

Annual Report 2022

Topics and Figures on the
Development of the German
Automotive Industry

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Foreword



Dear ladies and gentlemen, Dear readers,

For the German automotive industry, climate-neutral mobility as of 2050 is something far more than a mere vision. It is a commitment that we vouch for. Our industry is pursuing it with great vigor and we are making massive advance investments and innovations to bring it about.

That said, the path to climate neutrality is by no means a matter of course. We have experienced this in the past two years. First came the coronavirus pandemic. In addition to the far-reaching health ramifications, the pandemic also had severe economic consequences. It was exacerbated by the zero-Covid strategy in China, which strained supply chains and thus affected industrial production around the world. Many of our affiliates are still reeling from the upheavals and disruptions.

This year, however, we have also been hit by a war in Europe. A war like we have not seen on our continent for decades. Russia's terrible attack on Ukraine is a serious breach of international law that is being felt far beyond Ukraine's borders. Be it because of the millions of refugees or the

repercussions for the global energy and food supply. We express our solidarity with, and concern for, the victims and their families.

The companies in our sector immediately drew up a list of consequences and stopped doing business in and with Russia. We have taken a clear position and supported the EU's economic sanctions against Russia. Nevertheless, the economic impact of the war has of course also reached our affiliates.

The confluence of the pandemic and the war hits the German automotive industry in the midst of an unprecedented transformation. It is a transformation that is already putting great pressure on our industry even without the current crises. The German automotive industry, however, is home to highly innovative companies that are able to cope with this difficult situation. From the globally positioned manufacturers to the globally unique medium-sized companies, through to the myriad of creative start-ups, all companies in our industry are achieving great things.

The annual report is an impressive testimony to the innovative power of our industry. These companies are investing around 220 billion euros in research and development up to 2026. In so doing, they are bringing fascinating innovations to the market, from efficient electric cars and commercial vehicles to intelligent digital solutions for road transport and logistics. In addition, more than 100 billion euros will be invested in the plants. All these investments and innovations are paving the way to climate neutrality.

The manufacturers of passenger cars and commercial vehicles, the suppliers and the manufacturers

of trailers, bodies and buses are doing their part to make the transformation a success story – for the climate, for the employees and for the entire industry. Although, the transformation will only succeed if the right framework conditions are in place. This is where the political arena has a role to play. However, we are observing how promising future technologies are being thwarted and the essential course is not being set. Policy-makers cannot demand more speed from industry without creating suitable framework conditions for it or without accelerating their own pace to meet the challenges. We see this, for example, in the EU Commission's plans to allow only CO₂-free passenger cars and light commercial vehicles to be newly registered from 2035.

In order to achieve the CO₂ targets, electro-mobility needs to be ramped up quickly. However, this will only succeed with a rapid expansion of the charging infrastructure. Nevertheless, policy-makers in Germany and Europe are still lagging behind in their ambitions. For example, by the middle of this year, there was not a single charging point in almost half of the municipalities in Germany. The transformation towards climate neutrality will only succeed if we give customers the opportunity to charge their vehicles at anytime and anywhere. It is also crucial to pay due attention to the commercial vehicle sector. If all this is not accomplished, we run the risk that our project of the century will be doomed to failure owing to a lack of basic prerequisites.

In order to achieve Germany's and Europe's climate goals, we also need framework conditions that are open to technology. This includes making new technologies

such as e-fuels and hydrogen available for use in road transport. This is the only way, for example, that the vehicle fleet can also be addressed accordingly and made climate neutral. Unfortunately, these alternatives are not sufficiently reflected in the EU's plans.

Industry – and this is not only true for the automotive industry – also needs favorable location conditions so that we can continue to provide growth, prosperity and employment. Despite this, there has been little progress in speeding up planning and approval procedures, and a high level of bureaucracy and a dire need for reform in the digitalization of our country are stifling the development of industry. On top of that, we have to deal with enormously high energy prices. This is an especially compelling issue for small and medium-sized enterprises. People and companies in our country are at the limit of their resilience owing to rising prices. This is why we are lobbying the policy-makers for targeted relief. Europe is at a crossroads – can it survive in international competition or will it fall behind?

Therefore, policy-makers must take decisions now for the long term. Russia's war must not lead us to question the benefits of global trade, but rather to promote it further. Germany and Europe need more involvement in favor of free and fair trade. Apart from guaranteeing growth, prosperity and employment here at home, trade and investment deals are also a testament to the joint efforts of international partners for more climate protection, social standards and human rights. In addition, we need an active foreign policy on raw materials and energy partnerships

with new partners that show us the way out of a situation of one-sided dependency.

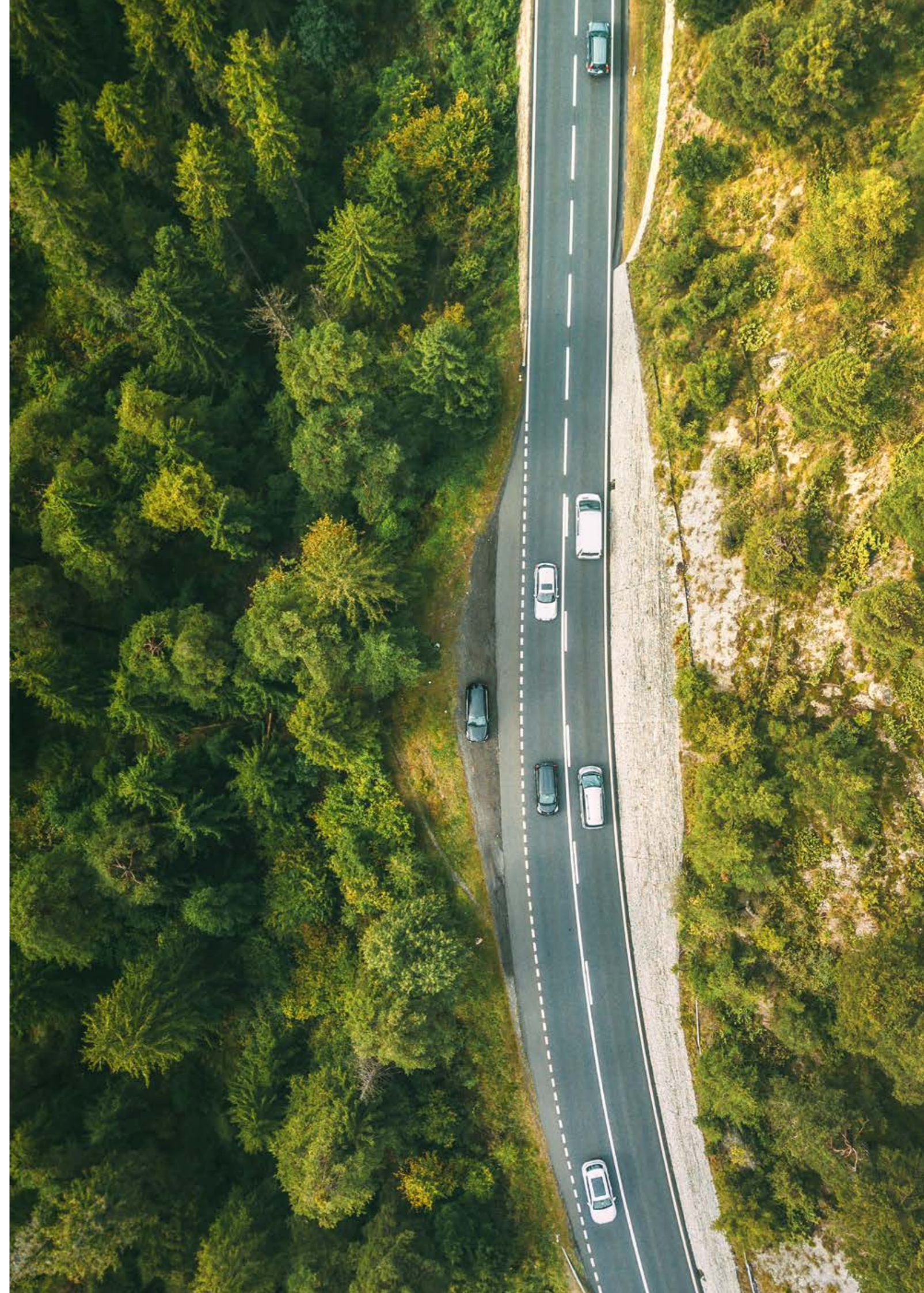
Russia's brutal war on Ukraine, which is contrary to international law, is a turning point in the history of our continent. We as the automotive industry are also feeling the effects of this turn of events. However, it is clear to us that our commitment to a sustainable future firmly stands. The mobility of the future is climate neutral, digital and connected. We as an industry are leading the way and creating important conditions for the metamorphosis to take place. However, it is a task that we will only successfully achieve in collaboration with policy-makers, other sectors of industry and various social actors. We as the VDA are committed to this every day – just as our members are. This annual report provides an insight into the activities with which we make our contribution.

