



Powering the Automotive Jobs of the Future

How the electrification of transport and other trends will change jobs in the automotive sector up to 2030 – and what this means for policymakers

STUDY



Publication Details

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Foreword

Dear readers,

Policymakers are responding to the threat posed by climate change. The EU is now striving to attain climate neutrality by 2050; the United States wants to achieve a 50–52 % reduction in greenhouse gas emissions by 2030 relative to 2005; and China has promised to reduce emissions to net zero by 2060. Yet these commitments are not sufficient by themselves to meet the Paris Agreement goal of limiting warming to 2C – or, if possible, to 1.5C – above pre-industrial levels. There is still much work to be done.

Nevertheless, the existing level of climate ambition is already of monumental significance for the automotive industry. Vehicles are responsible for approximately one-fifth of global CO₂ emissions. Accordingly, vehicle manufacturers can expect ever-stricter emissions regulations. At the same time, the world of business is in a moment of transition. Companies are increasingly realising that their public reputation and business models depend in no small part on their commitment to climate protection. Not only consumers, but also financial market investors are increasingly sensitive to this issue.

As a result, firms are shifting away from an exclusive focus on maximising shareholder value. More and more understand that climate protection is essential if markets are to thrive in the future. Abetted by global climate policy, new markets are giving rise to a range of climate friendly products, including electric vehicles, traction batteries and charging infrastructure. There is now fierce international competition for market share in these product segments. Policymakers will need to ensure a favourable climate for innovation by the German automotive industry. This is a prerequisite if the sector is to retain its status as a major global competitor. Numerous policy actions are required, not least of which are labour market measures to protect jobs. Indeed, measures to support workers will be crucial for ensuring goodwill on behalf of the populace for the far-reaching structural transformation in store. For the transformation will be built on the popular will – it can only succeed if it is equitable in terms of its socioeconomic impacts.

A number of studies have already been conducted on how the energy transition will impact employment in the automotive sector. Past studies have typically had

a narrow focus on the employment effects stemming from electric vehicles. But the transformation involves a series of changes. These include the digitalisation and automation of production processes; integrated mobility systems; and networked and self-driving vehicles. With our study, we broaden the consideration of employment effects by exploring how the transformation will impact employment not only in the automotive industry but also in related sectors.

Perhaps our most salient finding is that we expect no net employment losses or gains. Some subsectors will see significant employment declines – while others will flourish. As part of this “creative destruction” (Schumpeter), some factors of production will have to be reorganised. Some workers will need to acquire new skills. New jobs will be created in new locations, while old ones will disappear in places that workers and their families call home.

The implications of these changes for the life histories of workers and their families should not be ignored. Policymakers need to enact wise labour market policies to ease such frictions. Identifying such policies was one major aim of this study.

We hope you find this study both compelling and informative.

Christian Hochfeld

Director, Agora Verkehrswende

Key takeaways

- 1** **The rise of electric vehicles is just one of several factors transforming jobs in the automotive sector.** A range of factors are already changing vehicle manufacturing and employment in the automotive sector, and will do so even more intensely in the future, including networked and self-driving vehicles, integrated mobility systems, more stringent climate protection regulations and productivity enhancements for Industry 4.0.
- 2** **The transformation will have only a minor impact on the number of jobs in the automotive sector.** In fact, the size of the workforce on the whole is likely to grow slightly (+25,000 jobs). However, this net figure conceals large changes within individual subsectors. Especially in traditional automobile manufacturing, we anticipate a strong reduction in employment (-180,000 jobs). Upstream suppliers of non-powertrain-specific parts will benefit in particular from battery production (+95,000 jobs). In addition, numerous jobs related to the electric-vehicle charging infrastructure will be created (+70,000 jobs).
- 3** **Required skill profiles in the automotive sector will undergo fundamental change, creating an enormous need for retraining in tandem with a growing demand for skilled labour.** The transformation of the automotive sector will create some 260,000 new jobs, especially in battery production, software development and charging-infrastructure operations. Taking personnel needs arising from retirement and employee turnover into account, more than 800,000 new positions will need to be filled before 2030. This is nearly 50% higher than the equivalent figure from the past ten years. At the same time, many jobs will undergo changes or be eliminated altogether. Almost 760,000 workers need to retrain, and the retraining needs for one-third of these workers are significant.
- 4** **East German states will benefit most from the transformation.** While the size of the automotive workforce in 2030 will be similar to that in 2019 in most areas of Germany, East German states are anticipated to see a 9% increase (+16,000 jobs). This is predominantly attributable to decisions regarding the location of battery cell production.
- 5** **Policymakers should assist the automotive sector while also ensuring a just transition for workers.** In order to create jobs and manage changes in affected regions, policymakers should provide targeted support to companies. At the same time, it is important to ensure that Germany remains attractive as a location for investment in new productive capacities. Access to venture capital and skilled workers is essential for new firms to take root. In addition, the public and private sectors should collaborate to retrain workers with outmoded skill profiles. Strategic support for transformation is indispensable at the state and federal levels.

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1 | Transformation as opportunity

Numerous countries have vowed to ban the sale of conventional combustion engines in the coming decades. These pledges are of major significance for the German automobile industry, as 30% of German car exports flow to countries intending to ban combustion engines by 2040.¹

Clearly, German automobile manufacturers cannot afford to sit on the sidelines, clinging to conventional combustion engines while foreign manufacturers expand their competitive advantage and win ever-greater market share. Waiting on the sidelines would not only make the inevitable game of catch up all the more difficult. It would also lead to higher aggregate climate protection costs. Accordingly, the issue at hand is not whether automobile manufacturers shift to electric vehicle production, but how they can manage this transformation most effectively.

National climate ambitions are putting pressure on companies ...

