highlighting a strong dependency on the automotive industry as an economic sector in CEE. As a comparison: Cars represent 12.1% of the German export market, being the third of only three European countries whose export share of cars exceeds 10% (Ibid). The pending transition will therefore have a substantial impact on these countries.

The automotive sector accounts for 6.1% of the total EU employment

The industry's importance for the European economy further shows up when it comes to employment numbers. Today, the automotive sector accounts for approximately 13.8 million direct and indirect jobs in the European Union (EU), representing 6.1% of total EU employment (EU Commission 2021a). These jobs are distributed as follows: Manufacturing (direct and indirect): 3.5 million jobs; Sales and maintenance: 4.5 million jobs, Transport: 5.1 million jobs (Ibid).

Overall, it can be said that the automotive industry is one of the biggest industrial players in the EU – not only in terms of exports, but also in terms of employment. Its forthcoming transformation will therefore have a huge impact on the European economy and industrial employment.

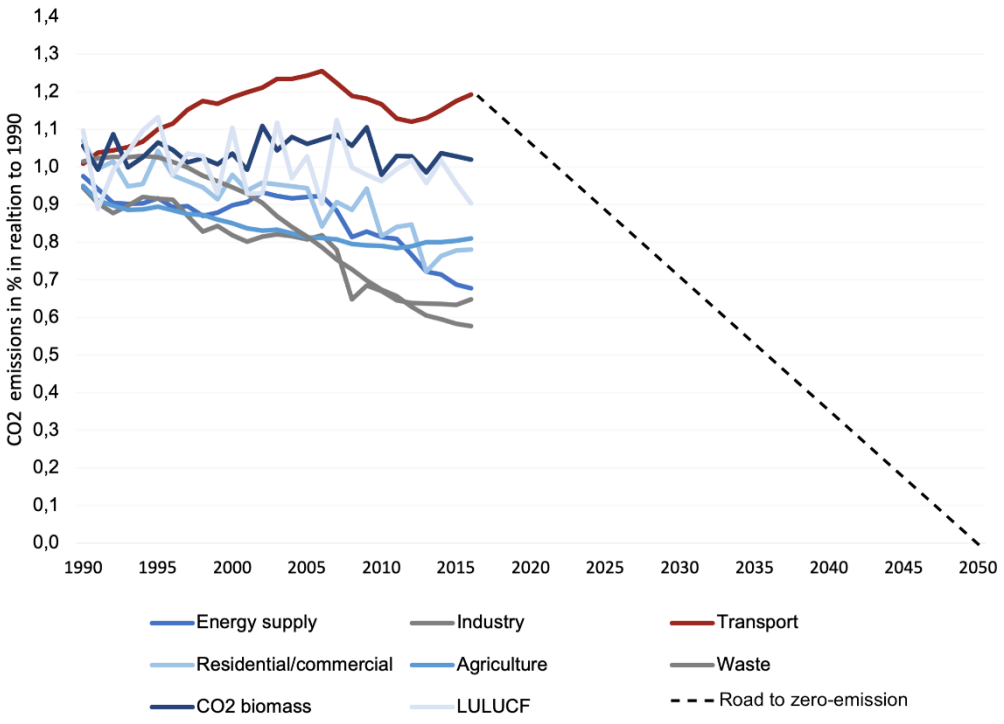
1.2 Environmental challenges of cars

This omnipresence of individual mobility, in conjunction with the automotive industry, poses a challenge to the attainability of EU climate goals due to greenhouse gas emissions during the production and usage of vehicles. **Today, the transport sector accounts for around 20% of all European CO2 emissions** (EU Commission 2021b), making it the second largest emission contributor behind the energy sector (EEA 2019e). 15% of these emissions are attributable to cars and vans (EU Commission 2017a).

20% of all European emissions are caused by transport, 15% by cars and these continue to rise

What distinguishes the transport sector from other economic sectors is that it is the only sector where emissions are not decreasing. As shown in figure 1 greenhouse gas emissions have decreased for most major sectors (energy, industry, agriculture, residential) during the last years, but continued to increase in the transport sector (EEA 2019c). As the graph further illustrates, the transport sector has experienced the biggest percentual growth of emissions since 1990.

Figure 1: European greenhouse gas emissions by aggregated sector



Source: EEA 2019a, own calculations

71.7% of emissions in the transport sector are caused by road transport (EEA 2019b). Of these, 44.3% of emissions are attributable to cars (EEA 2019a). During the last years, the new member states in Central and Eastern Europe (CEE) have become the main contributors to the growth of CO_2 emissions in transport. Their total CO_2 emissions from cars increased by 80% between 2000 and 2017, while in the EU17 countries they decreased by 6% (Pardi 2021). At least in the production of cars, there has been a positive development: According to the

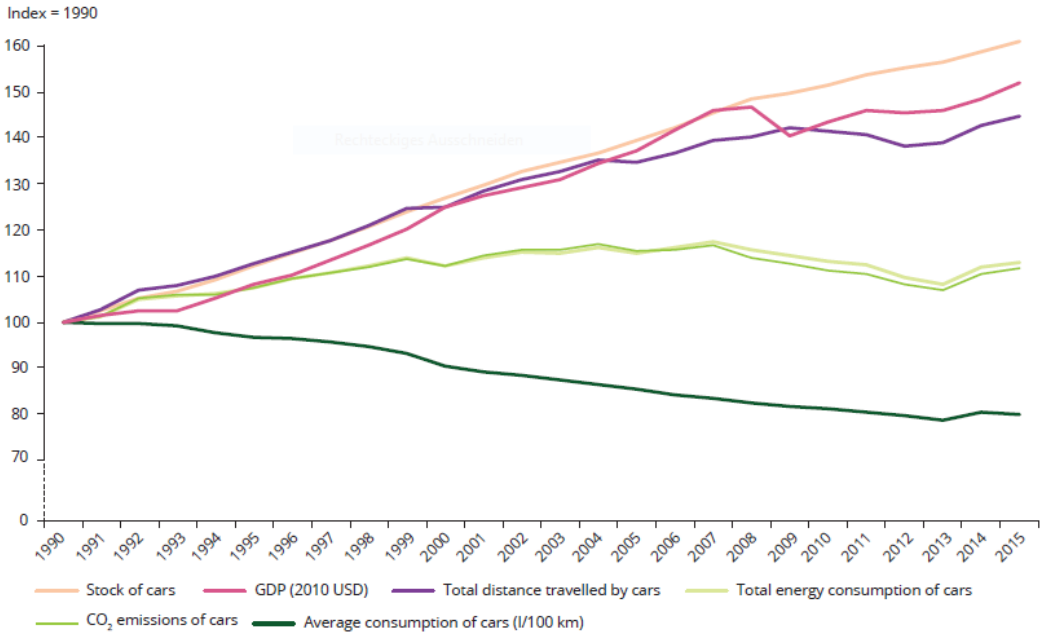
European Automobile Manufacturers Association (ACEA), there has been a reduction in the emissions per car produced during production by about 33% since 2005 (ACEA 2021). Alas, this achievement is not very helpful in the overall reduction of transport emissions since **the lion's share of emissions occurs during the usage, not the production of cars** (see Ch. 2.3). Therefore, it still holds true that the sector as a whole has totally failed to fulfil its climate ambitions during the last years.

The automotive industry is subject to a double rebound effect: More and bigger cars are evening out every efficiency gain made until the present

A reason for this failure can be attributed to the so-called 'Rebound Effect' which occurs when efficiency gains get absorbed by changed production and consumption patterns and/or increased production. That happened in the case of cars on both levels, demonstrating the limits of technological efficiency gains for environmental improvements.

1. **The trend towards ever larger and heavier vehicles**: While an increased efficiency of ICE led to a relative decrease of emissions, the steadily increasing weight and engine power of cars alongside an increasing preference for special utility vehicles (SUVs) have evened out these savings. It has even led to a rise in the average CO_2 emissions for newly registered cars and vans since 2017 (ICCT 2018; Pardi 2021a). Weight is the most important factor in determining fuel consumption, and therefore CO_2 emissions. A 10% weight increase is roughly equivalent to a 7% increase in CO_2 emissions (ICCT 2017). The weight depends heavily on the size of the car: The average European car became longer (+9 cm), wider (+4 cm) and taller (+2 cm) between 2008 and 2018, increasing the overall weight of cars (Pardi 2021).

Figure 2: Fuel efficiency and fuel consumption in private cars, 1990-2015



Source: EEA 2019d

2. **The ongoing growth of the European car fleet:** Car ownership in the EU28 area increased considerably between 2000 and 2017, from 411 cars per 1000 inhabitants to 516, an average increase of 1.4% per year (EEA 2019c). Consequently also the number of yearly registered cars across Europe has been increasing (despite a backlash in the COVID-19 crisis), reaching 15.2 million newly registered cars in 2017 (ICCT 2018). Figure 2 shows how the overall European car fleet, as well as the total distance travelled by cars, have steadily been increasing since the 1990s thus evening out efficiency gains from the lower emissions per car.

Further environmental challenges of car usage include an increased soil sealing caused by the extension of road and parking infrastructure across Europe (EU Commission 2013) and the emissions caused by tire abrasion.

In addition, health impacts emerge from noise pollution as well as from fine particles due to tire abrasion and combustion (Timmers and Achten 2016). More than 400.000 citizens die prematurely in the EU each year as a result of poor air quality (EU Commission 2017a).

Taking the bigger picture into consideration, car mobility has to struggle with environmental challenges that go beyond the emissions alone. Because current achievements regarding CO_2-savings are completely absorbed by rebound effects, there is still a big task to be solved by the automotive industry on its way to a zero-emission and climate-friendly transport system.

1.3 Scope and purpose of this report

All in all, the automotive sector is on the one hand a highly relevant and omnipresent economic and societal constituent of the EU – on the other hand, it brings about deep environmental challenges. As a consequence, policymakers, companies, trade unions and large shares of the working population in dependent regions have an incentive to maintain cars as a central mode of transport to keep the industry alive. At the same time, the contribution of the transport sector to the EU's emissions calls for action towards climate protection goals. A thorough transformation of the European automotive industry seems inevitable. Due to legislative changes on the EU level over the last years, and broader societal trends and developments, this transformation has already started. Questions remain however about what **a Just Transition of the industry could look like, securing income and employment for millions of workers amidst this demand for emission reductions**.

This report provides guidance through the complex situation of the automotive industry during this transformation. It provides valuable insights and perspectives on a Just Transition of the European automotive industry by highlighting the status quo of this transition (Chapter 2), and by discussing potential policy strategies for future steps in this direction (Chapter 3).

It is based on extensive desk research during which media articles, policy documents, academic research papers and reports from independent NGOs were identified and analysed. Subsequently, semi-structured expert interviews were conducted with 14 stakeholders, including four trade union representatives (TU), three European policymakers (EP), two automotive supplier representatives, four civil society representatives (CS) as well as an academic representative (AR). The results of the interviews are embedded in the report highlighting their different and sometimes conflicting assessments of the challenging situation of the European automotive industry.

2 Status Quo of the transition in the European automotive industry

The automotive industry has already started reacting to the pressure for change. Initially, mostly legal regulations forced the European automotive industry to transform, but international competition has also played an important role. Now a change is unstoppable, leading not only towards a complete change of driving technologies, but also to a shift in transport in general. This chapter investigates the current situation in the European automotive industry's transition towards climate neutrality, based on deep desk research of existing studies and complementing them with insights from our interviews. It includes the following aspects: A depiction of new legal regulations on an EU level (Ch. 2.1), an analysis of ongoing changes in engine technology (Ch. 2.2), the environmental effects of electrification (Ch. 2.3), the role of cars in a mobility modal shift (Ch. 2.4) and employment effects of the transition (Ch. 2.5).

2.1 European legal regulations

In November of 2019, the EU Parliament declared a climate emergency. In the same month, the European Commission presented the **'European Green Deal' which aims to make Europe the first climate-neutral continent by 2050**. This deal is understood as an action plan for a strategy "*to transform the EU into a fair and prosperous society, with a modern, resource-efficient and competitive economy where there are no net emissions of greenhouse gasses in 2050 and where economic growth is decoupled from resource use*" (EU Commission 2019b). Central to the European Green Deal is a **reduction of greenhouse gas emissions by at least 55% by 2030** (compared to 1990 levels). As overall emissions have been increasing in the transport sector since 1990 this will require a drop of around 75% compared to today´s emissions (see figure 1 above) – a monumental task.

The EU aims at cutting down 90% of transport emissions by 2050

The central transport strategy within the European Green Deal is the '**Sustainable and Smart Mobility Strategy**' by the European Commission. It aims to cut down 90% of transport emissions by 2050 (compared to 1990) through a "*smart, competitive, safe, accessible and affordable transport system*" (EU Commission 2020e). It includes the demand for 30 million zero-emission cars on European roads by 2030. By 2050, nearly all cars, vans, buses as well as new heavy-duty vehicles shall be zero-emission according to this strategy. Since the use of ICEs is a central contributor to these emissions, effective measures need to be taken to lower the attractiveness of producing and using ICEs and switch to other zero-emission technologies.

In July 2021, the Commission stated in their 'Fit for 55' package that all newly registered cars should be emission-free by 2035 to help meet the carbon neutrality goal by 2050 (EU Commission 2021m). This has intensified the debate on a possible ban of ICEs. In an open letter, nine member stations of the EU asked the European Commission to set a phase-out date for the sale of ICE vehicles (Electrive 2021; Leonore et al. 2021). While the Commission statement does not translate directly into a ban on ICEs, it has been argued by several stakeholders that it effectively will (Energy Monitor 2021). Individual nations have already implemented a phase-out through registration bans by 2030, including the Netherlands,

Denmark or Slovenia (ICCT and Wappelhorst 2020). However, on a European level, there does not exist an outright ban yet.

What is already in place for all of Europe are legal regulations setting binding CO_2 emission-targets for newly registered cars and incentivising the uptake of zero-emission cars.

From 2021 until 2024, the **EU fleetwide average emission target for new cars is 95 g CO_2/km,** corresponding to a fuel consumption of 4.1 l/100 km of petrol or 3.6 l/100 km of diesel. With this strategy, European institutions aim for a reduction scenario for CO_2 emissions of new passenger car registrations of 15% by 2025 and 37.5% by 2030, compared to 2021 levels (EU Commission 2020a).