I wish you a richly varied and engaging read and look forward to a lively dialogue with you!

Sincerely,



Hildegard Müller



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An aerial photograph of a winding asphalt road that curves through a dense green forest. Several cars are visible on the road, including a white car, a blue car, and a dark car. The road has white dashed lines for lane markings. The overall scene is a mix of dark green trees and lighter green grassy areas.

The Automotive Industry at a Turning Point

Maintaining economic strength, bringing innovations to the global market, developing technologies to combat climate change – these are our goals.

The German automotive industry is committed to climate protection and is driving forward the technology change resolutely. It is rising to the challenges, investing record amounts and doing everything in its power to offer affordable, efficient, digitally connected and climate-neutral mobility with a continuing stream of new products.

The automotive industry wants to turn this transformation into a success story. That is why we must succeed in transforming technologies, value creation and employment.

In the following sections, you can read what we need to succeed and what successes we have already achieved.

Our Turning Point – Aftermath of War and Markets

There has been a war raging in the middle of Europe since February 24, 2022. The invasion of Ukraine by Russian troops represents a deep cut for our continent. The Russian invasion marks an attack on the international order, and on the free world. Several million people have fled Ukraine since the war began, many innocent people have lost their lives.

The European Union was quick and well advised in its response to this act, which is contrary to international law. The German automotive industry also welcomed this resolute reaction by the EU and its international partners and supports the imposed sanctions. Manufacturers and suppliers immediately chose to draw consequences and stopped doing business in and with Russia without any further delay.

The VDA, like these companies, immediately set up a task force. Since the outbreak of war, we have been continuously informing members about current developments. While the initial focus was on the stability of supply and logistics chains and sanction decisions, we found that energy supply issues gradually rose to the forefront. Time and again, the current challenges proved to be the dominant topic in our committees – the Board of Directors, the Production and Logistics Committee, the Export Control Working Group or the Trade Policy Working Group – to mention but a few. For instance, whenever a new sanctions package is being discussed, we have an intensive discussion with the companies about the effects of the sanctions so that we can clarify any undesired consequences with the politicians as soon as possible. And in the companies,

products and supply chains are continuously checked in order to implement all current sanction requirements.

After the outbreak of the war, the German government promptly sought close dialogue with the industry and its leading trade associations and actively involved them in the consultations. In this context, the German Minister of Economics, Robert Habeck, repeatedly emphasized the central role of the associations. He said that the associations are in a unique position to pool the concerns of their sectors and thus to be able to comprehensively map them. This is especially true for the industrial SME sector, which rarely has direct political contacts at the top level.

The VDA thus brings the unresolved issues of the automotive industry into the consultations. The association is also active in committees of the Federal Ministry of Economics and Climate Protection and the Federal Foreign Office, among others. In these discussion groups, we seize the opportunity to put forward our arguments and information. This pertains to the manufacturers' concerns as well as to the issues of the suppliers and especially to the challenges of the manufacturers of trailers and superstructures. They are all massively affected by the consequences of war. However, we do not only engage in discussion rounds with the Federal Government, but are also in direct contact with many other political players in order to address the challenges of the companies in a more focused fashion. Especially at the beginning, there was still a great deal of uncertainty among companies regarding the implementation of the sanc-



tions. There seemed to be no concrete interpretation of some of the requirements and formulations. In this regard, we repeatedly pressed for quick clarification on the part of the authorities. In close coordination with the members, we could, for example, clarify outstanding points on the lists of goods specific to Russia by means of a collective request to the Federal Office of Economics and Export Control (BAFA).

In the first weeks after the outbreak of the war, companies did everything in their power to maintain production. Nevertheless, there were isolated instances of production cutbacks. In some factories, assembly lines were brought to a halt – and this was not restricted to Germany. In view of the massive disruptions in the supply chain – also triggered by developments in China – the situation grew more difficult by the day.

The companies in the automotive industry have meanwhile adapted to the fact that logistics and supply chains will be severely disrupted for a fairly long period of time. They are working in high gear to compensate for the failures and disruptions in the

supply chains, to ramp up alternatives and to reorganize procurement processes. A continuation of production at alternative locations is in the interest of customers, employees, companies and of a thriving business fabric in Germany and Europe.

It is crucial to prevent structural breaks. An efficient economy forms the basis for a sustained sanctions regime and thus also for social peace and the stability of our society.

In the meantime, other issues are now the prime focus in the context of the Ukraine war. These include, above all, the increasingly difficult supply of energy and raw materials. Since March 30, 2022, German energy supply security has been at the top of the political agenda. On this day, Federal Minister of Economics, Robert Habeck, declared an early state of alert for the gas emergency plan. This was done in the light of the Russian government's decision to accept payments for gas deliveries only in rubles and the G7's declaration not to accept this. After all, this measure by Russia represents a breach of existing agreements.

For the German automotive industry, the secure supply of affordable energy is a pivotal issue. Industrial SMEs above all are faced with existential risks in the wake of skyrocketing prices of gas and electricity. Therefore, the security of electricity supply must be put at the top of the German government's economic policy agenda, alongside gas supply. Among the more pressing measures that ought to be taken are a reduction in the electricity tax to the minimum European limit and a review of the energy tax load in production.

Against this background, close coordination with the Federal Government and the relevant authorities is of utmost importance to the VDA. That is why we are also in constant dialogue with various committees of the Federal Network Agency with our VDA task force, which would act as the federal load distributor to allocate residual gas quantities by order if a gas shortage situation were to occur. We advocate that in the event of gas rationing, the industry should be able to retain as much flexibility as possible and, for

example, they should not be “penalized” for gas savings that have already been made, but that such savings should be credited.

In the winter of 2022/2023 it will be absolutely crucial to save as much gas as possible in order to prevent the worst-case scenario of gas rationing in industry. According to the Federal Network Agency, German industry has already made an important contribution with hard savings of over 20 percent. In the coming months, household heating patterns will also play a decisive role. In addition, the Federal Government must ensure that industry has planning security in the current situation. And it must exhaust all possibilities to support Germany as an industrial location and, first and foremost, the SME sector, which is unparalleled across the globe.

Why reforms in Germany are becoming more and more urgent

Against the background of geostrategic developments, reforms here in Germany are becoming all the more urgent. The consequences of this war affect the European economic area more directly than, for example, the USA or the Asia-Pacific region. If we persist, there will be negative effects on the will to invest.

The threefold combination of rising inflation, the challenge on important procurement markets and restrictions on export markets threatens to make Europe, and above all Germany, dramatically weaker in terms of competitiveness. Therefore, it is imperative to take swift action. This applies to the development and expansion of the digital infrastructure as well as to the need for faster planning and approval procedures and, especially, to the location conditions with taxes, duties and levies, which must finally become competitively viable again in terms of international comparison. It is only in this manner that we will achieve the necessary efficiency and resilience to remain geostrategically relevant and to sustain our prosperity.

Germany and Europe must now act with a sense of urgency to conclude agreements for alternative raw material and energy pro-

duction. Such agreements are crucial for the success of our economy and for a promising transformation. However, important markets are currently being distributed without us, and time is rolling against us. In order to build a climate-neutral economy, however, we are dependent on raw materials, which we must procure from all over the world – in as diversified a manner as possible.

As a matter of principle: The most efficient course to combat recession, loss of prosperity, etc., is a booming economy. Investments in the economy represent investments in society.

At the same time as the crisis situation in Europe, the relationship between Western countries and China has become more acute. Taiwan stands in the spotlight here specifically. Like the rest of the world, the German automotive industry is watching the tensions between China and Taiwan with growing concern. All parties involved must now work together to avoid further escalation. Above all, diplomatic talks must be continued and indeed intensified.

The USA has been realigning its China policy for years. The German government is also currently working on a new strategy for China. From the automotive industry’s point of view, the goal should be to pursue an integrated strategy for China. Simply pulling out of China is not the solution – in fact it’s quite the opposite. This country and its political and economic importance are far beyond the scope of this approach. We cannot isolate China. That would be fatal on both the political and economic fronts.