Firms are under pressure to augment the sustainability of their business activities. With the US and China recently joining the EU in ratcheting up climate ambition, a new international sense of climate urgency has emerged, and the newest report from the Intergovernmental Panel on Climate Change (IPCC) has further upped the ante. Germany, for its part, recently adopted a more stringent target date for achieving net zero, moving it up from 2050 to 2045 after the German Supreme Court ruled that current efforts are insufficient to protect the rights of future generations. Yet investors and financial markets are also exerting increasing pressure on companies. Calls have been growing for companies to reduce the carbon footprint of their production processes and supply chains, as well as to make their products more sustainable.

Corporate sustainability efforts are particularly relevant for the automotive industry, as the sector is responsible for a considerable share of global emissions. Beyond the direct emissions that arise from the active use of a conventional combustion engine, one must also take into account the emissions created during vehicle

production (including upstream parts manufacture), during end-of-life disposal and during petroleum extraction and refining. To bring the automotive sector in line with the goals of the Paris Agreement, companies will need to significantly reduce emissions over the entire life cycle of the vehicle. In this respect, the transition to sustainable mobility involves more than just introducing electric vehicles.

In the sustainable transport sector of the future, there will need to be less reliance on privately owned vehicles, and a larger role for mobility solutions such as ride-sharing. The ongoing digital transformation of the transport sector has given rise to novel mobility solutions, including apps that identify optimal travel routes or the best combination of various transport services, so that ride-sharing, public transport and other mobility options can be seamlessly blended. At the same time, advanced software is fundamentally changing how vehicles operate. Self-driving and networked vehicles are expected to completely transform everyday mobility in the coming years.

... while market competition is becoming more intense

As a result, automobile manufacturers are increasingly competing head-to-head with multinational IT companies and software developers. Manufacturers and parts suppliers are being forced to enter into new business segments while transforming their business models. Indeed, the automotive industry of the future will compete in the domain of "software-based mobility services." Yet automotive manufacturers must act in the near term if they hope to remain competitive and capture significant market share in the business environment of tomorrow.

However, the digital transformation is not just changing how vehicles are used. It is also revolutionising vehicle production as part of "Industry 4.0". Advancements in automation are one aspect of this megatrend. For example, advanced sensors, cameras and more powerful CPUs are enabling robots to perform ever more complex tasks, such as joining elastic parts. Yet another aspect of the revolution that is underway in industry pertains to the management of production inputs: as an integrated

1 <https://www.agora-verkehrswende.de/en/press/news/40-percent-of-german-car-exports-go-to-countries-intending-to-phase-out-fossil-fuel-vehicles/>

system of machines and employees, factories are increasingly linked to the digital world, making manufacturing processes ever-more efficient.

This has led to further productivity gains, allowing companies to produce the required volume of goods with a smaller workforce. This effect will be more pronounced in new subsectors, such as battery manufacturing, as a lower starting point for productivity per worker makes achieving productivity gains even easier.

2 | Anticipated impacts to the labour market

Our analysis indicates that the total number of employees in the automotive sector and related industries will undergo little change. While there could be a small net increase in employment (+25,000 jobs), this figure is small – just over 1% – of the nearly 1.7 million employed in the sector (see Figure 1).

The transformation will create winners and losers

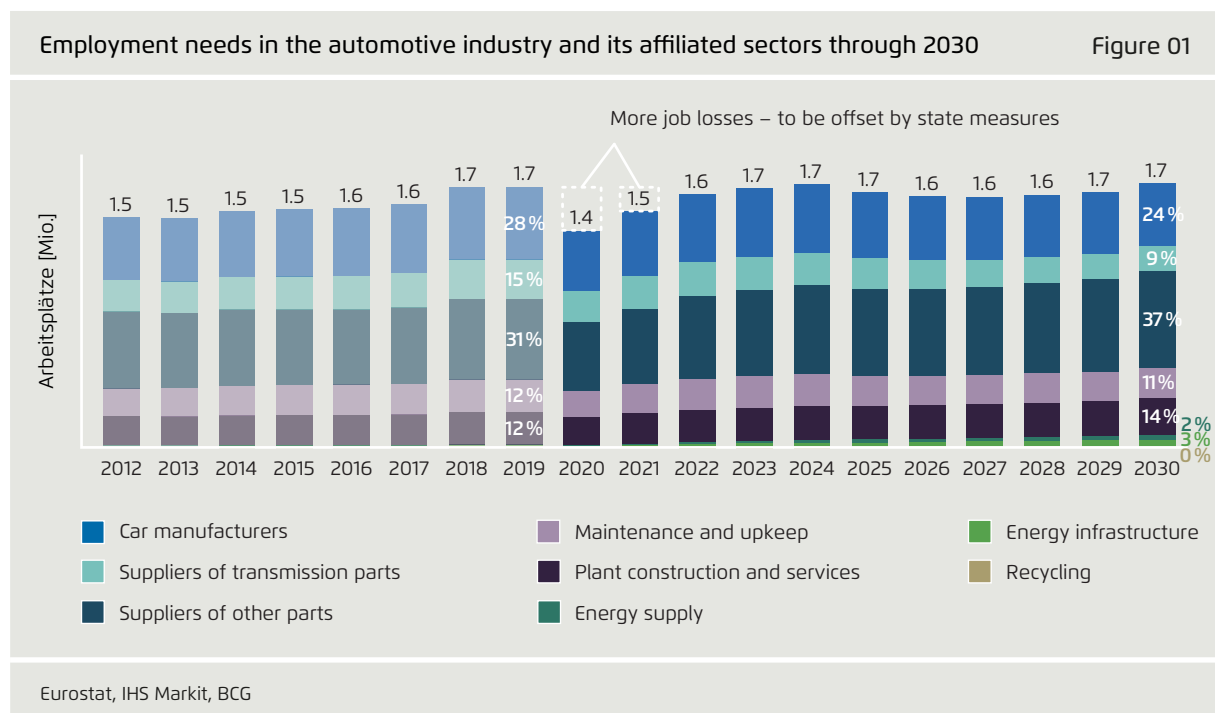
While net employment in the sector is anticipated to experience little change, the situation within individual subsectors will be very dynamic. In terms of employment, some subsectors will benefit, while others will lose out.