If the average CO_2 emissions of a manufacturer's fleet exceed its specific emission target in a given year, the manufacturer has to pay – for each of its vehicles newly registered in that year – "*an excess emissions premium of €95 per g/km of target exceedance*" (EU Commission 2017b). In 2019, the average emissions of newly registered passenger cars in Germany were 122.3 g CO_2/km, across the EU (EEA 2021). Therefore, car manufacturers in the EU were not expected to meet the new 95g/km target in 2021. It was therefore reported that major German carmakers could face fines amounting to more than €20 billion in both 2021 and 2022 (Autovista24 2020). In fact, due to diverse avoidance strategies, most car manufacturers did not pay any fines. Only VW-SAIC will face a fine of €100 million (Fleetnews 2021).

A problem with the emission targets is that the regulations are weight-based, meaning that carmakers that sell heavier cars have easier CO_2 targets. For 2021 an SUV will be compliant with the regulation if it reaches 102 CO_2 g/km, while the generalist group will have to reach 92 CO_2 g/km (Pardi 2021). Doing this the regulation sets a counterproductive incentive towards the production of heavier cars, reinforcing the aforementioned rebound effect.

An additional policy measure starting in 2025 is an **EU-wide zero- and low-emission vehicle (ZLEV´s) crediting system** to incentivise the uptake of ZLEV production. A ZLEV is defined as a passenger car or a van with CO_2 emissions between 0 and 50 g/km. Manufacturers with a higher fleet share of ZLEVs will be credited with less strict fleet emission targets (EU Commission 2017b).

European policy promotes the electrification of cars, to which the promotion of **European battery production** is central. To this end, the EU has set ambitious aims. Recent announcements from the European Commission indicate plans to increase the global battery market share to 7%-25% to meet European demand for batteries by 2025 and become the second largest provider of batteries after China (EU Commission 2018; DW 2021b; Transport & Environment 2021a). In 2017, the European Commission had already launched the European Battery Alliance that supports battery manufacturing within Europe (EU Commission 2021b). Currently, 75% of battery manufacturing capacity is located in Asia, while Europe only accounts for 3% of the global production capacity of lithium-ion batteries (EU Commission 2018). As a response, as of May 2021, 38 lithium-ion battery factories were planned or under construction in the EU and UK. 17 of these had secured complete funding, another ten had received partial funding. Under the "European Battery Innovation" scheme, 42 companies across 12 EU states will further receive 2.9 billion Euros to ensure sufficient resources for batteries to fuel the increasing demand for BEVs (DW 2021a).

In summary, the European Green Deal currently serves as the central instrument advancing climate neutrality ambitions of the European automotive industry by setting the goal of a 55% CO_2 emission reduction by 2030 (compared to 1990). The legislation that has been introduced so far, has aimed at advancing these emission targets for newly registered cars and incentives

to produce ZLEVs. Furthermore, battery production is supported within the European battery innovation scheme. What is still missing though is a thorough addressing of the social challenges which accompany this transition. Although the European Green Deal calls for a Just Transition "*leaving no one and no place behind*" (EU Commission 2021m), until now no concrete measures have been taken to build protection mechanisms for automotive industry workers in this transformation.

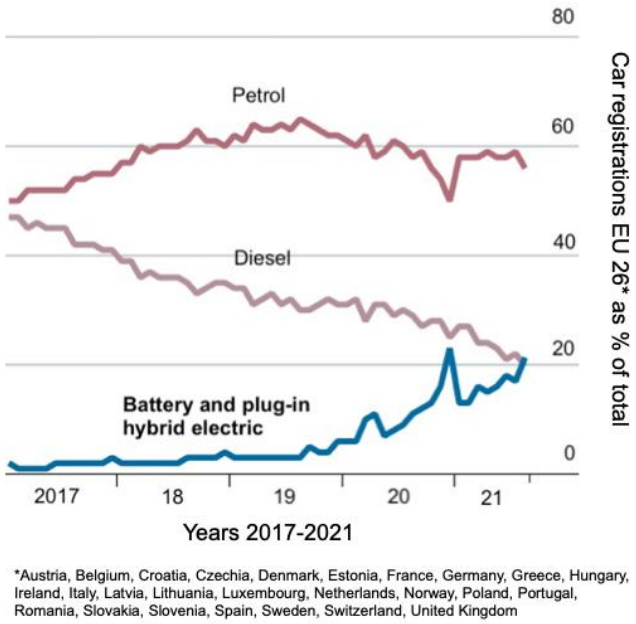
2.2 New driving technologies

Different technological changes are already happening in the European automotive industry, bringing with them severe challenges to the prospects that emerge accordingly.

Electric vehicles made up around 25% of the total EU sales in 2020

Currently, the EU car market is still dominated by ICE vehicles, but there has been a steady **increase in the number of registrations of BEVs and plug-in hybrid electric vehicles (PHEVs)** across the EU in recent years. These have risen from 300,000 vehicles in 2013 to over 2 million in 2017. In 2020, the total number of electric vehicles (EV) as in BEVs and PHEVs made up around 25% of total European car sales. Most of these vehicles were hybrid, i.e. including both a battery and a combustion engine (EU Commission 2019c). PHEVs which can be recharged using a power outlet, made up for almost one-quarter of the global sales of BEVs in 2020 (Statista 2021c). However, there are regional differences across the EU: While in Norway more than 75% of newly registered cars in 2020 were electric, in Italy and Spain it was less than 10% (Statista 2021b). Nonetheless, Ernst & Young forecast that BEVs will outsell other engine types by 2028 in the EU (Automotive News Europe 2021). Figure 3 shows the recent rise of EV sales compared to ICEs in Europe since 2017.

Figure 3: European car sales by fuel type, in % of total sales



Source: The Economist 2021

There is a deep change today shifting the debates about future investments from boosting the efficiency of the ICE to investments in electrification which was not foreseeable a couple of years ago (TU 9). In nearly all interviews, except from the supplier representatives, experts from different stakeholder perspectives agreed that the future of ZLEVs lies within BEVs especially for passenger cars (EP 2, 3, 14, CS 5, 6, 11, TU 7, 8, 9, 10). They also mostly agreed that this development will end up in a phase-out of the ICE.

"The future of the ICE, whether that's in a Plug-In hybrid or just a fully internal combustion engine, is not part of the future. There's no way it can be. So, the best thing for Europe to do, for workers and trade unions, (...) is to accept this and to own the transition" (CS 4).

Whereas they mostly agreed that the internal combustion engine won't be a relevant technology in the future, the **timing of this phase-out remains a big point of discussion**. While the civil society representative puts pressure on a fast phase-out within the next ten years (6), trade unions, industry and supplier representatives are more reluctant. Putting stakeholders' positions aside, even if a phase-out for newly registered cars would be feasible soon, a complete phase-out of ICE in the European car fleet will probably not take place until 2030. This is because new (ICE) cars have a lifespan of 12 years on average (AARP 2018). Meaning, even if the production of ICE cars stopped today, there would be ICE cars on European streets until at least 2034.

A further point of discussion is the **future of PHEVs.** On the one hand, most people agree on the fact that hybrids will, at least in the short run, play a role in the manufacturers' portfolio unless a political decision is reached to stop new registrations of ICEs. This seems to be necessary to avoid the social damages resulting from potential workers' lay-offs when solely producing the less labour-intensive BEVs (see Ch. 2.5). On the other hand, there are diverging opinions on the length of this phase: Civil society representatives and European policymakers opted for the short-term (6,11,3,4), while trade unions and supplier representatives advocated that PHEVs will still be produced in the medium-term, because the PHEV maintains the workers and the capacity utilisation of industrial infrastructure based on ICE (9,13).

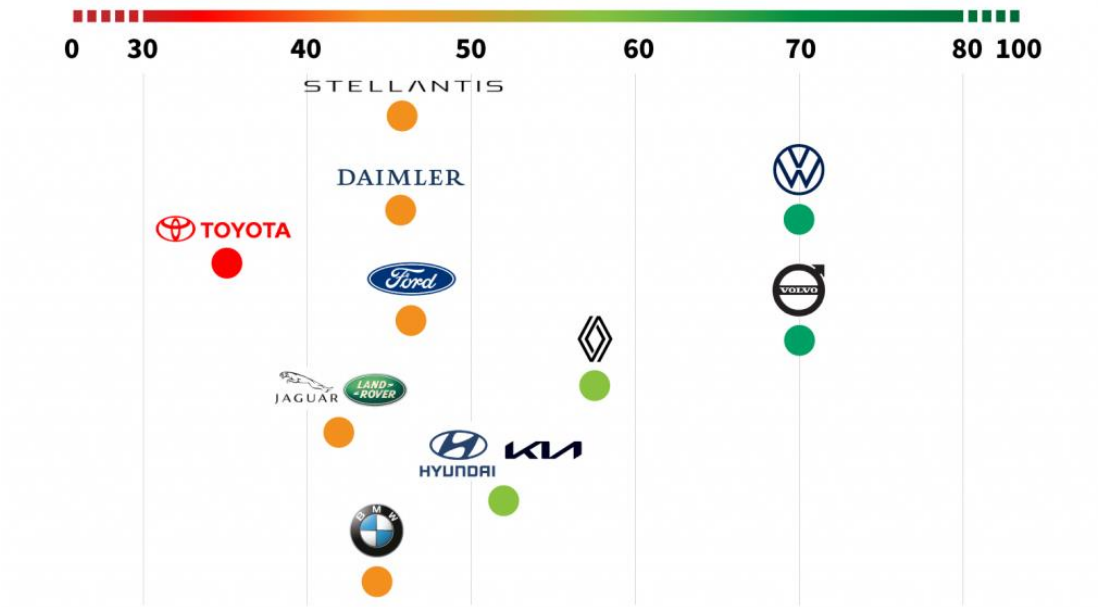
European carmakers are not expected to meet their climate goals by 2030

Today, the EU is not yet an established player on the global market for EV. In 2020, the European trade balance regarding EVs is still negative, but the gap between imports and exports is shrinking (EU Commission 2021l). However, considering EU regulation and increasing sales, it seems like BEVs will rather dominate than decline in the foreseeable future. This entails consequences for the automotive industry. It will increasingly have to shift its manufacturing towards BEVs, which not all industry actors appear to be entirely prepared for. A study conducted by the non-profit organisation Transport & Environment ranks the preparedness of 10 major manufacturers in Europe for an electrification of the automotive industry. As figure 4 highlights the conclusion is that only Volvo and VW seem ready to switch to electric mobility in line with Europe's net-zero climate target (Transport & Environment 2021b). It further states that even if the current predictions were met, **sales of BEVs in Europe will likely be at least 10% lower than they would need to be in 2030 to comply with the "Smart and Sustainable Mobility Strategy"** (ibid).

The importance of the battery in the car of the future will change power structures both in terms of the global car market and between OEMs and suppliers

The shift from ICE to BEV technology is not merely a change of one production step. Instead, **the manufacturing of BEVs requires around 200 parts, compared to 1200 parts of a combustion engine**. This impacts the supply and value chain downwards from the car manufacturers, potentially rendering producers of specific parts necessary for ICEs obsolete (e.g. all parts specific for combustion engines). Furthermore, the composition of the value chain changes significantly. Currently, batteries make up to 40-50% of the total price of a BEV. According to forecasts, this share will drop to 25% in the near future (Galgoczi 2019), which still remains a significant share of the value chain. Not least, the shift to BEV and the demand for batteries puts established car companies in competition with new actors, including

Figure 4: Carmakers EV readiness-index



Source: Transport & Environment 2021

automotive newcomers such as Chinese manufacturer Geely or US company Tesla, as well as other companies from the technology sector that require batteries (Wissen and Haas 2020; Anne-Gaëlle and Guga 2019). In addition, this implies among other things a **shift in power within the supplier industry as well as between OEMs and suppliers**. While the traditional ICE suppliers will lose their business model, new suppliers of batteries and electric parts will emerge (SR 13).

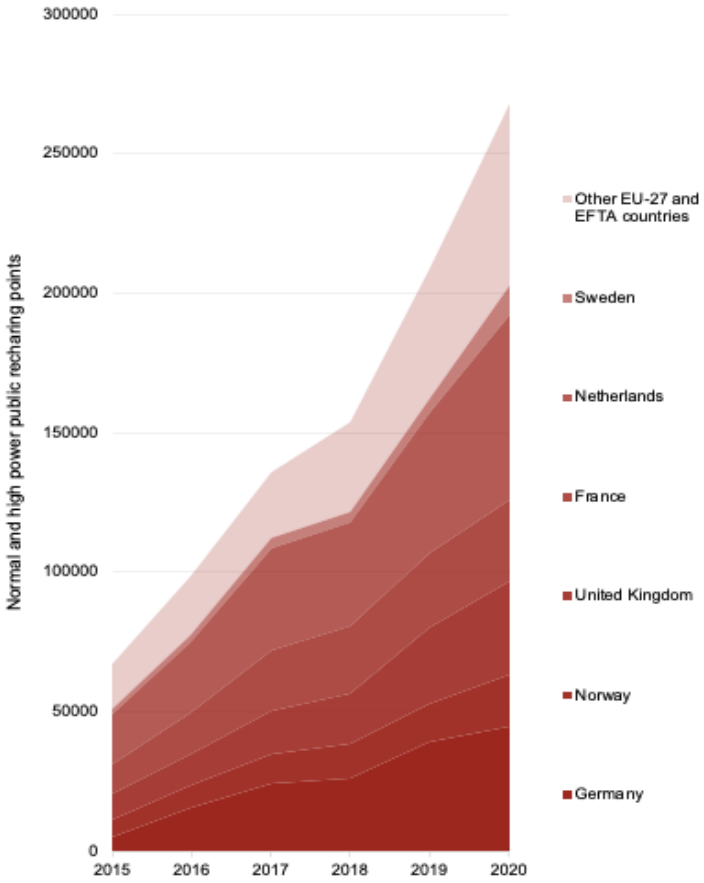
This could put an end to traditional power structures between suppliers and OEMs as the latter will find it increasingly difficult to boost margins by pressuring the former to reduce prices (Lefeuvre and Guga 2019). Overall, in our interviews, policymakers, trade unions and civil society seemed to trust in Europe's capabilities to raise battery production in the future (EP 2,

TU 7, CS 11). Only the supplier representative was quite sceptical about the possibility for European battery manufacturing to catch up globally, since environmental regulations are very strict in the EU and constitute a competitive disadvantage compared to producing in China (SR 13). In addition, a civil society representative pointed out that also within Europe competition regarding battery production is high, with most of the production happening in Hungary and Germany (SR 11). This means regional imbalances are going to emerge with a possible loss of relevance of other European car-producing countries like Eastern European countries.