China’s importance for the automotive industry is enormous: Every third passenger car made by a German manufacturer is sold in China. Almost 270,000 passenger cars are exported from Germany to China every year. In the year 2021, German manufacturers produced 4.3 million passenger cars here, which is more than in any other country. There are major linkages along the value chain and it is only with the USA that Germany trades more automotive goods than with China. In addition, the direct investments of German companies (i.e. not only the auto-

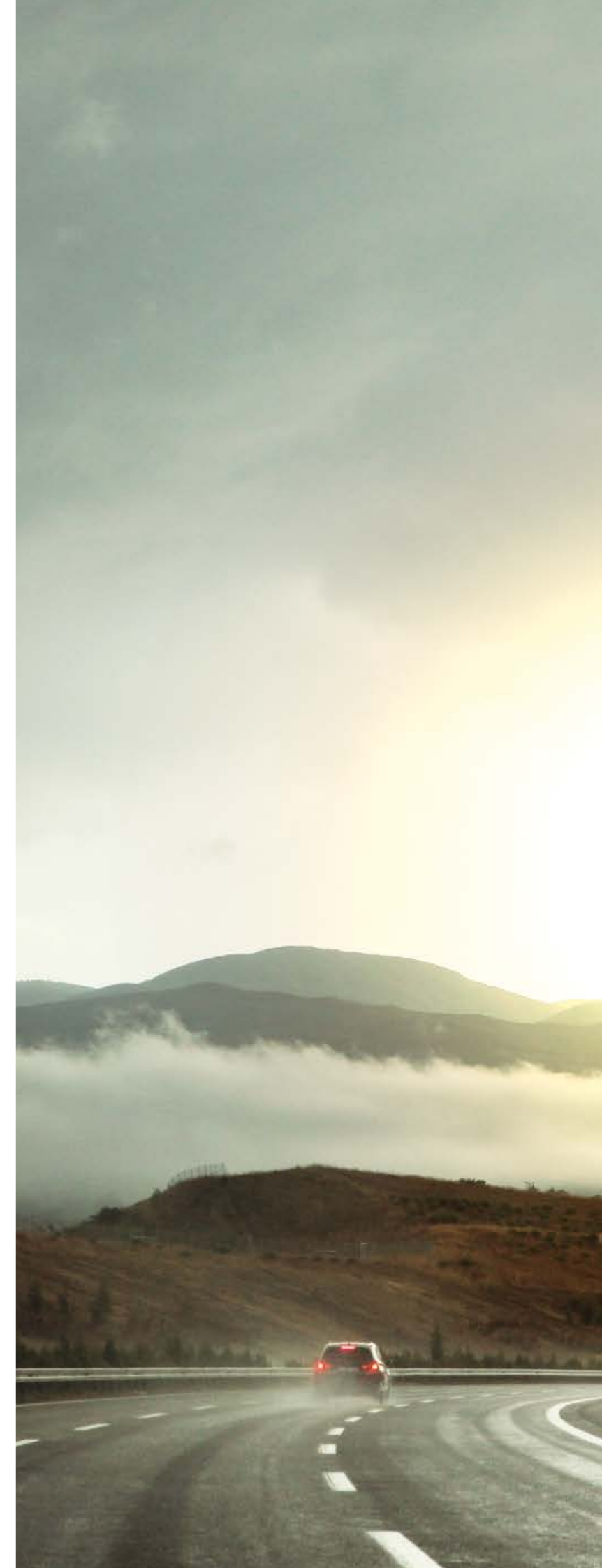
motive industry) in China amount to 90 billion euros (about 7 percent of total investments by German companies abroad), which is also a politically significant figure.

What the figures suggest is that China is a key force behind the global economy – and an important sales and procurement market for German industry. This highlights the importance of a solid German and European economy, so that we can act accordingly in the dialogue with China, and in this trial of strength, German industry wants to cooperate with China on equal terms. German companies want to drive economic and technological development in both countries in a spirit of fair competition. To achieve this, we need more trade, more partnerships, more networking – above all, we need it to be broader and more diverse.

The semiconductor issue must also be viewed in this context, as well as in the context of external raw materials policy. For the time being, no relief is in sight. In fact, it is unlikely that the situation will be resolved any time soon. The semiconductor shortage will certainly continue to haunt the industry until the year 2023. The current conflict between China and Taiwan will intensify this problem. In our view, it is crucial that Germany and Europe grow less dependent on Asia in the field of semiconductors supply. In order to be able to cover the further rising demand for semiconductors, we need a rapid expansion in the European semiconductor production.

Transformation – a Herculean task

The challenges faced by the automotive industry could not be greater in the face of three coinciding crises – the Ukraine war, the effects of the coronavirus pandemic and the ongoing supply shortages. This unprecedented bundling of crises poses major challenges for the German automotive industry – manufacturers and suppliers alike. After all, the transformation of the industry into carbon neutrality is taking place simultaneously in this environment – undoubtedly, a Herculean task for all those involved.



Our Location – Securing Competitiveness



The contribution of industry in general and the automobile industry in particular to employment and prosperity in Germany and Europe is essential. Our industry offers very good jobs. This applies to large industrial companies as well as to the globally uniquely strong small and medium-sized enterprises, which make a decisive contribution to the prosperity of the regions. Germany's automobile industry – manufacturers and suppliers – stands for good wages, high social standards, stability and security.

This should remain so in the future. Germany has the most ambitious climate targets in the world. In order to realize these goals and make the location fit for the future, Germany needs the world's best location conditions. It needs the appropriate conditions that optimally support companies on their path of transformation towards climate-neutral and even more customer-oriented mobility.

These challenges are all the more urgent at present. Most recently, with the Russian war of aggression in Ukraine, geopolitics has once again become part of daily political reality. Economic relations are increasingly being used for political goals. With the war in Ukraine, there can certainly be no simple "business as usual" – but the calls for "de-globalization" are sawing off the branch on which the European idea is founded.

Transformation needs interdependence

In view of the current crises, there are calls for "reshoring," "nearshoring" or even "decoupling." What may appear to be a strategic response would prove unsuitable in reality. The automotive industry, for example, would be cut off from the world's growth markets, and at the same time its capacity for innovation would be eroded.

The automotive industry, especially the suppliers, is particularly affected by the challenge of the simultaneous transformation – decarbonization and digitalization – of changes in international markets and framework conditions. At the same time, it depends on its stability and expansion: The pandemic and now even the war in Ukraine, have shown effects on supply chains, dependencies and shortages.

The right strategy to avoid strategic dependencies is therefore to diversify supply chains and place them on as many pillars as possible. For this purpose, it needs as many trading partners as possible. The German government should therefore increasingly take a leading role in the European Union and work towards launching a bold trade offensive now and bringing faltering negotiations to a conclusion (e.g. Mercosur, India, various ASEAN states). The deepening of trade relations with liberal democracies worldwide must be advanced right now. The ratification of the CETA agreement with our partner Canada must not be delayed any further. The conclusion of the agreement would be an important signal that the German government has recognized the signs of the times and is strengthening the global competitiveness of German and European industry with partnership initiatives. At the same time, we can set global standards in solidarity with liberal democracies.

Other regions of the world are also more independently positioned because of different prerequisites. Not least because of a different raw material base. These countries are our competitors. It is certain that Germany and Europe will be dependent on imports for the raw materials and technologies necessary for electromobility – we cannot and will not be self-sufficient in this regard. It is therefore all the more important to set the political course in a way that is open to technology.

International cooperation is essential – many raw materials are available only in a few regions. Policy-makers must open up access to different regions of the world (especially South America, Africa, Indo-Pacific) and make it as barrier-free as possible for their own companies through trade agreements. At the same time, the securing of raw materials must be promoted. This is particularly important as long as the circular economy in the EU has not yet reached the necessary and desired scope. Companies must be supported in diversifying their sources of raw material supply, for example also through the instrument of untied financial credits (UFC). Promotion of stockpiling should also be considered.

A secure and sustainable supply of raw materials as a strategic goal

Likewise, the promotion of the domestic raw material base must be focused on, as well as support for research and development of new technologies. To secure a sustainable supply of the raw materials needed for transformation, we need all instruments and their strategic use at both EU and national level. Other countries, such as the USA and China, are already in a completely different position here. One thing is certain: It is high time for an active foreign policy on raw materials and more energy partnerships. We can see that other countries are very active and are trying to secure access. Germany must be more than a mere spectator here. The consequences of the current scarcity of resources for the economy can already be seen in the situation of the automobile industry. It is characterized by a shortage of supply due to a lack of primary products. This must not become a permanent state of affairs or even get worse.