Firms and subsectors that manufacture conventional powertrain components (including engines, clutches, transmissions, and exhaust systems) will be particularly hard hit by change. Conventional powertrain parts suppliers will shed some 95,000 jobs (-38%), while car manufacturers are expected to cut 70,000 jobs (-15%). Among automobile repair and service providers, employment is anticipated to decline by less than 10%.

These jobs losses will probably be offset by workforce growth in other subsectors, however.

About 95,000 jobs alone will be created among parts suppliers whose products are not exclusively suitable for conventional vehicles. Battery manufacturers in particular stand to benefit – assuming German demand for power cells is served by domestic production. A further 70,000 jobs will be created to operate and maintain the energy infrastructure of the future – EV charging stations in particular. Due to the growing demand for electrical power needed to run electric vehicles, the energy utilities in general will see higher employment. In particular, the increasing share of renewables in the power mix will create jobs, as PV and wind power systems are more labour-intensive to operate than conventional power plants. In this connection, some 25,000 new jobs will be created.

Employment trends are driven by numerous – and partially countervailing – factors. Technological advancements and associated increases in the size and maturity of the EV market will lead to employment increases, while productivity gains, the phasing out of conventional vehicles and the relocation of production to Eastern Europe will create domestic job losses.



Not only a bigger market will create more jobs ...

Labour demand in automotive sector sales will be bolstered by networked and self-driving vehicles as well as by continued increases in demand for vehicles in the luxury segment.

German automobile production is expected return to the pre-pandemic level of 4.9 million vehicles by 2022 (a figure that includes passenger cars and commercial vehicles up to 3.5 tonnes). While additional increases are anticipated in the coming years, we forecast production to trend sideways at 5.4 million vehicles per year between 2025 and 2030. Until 2030, annual German production is expected to be 0.9% higher on average. An increasing share of these vehicles will be exported to serve growing foreign demand. Since the German automobile market already has a high level of saturation, we anticipate domestic sales to drop by 1.5% annually, falling from just under 4 million vehicles in 2019 to around 3.3 million vehicles in 2030. This means that the vehicle fleet in Germany will grow only by 0.5 percent per year over the next ten years. In 2030, there will thus be some 53 million vehicles on German roads (see Figure 2). By way of comparison, in 2020, some 50.7 million passenger cars and commercial vehicles up to 3.5 tonnes were registered in Germany. This was 1.5% higher than in 2019.²

Higher sales volumes will lead to increased demand for workers (+105,000 up to 2030). Vehicle manufacturers will need to hire an additional 27,000 workers, and another 59,000 jobs will be created at parts suppliers due to increased demand for vehicle components. In the area of vehicle repair and maintenance, some 12,000 jobs will be created to service the slightly larger vehicle fleet. A small positive impact (+9,000 jobs) is also expected in the area of factory construction and maintenance, as increased sales volumes will require the installation and servicing of additional manufacturing capacity.

... but also vehicle digitalisation ...

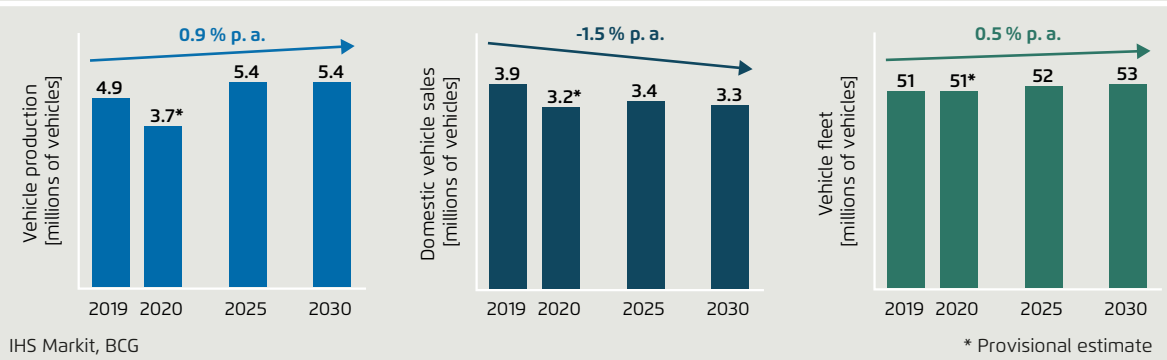
Advances in vehicle technology will also promote job growth in the automotive sector. The introduction of autonomous and networked vehicles will require the digitalisation of vehicle components. For example, under recently steering wheels were entirely mechanical in their design and function. However, the introduction of various features (such as lane-departure warning systems) has required the integration of digital control systems and electric motors. As digitalisation continues, we estimate that the value of installed software will increase by 10.6% per year – from around 280 euros per vehicle in 2020 to around 765 euros per vehicle in 2030 (see Figure 3). Equipping vehicles with new digital features will augment demand for software and vehicle engineers. This effect will create some 20,000 additional jobs, mainly among car manufacturers (+14,000 jobs), but also among parts suppliers (+6,000 jobs).