The number of charging points are proliferating and will soon reach more than a million all over Europe

Aside from battery manufacturing, there lie further challenges in the shift towards electromobility. Importantly, PHEV and BEV require charging infrastructure. **During the last ten years, the grid expanded from close to 0 to slightly below 300.000 charging stations across Europe** (Statista 2021a, eafo 2021). Yet, this infrastructure is often poorly developed outside of urban centres and in more rural regions, with significant regional differences. The distribution of charging points further differs significantly between countries, with Germany, France and the Netherlands making up for the majority across Europe as shown in Figure 5. The demand for public charging in the EU is estimated to reach 1.3 million stations in 2025

Figure 5: Public normal and high-power recharging points in Europe, 2015-2020



Source: EAFO 2021

and around 2.9 million in 2030 (Transport & Environment 2020a). Therefore, there is an increasing investment in charging infrastructure. As an example, Volkswagen plans to operate 18,000 fast-charging points by 2025 (Nasdaq 2021).

E-Fuels lack energy efficiency compared to electric cars

In our interviews, several stakeholders (notably from the industry) criticised the exclusive focus on electromobility in the transformation and opted for a technological openness in shaping the future car market (SR 13). Thereby they highlighted the potentials they see in hydrogen technology and e-fuels. According to them the advantage of these alternative fuels would be that they could be used in ICE engines and use available infrastructures such as petrol stations. The biggest current challenge here is that at the moment these technologies lack energy efficiency. To produce e-fuels, electricity is first converted into fuel, thus indirectly electrifying transport. This conversion is currently very inefficient. According to the German Federal Environment Agency, the battery-electric car has an overall efficiency of 62%, while for the hydrogen car with fuel cell and green hydrogen, the efficiency is only 28% (Umweltbundesamt 2021). So, **while in the BEV only 30% of the electricity produced cannot be used to power the vehicle, in the fuel cell car it is almost three-quarters of the electricity**. This is why alternative fuels should be used in the future exclusively in other sectors where decarbonization is more difficult to achieve such as in sectors with heavy-duty vehicles (CS 11). Against these facts, proponents are optimistic about the future potential arguing that the efficiency will increase in the upcoming years through technological developments (SR 13). In 2020, the private sector lobby organization ‘eFuel Alliance’ was founded to call for technological openness and regulatory mechanisms for hydrogen fuels. Among the members are companies and associations of the automotive supply industry and mineral oil trade. Notably, no European OEM is a member. The Japanese car manufacturer Mazda is the only OEM in the interest group (eFuel Alliance 2021).

In summary, the European automotive industry is already in the midst of a deep transformation towards electromobility, although it is still too slow regarding the goal of climate neutrality. Some stakeholders opt for technological openness and the further development of e-fuels – alas they are still inefficient from an ecological perspective. But it is also questionable if electromobility alone will solve the climate challenges of transport. The next chapter, therefore, focuses on the remaining environmental challenges in an electrification scenario.

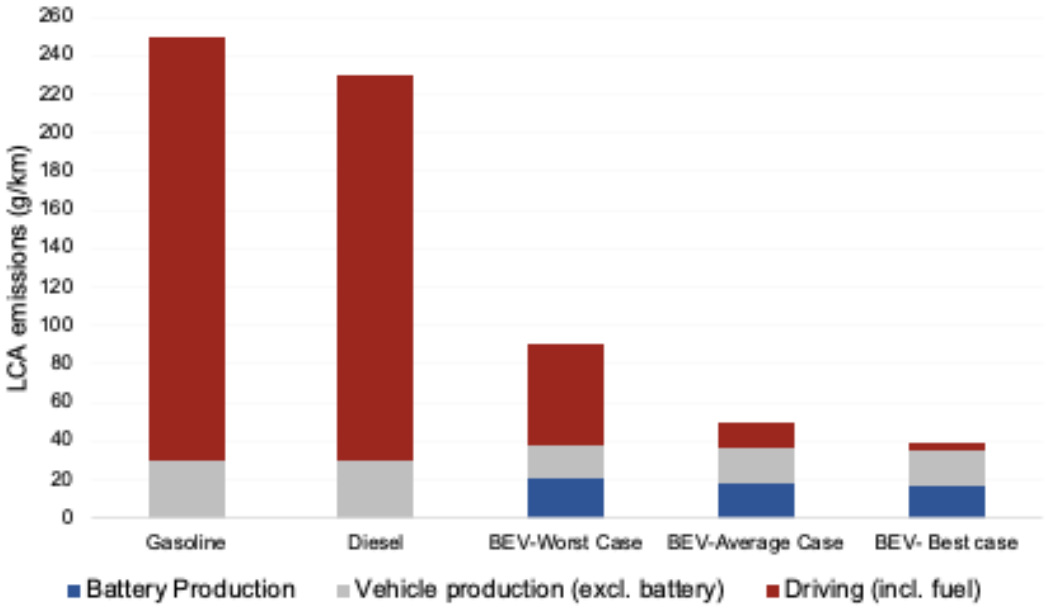
2.3 Ecological impacts of BEVs

In our interviews, a supplier representative challenged the assumption that BEVs were climate-neutral by pointing out that emissions are often only quantified ‘tank-to-wheel’, omitting emissions from the manufacturing process and disposal (SR 12). Indeed, this limited perspective on a car’s life cycle leads to flawed comparisons between engine technologies (Hoekstra and Steinbuch 2020). Although scientific debates are still ongoing on how the calculations for the BEVs should be conducted to fairly evaluate the emissions savings, it still holds true that **the much greater share of emissions occurs during the process of car usage, not its production**. A study by Transport & Environment (2020a) claims that the tank to wheel (fuel usage) of the ICE still exceeds any emissions taking place at the battery production phase (Transport & Environment 2020b). Figure 6 visualizes these calculations while assuming the following scenarios:

1. Base case: BEV running in Sweden and battery produced in Sweden

2. Average case: BEV running with EU27 average electricity mix, and battery produced with the EU27 average electricity mix
3. Worst case: BEV running in Poland and battery produced in Poland

Figure 6: The climate impact of BEVs in comparison to other engine types



Source: Transport & Environment 2020b

The cases mentioned above show that BEVs are more emission-intensive in the production in any scenario, but they are still overall much less polluting. In this example, ICEs emissions during the car usage far exceed BEVs in any scenario, resulting in lower emissions for BEVs in total.

Green electricity is key to reducing the CO2-emissions caused by cars

Nonetheless, the possible success of electric cars regarding emission savings is not completely undisputed. A supplier representative discarded the T&E studies as being on the level of school mathematics and physics (SR 13). A study opting for technological openness he referred to criticises that most of the studies concerning emission reduction do not even consider e-fuels and its results depend a lot on the underlying parameters including the mileage, the frequency of use, the size of the vehicle and the loading – giving a lot of room to manipulate figures (FVV 2020). Moreover, according to them, current studies around the BEV do not mention the emissions occurring at the end of life as well as the emissions which are released installing the charging infrastructure (Ibid). The validity of these statements cannot be validated within this report. But what is sure is that there are several factors that have a great influence on the life cycle emissions of BEVs:

1. The major factor deciding on a BEVs carbon emissions is the **source of electricity** (EEA 2018). A recent study found out that in some countries where coal power generation, is still dominant, the life cycle of BEVs' CO_2-emissions can be higher than ICEs life cycle emissions (Zheng and Peng 2021). But another study suggests that already under current carbon intensities of electricity generation, BEVs are less emission-intensive than fossil-fuel-based alternatives in 53 world regions,

representing 95% of the global transport demand (Knobloch et al. 2020). Nonetheless, the development of the European energy sector, will heavily influence the potential of the European automotive sector to reach its climate ambitions. The increasing demand for green energy will require an expansion of renewable energy sources and investments into the power grid to bridge regional differences in energy generation
.

2. Another important factor for the life cycle analysis is the **lifetime mileage**. In studies, the expected lifetime mileage of an electric car is often estimated very conservatively at 180.000 km or below (Singh and Strømman 2016). However, as Hoekstra & Steinbuch highlight, 500.000 km or more are becoming realistic for today's battery technology, vastly exceeding the lifetime of non-electric cars (2020). Taking this into account, the impact of production- and disposal-related emissions per lifetime kilometre decreases for BEVs.

3. The third factor to be considered is **battery recycling.** Recycling has a major impact on a battery's carbon footprint. Estimates say that using recycled materials for the entire battery could result in reductions in emissions of up to 50% across the battery production process (Dunn et al. 2015). Although the recycling process does require additional energy inputs at the end of a vehicle's life, the benefit in terms of resources saved by not producing new products usually outweighs these expenditures. However, there is considerable uncertainty to this end, since the recycling of large vehicle batteries is still a new sector (EEA 2018). The contribution of recycled battery metals, for example, is quite variable, ranging from a relatively well established and efficient recycling chain for cobalt (22%) to nearly non-existent for lithium (>1%) (Bolger et al. 2021).

4. Another environmental challenge, that increases with the expansion of BEVs: Is **the raw material extraction.** The amount of required raw materials, especially lithium, cobalt and nickel, will increase as BEV production grows (Öko-Institut e.V. and Jürgen Sutter 2020), posing new environmental and social problems associated with the mining process. To produce BEVs and electric storage, the EU will need up to 18 times more lithium and five times more cobalt by 2030, and nearly 60 times more lithium and 15 times more cobalt by 2050. Studies estimate that emissions from Li-ion batteries could be responsible for around 20% of the total greenhouse gas emissions from battery production (EEA 2018; Ellingsen and Hung 2018). Adding onto the emissions' raw material extraction causes eutrophication, acidification of water bodies and wetlands, soil contamination with heavy metals, soil erosion and loss of biodiversity, including of land vegetation and aquatic species, especially fish. Additionally, significant amounts of drinking water are used to extract the raw materials, for example, lithium (Dunn et al. 2015; Hawkins et al. 2013; Timmers and Achten 2016). The emissions, as well as the resource intensity, of raw material supply, can be reduced through recycling. For example, producing primary aluminium requires around 20 times as much energy as recycling scrap aluminium (EEA 2018). That is another factor why recycling becomes ever more important in the environmental performance. Recycling will not be enough to stay within planetary boundaries: Friends of the Earth suggest a 65% reduction of the material footprint – which would require an overall reduction in traffic by cars.

5. It also holds true that PHEVs today account for a significant share of BEV sales. The use of PHEVs is controversial because the ecological benefit of them is highly

disputable. In a 2020 study, it was found, that **real emissions from PHEVs are two to four times higher than type-approval rates, with 117g CO_2/km on average** (ICCT 2020). Compared to the fleetwide goal of 95 g/km (see Ch. 2.1), it appears that PHEVs are not likely to fulfil the emission savings needed to reach climate targets.

In summary, we cannot easily say that with BEVs we are going to save our planet and reduce emissions as far as we need to meet the climate goals. The success of climate-friendly BEVs depends on a lot of different factors: Electricity generation, lifetime mileage, the recycling rate of batteries and raw materials. Additionally, there are significant environmental damages caused by the raw materials use in the BEV production that can only be reduced by a reduction of the sourcing of raw materials. Adding up to the inevitable fact that the BEV life cycle emissions will never be zero, it makes the point for an altogether different mobility behaviour, shifting away from a focus of the mobility system on cars. This is the topic of the next chapter.

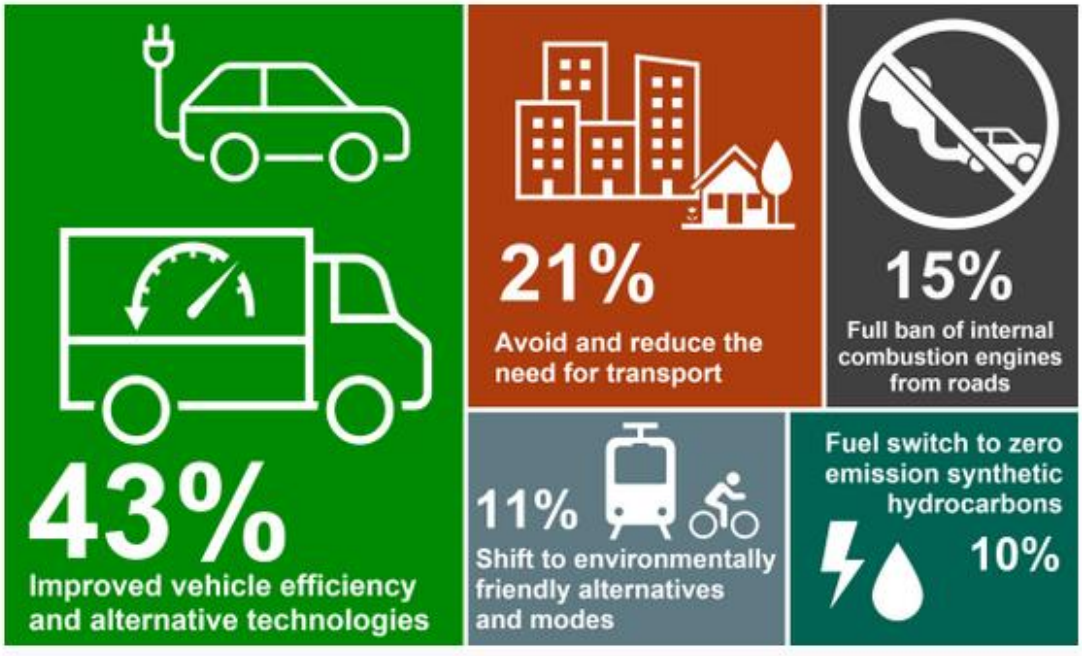
2.4 Role of the car in a modal shift of transport

Not only engine technologies are changing – so is mobility behaviour in general. This chapter sheds light on the meaning of the concept of a modal shift, explaining why it is happening and what the possible consequences are for the automotive industry.