Global integration creates jobs in the target markets and, at the same time, secures well-paid jobs and innovative capacity in Germany and Europe.

The decisive factor here is an industrial policy that strengthens the competitiveness and innovative capacity of the automobile industry and increases the attractiveness of the locations in Germany and Europe. Overall, it is clear. Germany must work on its global competitiveness.

Many decisions need to be taken now

1. Analogue and digital infrastructures must be continuously kept up to date, research and innovation must be broadly promoted, cooperation between science and business must be facilitated at all levels, and a positive environment for innovation and investment must be created.
2. Targeted investment in key technologies for which Europe must become a strategic leader, such as battery cells, hydrogen, electrofuels (e-fuels) and semiconductors, software and artificial intelligence (AI).
3. Accelerated expansion of the charging infrastructure and, in parallel, of renewable energies.
4. A sustainable and globally competitive tax system as well as incentive-based framework conditions that strengthen our companies in global competition and enable growth. There is a great need for action here: Loss offsetting must be made more flexible and depreciation conditions improved. Taxation procedures must be accelerated and digitalized. At the same time, the excessive bureaucratic compliance requirements that threaten to crush companies must be streamlined. In the implementation of the OECD and EU requirements for the redistribution of taxation rights and, in particular, the introduction of a global minimum taxation, there is an urgent need for a coordinated postponement of the first application to 2024 as well as simplifying transitional regulations. Here, too, the foreseeably disproportionately high administrative burden for companies and the tax authorities must be reduced. We reject a wealth tax or other forms of taxation on assets.
5. Competitive energy prices are needed so that energy-intensive production does not migrate to countries that do less for climate protection. In the current situation, the rise in energy prices is threatening the very existence of some businesses.
6. A thorough reduction of bureaucracy that invites investment in Germany and relieves companies of costs.
7. An acceleration and streamlining of planning and approval procedures that do not place insurmountable hurdles in the way of companies planning to invest in Germany as a business location and, at the same time, do not hinder strategic political decisions to reduce excessive dependencies.
8. Intelligent research funding that rewards applied research, innovation and entrepreneurship.
9. A qualifications and skills initiative for skilled workers to cushion the social impact of transformation and to be best positioned in new technologies.
10. A low-bureaucracy implementation of the Supply Chain Due Diligence Law and no further tightening via EU requirements that overshoot the target.



Never before have the European community of values and its foundations been as challenged as they are today. Europe is the promise of democracy, freedom, peace and prosperity. It is all the more necessary now that Europe reflects on its strengths, sets its goals clearly and takes the necessary decisions so that the European success story can be continued.

We need the EU

The European peace project is also based on the idea of making the world a safer place through cooperation, reconciliation of interests and partnerships. The EU has thus become the largest single market on earth, ensuring security and prosperity for more than 445 million people. The economic integration of Europe has contributed significantly to Germany's prosperity and created the framework for the success of the automobile industry.

The German automobile industry stands by the EU peace and prosperity project with full conviction and determination. Our community of values, but also our economic and prosperity model, needs the commitment of all of us and must be adapted to the changed geopolitical framework conditions. We need Europe more than ever before.

The EU must stand up in the world for more free trade and globalization for the good of all – protectionism is the wrong way. It is also the task of business and politics to show why globalization and open markets will continue to be indispensable in the future. With the new geopolitical situation and the continuing consequences of the coronavirus pandemic, Europe's industrial base is in danger. Our prosperity and economic growth depend on industrial jobs in Europe. The German automobile industry contributes significantly to value creation and jobs throughout Europe.

Developing globalization together

The European Green Deal and the Digital Agenda are the two central priorities of Ursula von der Leyen's European Commission. It follows that the key decisions for climate, economy and industry are negotiated and taken in Europe. The framework conditions for the ecological and digital transformation are set in Brussels. This must be reflected even more strongly in the German government's European policy. The German government must show maximum commitment to the further development of the EU and take more leadership for this.



Agenda for improving competitiveness for Germany as a business location

1. A Federal Government that takes a leading role in Europe and initiates and carries bold reforms of the European treaties.
2. A return to the effectiveness of market-based instruments as the guiding principle of European economic policy.
3. The consistent implementation of the 1-in-1-out principle to curb bureaucracy.
4. Regulations that are no longer thought of in silos, but have an eye on the impact on companies as a whole and in international comparison.
5. A European industrial policy that lives up to its name and sets the course for securing and expanding industrial value creation in Europe.
6. Completion of the internal market, especially for digital infrastructure and energy.
7. A coherent, internationally compatible climate policy that focuses on the market and innovation.
8. An active European foreign trade and raw materials policy and a Federal Government that acts as a prominent advocate for globalization.
9. A member of the European Commission to strengthen the framework conditions for industry and SMEs, who sees itself firmly as a contact partner for industry.
10. An extension of qualified majority voting in the European Council of the EU.
11. An end to the accumulation of competences by the Environment Committee and a shift of competences back to other committees in the European Parliament.
12. The Industry Committee should have a prominent role on all legislation with an impact on business.
13. The bundling of all mobility-related issues in one Directorate General.

Our Commitment – to Climate Targets and Transformation

For the automobile industry – for the more than 600 member companies of the VDA and their approximately 800,000 employees – the transformation to climate-neutral road transport is a challenge as well as an incentive. Our goal is climate-neutral mobility in Europe by 2050 at the latest – in line with the Paris climate protection agreements.

In recent years, highly ambitious climate targets have been formulated by politicians, both at national and European level. According to the European Green Deal, transport on European roads must be completely climate-neutral in less than 30 years, not only in Germany, France and Denmark, but also in Croatia, Bulgaria and Romania. In Germany, CO₂ emissions from transport are already to be almost halved within the next eight years according to the current national Climate Protection Law.

The automobile industry is driving the transformation

In road transport, the climate targets are associated with special challenges. The fact is, despite the considerable efforts of the automobile industry and the enormous progress made in the efficiency of new cars, CO₂ emissions in transport have not yet decreased to the necessary extent. The reason for this lies primarily in the rapidly growing volume of traffic: Road traffic in Germany has almost doubled since 1990.

But we can be optimistic about the future. The automobile industry is determined to make its contribution to climate protection through innovations and new technologies.

The innovative strength of the companies in the German automobile industry is unique in the world. Manufacturers and suppliers will invest more than 220 billion euros from 2022 to 2026, in electromobility, batteries, digitalization and other research fields.

Meanwhile, a rapidly growing range of electric vehicles is facilitating the transition. From 100 electric vehicle models today, the range of German group brands will already grow by a further 50 percent to 150 models by 2023. With the effect that in Germany, the share of electric vehicles in new registrations last year was already a good quarter; among the major car markets, Germany is thus experiencing the second-highest sales growth worldwide. German manufacturers are leading the European market, and the trend is also positive globally. Technologically, the vehicles are now so sophisticated that the user experience is convincing. Even the range anxiety of fully electric vehicles with standard ranges of well over 350 kilometers is no longer due to battery capacity, but above all to the still inadequate expansion of the charging infrastructure. In the future, electric cars as mobile energy storage units will even help to balance short-term fluctuations in the electricity grid and integrate more renewable energies.

Hard work and the highest investments are behind these success stories. Automobile plants are being converted at an unprecedented speed to scale the production of increasingly electrified plug-in hybrids and of fully electric vehicles, as well as the components and parts required for them. The automobile industry will invest at least 100 billion euros in the conversion of plants in

Germany alone by 2030. Thanks to a joint effort, we are also catching up rapidly in Europe in areas where we previously had to catch up, namely in traction batteries, which until now was the domain of Asian and US companies in particular. At least 27 gigafactories for battery cell and module production need to be built across Europe in the coming years, many of them with the direct or indirect participation of German companies in the automobile industry.