2 VDA (2021): Tatsachen und Zahlen 2020.

Main trends at a glance

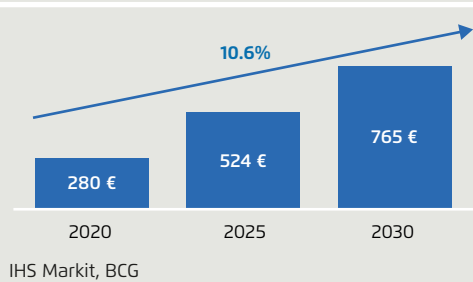
Market volumes of vehicles and light trucks up to 3.5 tonnes

Figure 02



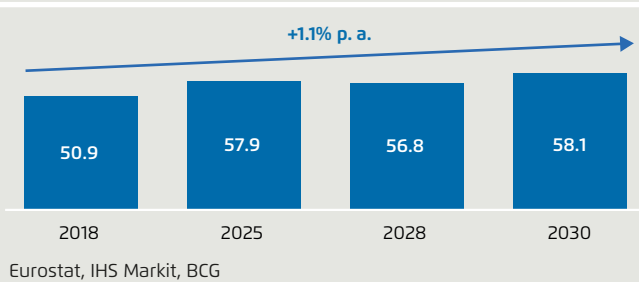
Value of vehicle software

Figure 03



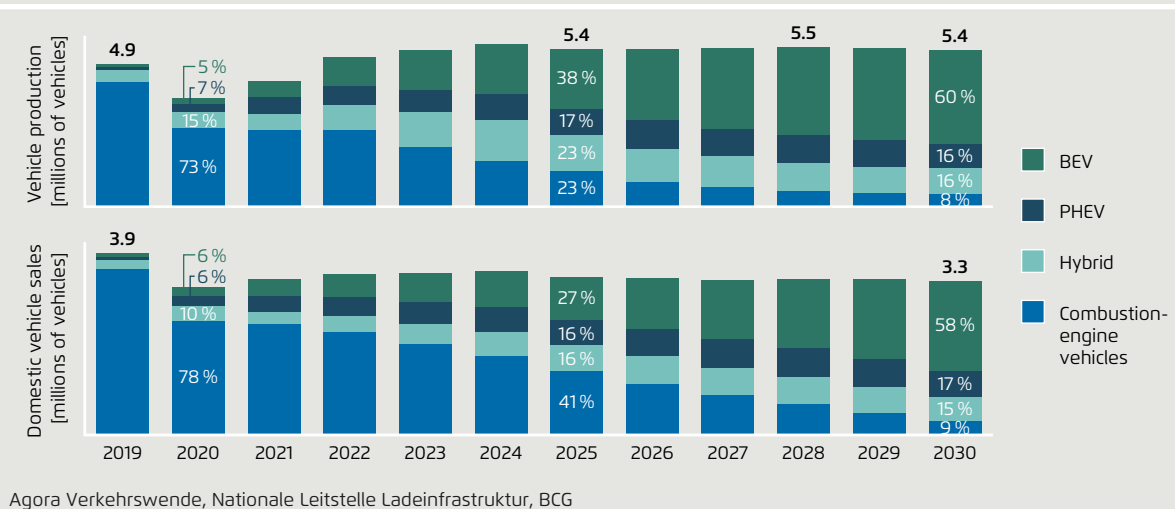
Average vehicle value [thousands of euros]

Figure 04



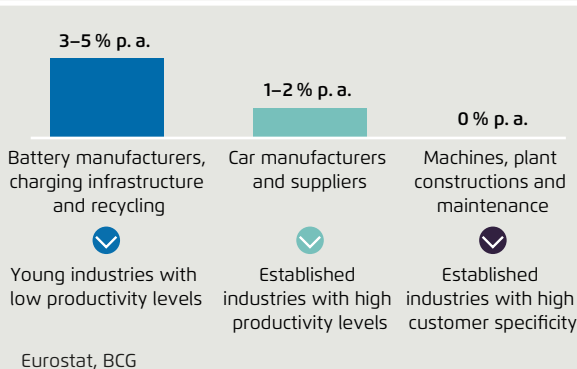
Shares of various vehicle technologies in production and sales

Figure 06



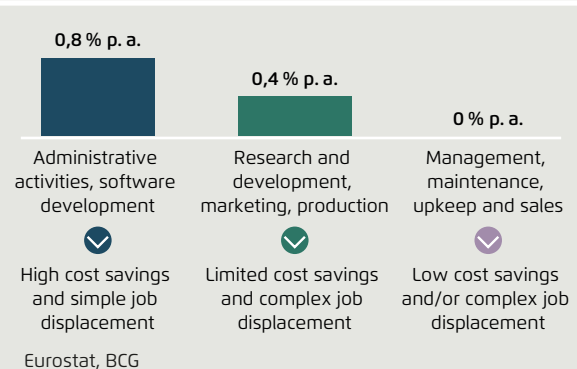
Productivity increases through

Figure 05



Shifts in jobs through

Figure 07



... and the trend to higher-quality vehicles

Of course, it is not only the increasingly sophisticated vehicle equipment that is causing employment to rise. In addition, demand is shifting towards higher-value vehicles, a trend that can already be seen today: Premium-class vehicles are gaining market share. As a result, production costs per vehicle will increase by approximately 1.1 percent per year through 2030 (see Figure 4).

The trend towards a higher-priced product portfolio will have a significant job creation effect, which we estimate at +80,000 by 2030. This job increase will be seen first and foremost among parts suppliers (+63,000 jobs), as additional employees will be required to develop and manufacture higher-value vehicle components (e.g. massage seats; head-up displays). There will also be a positive employment effect for vehicle manufacturers, though, at around 3,000 additional jobs, the effect will be relatively small, as higher-priced components will generally not lead to higher assembly costs. For example, the amount of work required to install an on-board display is the same with a low or high resolution variant. Around 14,000 jobs will be created in the "factory construction and services" sector.

Productivity gains in vehicle manufacturing will cost jobs ...

The factors that will boost employment are also offset by trends with negative employment effects. These include the digitalisation and automation of car production, the growing EV market share and the relocation of jobs outside Germany.

The digitalisation and automation of manufacturing will generate significant productivity increases over the next ten years. Growth industries such as battery production can expect annual productivity increases of up to 5% (see Figure 5).

Industry 4.0 trends will streamline the manufacturing of conventional and electric vehicles, reducing the required amount of work per vehicle. By 2030, we anticipate this trend to eliminate some 100,000 jobs. Lower labour

demand will impact car manufacturers (-41,000 jobs) as well as parts suppliers (-51,000 jobs).

... as well as e-mobility ...