"We consider a shift of one-third of the current motorised individual traffic to be possible and necessary. In the future, the majority would be handled by public transport, which corresponds to about a doubling of passenger numbers compared to the situation before Corona" (civil society representative 5).

The scenario sketched in this interviewee's quote is not uncommon. The general debate on the future of mobility revolves around the idea of a modal shift. This modal shift includes an expansion of public transport, especially an intensification of rail transport as being the most ecological one. At the same time, attempting to shift individual mobility towards means like bicycles and reducing the ones based on cars, by expanding sharing options. Multiple trends impact the shift from individual car usage towards more diverse means of transportation. The strongest trend, from a climate perspective, are the aforementioned means of transportation. These are far more sustainable, and this shift seems, therefore, necessary to keep overall transport emissions low in the long term. A scenario study of the modal shift in Europe concludes that to reach zero emission in transport by 2040, the switch of engine technology is not enough. Rather, massive changes in transport are necessary, including an overall reduction of transport by 21% (see Figure 7). For cars, this means a drop in passenger transport by cars from 62% towards 43% in urban areas and from 79% to 68% in non-urban areas between 2015 and 2040 (Martin et al. 2020).

Figure 7: Share of total emission reduction by 2040



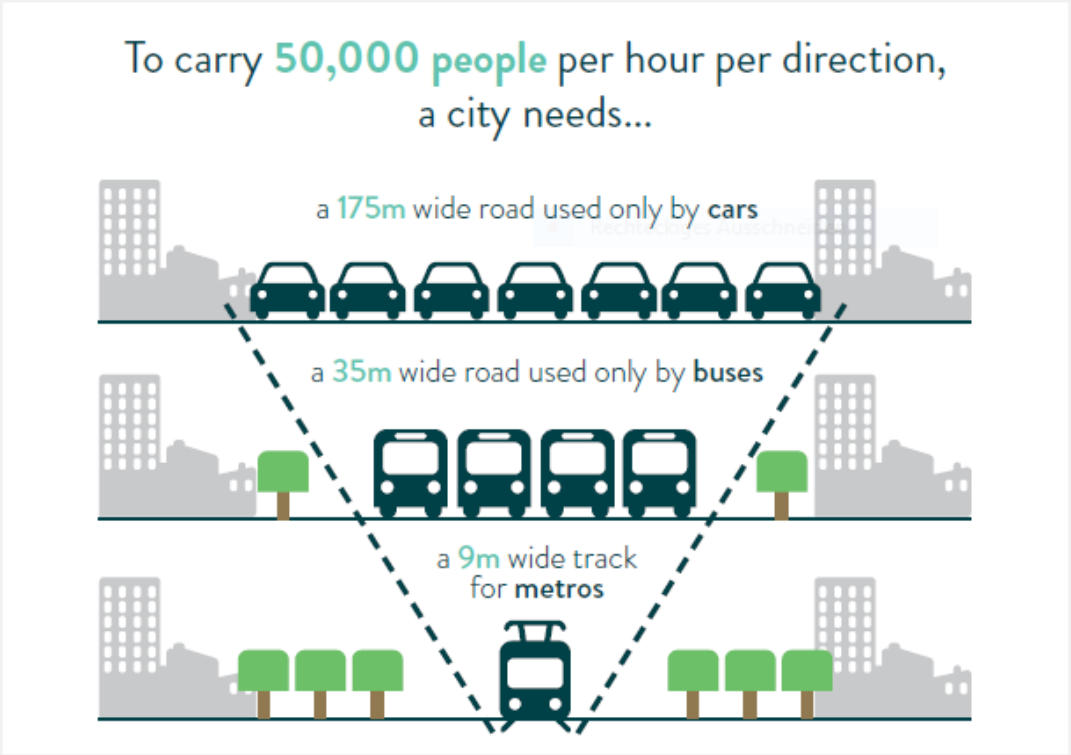
Source: Martin et al. 2020

This shift is being advanced on several policy levels. The **European legislation** provides guidance in this direction with its aim of doubling high-speed railway traffic by 2030 and tripling it by 2050 compared to today (Railtech 2020). Currently, the EU is working on the Trans-European Transport Network (TEN-T), which aims to provide a “Europe-wide network of railway lines, roads, inland waterways, maritime shipping routes, ports, airports and railroad terminals" to promote shared transport (EU Commission 2021f).

Another crucial policy level advancing this shift is the **urban level**. As the number of people in the EU living in cities is steadily rising, reaching 72% of the EU population in urban areas in 2016 (PBL 2016), also a growing part of mobility is happening within cities and in densely populated areas. This is why cities increasingly experience intense car traffic, which is not only associated with high carbon emissions, but also with noise and space consumption by big streets, which poses a danger to the overall quality of urban life. As Figure 8 highlights, the transport via cars consumes vastly more urban space than other modes of transport. This problem becomes even more intensified when considering that more than 90% of the time cars are parked somewhere without moving (Canzler and Knie 2019).

To increase their living quality many European cities develop local policies to support a modal shift by developing faster, better connected public transport or wider bike lines. The sales of bicycles in Europe are forecasted to grow to 30 million a year by 2030, a 47% increase from 2019, with most of this growth coming from e-bikes (Mordret 2021). Additionally, cities ban strongly polluting ICE vehicles from city centres by installing Low Emission Zones, which have been implemented in over 13 European countries (Mordret 2021).

Figure 8: Physical space used by different modes of transport



Source: Mordret 2021

Aside from these policy-driven changes, another reason for the decline in the importance of cars might be the **change in perception of automobility**. As an interviewed civil society representative highlighted, cars nowadays are no longer regarded as status symbols among younger generations – especially among those aware of the climate situation (11). While this assumption is common, it is currently not supported by research (Örtl 2019). However, the climate activism of the youth concerning a modal shift has become more visible and influential during the last years. Climate activists are now not only addressing governments but also industry players such as Volkswagen to take action (Clean Energy Wire 2019). During the automotive show in September 2021, more than 13,000 protestors gathered to oppose the lack of action from the automotive industry towards sustainable mobility (Clean Energy Wire 2021).

Every car-sharing vehicle replaces 16 privately owned cars.

Probably the most important factor driving the modal shift is **digitalisation**. The digital connectedness via smartphones lays the ground for the development of 'mobility as a service, being the possibility to connect and spot different available modes of transport in real-time. Regarding car transport, car-sharing makes it possible to intensify the use of fewer cars by more people, via digital coordination, thus making it superfluous to own a car in order to be able to move in a car. This is revolutionary for an industry that has, from its inception, been dependent on the manufacture and sale of privately-owned cars. A study in Bremen, Germany, found that **every car-sharing vehicle replaced 16 privately owned vehicles** or prevents their purchase, and at the time, car-sharing had already contributed to a reduction of more than 2,300 privately owned cars (Schreier et al. 2018). So, **digitalisation does not only**

advance the modal shift, it also fundamentally shapes the image of the automotive industry of the future. Today, in this industry, electronics and software components are becoming ever more important (TU 7). Furthermore IT-driven solutions increasingly constitute buying criteria for potential consumers (Winkelhake 2017). Consequently, the implementation of software into cars is expected to increase substantially in the coming years and could be the new key differentiator between car models and brands (Lefeuvre and Guga 2019). This development of increasingly including digital technologies in cars, has also resulted in the expectation that soon autonomous, self-driving cars will be driving on our roads. PWC forecasts that by 2030 42% of all mileage driving will be by self-driving cars (PWC 2017).

Shared mobility services are expected to become the most dynamic and profitable side of the automotive ecosystem

What does all this mean for the future of the automotive industry? According to a PWC study in 2030, around 33% of all new vehicles will be used for shared mobility and 36% of all mileage driven in Europe will be in shared-use vehicles, and 42% in self-driving vehicles (PWC 2017)**.** This could lead to a fundamental shift in the profit structure of the industry: While today 85% of the value added are contributed from car production or car sales, this figure is expected to drop to under 50% (Ibid). Instead, the share of digital solutions will rise. The study expects **shared mobility services to become the most dynamic and profitable side of the automotive ecosystem**, with annual revenues of 467bn$ in the EU by 2030 in comparison to 25bn$ in 2017 (PWC 2017).

Over 70% of the value of future cars may be created in economic sectors that are not part of the traditional automotive industry

This development was also confirmed by our interviewees: Information and communication technologies (ICT) may make up more than half of the value of a car in the future (TU 8). In combination with the share of battery production of the total value chain, over 70% of the value of future cars may be created in economic sectors (battery manufacturing and IT) that are not part of the traditional automotive industry.

Additionally, the modal shift could account for the decrease of the importance of cars as a central means of transport in Europe. Regardless of these developments, there was agreement among interviewees that cars will continue to play an important role within European society in the future. Especially in **rural areas,** cars will continue to be important because reliance on public transportation is not viable and car-sharing might not catch up as an alternative to individual mobility (CS 9, TU 4). The **impacts of COVID-19** have also clearly shown how individual mobility becomes easily influenced by shocks, either by being reduced due to the rise of home office work or expanded due to a reluctance of public transportation usage during a pandemic – leading to a possible return to cars or a shift to bicycles (CS 6). Although the COVID-19 crisis led to a huge drop in the demand for cars – in 2020 car sales across Europe decreased by 24.3% compared to 2019 (Car Sales Statistics 2021) - it could nonetheless also contribute to a reallocation of mobility towards cars in the long run.

The reduction of the European car fleet by 27% in 2030 is necessary to reach the climate goals

In the end, the overall impact of digitalisation and the modal shift for the automotive industry remains unclear. Still, there is a shared agreement among stakeholders on the foreseeable drop in demand for cars' private ownership (EP 2, TU 10, CS 11). Studies come to different conclusions concerning the future overall size of the European automotive industry. While a

Deloitte study predicts a decline by just 10% until 2035 (Deloitte 2020), PWC predicts that 25% fewer cars will be travelling on the roads in Europe, the USA and in other mature markets in the future (PWC 2017)**.** From an environmental perspective, even more reduction is indispensable: The reduction of the European car fleet by at least 27% in 2030 (compared to 2015) is regarded as necessary to reach zero emissions (Martin et al. 2020). To sum up, a fundamental mobility shift can be observed on different policy levels especially in urban areas. As it favours public rail, bicycle, and shared transport instead of privately-owned cars it poses a challenge to the automotive industry. As a consequence, the overall demand for cars is likely to drop in the future while its business models are expected to change due to the increasing digitalisation. In the future, traditional manufacturing will lose importance while digital and sharing solutions will gain market shares.

2.5 Employment effects of the transformation

The developments mentioned above – legal regulations, electrification, digitalisation and modal shift – coincide with heterogenous challenges and possibilities for the job situation in the European automobile market. As we will see, exact forecasts about the job situation are speculative, as they depend on a lot of unforeseeable developments. For example, the concrete effects of electrification on the labour market will depend on various aspects: If Europe reaches its ambitious goal of becoming a forerunner in electromobility, if BEV demand consolidates, if PHEVs continue to be sold alongside BEVs or if the goal of climate neutrality is compatible with current strategies etc. This chapter provides an overview on which jobs are generally at risk and which may rather increase or be newly created within the transition, and the consequences this could have for the overall job market. But also, here our interviews, as well as scientific studies, show quite a large ambiguity. While supplier and trade union representatives were more pessimistic, expecting net losses and social disruptions (SR 12, TU 10), European policymaker and civil society representatives were more optimistic, stating that all losses can be compensated in the long run and that overall effects could even be positive (EP 3, CS 6).

The biggest job losses will occur concerning blue-collar jobs during ICE production

The different stakeholders agreed that **mainly blue-collar jobs in the manufacturing of ICE engines and components are going to decrease quite heavily** in the coming decades. That is mostly due to the reduction of manufacturing: The ratio of required labour in production is ten workers in the production of a diesel car to three workers for an ICE vehicle to one worker in EV production (SR 12). A trade union representative formulated the challenge even more drastically:

"[A]ll the jobs that are related to the manufacturing of components that exist in an internal combustion engine and do not exist in full EVs would be at risk if we go for a full electrification scenario of the automotive industry" (TU 10).

This is supported by a recent study of the German NGO Agora Verkehrswende. It states that fewer jobs will be needed in vehicle production and at suppliers who concentrate on the production of components for the internal combustion engine (Agora Verkehrswende 2021). These sectors will experience the biggest losses. Another sector that will be affected in the long-term by job losses will be the **industry that makes, transports, and sells fuels** (TU 10).

The projections of how many jobs exactly will be lost through electrification, depend on the underlying scenarios. The European Association of Automotive Suppliers (CLEPA) assumes that up to 501.000 jobs in Europe will be lost by 2040 in parts of the value chain, mainly within ICE suppliers (CLEPA 2021). This would mean a reduction of 84% of the current jobs in the ICE value chain (Ibid). The losses are partially compensated by the BEV powertrain production that is expected to create 226.000 jobs, but still, there could be an overall loss of 275.000 jobs until 2040 (Ibid). A study by FTI Intelligence has a bit more optimistic forecasts, stating that electrification could lead to a reduction in employment of "around 60 percent in powertrain, spare parts manufacturing and maintenance" (2018). The lowest job losses are projected in a study by the Centre for Automotive Research (CAR). It concludes that strict emissions limits might lead to 28.000 lost jobs in Germany, France, Italy, Spain, and Slovakia, that is 1,9% of the automotive employees in these countries. These countries account for 70% of the total manufactured passenger cars in the EU27 in 2019 (CAR and Dudenhöffer 2021). Overall, it is unclear how many jobs will be lost within other sectors that will also be affected. These include the **industries that make, transport, and sell fuels**, as they are becoming superfluous in an electrified society (TU 10). Jobs that concern the **sale of cars**, as with many goods, are also progressively shifting towards digital dealerships that replace physical stores and their associated jobs (Lefeuvre and Guga 2019).

Overall, the employment effects of electrification could be positive, creating up to 1.1 million new jobs all over Europe

Whereas the previously mentioned studies speak mostly of net job losses, some civil society representatives even estimate an overall positive effect. They think that the number of jobs at risk from the transition to electrification has been overstated in the past by unions and the automotive industry (CS 4, 6). The above mentioned CAR study also moves in that direction, stating that the losses mentioned above will be more than compensated by the creation of new jobs (CAR and Dudenhöffer 2021). Regarding all Europe, Agora projected for 2030 that *"[t]here will be a strong increase in jobs among manufacturers and suppliers who are independent of the traditional powertrain, as well as among companies in energy infrastructure, energy production and, to a lesser extent, in mechanical and plant engineering (in total: +205,000 jobs)*" (Agora 2021). The Platform Electromobility is even more optimistic, projecting around **1.1 million new jobs to be created in Europe due to the shift to electromobility by 2030** (Platform Electromobility 2020).