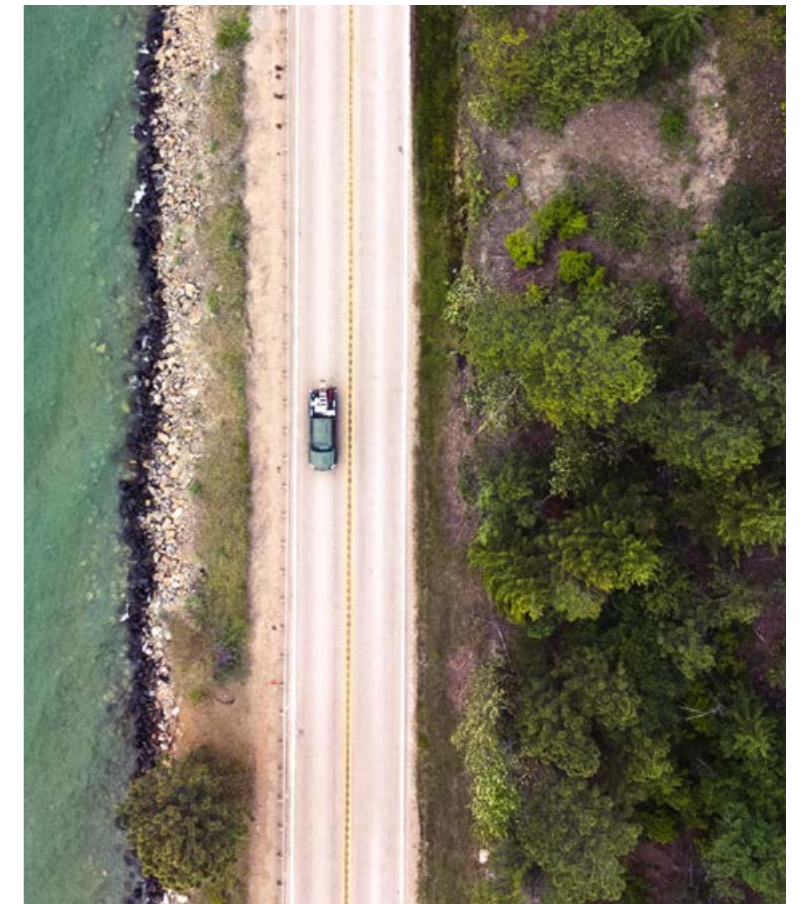
Making road traffic climate neutral

Together with the Federation of German Industries, we as the German Association of the Automotive Industry have conducted the Climate Paths 2.0 study, to show how the ambitious climate targets for transport can be achieved. The study confirms the path taken by the automobile industry: Innovation and competition are crucial for achieving the goals. First and foremost, a strongly accelerated market ramp-up of alternative drive systems and especially e-mobility is needed. There will have to be up to 15 million electric vehicles in Germany by 2030, including plug-in hybrids, which will remain indispensable for a successful transformation in the plants and for achieving the climate targets in the medium term.

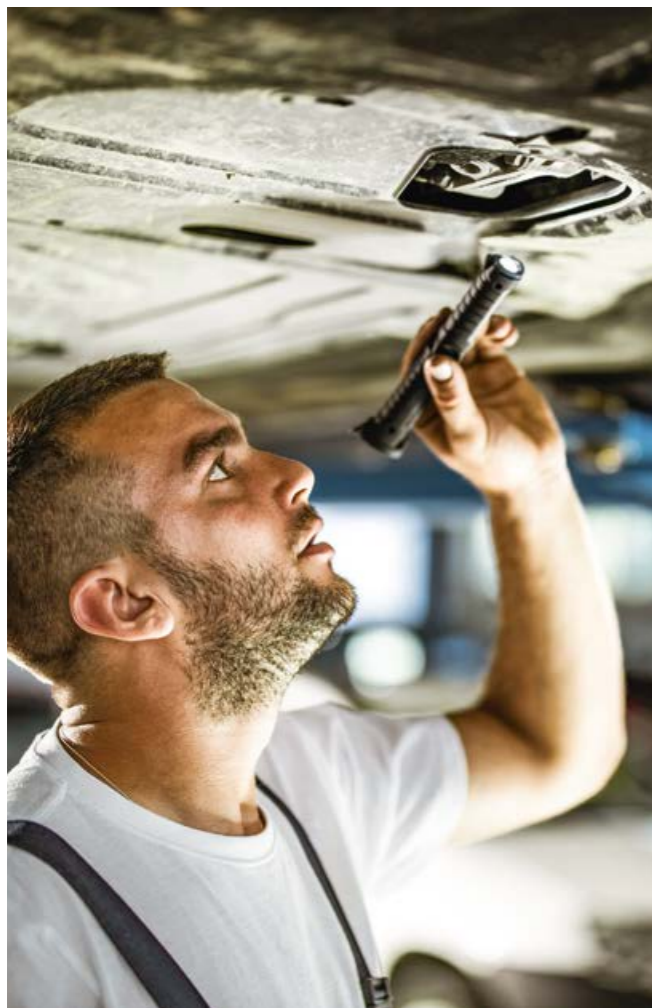
However, the market ramp-up of electric vehicles alone, as the study also confirms, will not be sufficient to achieve the goals. Even in road transport, the path to climate neutrality inevitably leads to the use of considerable quantities of electricity-based e-fuels and advanced biofuels. There is simply no alternative to the de-fossilization of the existing fleet, which will still consist of well over 30 million vehicles in 2030. Of course, the potential offered by digital technologies in vehicles and for the networking of different means of transport and sectors must continue to be exploited – for climate protection and the energy transition, as well as for traffic flow and safety. And finally, market-based control instruments and corresponding price signals must support the switch to

climate-friendly technologies and energy sources. Only cross-sectoral emissions trading with a “CO₂ cap” is capable of ensuring the achievement of climate policy goals in the long term. CO₂ emissions can be saved, where this is the most cost-effective option, only with such emissions trading.

Making road transport climate neutral: For the automobile industry, transformation is not an abstract objective, but a concrete task. In the coming year, we will continue to face this challenge with determination and single-mindedness.



Our Responsibility – for People and Employees



Manufacturers are fulfilling this responsibility even in the midst of the industry’s transformation. Around 786,000 people were employed in the automobile industry in Germany in 2021 – in the manufacturing sector, only mechanical engineering employs more people (see Figure 1). Worldwide, a total of 1.7 million employees work for German manufacturers. In Germany alone, two million jobs depend on the automobile industry – and thus the livelihoods of families and entire regions.

A sector comparison shows that the automotive industry pays above-average wages. In 2021, wages for employees in the “manufacture of motor vehicles and motor vehicle parts” sector continued to rise – despite a difficult overall economic situation (see Figure 2). Surveys show that the German automobile industry is one of the top employers in manufacturing and beyond. In the lists of the 100 most popular employers, VDA members are traditionally to be found close to the top.

Around a third of all employees in the research sector of the German economy work in the automotive industry – almost 140,000 people in 2019 alone. They all help to ensure that the German automobile industry remains a leader in innovation – and can also guarantee attractive working conditions for employees.

The German Automotive Industry Secures Hundreds of Thousands of Jobs – here in Germany and Worldwide.

Jobs in manufacturing sectors

Employment in 2021 as per sectors annual average

WZ 20 Chemical products	330,650
WZ 21 Pharmaceutical products	116,726
WZ 22 Rubber and plastic products	339,598
WZ 23 Glass, ceramic, stone/earth	152,580
WZ 24 Metal production and processing	224,515
WZ 25 Metal products	510,976
WZ 26 DP devices, electronic/optical products	290,531
WZ 27 Electrical equipment	378,804
WZ 28 Mechanical engineering	935,902
WZ 29 Motor vehicles and motor vehicle parts	786,109
For comparison: Mining/Processing industry total	5,486,733

Figure 1 – Source: Federal Statistical Office

Wage trends in the automotive industry

Average gross annual earnings of full-time employees

2010	52,564
2011	57,034
2012	59,837
2013	61,422
2014	63,235
2015	64,977
2016	65,989
2017	68,131
2018	70,676
2019	71,261
2020	66,421
2021	67,823

Figure 2 – Source: Federal Statistical Office, Reference series 16.2.3

Transformation of the industry in full swing

The automobile industry is undergoing a transformation, which holds many opportunities, but also risks. A study conducted by the ifo Institute on behalf of the VDA in May 2021 comes to the conclusion that the change in employment in the period up to 2025 and beyond until 2030 will probably not be completely cushioned by age-related employment turnover. By 2025, at least 178,000 workers will be affected by the transformation, and by 2030, at least 215,000 jobs. On the other hand, about 75,000 workers will retire by 2025 and 147,000 workers by 2030. Thus, there is a considerable gap between the affected employees and the upcoming age-related employment turnover. The development of parallel structures and the resulting lower labor productivity, increasing automation and the reduced depth of value creation may have negative effects on employment in the sector in the future. This aspect must also be taken into account in policy-making decisions.

The transformation affects the entire industry, but especially the suppliers. Of the approximately 645,000 jobs in power-train production at European suppliers, a good 500,000 (79 percent) could be lost by 2040. On the other hand, around 226,000 new jobs could be created in the production of e-drive trains at suppliers. The bottom line could be a net loss of around 275,000 jobs, according to a study by PwC Strategy commissioned by the European automobile supplier association CLEPA.