The rise of electric vehicles will have an even greater impact on labour demand than the aforementioned productivity improvements. We assume that over the next ten years, automobile production will be almost completely converted from combustion engines to battery-electric vehicles. In 2020, some 73% of vehicles manufactured in Germany were equipped exclusively with a combustion engine. By 2030, this share will have dropped drastically, to an anticipated 8%. Together, battery-electric vehicles (BEV) and plug-in hybrid electric vehicles (PHEV) will represent 76% of production (with BEVs accounting for a 60% share). Non-plug-in hybrids will represent another 16% of production (see Figure 6).

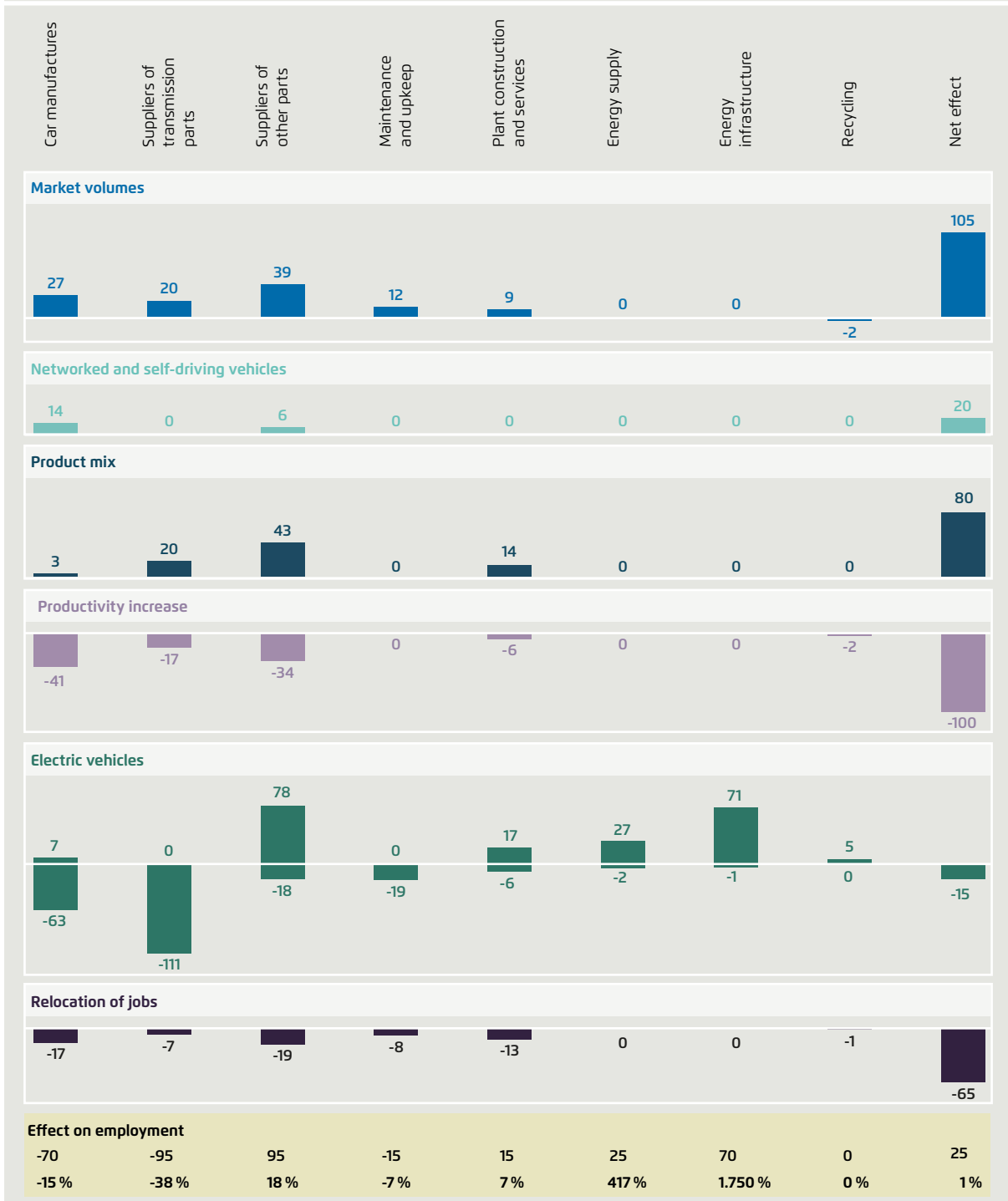
BEVs have significantly fewer parts than vehicles with diesel or gasoline engines, so the amount of work required to manufacture them is much lower. In addition, BEVs also have considerably fewer parts that require periodic maintenance or replacement due to wear and tear. As a result, vehicle manufacturers, parts suppliers and repair shops will shed some 220,000 jobs by 2030.

At the same time, BEVs require additional components, battery packs, in particular. Given their importance for performance and safety, we anticipate that battery cell, module and pack production will take place for the most part domestically, creating a considerable employment boost. Based on recent company announcements, we assume annual production to reach more than 300 gigawatt hours (GWh) in 2030. Around 205,000 jobs will be created to manufacture related components (battery cells; electric motors), to produce the required additional electricity, to operate and maintain charging infrastructure and to provide for battery recycling.

When the positive and negative employment effects of the shift to electric vehicle production are weighed against each other, the net negative effect on employment is -15,000 jobs.

Effect of trends on employment in the automotive industry and in its affiliated branches through 2030 [thousands of jobs]

Figure 08



Note: Sector boundaries are not static. They change as business models are adjusted and new market are created. This figure shows the aggregated results of 806 positions (see methodology). The sum of all positive values is 260,000. The sum of all negative values is 235,000.

... and the relocation of production to Eastern Europe

Finally, trends related to the international division of labour in automobile manufacturing will also have employment effects. Between 2015 and 2018, the number of employees at European vehicle manufacturers increased by about 3.5 percent per year.³ However, at the same time there was a net migration of jobs away from Germany to other European countries. On average, some 0.8% of jobs were lost annually in Germany, with higher and lower levels depending on the subsector (see Figure 7).