White-collar office jobs, that require higher education levels will increase

While we saw above that the job losses will mainly occur in ICE manufacturing, on the other hand, the projected job gains will occur in different sectors. **These jobs are mostly not blue-collar jobs, meaning classical manual manufacturing work, but white-collar, office jobs that require a higher level of education**.

A sector that will benefit from the transition are **battery manufacturers**, who could gain sizeable parts of the upstream value chain. The production of batteries in the EU may be crucial for the future of the European automotive industry yielding a high job potential. The European Commission expects up to 4 million new jobs to be created in the EU by 2025 through soaring battery cell business. Amidst the production of batteries, this also includes their **recycling**, which is a focal point of the European Green Deal's commitment to a circular economy (EU Commission 2021j). The **creation and maintenance of charging infrastructure**, which the success of electromobility will depend on, will also create new employment throughout its European roll-out (EU Commission 2021j). The increasing role of **digitalisation and automation** in the automotive sector also impacts the job situation in different areas of the automotive sector. As we have seen before, **c**ars and their production

sites gain evermore digital capabilities. This includes the integration of smart technologies as well as digital communication features. This development will increase the demand for IT-related skill sets and will possibly create a lot of jobs in the **IT sector**. Until 2025 it is predicted that up to 12% of OEM employment could consist of IT specialists (Lefeuvre and Guga 2019). Both electrification and digitalisation require **R&D** in their development. So, R&D jobs are possibly going to increase as well. Furthermore, the rise of **mobility services** could have a positive effect on employment. But it will be limited since many of their functions can be automated or outsourced.

In addition, positive employment effects are expected from the **development of infrastructure for means of transport other than cars** e.g. rail expansion in Europe through the completion of the 'Trans-European Transport Network´ (TEN-T) or the operation of public transport (EU Commission 2021f). The TEN-T addresses the implementation and development of a Europe-wide network of railway lines, roads, inland waterways, maritime shipping routes, ports, airports and railroad terminals. An additional 800,000 Europeans are expected to be employed in 2030 through the completion of the TEN-T (Schade, Hartwig, and Welter 2019). It is therefore necessary to assess the mobility sector as a whole when considering the development of the job market (CS 6, TU 10). The perspective of future working opportunities could be even broader in the future green economy as a whole. Not least, the electrification of the automotive sector will go hand-in-hand with the decarbonisation of the European energy sector, and will increase the demand for renewable energy. The expected investments in this sector will further create **new job opportunities in renewable energies**. If we look at **the green and circular economy** as a whole, the European Commission expects up to **2 million new jobs** to be created (EU Commission 2021e). For the whole world the International Labour Organization is even more optimistic, talking about around 24 million more jobs being possible by 2030 (ILO 2018).

To sum up, the quantitative development of employment in the automotive sector is hard to project – even more so if one expands it to other mobility and green sectors. However, concerning the job profile, important things can be highlighted: **More highly skilled white-collar jobs will be required in the future and lower-skilled blue-collar jobs are in danger of becoming obsolete**. While the overall employment effect is likely to be even positive in the medium- and long-term in the green economy, there are still several problems accompanying these new jobs. These fundamentally concern gaps between the old and the new jobs.

"On a massive scale, jobs are being lost and other jobs are being created, but they are not compatible with each other. And it is not very clear how, well, a specialist in diesel technology would appear as "Information and Communication Technology" expert or in battery manufacturing. So, you need the policies there to help that." (CR 7).

The task of a Just Transition must be to find solutions to them. The final chapter therefore debates which strategies and policies may be applied to do so.

3 Just Transition

As we have seen so far, the automotive industry is facing a fundamental transformation. Many of the changes will have unclear, potentially negative effects on employment. This is where Just Transition policies step in. As defined by the International Labour Organization, a 'Just Transition' is understood as *"greening the economy in a way that is as fair and inclusive as possible to everyone concerned, creating decent work opportunities and leaving no one behind. A Just Transition involves maximizing the social and economic opportunities of climate action, while minimizing and carefully managing any challenges – including through effective social dialogue among all groups impacted, and respect for fundamental labour principles and rights"* (ILO 2021). In this context, Just Transition doesn't only have the task of creating a green, climate-neutral economy, as outlined in the European Green Deal. Just Transition also further creates social acceptance for fundamental economic transformations by enabling security and job perspectives for workers as well as participation schemes. There are discrepancies in the discourse concerning the scope a Just Transition should have. Two competing concepts of Just Transition exist – the pragmatic trade unionist view, and the more idealistic academic concept. The former emerges from a more regionalist perspective and is focused on the development of social transition strategies for the members of a specific region or group of workers as represented by their respective unions. The latter has a strong focus on global justice and looks at the consequences for all workers around the world (Morena, Krause, and Stevis 2020). As the European perspective is necessarily rather global than just regional, this report follows the academic interpretation when speaking about a Just Transition.

This chapter outlines the four gaps that a Just Transition in the automotive industry must bridge as well as concrete policy proposals which would contribute to a Just Transition in the European automotive industry. The policies are placed in four different policy areas: 1) industrial policies, as being the ones which account for the climate-neutral industry transformation and the job situation in industries, 2) regional development policies, which take into consideration the regional challenges in the transition, 3) active labour market policies and social protection schemes, which develop a labour infrastructure that is apt to support workers in the transition and last but not least, 4) stakeholder participation schemes, which ensure that the voices of the different stakeholders affected by the transition have a stake when designing Just Transition policies.

3.1 The four gaps of a Just Transition

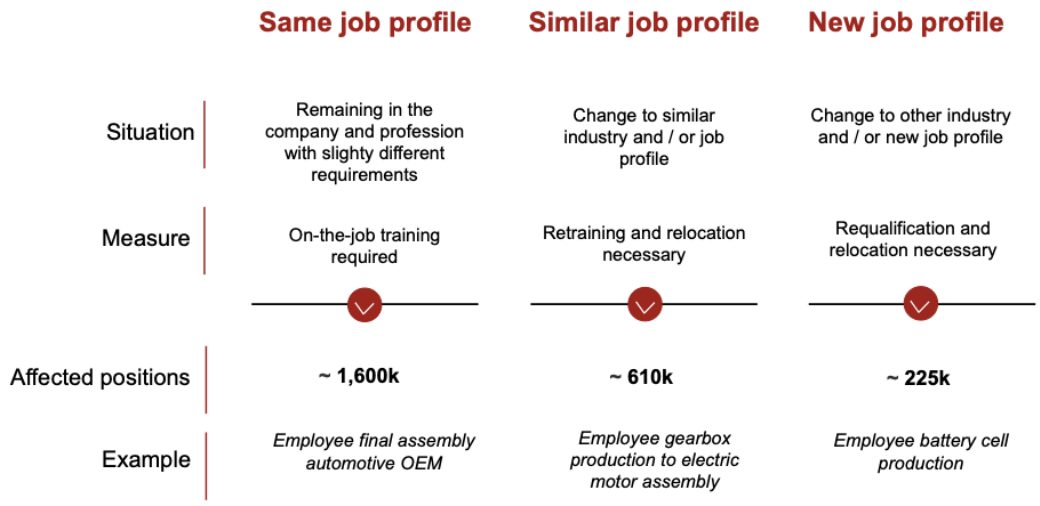
A Just Transition reacts to social challenges accompanying an industrial transformation process. According to our interviewees, to enable a smooth transition for the workers in the European automotive industry, Just Transition policies must close four gaps: **The geographical, the skill gap, the timing gap and the attractiveness gap.**

1. The first one is the **geographical gap** (TU 10). It describes the regional challenges arising during a transition. A study from the FTI intelligence mentions 14 European regions where the automotive employment exceeds 20% of the total manufacturing employment (FTI Intelligence 2018). But it is not clear that the investments related to the BEVs, creation of Gigafactories will take place in the same regions (TU 10). So, if a company gets hit badly by the transition that is important in a specific region, accounting for a large share of regional jobs and tax income, the challenge this region

is facing will not be solved by an overall positive job development. Possibly the new jobs will emerge somewhere else, and the region has to struggle with unemployment and diminished public resources to find solutions to this problem. Just Transition policies have to step in here, to find a solution for specific regional challenges.

2. The second gap which is absolutely crucial, is the **skills gap** (TU 10). During the transitions from old to new jobs there arises a mismatch between the skills, which is complicated to fix. As mentioned before, the new jobs will be mostly white-collar ones, meaning that blue-collar jobs will hardly be needed anymore. Many of these new jobs require on average higher and/or different sets of skills than current jobs. This imposes a great challenge of replacing jobs in the industry, because it will not be possible to reskill all workers into completely new fields. A study by the Boston Consulting Group concluded that up to 2.4 million jobs will require partly high retraining in this transition by 2030 (Kuhlmann et al. 2021). Figure 9 describes the different amount of reskilling needed: While 1,6 million persons just need reskilling within the same job profile, 610.000 persons have to slightly change their job profiles, while just 225.000 persons need radical retraining into completely different job profiles and industries (Ibid). Just Transition has to find policies to foster a smooth skill transformation.

Figure 9: Reskilling needs in the European automotive industry



Source: Kuhlmann et al. 2021

3. The third one is the **timing gap** (TU 10). This gap opens up when there is time between the layoffs of jobs in old industries and the creation of jobs in new industries. Just transition policies have to create solutions for the meantime, when the old is gone, but the new has not still been created.

4. The last one is the **attractiveness gap** (CS 11, TU 9). It arises when the new jobs are less attractive than the old ones. This is especially relevant for the automotive industry and its suppliers, because historically, they have benefitted from above-average wages and working conditions. These have been achieved, among other things,

through effective trade union organising. In the face of the transition, there is a fear that these conditions will deteriorate leading to less attractive jobs in the future (CS 11, TU 9). This fear has substance: Many of the jobs created in the transition of the automotive industry nowadays have lower pay levels, might not be unionised and therefore are less attractive than the existing jobs in the automotive industry. So Just Transition policies have to find a way how to create attractive job opportunities in new fields.

Taken together these gaps highlight that even though, at the macroeconomic level, there might be a net-positive impact in terms of employment creation, it doesn't mean that at company level, or at the regional level, that challenges do not exist. As we have seen in the last chapter, the automotive industry and its employment have a lot of great development opportunities in the future, that might even lead to a positive development over time. Nonetheless, the above mentioned challenges are real and can all be found in the automotive industry. Just Transition policies therefore need to find solutions to them.

3.2 Industrial policy

When it comes to the transformation of an industry, industrial policy plays a key role. It creates the planning ground on which new job prospects emerge and is thus a crucial pillar for a Just Transition. This is reflected in the interviews in which industrial policy has always played an important role and many proposals concerning industrial policies were brought forward. The table below summarizes the main industrial policies that stakeholders suggested in the interviews. This chapter further elaborates on these industrial policy proposals, advancing arguments from different perspectives in favour of it and concluding the policy design.

Table 1: Industrial policies for a Just Transition of the European automotive industry

Policy	Policy level	Summary
Green industrial policy agenda for the transport industry	Europe	Create an EU-level industrial policy agenda to maintain and create jobs that align with the green future for the automotive industry as part of the transport industry as a whole.
Financial incentives for a zero-emission transport industry	National	Cut misdirected financial and fossil fuel subsidies in the automobile and transport sector and redirect them towards the promotion of climate-neutral transport alternatives.
Modal shift policies	National Regional	Push for a decrease in car transportation through developing and investing in public transport and urban transport, connected sharing options and railways.
Conversion strategies for the automotive industry	Company	Develop strategies how to redirect the automotive industry resources into sustainable sectors such as vehicles for public transportation.
Phase-out date for the ICE	Europe	Set a legally binding phase-out date for the ICE phase-out by the EU.

R&D Climate-neutral electrification and digitalisation	Business	Increase R&D efforts in how electrification, battery manufacturing, recycling and software and IT development can contribute to a climate-neutral transport system.
Local battery production and recycling	Business Regional	Localise battery production and recycling close to the manufacturing sites with high environmental standards and sufficient provision with clean energy resources.
Supply chain standards for raw materials	Europe National	Develop binding mining and supply standards for raw material use, setting incentives for manufacturers to comply with them and to produce smaller cars.
Battery charging infrastructure	Business Regional	Expand regional battery charging infrastructure to facilitate access also for the rural population and ease the diffusion of BEVs by setting a binding target on the increase of charging stations.
Renewable energy	Europe National Regional	Promote the transformation towards renewable energies at the same pace as the energy is demanded for the transport production and usage.

Source: Own compilation based on interview material

There is the need for a European green transport industry agenda, taking the automotive industry as part of the broader transport industry.

Currently, an important result of the European Green Deal is the significant focus on the establishment of a green industrial policy. It entails a correction of market failures linked to climate change with the goal of fostering a 'green' industry (Tagliapietra and Veugelers 2020). In an attempt to achieve a comprehensive agenda towards this goal, the European Commission updated their industrial policy in favour of an ecological and digital transformation in March 2020 (EU Commission 2021d). A key problem of the current European green industrial policy agenda is that it does not propose a straightforward way for the transformation of the European automotive industry and the infrastructure needed around it. Therefore, a more proactive strategy for managing the transition in the industry, rather than sticking to established technology for as long as possible, would be necessary (CS 5, 6). This will be crucial to remain competitive in changing global markets, protect jobs and create new jobs in the long run. An important policy to achieve this aim would be the creation of an encompassing industrial policy agenda for the climate-neutral transformation of the European automotive industry (AR 1, CS 4, 5, TU 8,9,10). Such an industrial policy agenda would need to set the pathways towards a general vision for the European automotive industry in the future. This idea could even be expanded towards the integration of the industrial policy agenda for cars within an agenda for the whole transport industry (EP 14).