However, the transformation is also associated with many opportunities. Electromobility and battery cell production can create many new jobs – eastern regions of Germany can benefit from this in particular. The automobile industry in the new federal states has already seen employment growth in recent years. By 2030, 16,000 additional jobs could be created in the east of the country, which would correspond to a growth of 9 percent. Saxony is already the nationwide leader in the production of electric vehicles. The German federal state

alone would be the third-largest production location for electric vehicles in Europe and the seventh-largest worldwide.

Furthermore, synthetic fuels can make a valuable contribution to the decarbonization of the transport sector and to securing and creating jobs. An expert report by the Institute of the German Economy concluded in March 2021 that 1.2 million new jobs could be created in Europe through the production and export of PtX plants. With just under 400,000 new employees, the effect would be greatest in Germany.

Securing skilled labor through further training

An important key to a successful transformation of the automobile industry lies in continuing education. Many of the job potentials mentioned can only be raised if skilled workers are retrained or further educated. Almost 760,000 workers will have to retrain, and a good third of them will probably pursue at least similar or completely new occupations.

Our member companies, the VDA and IG Metall are taking up this enormous challenge. An expression of this is a joint working group within the framework of the national platform for the future of mobility. In the final report of the working group, the role of small and medium-sized enterprises (SMEs), in particular, in further training was emphasized. Particularly for SMEs, finding sufficient financial and personnel resources for the further training of their employees presents a considerable challenge. Here, for example, software tools for strategic personnel planning or “regional competence hubs” can help. Such hubs at the federal state level can be an adequate point of contact for meeting the challenges of education and training, bringing employers and employees together and coordinating regional CET needs. The Federal Ministry of Labour and Social Affairs has taken up this idea within the framework of its National CET Strategy (NWS). Between March and August 2022, among other things, 15 continuing education networks specifically for companies in the vehicle and supplier industry were launched.

Another positive example is the initiative “Alliance of Opportunities,” with which leading German companies want to jointly combat the shortage of skilled workers, including automobile suppliers and manufacturers of trailers, bodies and buses.

Step up efforts in recruiting young talent

The coronavirus pandemic has hit the training market hard across all sectors. In 2021, around 467,100 people in Germany signed a new training contract in dual vocational education and training. Although this represents a slight increase compared to 2020, it is still far below the pre-pandemic level (2019: 513,300 new contracts).

The VET report of 2021 shows that the industry and commerce sector provides the most training offers. From 2019 to 2020, the number of training places on offer however fell by around 12.1 per cent, which is above the national trend (-9.1 per cent). A look at individual training occupations in the automobile industry shows that the demand for training opportunities is also declining.

Nevertheless, training occupations in, and related to, the automobile industry continue to be among the most popular training opportunities in Germany (see Figure 3). Against the backdrop of the coronavirus pandemic and demographic change, however, the automobile industry also faces challenges in attracting the skilled workers of tomorrow.

Training in the automotive industry

Trainees as per the skilled professions (top 20)

	Number	%
Total	1,288,962	100.0
Out of which		
1 Automotive mechatronics technician	66,147	5.1
2 Employee for office management	63,591	4.9
3 Employee for retail business	51,075	4.0
4 Industrial business management assistant	45,030	3.5
5 Electronics technician	42,498	3.3
6 IT specialist	41,799	3.2
7 Healthcare specialist worker	41,472	3.2
8 Industrial mechanic	41,232	3.2
9 Salesperson	37,908	2.9
10 System technician for sanitary, heating and air-conditioning technology	37,317	2.9
11 Employee for large and outdoor trade management	32,088	2.5
12 Specialist worker for dental care	31,104	2.4
13 Mechatronics technician	28,032	2.2
14 Expert for warehouse logistics	24,501	1.9
15 Bank employee	22,920	1.8
16 Electronics technician for industrial engineering	22,902	1.8
17 Management expert	19,821	1.5
18 Cutting machine operator	18,282	1.4
19 Carpenter	17,820	1.4
20 Hairdresser	17,694	1.4

Figure 3 – Source: Federal Statistical Office, as of August 11 2021



Germany as an industrial location – and thus also the German automotive industry – is dependent on skilled workers. This requires the mobilization of domestic labor potential, but also skilled labor immigration from foreign countries. According to calculations by the Institute for Employment Research (Institut für Arbeitsmarkt- und Berufsforschung), net annual immigration of 400,000 people is needed to keep the labor supply constant until 2060.

The potential of skilled labor immigration

Not least due to the coronavirus pandemic, the current immigration figures fall well short of this target. While net immigration in 2017 was still around 416,000, it will be only 220,000 persons in 2020. This development and trend are primarily due to reduced immigration from non-European countries.

On the other hand, there is a growing shortage of skilled workers. In May 2021, around 270,000 vacancies for which there are no suitably qualified unemployed persons at the same time were registered in Germany. The demand for IT experts is particularly high. Across all sectors, the number of vacancies

for IT professionals in 2021 was around 96,000 – an increase of 12 percent compared to the previous year.

This also affects the automotive industry. According to the ifo Institute, more IT specialists are currently being sought in the automotive industry than engineers. In a survey conducted by the institute in April 2022, 31.3 percent of the companies surveyed in the automotive industry also state that they are suffering from a shortage of skilled workers – the highest figure since reunification.

The acute shortage of skilled workers cannot be remedied by domestic labor potential alone. The Skilled Workers Immigration Act, which came into force in March 2020, must be used more intensively and, if necessary, expanded to strengthen labor migration. Bureaucratic hurdles to labor migration must also be removed, qualifications recognized more quickly and orientation services expanded. In this context, the idea of an “opportunity card based on a points system” outlined in the coalition agreement can also make its contribution to granting foreign skilled workers transparent access to the German labor market.

Our Contribution – Innovations and Economic Power



Out of all the industrial sectors in Germany, the automotive industry is traditionally by far the most important in terms of turnover, investment, exports and research expenditure. Through its complex network of intermediate inputs, it also generates prosperity, growth and employment in numerous other sectors.

The German automotive industry is the heart of German industry

In 2020, despite the challenges of the coronavirus pandemic, the automotive industry generated turnover of 378 billion euros, accounting for over 22 percent of total turnover in manufacturing. The mechanical engineering industry followed in second place with a turnover of 217 billion euros.

No other industrial sector invests more in plant, equipment and buildings. Gross fixed capital formation in the automotive industry in Germany amounted to over 107 billion euros in 2019. This is more than one third of the gross fixed capital formation of the manufacturing industry as a whole.

The automotive industry exported products worth over 210 billion euros in 2021. This corresponds to more than 15 percent of Germany's total exports. The mechanical engineering industry, as the sector with the next highest turnover, exported products worth 196 billion euros.

In 2020, the automotive industry employed over 844,000 people in Germany. It traditionally ranks second behind mechanical engineering. The latter had over 1,067,000 employees in 2020. Due to the complexity of its input network, the automotive industry also generates value added and employment in numerous other economic sectors such as metal products (bodywork, power train), rubber and plastic goods (e.g. tires), but also in the service sector such as “economic services” (e.g. congress organizers), legal/tax and business consultancies or security services. The employment in these sectors, which is due to the demand of the automobile industry, amounts to about 660,000 employees.

In addition, there are 640,000 employees in the downstream industries “automobile trade” and “aftermarket” (maintenance and repairs).

This shows how important the automotive industry is for employment in Germany as a whole. However, there is a consensus among economic experts that the further development towards e-mobility will lead to employment losses in the automobile industry. This is shown by all the studies that have been presented on this subject in recent years. The main job losses will be among suppliers. The ifo Institute has calculated that compliance with the current target of a -37.5 percent reduction in CO₂ emissions from passenger cars by 2030 will lead to a loss of between 165,360 and 222,000 jobs in the “conventional drive” sector. If the CO₂ target were to be more stringent, the employment losses would also be correspondingly higher. The loss of jobs in the “conventional drive” sector will be offset by an increase in jobs in the electrification of the drive train.