The international relocation of jobs – particularly to Eastern Europe – will lead an additional 65,000 jobs to be lost in Germany by 2030. This trend will mainly impact vehicle manufacturers and parts suppliers, yet factory construction contractors and maintenance and repair service providers will also be affected (-56,000 jobs). Companies will tend to relocate certain types of jobs abroad. The relocation must be easy to manage, and it also make economic sense, i.e. leading to lower labour costs. For example, business accounting activities are at significant risk of being relocated, as employees in this field are paid comparatively high wages in Germany, and their work can be easily performed from a remote location thanks to modern IT solutions.

On balance, the trends will cancel each other out or generate a slightly positive net effect. If the local automotive industry were to buck global trends or if policymakers were to strengthen existing inertia, however, then massive job losses are likely.

Half of all jobs through 2030 have to be staffed ...

The total number of jobs related to automobile manufacturing will remain virtually unchanged through 2030. However, this statistic conceals the fact that we expect significant structural shifts to take place within individual subsectors. These challenges have a quantitative and a qualitative dimension.

In purely quantitative terms, companies will cut about 235,000 jobs by 2030, but they will also have to fill some 260,000 new positions. In addition, some 350,000 vacancies will need to be filled due to the retirement of older employees, and some 210,000 jobs will become vacant due to natural turnover in other industries. Accordingly, some 820,000 positions will need to be filled over the next ten years. This corresponds to almost every second job in the broader world of work related to the automotive sector.

Impacts related to retirement and natural employee turnover have already occurred over the past ten years, albeit to a lesser extent. However, the need to fill some 260,000 jobs is almost solely attributable to the rise of electric vehicles. Accommodating this structural shift in the workforce will be challenging for companies. While companies in the automotive sector filled some 560,000 vacancies over the past ten years, there will be 820,000 vacancies to fill over the next ten years – an increase of nearly 50%.

... with employees, who partially need fundamentally new qualifications

The changes in the structural composition of the workforce that were outlined in previous sections will take place in two phases over the next decade. In the first phase, which will last until 2023, the COVID-driven economic slump will lead to a significant decline in production volumes, and massive job losses will be averted through government support programmes. The pre-COVID employment level of 1.7 million workers will not be reached until approximately 2023. In the second phase, which will last from 2025 to 2028, we expect a small decline in the automotive sector workforce, followed by a sideways trend. Net annual growth in the size of the workforce will not occur again until 2030 (see Figure 1, p. 11).

Qualitatively, workers will need to bring new skill sets to bear, creating significant retraining requirements. While the net employment effects related to this trend are anticipated to be small, this belies a significant substantive change in job profiles. Demand for expertise in mechanical and automotive engineering will fall as companies hire additional software developers and electrical engineers.

³ Eurostat, BCG analysis.

It should be possible to retrain a large share of the workforce for new positions within the context of part-time advanced training courses. Some 500,000 workers will remain at their current companies and/or in their current professions. However, due to changing job requirements, retraining of some form will be inevitable for a large share of employees.

Approximately one-third of affected workers will have significant retraining needs. Some 200,000 workers will move to a similar subsector and/or occupation from transmission to electric-motor manufacturing), say. However, some 70,000 workers will move to a new industry and/or occupation (from vehicle assembly to battery-cell production, say) (see Table 1). Such workers will have to be retrained, and may also need to relocate to a new company and/or city.

Eastern Germany is one of the winners of the transformation ...

We also anticipate changes in the regional distribution of jobs.




East Germany in particular stands to benefit from this structural transformation. We estimate a net job increase of 16,000 in East German states, which corresponds to an increase of 9%. While Germany's automobile manufacturers are all based in West Germany, numerous production sites have been established in East Germany since German reunification, particularly for the produc-

tion of electric vehicles. The German state of Saxony, for example, already has a large microelectronics and IT industry, and thus represents a favourable environment for investment in vehicle software and battery manufacturing. Various companies are currently developing battery-cell manufacturing capacities – or have announced their intention to do so.

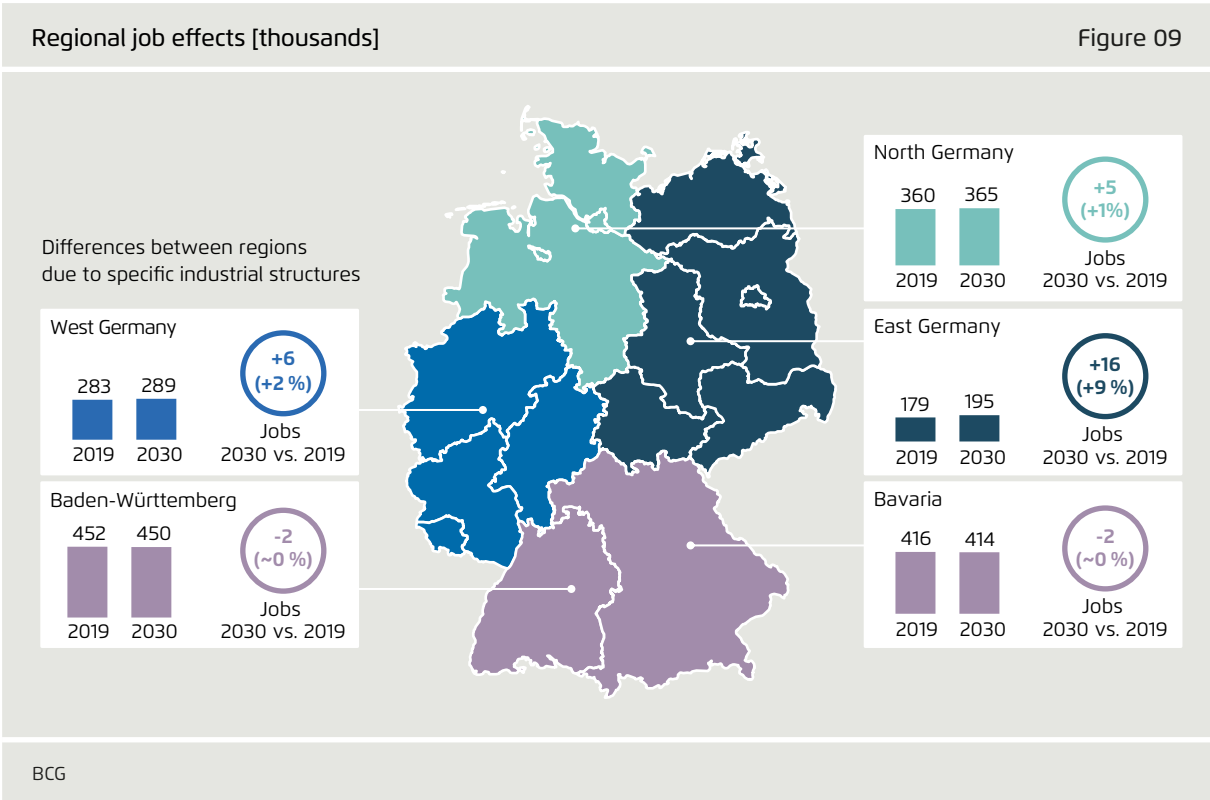
The South is likely to have some job losses