Taking these statements together, and the remaining environmental changes of BEVs (Ch. 2.3) and modal shift developments, (Ch. 2.4) it makes sense to take an integrated stance. This can be done by **regarding the automotive industry as just a part of the bigger transport system** and developing a **European green industrial policy agenda for the transport industry**, while obviously considering the automotive industry as a crucial part of it. The aim

of such an agenda must be to project the industrial policies necessary for an efficient climate-neutral transport system – an industry capable of providing Europe with climate-neutral transport that diminishes the remaining ecological impacts as mentioned in Ch. 2.3 and does not relocate the environmental damages towards production sites outside of Europe. This agenda would be the counterpart of the Smart and Sustainable Mobility Strategy already in place, but instead of focusing just on transport systems it would develop the industrial side that is needed as well. It could also serve as a basis for regional transition plans (see Ch. 3.2).

Redirect misguided financial incentives towards green alternatives

Civil society and academic representatives agreed that the European automotive industry is receiving many subsidies and that they are still supporting non-sustainable structures (AR 1, CS 11). A concrete example is the German support of company cars*: "What immediately comes to mind is the company car privilege. Billions are poured into it every year in subsidies. That could be stopped"* (CS 11). Transport & Environment estimates that tax deductions and write-offs for company cars in the eight largest markets alone cost European taxpayers €32 billion every year (Lopez 2020). These subsidies should be cut and be redirected towards green alternatives (AR 1). Although the OEMs are already working on their product mix, monetary incentives would speed up the technological advances needed to 'clean up' the sector (Ibid).

This means for a green industrial policy agenda that it needs to **cut misguided subsidies and set the right financial incentives** so that it becomes favourable for OEMs and suppliers to enter the desired transition path.

Combine modal shift policies with the industrial policy agenda and advance conversion strategies

If the industrial policy agenda encompasses the whole transport sector, modal shifts too must be considered. As we have seen above (see Ch. 2.4) a lot of modal shift policies are already being implemented. Further policy proposals include: free public transport, more investments in public transport (especially in rural areas), increases in shared mobility, smaller cars (CS 4), and efficient urban planning for a modal shift that favours integrated mobility concepts (EP 14).

Consequently, another part of the industrial policy agenda would be the **strengthening of modal shift policies together with its necessary industrial changes**. This could help to improve the job situations in other mobility sectors, possibly enabling a shift from car workers into other transport sectors.

This shift could even occur within the old car industry, if **OEMs and suppliers explore their conversion strategies** (AR 1, CS 11). This would entail the analysis of these industries regarding the skill sets of their employees as well as the respective technologies and production sites, with the goal of finding alternative production options. As a civil society representative put it: *"The question is 'Why don't we build vehicles for rail and public transport instead of individual cars? According to IG Metall employees, this is easily possible"* (CS 11). To support these aims, conversion funds could be shifted towards converting the automotive industry's production capacities into the manufacturing of parts and vehicles for public transport. This could be done because these industries are already experiencing great shortages that could increase in the modal shift (AR 1). For example, the 'Deutsche Bahn', the German train company, sometimes has to wait years for an ordered wagon simply due to a lack of production capacities (CS11). These missing capacities could possibly be compensated by an opening of production opportunities within the automotive industry (Ibid).

These policies could stabilize regional production systems through a diversification of transport, and thus address the regional gap.

Set a legally binding exit date for ICEs

In terms of this general agenda, it is not only the policy instrument that matters but also the timing and interaction between them would be crucial. Considering the elimination of the timing gap, a **legally binding exit date for ICEs** would be an important part of such an industrial policy agenda (CS 4, 6). It would create planning security within the automotive industry and help OEMs and suppliers to efficiently plan and prepare for the expansion of BEVs (CS 6). As we have seen above (Ch. 2.2) the exact phase-out out date remains a big point of discussion. But it also holds true that a phase-out date for newly registered cars should be done at the latest by 2035, if the goal of a decarbonisation of the car sector by 2050 is to be accomplished, estimating a more conservative lifetime of an engine of about 15 years (CS 4).

Push R&D for green electrification and digitalisation

The fundamental shift towards climate-neutral transport systems needs to go along with deep technological research. The industrial policy agenda should consider this as a central element. It would need to push **research and development** (R&D) in the two sectors that can be identified to be decisive for the competitive position of the industry in the future: **electrification and digitalisation** (CS 5, SR 12, EP 14).

Both fields would benefit greatly from a concentrated effort on research and development in key technologies, such as battery manufacturing, recycling, as well as information and communication technology. The general aim of the research should be a climate-neutral transport system focusing on the contribution of respective technologies to climate neutrality while not sticking just to research for the automotive industry, but to the transport industry as a whole.

Legal regulations for raw material use and battery recycling

Concerning battery manufacturing, several policy developments have been mentioned in Chapter 2.2 that will attract increasing battery manufacturing to Europe. Still, gaps can be identified which refer to two main categories: **the sustainability of the raw materials used, and the recycling of the batteries**.

Currently, the EU is heavily dependent on raw materials from three countries: China, Chile and South Africa. The recent establishment of the European Raw Materials Alliance aims to diversify the source of supply of these raw materials, and highlights the importance of recycling versus extraction (DW 2021b). In 2020, the EU further proposed a new Sustainable Batteries Regulation, which would set new sustainability standards for the production and recycling of batteries (Lexology 2021). Within this context, interviewees mentioned the development of integrated supply chain standards for raw materials through investments in securing Europe's autonomy for raw materials, while taking into account their socio-environmental sustainability (CS 11, EP 14). This is already beginning to be approached through the launch of the annual 'Roundtable on the Environmentally and Socially Sustainable Raw Materials Mining' (EU Commission 2021j). What is missing nonetheless are **incentives and legally binding regulations**, to push

industry towards **more compliance in the sustainable use of raw materials** (CS 11). These could include efficiency rules for the use of raw materials; setting standards of battery efficiency in relation to the use of raw materials to avoid waste. This would also set incentives for the production of smaller cars. Both, typical battery capacity and the driving ranges of BEVs increase across car segments from 'mini-cars' to 'luxury cars'. But while the battery size in the

luxury segment is around 3.4 times greater than in mini-cars, the driving range is only about 2.3 times greater due to the doubling of vehicle weight (EEA 2018). This means that the larger extension of the driving range diminishes with the size. Smaller BEVs are thus generally more energy efficient. Chapter 2.1 shows, that under current emission targets, bigger cars are rewarded with lower limits – a policy failure regarding the aim of climate neutrality. The regulations could fix this.

Until today, there exists also a gap concerning battery recycling. It is utterly necessary to recycle batteries in Europe in the future to achieve climate neutrality: *"On the one hand, there are the jobs that will be created, of course, but also the resources that are contained in the battery (…). Therefore, building up recycling capacities is certainly crucial."* (CS 6). What is missing are **binding regulations and further incentives for local battery recycling** (CS 11, 5, EP 14). The European Green Deal aims for a circular economy by 2050, which may increase pressure to this end (EU Commission 2021b). To realise local recycling, it must be ensured that end-of-life vehicles are not exported to countries outside of Europe, as is happening now (CS 5). For the efficient use of batteries, another idea proposed is that before recycling them, an important first step would be to search for a 'second use', such as in urban energy storage systems, where their reduced charging capacity is still suitable (CS 4).

Roll out green electricity and charging stations all over Europe

An all-encompassing industrial policy agenda would also need to entail the accompanying measures to facilitate the electrification of the automotive industry (CS 10). This concerns, for example, **green electricity** and **charging stations** as necessary infrastructure for the roll-out of BEVs:

"If you look at the 55 per cent objective for (…) the scenarios that would be compatible with such an objective they entail a market share for EVs between 60 and 88 percent (…). We still have to calculate what that means in terms of renewable energy production, in terms of the electricity grid, in terms of charging stations? (...) This is a little bit of what we are missing at this stage at the industrial policy level" (CS 10).

Regarding the latter, European institutions should work towards a **harmonized European charging infrastructure for BEVs** (SR 13, EP 14). This will increase consumers' trust in the reliability, range and thus viability of BEVs (SR 13). The European Clean Energy Package (a European policy package on energy transition) will already require newly built buildings to include home charging infrastructure, and will reward consumers for flexibility in charging demand through better rates for non-peak hours (Transport & Environment 2020c). Nonetheless, a study by Transport & Environment calculates the growth of charging stations at 1.2 million by 2025 under the current policies while 1.3 million stations are needed for the estimated growth of BEVs that will meet the Green Deal's carbon requirements. EU member states should therefore set a **binding target number of stations** towards this joint goal (Transport & Environment 2020c).

As we have seen in chapter 2.3 **green electricity** is a major factor for the sustainable transition towards electrification.

"The success of the energy transition in transport stands and falls with the success of the energy transition in the electricity sector. More electricity from wind and solar energy is a prerequisite for successful sector coupling and for the interaction between the energy and transport sectors to lead to even more significant greenhouse gas savings overall" (CS 5).

In Europe, the share of clean energy used for transport purposes has risen since 2012 from 4,0% to 8,4% of total energy consumption. However, the global IEA electricity market report from July 2021 states that global electricity demand is currently rising at a higher pace than renewable energy supplies (IEA 2021). Meanwhile, the European Commission has revised the Renewable Energy Directive of the EU, now proposing a new target of 38-40% until 2030, compared to the previous target of 32%. Concerning the car and transport industry, these renewable energy generation sites should be close to high energy-intensive vehicle production and usage. The need for green electricity for a climate-neutral production and usage of cars shows the interconnectedness of sectors in this transition. Consequently, the industrial policy agenda should take this interconnectedness into account.

Summarizing this chapter, the crucial industrial policy for a Just Transition would be the development of a **European industrial policy agenda for the transport industry which takes the automotive industry as a part of the broader transport industry.** Thereby it is important to take the broader picture seeing the **automotive industry as part of the transport industry** and its ambitions to become climate neutral. How could this agenda tackle the above mentioned challenges of a Just Transition, coping with the geographical, the skill, the time, and the attractiveness gap? The biggest problem accompanying the gaps is missing anticipation of change, because it affords no time to prepare for change. By anticipating the developments within the car and transport industry an industrial policy agenda would allow for preparation, indirectly tackling all gaps, in the best case, by preventing their emergence.

The industrial policy agenda is a tool for anticipation. The next step is to concretise these policies on a local level, to adapt them to the different circumstances in different regions. That is the task of regional development.

3.3 Regional development

In the end, the success of transformation depends on its regional implementation. The transformation of the automotive industry will have huge varying impacts on different regions (CS 5, 7). Some will have great job losses that can be replaced by other green jobs, others will need the establishment of new industries to be able to compensate layoffs. Some will simply be affected by rising unemployment rates. Additionally, it is not clear that the roll-out of industrial branches of electromobility will take place exactly in these regions that have great job losses. Most battery production sites are planned in Western European countries (Transport & Environment 2021a). Notably, Germany dominates the list nationally with 12 planned production sites (En-former 2021). In comparison, CEE countries together account for 6 production sites (Transport & Environment 2021a). This highlights that the gigafactories will be unevenly distributed in the EU, with the risk that Central and Eastern European regions are being left behind. That is where the geographical gap comes up and Just Transition policies concerning regional development need to be implemented.

This chapter first elaborates on the European cohesion policies, as being the European instrument to address regional differences and then elaborates on the policy proposals for cohesion policy and regional development brought forward by the interviewed stakeholders.

Currently, the automotive industry is not covered by European Just Transition policies

As mentioned above, uneven developments create the need for targeted regional policies. To this end, the EU Cohesion Policy is an existent mechanism set in place to ensure the

elimination of imbalances between countries throughout the green and digital transition. It aims at *"reducing disparities between the various regions and the backwardness of the least-favoured regions*" (Single European Act 1986) and creating "*economic, social and territorial cohesion*" (Lisbon Treaty). As part of the cohesion policy the Just Transition fund for energy-intensive industries was established in early 2020 (EU Commission 2021h). It aims at supporting regions *"that are the most carbon-intensive or with the most people working in fossil fuels. Member States can get access by preparing territorial Just Transition plans that cover the period up to 2030, identifying the territories that should get the most support. The plans should also set out ways to best address social, economic and environmental challenges"* (EU Commission 2020a). The Just Transition Mechanism consists of three instruments, which are supposed to mobilise public and private funding of €150 billion in total (EU Commission 2020d). The instruments will be facilitated through the Just Transition Platform brought forward by the Commission. This Platform is designed as an access point for affected regions to receive support and guidance in outlining plans for a Just Transition. Countries are required to submit a territorial Just Transition plan to get access to the funding (Ibid). Importantly, however, carbon intensity in production is the decisive factor for eligibility for funding (Ibid), meaning that the Just Transition Mechanism currently only applies to the coal industry and other emission-intensive industries. As in the automotive industry, the biggest part of the emissions are emitted not during the production, but during the process of vehicle usage (see Ch. 2.3), which is regionally dispersed compared to the production. The regions dependent on the automotive industry are not covered by the European Just Transition Mechanism.

Consequently, there is a policy gap concerning cohesion policies for a smooth transition of the car and transport industry. The table below summarizes the central policies which were brought forward in the interviews.

Table 2: Regional development policies for a Just Transition of the European automotive industry

Policy	Policy level	Summary
European Just transition funding schemes for the automotive industry	Europe	Develop targeted funding schemes for the Just Transition of the automotive industry towards climate neutrality.
Regional just transition plans for the automotive industry	Regional	Develop region-specific plans for the Just Transition of the transformation of the automotive industry, its skills and workers, integrating them into the broader regional demands for workers in the future.
Localisation and reorganisation of economic systems	National	Reconfigure food supply chains, regionalise production to shorten transport distances and reduce the need for mobility while creating jobs in the regions
Increasing attractiveness of regions to locate and retain car production	Regional	Invest in infrastructure to enable modern production sites and prevent competition with low wage destinations abroad.