Securing employment in Germany

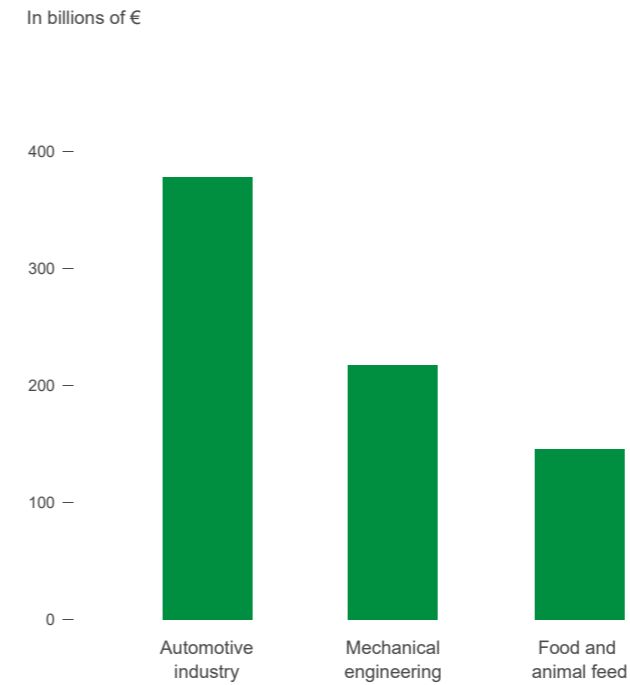
However, in order for this employment to actually be created here in Germany, it is important that policy supports retraining and further education programs offered by companies for their employees. Only in this way will it be possible for companies to de-

ploy as many of their experienced, proven employees as possible in the newly emerging production of components for e-mobility. But even in the best-case scenario, the loss of employment in the “conventional drive” sector will not be fully compensated for by an adequate increase in employment in the “e-mobility” sector. The main reason for this is that far fewer parts need to be installed in an electric motor and correspondingly fewer need to be integrated with each other than in a piston engine.

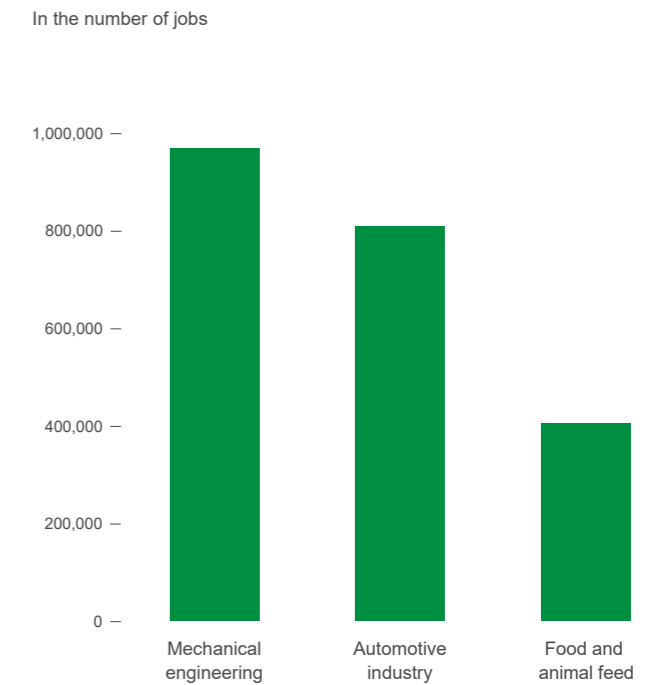
The loss of employment within the automotive industry is compounded by the loss of employment in upstream and downstream industries.



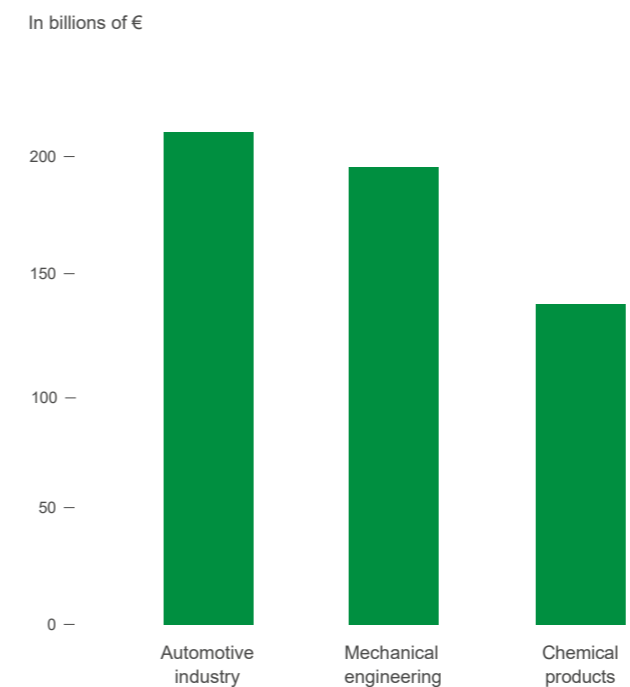
Comparison of the sales in the automotive industry



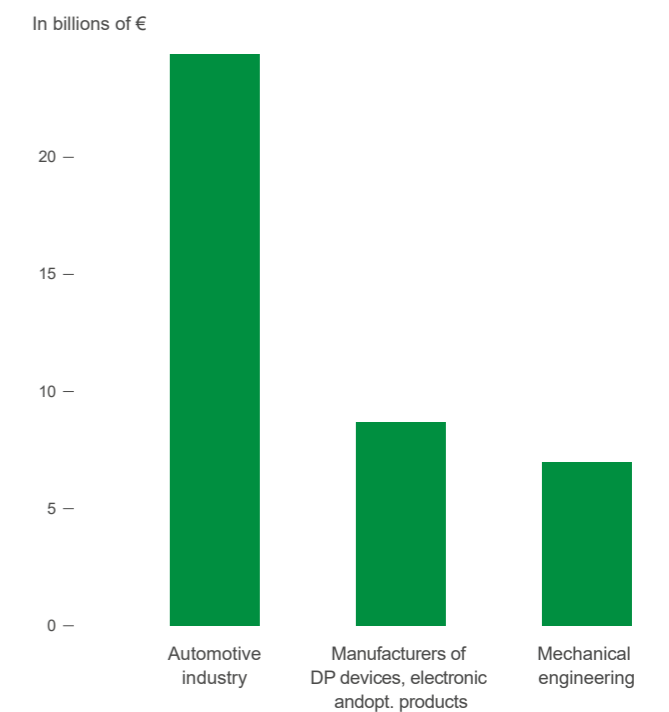
Comparison of employees in the automotive industry



Comparison of exports of the automotive industry



Comparison of R&D expenditures of the automotive industry



The German automotive industry is the global innovation leader

The global market success of the German automotive industry is based above all on its importance as a technological innovation leader. The extent to which the German automobile manufacturers and suppliers are investing in the future of the car is shown, among other things, by the fact that they shoulder more than 40 percent of the R&D expenditure of the entire manufacturing sector in Germany with 24.4 billion euros, far more than any other industry. From 2022 to 2026, the German automobile industry will invest more than 220 billion euros in electromobility, including battery technology, digitalization and other research fields.

But the output-side indicators of innovative capacity also speak for themselves:

Among the ten companies that filed the most number of patents in 2020, the German Patent Office (DPMA) lists seven companies from the German automobile and supplier industry. This includes all patents effective in Germany, i.e., both patents filed directly with the (DPMA) and patents filed abroad as international patents and thus also effective for Germany.

In addition, in the global ranking of the innovative strength of automobile companies, which is published annually by the Centre of Automotive Management (CAM), the first three places are occupied by German automobile companies. The German automobile industry is strong in innovation in both areas of the future: new drives and connectivity/automated driving.

According to the DPMA, Germany is the clear leader in the country ranking of patent applications with effect in Germany in the fields of electric drives, batteries and fuel cells. Japan, the USA, China and Korea follow far behind.

Every year, the CAM also carries out a special evaluation of the innovative strength of the global automobile groups in the field of “connected car/automated driving.” Here, too, the top three places are occupied by German manufacturers.

German car manufacturers are also correspondingly successful in the IW Patentscope. Accordingly, almost one third of all patents registered worldwide to date on automated driving originate from the automobile industry and its suppliers in Germany.

The latest innovations of the German automobile and supplier industry include, for example, the development of a power bank for charging cars at locations that are not yet connected to the power grid, the emission-free heating and air-conditioning of e-buses or the crash shield, which, as a kind of further development of the crumple zone, distributes and absorbs the energy introduced over a large area and thus provides even better protection in accidents than before.

In order to maintain its global innovation leadership, the German automobile industry presented proposals in March 2020 for the sustainable protection of Germany as a technology location. It highlights the need for an efficient, interdepartmental research and innovation policy. Among other things, this should offer a complete, interministerial overview of funding opportunities. In view of ever-shorter innovation cycles, funding must also be made possible in ad-hoc procedures, the bureaucratic effort from application to proof of use must be reduced and, last but not least, long-term technology roadmaps must be developed as strategic tools for innovation management. The German automobile industry also drew up such a roadmap in June 2021 for pre-competitive research and innovation over the next ten years. It explains the relevant fields of action and characterizes its research areas in detailed topic profiles.