By contrast, Germany's southern states – Baden-Württemberg and Bavaria – can expect employment levels to stagnate or decline slightly. These regions have a strong focus on conventional transmission and combustion engine technology, subsectors that will decline in significance over the current decade.

Northern and western Germany can expect to experience small increases in employment. Western Germany is home to a diverse range of parts suppliers, many of which manufacture non-powertrain-specific products. Within each of the aforementioned regions, we do expect job losses and gains to be geographically lopsided. In Western Germany, there is likely to be a small net gain in employment, due to higher production volumes and the shift to higher value vehicles and components. Northern Germany is also likely to see employment gains – first and foremost due to growth in renewable energy, particularly wind power (see Figure 9).

Training needs through 2030			Table 1
Same job profile	Similar job description	New job profile	
Remaining at company and in same occupation with slightly changed requirements	Switch to a similar industry and/or a similar job description	Change to a different industry and/or a new job description	
			
In-service training required for approximately 500,000 employees	Retraining and job switch necessary for about 190,000 workers	Re-skilling and job switch necessary for about 70,000 workers	

BCG



At the pan-European level, the net change in employment is likely to be minimal. Some 5.65 million people were employed in automotive-related jobs in 2020.⁴ We expect the broader industry in Europe to lose 36,000 jobs by 2030. Due to business cycle effects, Spain will see the largest jobs losses, while Germany in particular will witness the positive employment effects described above (+25,000).

4 Eurostat, BCG analysis.

3 | What needs to be done

Transformation presents numerous opportunities but also poses challenges. In crucial respects, these challenges and opportunities are two sides of the same coin, and must be addressed simultaneously. Beyond serving climate protection, policy measures in this domain should strive to encourage the economic competitiveness of German companies while supporting job growth. In the following sections, we discuss the actions that should be taken in furthering these aims.

Driving the transformation politically

The successful transformation of the automotive sector will necessitate not only a clear political agenda but also a reliable regulatory framework. Companies require clear and stable regulatory conditions to successfully manage the transformation. Indeed, corporate decision makers will only make large-scale investments in the modernisation of factories, in the development of new business models and in the retraining of employees if they have reasonable confidence in the future profitability of climate-friendly technologies.

German automotive manufacturers will need to develop new business models to comply with domestic climate requirements. But their international success will also depend on their competitiveness in the EV market, because ever-more stringent climate regulations are being passed in key German export markets. The world has awakened to the dangers posed by anthropogenic warming: unchecked greenhouse gas emissions are threatening habitats worldwide, including that of homo sapiens. Accordingly, Germany has no choice but to elaborate a long-term strategy for net zero in the automotive industry by 2045. It is important that our policy planning at the current moment cover the period through at least 2030. Resolute policy commitments with validity up to the end of this decade will help companies to make forward-looking investments so they can position themselves optimally in nascent product markets.

Furthermore, the government policy strategy should give due consideration to the need for climate-neutral basic material inputs, including steel and aluminium, so upstream supply chains in the automotive sector can be completely decarbonised.

Specific policies should also be enacted to give targeted political support to the transformation of the German automotive industry, including measures to support the adoption of electric vehicles. In addition to the EU's Fit-for-55 package, German legislators currently plan to reform the current system of levies and surcharges on the electricity price and to create a stronger link between vehicle taxes and CO₂ emitted while driving. Government action is also needed to ensure sufficient charging infrastructure for electric vehicles, as the development of infrequently used sites is necessary for a broad network, yet it is not profitable for private-sector operators. The permanent funding of public charging infrastructure cannot be the solution, however. Instead, viable financing solutions must be developed for the construction and operation of charging stations.

Another necessary step is to create a permanent system for government monitoring of the automotive sector. To date, such monitoring activities remain the purview of temporary committees – including the Automotive Industry Transformation Dialogue and the Expert Committee on the Automotive Industry Future Fund. But in the coming years the transformation will continue to pose challenges for the automotive industry and affected regions. As a result, we recommend the formation of a consolidated platform for strategic dialogue and knowledge sharing that features representatives from federal ministries, the automotive sector, trade unions, civil society and academia. This platform should be tasked with distilling action recommendations that support the necessary long-term structural changes. In addition to promoting strategic coordination between Germany's federal states, the platform should evaluate ongoing measures for the transformation of the automotive industry.

Creating jobs and meeting the demand for skilled workers

To ensure that employment levels in the German automotive industry do not suffer a significant drop through 2030, the government must support companies in their transformation efforts. An active effort should be made to keep production – and its associated value chains – in Germany. To this end, firms will require sufficient access to investment capital. However, for some companies – particularly SMEs – access to risk capital is limited, not only due to market pressures, but also because their reserves have been depleted over the course of the Corona crisis, impairing their ability to invest in and develop new business models. One possible measure for addressing this problem would be to establish a federal investment fund designed to finance innovations in the automotive sector.