Source: Own compilation based on interview material

It is unclear if wealthy automotive regions should get funding or if companies should be held responsible to finance the transition

The policy gap mentioned above for the automotive regions could be solved by the implementation of **European funding schemes for regional Just Transitions of the automotive industry** (CS 4, TU 7, 8, 9, 10). The necessity of this scheme was a central and very controversially discussed topic in all interviews: Mostly trade unions, but also supplier representatives and one civil society representative opted for it. They emphasised the importance of a fund for the automotive industry comparing the total number of workers in the coal-related industry in Europe (around 500,000) to the almost 14 million workers in the automotive sector, highlighting the discrepancies in the number of jobs that could possibly be at stake (TU 10). In the current scheme, the just transition fund was set up to be equipped with €40 million but was cut down to €17.5 million. A possible policy would be an inclusion of the automotive industry and an increase to 40, or even 60 or 80 million euros, as *"the current Just Transition Fund simply lacks money"* (TU 9). On the other hand, European policymakers, most civil society representatives, and the academic representative were rather reluctant regarding such a Fund, bringing forward several arguments:

1. **No phase-out for the automotive industry:** Different from the coal industry, which will be phased out completely, the automotive industry will be transformed, likely from ICE vehicles to BEVs, but there will not be an industry phase-out. It is yet unclear to which extent this will decrease the number of jobs in different regions and the automotive industry. There are even forecasts which speak of positive employment effects (see Ch. 2.5), making a Just Transition Fund potentially unnecessary.
2. **Unclear origins of challenges:** The situation of the automotive industry is highly complex due to its imminent multiple transitions and challenges. These challenges may either emerge from stricter climate policies, or simply from a lack of competitiveness of the industry. For the latter case, a Just Transition Fund may not be the proper instrument (EP 3). If the problem is just a competitive one, it shields the danger of keeping alive an unsuccessful industry.
3. **Existent funding mechanisms**: Existent EU programs other than the Just Transition Mechanism were mentioned that the automotive industry could approach for support in a Just Transition (EP 3, TU 10). These include:
    a) The **Recovery and Resilience Facility (RRF),** which consists of large-scale financial support to public investments and areas such as green and digital projects (EU Commission 2020c),
    b) The **Pact for Skills**, which serves as a networking, knowledge, and resource hub for private and public organisations to *"upskill and reskill people in Europe" to "support (...) the green and digital transitions and of the EU Industrial and SME Strategies."* Here, the automotive industry already is one of three key industries, with the goal of upskilling 5% of the workforce each year (EU Commission 2021g).
    c) The **European Social Fund** is *"Europe's main instrument for supporting jobs, helping people get better jobs and ensuring fairer job opportunities for all EU citizens*" (EU Commission 2021k). It provides funding for national and local projects with a long-term perspective, focusing on skill development and employment access in cooperation with private and public organisations.
    d) The **European Globalisation Adjustment Fund for Displaced Workers** (EGF) focuses on workers that were laid off on a larger scale due to restructuring. It supports limited-time projects "*designed to help workers made*

redundant find another job or set up their own businesses" (EU Commission 2021c)

4. **Car regions are wealthy regions:** Cohesion policy focuses on the support of regions that are economically left behind. However, the European automotive industry is typically located in economically flourishing regions with high levels of income (CS 11, TU 9). It could thus be argued that these do not need assistance from cohesion policy. One trade unionist saw there a blank space that needs to be filled:

   "I think we have a structural problem in the funding environment in Europe, which is that the funding is geared towards promoting structurally weak areas. Now Baden-Württemberg is everything but a structurally weak area. (…) You can actually go like this through all the member states of the European Union. Where there is a automotive industry, the region is actually structurally strong, economically strong." (TU 9).

   It therefore remains unclear whether economically well-off regions should receive access to public funding, or if they and their companies should be held responsible for funding the transition themselves.

5. **Other industries have a bigger need for funding of a Just Transition:** One civil society representative suggested that "*one must always be careful not to provide (money) only where the loudest shouting is. (...) Transformation is also taking place in other sectors. Every euro that is allocated to the automotive industry is missing elsewhere." (CS 6).* The economic importance and strong lobby of the automotive sector should thus not distract from the fact that there may be sectors that are more in need of support for an ecological transition.

The question arising in these two last paragraphs is: 'Who has to pay for the Just Transition of the automotive industry?' Several interviewees (notably from the civil society and academia) agreed that first and foremost the automotive industry itself has to come up financing its own transition (AR 1, CS 11), at least the retraining part (CS 4). *"I don't see that the automotive industry should get this money" (AR 1).* So public funding of regional transformation versus private funding of rich companies remains a crucial point of discussion when it comes to the Just transition automotive sector.

It needs regional Just Transition Plans to develop strategies for specific regional challenges

It seems clear that if the European automotive industry really needs financial support, it still must demonstrate its need. As a first step, **regional Just Transition plans for the automotive industry** (EP 3, CS 5, 6) would be necessary for this. There is a lack of concrete transformation strategies and plans for car-dependent regions (TU 7, 10, EP 3).

"So if, so to speak, the spark plugs in a small town in the Palatinate are no longer needed at some point, then the largest taxpayer breaks away. The largest employer. And then what? Then, of course, they still have the problem of social acceptance and social dislocation. (…) You just have to look at it geographically again in more detail, what it means then just for the individual regions" (CS 6).

This quote demonstrates that European industrial policy needs to be anchored in regional development, because regional preconditions vary a lot (Tagliapietra and Veugelers 2020). In past transitions, a lot of tools were developed to adequately cope with them, but what is

needed is the design of regional strategies which anticipate these changes and enable a targeted application of policies (EP 3). Additionally, these plans need to develop concepts on how to implement a social-ecological transformation within each region and how to spend the available money (TU 9), while acknowledging and respecting local contexts and cultures (UNFCCC 2020).

Concludingly this means that the fundamental tool to evaluate the necessity of regions for a Just Transition are plans how to attract green industries, cope with displaced workers, the mismatch of skills that will possibly come up during the transition.

Increase the attractiveness of regions by making local economies and infrastructures more sustainable

Further concrete green regional policies were suggested by the interviewees to **increase the attractiveness of regions** by investments localization of economic systems and in attractive local infrastructures.

A policy proposal to increase the attractiveness of regions would be to diversify their economic structures by **localizing economic systems** (AR 1). This means that regional development should aim at diversifying the economy in such a way, that what can be produced locally is being produced there. That reduces the dependence of regions on specific industries, reduces transport emissions and brings more diverse working opportunities (Ibid).

Additionally, the **strengthening of key infrastructures in rural areas** through the creation of hospitals, schools and cultural spaces to raise its attractiveness was proposed while reducing urbanization trends and the associated commute (AR 1). To attract and hold industries in the future, it will be more than necessary to have a "*huge modernization lift*" of regions (TU 8), meaning the investment in modern infrastructure and production sites.

Summarizing the chapter, a big open question is if the automotive industry needs public funding to support its regional Just Transition. If that is the case, regional transition plans would need to elaborate on this necessity, showing their way to transform the automotive industry and its workers within a climate-neutral transport system. Furthermore, regions need to think about structural policies to reduce their dependence on the automotive industry and raise its attractiveness through local economic systems and investment in key infrastructures. By searching solutions for specific regions, these policies mainly tackle the geographical gap. The regional Just Transition plans indirectly also tackle the skill and the time gap, targeting these challenges at their origin.

Nonetheless, the fundamental challenge of skill mismatch and the need for skill transformation transcend regional boundaries. Therefore, to accurately address them it is necessary to look at them separately.

3.4 Active labour market policies and social protection schemes

As explained in Chapter 2.5 the effects of the automotive industry's transformation on employment are diverse, but effectively unclear. What is for sure however is that job profiles will change profoundly, which will require a broad reskilling of the workforce. **Reskilling will therefore be a fundamental, if not the most important challenge during the transition of the automotive industry** (EP 2, 3, 14, CS 4, 5, 6, 11, SR 12, 13). This needs active labour market policies and social protection schemes for displaced workers. *"Let´s train former coal miners to be computer programmers - it doesn't work like that. You need unique pathways,*

(and) targeted training, you need anticipation of potential needs" (EP 3). The quote shows, that the skill gap is sometimes just too big, so active labour market policies, reskilling strategies and social protection schemes have to be developed for the following two groups: 1) people who can be reskilled and 2) people who cannot be reskilled, because of their age, handicaps or simply because the skill gap is too large.

This chapter will elaborate on policies for both groups. The table below summarizes the main labour market policies and social protection schemes which are elaborated in the following.

Table 3: Active Labour market policies and social protection schemes for a Just Transition of the European automotive industry

Policy	Policy level	Summary
Company employment and skill plan	Company	Develop company-based employment and skill plans that disclose information on the number of workers needed in the future, jobs at risk and reskilling ambitions.
Company reskilling programs	Company	Set up company retraining programs for employees and equipping them with required skills for future manufacturing.
Transparency of funding opportunities for reskilling	Europe National	Provide the companies with sufficient knowledge about existing funding structures, to raise the effectiveness of these measures.
Work time reduction	Company	Reduce the work time for employees to create spare time for reskilling programs.
Early Retirement	Company	Offering workers at risk of being fired the opportunity to go into early retirement, making this option attractive through fiscal support
Reskilling programs into other industries	European National Regional Company	Develop programs designed to retrain workers whose skills are no longer required into other industries where they have future prospects.

Source: Own compilation based on interview material

Companies must anticipate changes through a skill plan and develop appropriate reskilling programs

As mentioned before, anticipation is a crucial aspect of a successful Just Transition. Therefore, industry actors must plan and communicate which changes in employment and skill requirements they expect in the coming years. Consequently, regional Just Transition plans should be complemented by **company-specific employment and skill plans**. In these plans, it is crucial to elaborate on the differences between current and required skill sets and how to bridge them (TU 10). Thus, the industry needs to set clear pathways to apply targeted training (EP 3, CS 6). These plans could be fundamental to develop further strategies either for reskilling or for an effective socially acceptable layoff. For their development a cooperation with academics has shown to be successful, as the case of Volkswagen shows, who authorized the Fraunhofer institute to conduct such a study (Herrmann et al. 2020). Besides inter-industrial cooperation plays an important role here, to collectively determine which skills that are not yet sufficiently available are particularly needed in the transformation process (Ibid).

OEMs have developed programs to reskill their workers and cooperate in the reskilling with smaller companies to get funding

For people who can be reskilled, investments need to be put into providing vocational training and ensuring the professional mobility of the employees (EP 3, CS 6). The **development of appropriate reskilling programs** is a central task of big players within the automotive industry as OEMs and big suppliers themselves (AR 1). According to the formerly mentioned study by the Fraunhofer institute companies can avoid massive job losses by doing that (Herrmann et al. 2020). An already existing example is the training programme `Faculty 73´, which requalifies employees of Volkswagen to prepare them for the digital transformation (VW 2021). Nonetheless, there is still a huge need to expand company-based requalification programs. In these programs an important element is to **strengthen the inter-company cooperation** in terms of qualification, integrating small and medium enterprises into the training programs of the OEMs (Herrmann et al. 2020).

The enormous task of reskilling will likely cost a lot of money, for which the source of funding is a matter of debate. Besides the necessary proper investments of manufacturers and suppliers there are already a lot of national and regional funding schemes in place. A challenge is that funding structures are quite confusing (SR 13). It was claimed that there is a lack of transparency concerning the existing funding opportunities for reskilling calling for **better and more transparent funding opportunities for training measures** (Ibid). Funding structures should take into account that such measures potentially need to be scaled to several thousand employees in large corporations (Ibid). Nearly all of the national measures in Germany were aimed at small and medium-sized enterprises, opening a lack of support for large corporations (Ibid). Other stakeholders argued, that while the automotive industry continues to make high profits the funds for reskilling have – to a significant share - to come from profits within the industry (AR 1). It remains unclear whether larger corporations should get access to public funding programs. A way would be if these programs do not only benefit the employees of the corporations but establish collaborations with small and medium enterprises as mentioned above.

Companies must implement working time reduction schemes to allow workers to reskill

In addition to funding, another major factor is the provision of the time needed to reskill to the workforce. A supplier representative pointed to the difficulties of integrating this training into day-to-day operations:

"That's a very, very big balancing act, (...) and I think that's what you don't see in many cases. These people are not simply taken out and the business continues. If you now requalify 500 people, there are 500 people missing who do not generate a business contribution (…). Somehow, a little more breathing space would be very helpful" (SR 13).

This highlights the importance of time for the process of reskilling and its challenges for the industry. A measure to provide the time needed would be a **reduction of working hours** with full wage compensation (AR 1). This provides employees with more time to do proper reskilling, by reducing their working amount. But more than that, there would be evidence that working time reductions could lead to an increase in the individual wellbeing and increase the quality of life of employees (1). Additionally, this policy is widely regarded as an important instrument to advance a green economy (Pullinger 2014). Research even indicates that a working time reduction of 1 hour could contribute to a reduction of carbon emissions in

between 0.7 or 0.8% (Nässén and Larsson 2015). Consequently, a 30-hours working week could make a significant contribution to reaching climate goals (Ibid).

Laid off workers need early retirement schemes and cross-sectional reskilling programs

Besides the employees who get reskilling within their companies, there will always be individuals that cannot be reskilled within the sector. The reduction of working hours is not only an appropriate instrument to provide employees with time for their reskilling – it can even be a good one when it comes to people who cannot be reskilled. This could open the opportunity for people to continue to work in their areas for a longer time at a shrinking intensity. If these affected workers are already close to their retirement, also **early retirement schemes** can be an appropriate answer to the loss of their workforce requirements (CS 4,11). Throughout the transformation, the industry and policy actors should prioritize the **elaboration of cross-sectoral reskilling programs** for workers who have no further perspective within the automotive industry and redirect them into other, potentially newly developing sectors, to enable a smooth transition for them. A big German automotive supplier already has implemented reskilling programs for employees to be retrained to become care workers (SR 13). However, such programs are an exemption and it require a lot of flexibility of the workers that is not always easy to attain. Working in the automotive industry often creates a sense of pride for many employees, and forcing them out of the industry may lead to frustrations (EP 14). Therefore, the priority should be to keep them in the sector even if the nature of the job changes (Ibid).

As a conclusion to this chapter, it can be stated that the key issue of labour market policies for a Just Transition evolves around the question of a proper and forward-looking reskilling of the workforce. It is necessary to develop company reskilling programs to reskill workers within the industry. To receive funding, OEMs need to cooperate with smaller ones in the reskilling. For workers that are laid off social protection schemes and cross-sectoral reskilling will be necessary. Work time reduction can help both workers to create time for the reskilling process. Reskilling policies eventually close the skill gap, but including the social protection schemes, like the early retirement scheme they can further address the geographical and the time gap, if accurately planned in advance.

Labour market policies and social protection schemes are very delicate as they decide about biographies, personal perspectives and living standards not only for households, but entire regions. In order not to create resentments, it is necessary to carry affected people along in the development and introduction of concrete policy measures. For this, participation mechanisms will be required, which will be the topic of the last chapter.