To be sure, the transformation of the automotive sector and its associated industries will create new jobs, but it will also obviate existing skill sets such as conventional transmission engineering. Employees whose skills are no longer in demand must receive retraining for new jobs. In this area, the need is enormous: 760,000 workers will require supplemental training or new qualifications. To meet this challenge, government support will be just as crucial as entrepreneurial initiative.

The challenge at hand involves much more than making sure employees possess the right skill sets, however. The quantitative scope of the transformation is an additional challenge. Through 2030, the automotive industry will need to fill 50% more vacancies than it did over the past ten years. This highlights another challenge: Skilled workers are essential for business growth. However, there is already a shortage of skilled workers in Germany today – and it will become even more acute in the future, in part due to demographic change. To prevent this weakness from becoming an impediment to transformation, policymakers should act to ensure that the right training programmes are on offer and make it easier to recruit skilled workers, including those from abroad.

Promoting regional change

While the automobile industry is important for the German economy as a whole, in specific regions it plays a central role in the robustness of the economy and employment. Accordingly, support should be granted to regions that are particularly hard hit by the industry's transformation. Some German states – such as Baden-Württemberg and Lower Saxony – have already initiated strategic dialogues concerning the future of the automotive industry.

Dialogue is also needed to shed light on the impacts of transformation, including its associated challenges – such as those related to the development of new business models. There is clearly a need for the discussion of such issues. Indeed, in a survey of various industrial sectors conducted by the German metalworkers union IG Metall in 2019, only half of the queried companies had developed a strategy for the sustainable transformation of their business.⁵ Strategic dialogue can help actors to identify and implement regional solutions for managing transformation. For example, it can help regions to determine whether or not a focus should be placed on developing productive capacities in certain subsectors.

In this connection, policymakers should examine whether to revise European state aid law so that regions can receive support with structural change, as this would help to accelerate transformation. In our view, the forums for strategic dialogue that are currently in place should be preserved, and additional German states should make use of this model. Furthermore, dialogue at the state level should be linked with federal transformation strategy.

5 https://www.igmetall.de/download/20190605_20190605_Transformationsatlas_Pressekonferenz_f2c85bcec-886a59301dbebab85f136f36061cced.pdf (Last accessed: 20.08.2021).

Appendix: Methodology

Based on various expert interviews and a review of relevant literature, this study identified eight trends that will have a significant influence on automotive-related employment:

- Increasing sales volumes
- Advances in self-driving technology
- Vehicle networking
- Increasing luxury segment sales
- Production digitalisation
- Production automation
- Growing EV market share
- Job relocation to other countries

In order to examine the impact of these trends will have on employment in the automotive industry and related sectors, we subdivided jobs in accordance with the Statistical Classification of Economic Activities in the European Community (NACE-R2). Twenty-six industries with 31 job families each were identified as relevant, for a total of 806 job profiles (see Table 2).

In order to determine current automotive sector employment, we drew on *Eurostat* data. In some cases, no current figures were available (e.g. charging infrastructure). In such instances, we estimated the number of jobs based on expert assessments and our literature review.

After our fine-grained identification of the employment base, we assessed and quantified how each of the eight trends up to 2030 would impact the 806 different job profiles. This assessment was performed using a variety of databases, including IHS Markit. Information provided by experts and by the empirical findings of our own project work were then drawn upon to validate our findings.

Our applied methodology allows us to forecast employment in the considered fields of activity up to 2030, as well as to distinguish between the effects of the individual trends.

Sectors and job families under consideration		Table 2	
Industries	Job Families		
<ul style="list-style-type: none"> • Manufacture of motor vehicles • Manufacture of motor vehicles frames and assemblies • Manufacture of motor vehicle parts and accessories • Manufacture of other motor vehicle parts and accessories • Manufacture of rubber tires and hoses • Manufacture of computers and peripheral equipment • Manufacture of electric motors, generators and transformers 	Research and development <ul style="list-style-type: none"> • Aggregates/electronics researcher • Developer of engines/transmissions • (Vehicle) concept developer • (Vehicle) function developer • Software/systems developer • Systems/function developer • Electrical/mechatronics designer • Development project manager • Business partner manager 		
	<ul style="list-style-type: none"> • Manufacture of bearings, gears, gearboxes and drive elements • Manufacture of cooling and ventilation equipment • Manufacture of electric lighting equipment • Production of batteries and accumulators • Manufacture of other pumps and compressors • Shaping and processing of flat glass • Equipment and machinery • Industrial service companies • Maintenance and repair of motor vehicles • Production of refined petroleum products • Electricity generation • Transmission of electricity • Distribution of electricity • Electricity trading • Charging infrastructure (production & service) • Charging infrastructure (operation & maintenance) • Fuelling infrastructure (production & service) • Fuelling infrastructure (operation & maintenance) • Recovery of sorted materials 	Procurement <ul style="list-style-type: none"> • Procurement of production material • Procurement of production equipment • Procurement of services and transport • Procurement of parts • Controlling/accounting 	
		Production/service <ul style="list-style-type: none"> • Production planning • Operational staff (production) • Machine operator • Logistics planner • Operational staff (logistics) • Maintenance staff (production) • (Vehicle) mechanic • (Vehicle) electrician 	
Sales <ul style="list-style-type: none"> • Sales manager/planner • Sales/customer advisor • Sales analyst • Employee for marketing strategy • Employee for product marketing • Employee for digital marketing • Market analyst • Employee for service technology 			
Other			

NACE-R2, BCG

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In partnership with key players from the fields of politics, business, science and civil society, Agora Verkehrswende aims to lay the foundations for a comprehensive climate protection strategy for the German transport sector, with the ultimate goal of complete decarbonisation by 2045. To this end, we develop the knowledge base for climate protection strategies and support their implementation.

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