3.5 Stakeholder participation and social dialogue

If in the development of transition plans, workers are seen as passive recipients of change, *"there is a colossal danger of a big backlash against climate change"* (TU 10). This problem does not only account for workers, but all stakeholders involved in a transformation process (CS 6). That is why all persons who are directly affected by changes due to policy decisions must be able to have a stake within the planning and execution of the change. If not, the risk of rejection, resistance and counter movements rises because people do not feel considered. Consequently, social participation is a fundamental and often overlooked topic when shaping the transition. The **necessity of strong participation schemes** was the second point after the need for reskilling where nearly all interviewees agreed that it is a

crucial element during a Just Transition (AR 1, EP 3, 14, CS 4, 5, 6, TU 7, 8, 9, 10, SR 12). That is a special challenge in a field like the automotive industry, because it is a sector where big power concentrations and thus imbalances of discourse dynamics exist from the beginning. While the industry always has a big stake in the discussion, workers, civil society but even policymakers fall short sometimes.

Different participation formats were suggested for a Just Transition of the automotive industry. They are summarized in the table below and further elaborated in this chapter.

Table 4: Stakeholder participation schemes for a Just Transition of the European automotive industry

Policy	Policy level	Summary
Social dialogue and participation	Europe, National, Regional, Companies, Trade union, Civil society	Create formats where stakeholders can understand each other in a trustful environment and an active role when designing the anticipation plans for the future of the automotive industry on every level.
Regional Social Dialogues	Regional	Create regional structures for a social dialogue around the transition to make sure that affected persons are heard.
Integrate social partners into EU decision-making	Europe	Integrating the social partners that operate on a national level into the process could support the implementation of the Just Transition strategy
Transformation councils	Trade unions	Establish transformation councils within trade unions including different regional stakeholders that support the shape of company transformation strategies and conversion processes.
Collective bargaining in other industries	Trade unions	Increase the attractiveness of other jobs in the economy to which workers in the automotive industry could switch to by strengthening the collective bargaining in other sectors like the care sector.
Unionization in new sectors	Trade unions	Strengthen trade union representation in emerging new ecological economic sectors.
Union cooperation for an ecological transformation	Trade unions	Establish and foster trade union cooperation between different industrial sectors and along the value chain to shape the ecological transformation in a just way for all workers of the global economy.

Source: Own compilation based on interview material

Social dialogue needs to take place at every level of transition planning

The task of **social dialogues** within a Just Transition is to counterbalance discourse imbalances aiming at a process where all stakeholders have a seat and a say at the table of the transition planning. A successful social dialogue comes in the form of formal mechanisms that allow knowledge sharing about what the current changes are and possibilities to address concerns from all stakeholders. The aim is to mutually understand needs, to find a common solution. *“One has an understanding for the needs of the other (...) that is our task, that spaces*

are created and that different actors talk to each other and get to know each other's needs" (CS 6). Social dialogue has to happen at several stages. All plans anticipating the transformation of the automotive industry, like the industrial policy plans, regional development plans, company transformation plans mentioned above, but also European plans for the future of the transport system are prone to more direct participation (TU 10). There are multiple different ways of participation that should always be in line with the needs of the participants. "*These formal mechanisms should build on and learn from existing local, regional and sectoral initiatives*" (ITUC 2017). The automotive industry can learn a lot from former participation processes of Just Transitions in other industries like the coal industry (TU 10). In this context trade union representatives mentioned that they had bad experiences with NGOs when discussing the coal phase-out in Germany, because NGOs apparently did not stick to their mutual agreement and denounced where they formerly agreed to, creating an atmosphere of mistrust (Ibid). This shows that in the process of integrating stakeholders with often opposing opinions it is highly relevant to create a level of trust and mutual understanding.

Two areas where stakeholders mentioned the urgency of having a participation very soon in the process were the regional level and the European level. A civil society expert claimed that much is being discussed at the European level and the level of the nation states, but nobody talks to the affected persons: "*But who talks to the employees in production, to the workers, to the representatives in the region? Who will ultimately talk to those actually affected?"* (6). The need for **social dialogues in the regions** was highlighted as being the only tool available to prevent frustrating the people affected. It is the only way to achieve that they do not remain passive victims of the transition where decisions are being taken over their heads, but become active designers of it.

Also on the EU level, a missing participatory structure was claimed by interviewees (trade union representative 9). How can a worker from a Czech supply firm have a stake in the EU decision-making processes? An interviewee suggested that it would be a good idea to introduce several **exchange bodies about the future of the automotive industry with stakeholders at the European level** following the role model of roundtables as they do it, for example in the Saarland (Germany) or the German car summit, where the Federal chancellor and the ministers come together to discuss with car manufacturers and suppliers and other political stakeholders as NGOs about ways to reach the climate targets (SR13).

With their participation trade unions must fight for good working conditions in the transition

Another important place where social dialogue must take place are trade unions. In the end, they are key stakeholders to stand up for the rights of workers.

It was mentioned above that conversion of the industry will be a possible pathway. To realise conversion in a good way it must start taking the workers' knowledge into account. The implementation of **transformation councils** would be a way to do this (AR 1) They are ***"****regional institutions in which workers, academics, politicians, environmental and welfare associations come together and think about what can be produced with the existing competencies, within the framework of the regional profile against the background of regional needs"* (AR 1). In the end, the expertise brought together in the transformation councils should be used to guide the transformation and conversion strategies of companies.

Another important area of union participation is when it comes to reskilling into other economic sectors within the transition. The challenge that then arises is that in most of the cases the wage level in other industries is much lower. In an effective transition, trade unions have to be aware of this and search for solutions to how people can maintain their standard of living in

other areas. *"It is simply also a matter of cooperating and improving working conditions in other areas like the care and health sectors, besides from just looking at the fact that one's own employees have good working conditions and company contracts"* (AR1). Therefore, a further task of a Just Transition would be to **improve working conditions in other sectors**. This happens through **participation and collective bargaining** in the respective sectors. This raises the challenge that, at the moment, a lot of sectors, for example in the renewable energy sector, are not covered by trade unions.

An important step necessary here would be to **strengthen unionization** in the new sectors, to enable them to fight for their rights. Another challenge are unionized sectors that still have to struggle with bad working conditions. For example, the care sector. It is one of the most important tasks and its weight is going to rise in the next few years. Nonetheless, it has quite low levels of pay. Stronger and targeted collective bargaining is necessary here to improve the attractiveness of working in this field. These activities require strong unions that mutually support each other instead of competing with each other.

In the best-case scenario, this would conclude with a serious **cooperation between different trade unions** so that they fight together for higher working standards. A civil society representative highlighted this opportunity taking reference to the German metalworkers' union and the services union. *"Why doesn't IG Metall, for example, join forces with Ver.di and say okay, a socio-ecological structural change would mean expanding the service sector, the care sector. And now we go out on the streets together and we are fighting for it together"* (CS 11). Regarded from a global justice point of view this cooperation needs to be expanded and include global unions along the whole value chain and to mutually support each other and fight for just social-ecological working conditions all over the world (AR 1). This could create an awareness of the social and ecological constellations at the different ends of the value chain (Ibid).

This chapter shows that there are quite different ways of participation and social dialogue that need to be implemented in the Just Transition. Every affected stakeholder should be integrated into the development of transition plans, but when it comes to working conditions in the transition trade unions play an especially key role. It becomes clear that there will be no Just Transition without stakeholder participation if you want to create a broad support of the change.

How do these participation policies tackle the challenges mentioned above? First and foremost, they can be an effective tool to anticipate changes, tackling indirectly all four gaps at the same time, by collecting differentiated knowledge. Furthermore, the union participation policies are crucial to address the attractiveness gap, as they have the potential to establish good working conditions well beyond the automotive industry, extending them to other industries and countries. This would be a great achievement not only for a European, but also for a global, Just Transition.

4 Conclusion

The European transport sector continues to have high carbon emissions. To reach the climate goals this must change radically in the coming years. With regards to the necessary transitions to be undertaken, the outlook for the future of the European automotive industry is highly uncertain. Although electrification seems to be a good alternative for future car transport, it seems necessary to prepare for even more fundamental transformations. The remaining environmental challenges of electrification and the transformation of transport within the modal shift, which is supported by digital technologies create the need to look at the car industry more holistically. Therefore, a fundamental insight of this report is that **the automotive industry should consider itself as a part of the more general modal shift of the transport industry towards climate neutrality**. The central question emerging from this perspective is not how the automotive industry can remain strong in the future, but how Europe can contribute to an efficient transport system within planetary boundaries, and skilled workers in such a way that they will not experience personal damages throughout the transformation process.

Although it is likely that the overall European car fleet will be declining in the future, due to the digitalisation and the modal shift, it is not clear if the overall job situation is going to deteriorate as well. On the contrary**,** some perspectives predict an increase in jobs – even more if one looks at the general job situation in the green industry. Nonetheless what is certain is that **blue-collar jobs will be supplemented more and more by white-collar jobs**. That means that the future working market in the car and transport industry will require different skill sets. Therefore, an overall positive change of the working market can also create difficult situations for some workers whose skill profile is not needed anymore in the future.

That means that although there will not be a total phase-out of the automotive industry and overall there are going to be enough jobs in the future, Just Transition policies still can be decisive for a socially stable transformation, due to a deep shift in the skill profile of workers. Therefore on a social level, a Just Transition needs to find solutions for **four challenges: 1) the geographical gap**, meaning regional different situations and challenges, **2) the skill gap**, meaning the gap between the skills required in the old industry versus the skills required in the new industry and **3) the time gap**, meaning time incongruencies between the different job situations and working biographies, and **4) the attractiveness gap,** providing job alternatives and closing the three gaps that are in danger of opening up during the transition itself.

To identify the gaps, on the level of industrial policy a European-wide industrial policy plan for the transformation of the transport industry could set a visionary framework not only for the future of the automotive industry, but green transport in general. Furthermore, regional development policies will be decisive. The regions where the automotive industry is very strong are generally not left-behind regions, but regions with a high living standard. It needs regional plans to confirm that and also confirm which kind of support will be needed in these regions to support the change of the industry, and skill structure, in this transition. This will be decisive to evaluate if political funding will be needed during this period. To be able to design and address proper active labour market policies and social protection schemes, companies have to develop their proper reskilling plans and anticipate how much of the workforce they will be able to reskill within the company. The rest is needed to be taken care of by other reskilling policies and social security mechanisms, like early retirement mechanisms. Throughout the design of this entire process, it is crucial to include the participation of the most affected stakeholders. This is key to creating social acceptance and understanding the different stakes involved. That concerns not just workers, but also the local population as well as environmentalists. But

workers nonetheless play a crucial role, as they have the power to influence working conditions within unions.

The findings of this report are heavily based on diverse (and partly contradictory) expert opinions. The biggest points of disagreement were the new driving technologies and the necessity of a Just Transition fund. Concerning the first, electrification was not questioned as such, but rather its pace. While more environmentally oriented stakeholders opted for the quickest possible phase-out, worker-oriented stakeholders said that to make the transition smooth they need more time – opting for a date well beyond 2035. Another point of discussion were eFuels. While suppliers tended more to argue for technological openness, civil society and European policymakers were strictly against it – referring to its lack of efficiency.

The two points where all stakeholders agreed were the importance of a proper reskilling for a socially successful Just Transition and the need for strong stakeholder participation schemes, to create acceptance for the transition.

This report reflects the importance of bringing together these different stakeholder views. While conducting the interviews it was interesting to see how different groups have more differentiated views about the challenges of the topic they are most concerned about. While civil society experts cared a lot about effective ways for real emission reduction and had expertise on what is needed to reach it, they often were not utterly aware of the four gaps that a Just Transition of the automotive industry needs to close on its way towards becoming a part of a climate-neutral transport system. Only taking these standpoints together, it is possible to see the whole picture of the complex process and needs of a Just Transition. Thanks to the sharing of the knowledge of the different stakeholders who contributed here, this report can contribute to the effort of combining different stakeholder views and create suggestions for the complex, intertangled pathway a Just Transition of the automotive industry must take.

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6 Methodology

The theory-generating expert interview represents the methodological basis of the interview series conducted here (Bogner and Menz 2002). It serves the “analytical reconstruction of the subjective dimension of expert knowledge” (Ibid). Expert knowledge is thus not only characterised by specific technical or special knowledge, but is extended by the character of practical or action knowledge. In contrast to other forms of expert knowledge, the theory-generating expert interview is thus primarily concerned with viewing experts as persons who, due to special competencies, have a certain social status and can make action orientations or definitions assertive.

To identify the interviewees, first, a stakeholder mapping was carried out to get an overview of the important actors in the field of Just Transition in the automotive industry. The circle of experts was further expanded through recommendations from the first interviewees. The selection aimed to reflect the heterogeneity of the viewpoints of the stakeholders involved. The semi-structured interviews had two main foci: 1) the assessment of the current situation and 2) the policy recommendations for a successful Just Transition. Most interviews were conducted online due to COVID-19 and lasted about an hour.

The data analysis follows the methodology of qualitative structuring content analysis according to Mayring (2010). The material is evaluated according to predefined criteria using a coding guide. First, deductive categories could be derived from the guide. In addition, further inductive categories were identified after reviewing the material. To reconstruct intersubjective verifiability and to ensure intercoder reliability, two persons created the coding guide, comparing their coding in the first interviews. As a final step after the coding, overarching statements were deducted from the coded material which was then substantiated with representative quotes in the report.

7 List of contact persons for interviews

1. AR 1: Academic representative, 25.3.2021
2. EP 2: European policymaker, 12.5.2021
3. EP 3: European policymaker, 20.5.2021
4. CS 4: Civil society representative, 11.3.2021
5. CS 5: Civil society representative, 2.4.2021
6. CS 6: Civil society representative, 14.4.2021
7. TU 7: Trade union representative, 22.1.2021
8. TU 8: Trade union representative, 7.4.2021
9. TU 9: Trade union representative, 9.3.2021
10. TU 10: Trade union representative, 27.1.2021
11. CS 11: Civil society representative, 12.3.2021
12. SR 12: Supplier representative, 10.6.2021
13. SR 13: Supplier representative, 15.7.2021
14. EP 14: European policymaker, 31.8.2021