Importance of the automotive industry for Germany has continued to grow

The automotive industry has always been Germany's most important industrial sector. However, its importance has grown even more since the beginning of the 1990s. It is thanks to its innovative strength that it has been the fastest-growing sector of all industries since then. Its nominal gross value added increased by an average of +3.9 percent annually, while the German industrial sector as a whole was only able to increase its gross value added by an average of 1.9

percent per year. Accordingly, the German industrial sector has shifted further and further towards the automobile industry. In 1991, its share of the gross value added of Germany's manufacturing sector as a whole was still 11.9 percent; today it is 20.5 percent. But that also means means that if the automobile industry comes under pressure and suffers damage, this will inevitably have a correspondingly strong impact on overall economic growth.

Germany as a location for innovation: attractive, but falling behind over time

Besides labor and energy costs, infrastructure, government activity and access to resources, innovation conditions are among the most important location factors of an economy. The ability of companies to generate innovations is based on two prerequisites – the knowledge intensity of the economy and good fiscal framework conditions for investment, research and development.

Germany has a fairly high knowledge intensity. In comparison with the other 15 most important industrialized countries, Germany is in the top third in this respect, but has lost ground to South Korea and China, in particular, because they have caught up. Germany's strengths in a country comparison lie in a high proportion of graduates in STEM fields of study and a high proportion of people with vocational training. Germany is only slightly above average in the share of R&D personnel in the total population and in corporate R&D spending as a share of gross domestic product. So obviously not all sectors invest as heavily in R&D as is the case in the automotive industry. Higher corporate R&D spending is seen in South Korea, Japan, the USA and Switzerland.

This shows how important it is to further stimulate R&D investments in Germany with attractive tax framework conditions. This is necessary because Germany is a high-tax country in an international comparison of locations. Against this background, it was right for policy-makers to introduce tax incentives for research in 2020. However, this can only be a first step, because capping the amount of funding at one million euros per company is not sufficient to send a strong signal in the international competition

between locations. This is especially true for the large companies that are very flexible in their choice of research location.

Direct funding of research projects remains just as important. Tax-based research funding and project funding are two approaches that complement each other. The advantages of project funding, namely the very targeted interlinking of universities, science societies, SMEs and large companies through publicly financed cooperation projects, cannot be replaced by broad-based tax-based research funding. What is important with project funding is that it is open to technology and does not favor or disadvantage any individual technologies. Discretionary project funding narrows the scope of possible technological solutions and restricts the freedom of consumers in their choice of technology.

In order for companies to successfully manage the ecological and digital transformation, however, it is not only necessary to invest heavily in R&D, but also in new production technologies: in the automotive industry, for example, in new production lines that produce electric vehicles instead of combustion vehicles or in the construction of factories for the production of battery cells. In this respect, it is to be welcomed that politicians are planning to introduce a super depreciation or an investment premium for investments in climate protection and digital assets. Leading economists also point out that a broad-based expansion of depreciation conditions would certainly create incentives to build new production facilities in Germany.

Our Needs – Infrastructure, Power and Openness to Technology

Making road transport climate neutral: The automotive industry is rising to this challenge and is resolutely driving the change forward with all its might. The path to climate neutrality can only be successfully mastered together. All players must make their contribution.

The construction sites are large, which means there is a lot to do: The expansion of renewable energies, electricity grids and charging infrastructure falls far short of current, and even more short of future, needs. The energy industry will therefore have to more than triple the expansion of renewable energies in the coming years in order to be able to reliably supply electric cars, but also heat pumps, for example, with renewable energy. The electricity grids must be expanded with foresight and comprehensively modernized in order to supply the 15 million electric vehicles envisaged by 2030 not only without interruption, but also intelligently with electricity from wind and solar energy.



The same applies to the necessary charging infrastructure, without which the targeted even faster market ramp-up of electric vehicles cannot succeed. Although Germany is still in a relatively good position in international comparison, the charging infrastructure is by far the biggest obstacle to the broad acceptance of electric mobility in this country. If Germany is to become the lead market for electromobility, as agreed in the coalition agreement, the expansion of the charging infrastructure must finally be massively accelerated.

The expansion of the charging infrastructure must finally pick up speed

In numbers, this means that in Germany alone, at least 2,000 public charging points must be added every week, almost six times more than the last years. To achieve this, around 74 billion euros must be invested in the charging infrastructure by 2030. Nevertheless, the energy industry is still holding back on investments. Their own economic interest in increasing the utilization and thus the profitability of charging points by artificially creating a shortage of them may be understandable, but it can lead to considerable acceptance problems and, in the worst case, even to the failure of battery-electric drives.

At European level, the EU Commission is therefore pursuing the fundamentally correct goal of prescribing binding targets for the expansion of the charging infrastructure and hydrogen filling stations to the energy industry in the member states with the regulation on the development of a charging and refueling infrastructure for alternative fuels (AFIR). But even here, the level of ambition in terms of charging capacity per electric vehicle falls short of what is required by a factor of three.

Even the most ambitious ramp-up of alternative drive systems and the most ambitious expansion of renewable energies will not be enough on their own to achieve the climate goals in transport. Above all, in order to address the vehicle population, the mineral oil industry will have to bring large quantities of climate-neutral fuels onto the market as quickly as possible. By 2030, German transport alone will need 89 terawatt hours of climate-neutral fuels, electricity-based hydrogen and e-fuels, according to the findings of the Climate Paths 2.0 study prepared by the VDA together with the BDI.

Renewable fuels for the existing fleet

In order to ramp up the production of e-fuels on an industrial scale, the petroleum industry must already enter into appropriate international cooperation and long-term energy partnerships with the future countries of origin. After all, it is true that in Germany we will certainly not be able to produce the required quantities of climate-neutral fuels entirely. Complete energy self-sufficiency in Germany, as some people are striving for, is neither possible nor desirable. Thanks to the energy yields, some of which are many times higher than those achieved by wind and solar plants in wind- and sun-rich locations such as Chile, Australia or the MENA region in North Africa, the much-criticized efficiency disadvantages in the production of the fuels in question are to a large extent offset.

Actually, the European Renewable Energy Directive (RED) should and must have set corresponding incentives in favor of climate-neutral fuels. But it is, above all, the far too lax requirements that have so far prevented the necessary ramp-up. For the first time, a sub-quota for e-fuels in transport is being discussed in the directive. But the level of ambition falls well short of the EU's own climate policy ambitions. In concrete terms, the ambition level of the THG reduction quota of the RED, which includes green electricity as well as renewable fuels, would have to be almost tripled in order to set real impulses in favor of alternative fuels in the mineral oil and energy industry.



The focus of the automobile industry is clearly on the market ramp-up of e-mobility. But if every car, every bus and every truck on European roads is to be climate neutral by 2050 at the latest, this goal cannot be achieved with e-mobility alone, if only because of the usual useful life of vehicles. Instead, all technologies will continue to be needed for climate protection; the potential of plug-in hybrids, whose purely electric range is steadily improving, plays just as important a role as fuel cells and synthetic fuels. The latter are an important lever for making a significant contribution to CO₂ reduction in transport, also via the vehicle population.

Climate protection needs openness to technology – not prohibitions

In the competition between the different technologies, supply and demand should determine the scope and application. In view of the complexity of the regulatory task, it also makes sense to rely on technology-open instruments that leave the actors as much freedom as possible in choosing the solutions. We therefore consider the tightening of the CO₂ fleet limits to 0 grams, which in 2035 is de facto tantamount to a ban on the internal combustion engine, to be wrong. The ban on the internal combustion engine not only fails to take into account the already extreme pressure to adapt, especially for medium-sized automobile suppliers. It also fails to take into account the establishment of new value-added sectors such as battery production, which is necessary for the social compatibility of the transformation and which simply cannot be done overnight. The ban also fails to recognize that it is currently still completely unclear whether all member states will be able to create the prerequisites and framework conditions for a successful transformation. This applies, for example, to the expansion of the charging and refueling infrastructure, but also

to the measures to promote an accelerated ramp-up of electromobility, which are still insufficient in many member states.

Instead of technology bans, market-based control instruments and corresponding price signals should support the switch to climate-friendly technologies and energy sources. Following the introduction of the national CO₂ price in the Fuel Emissions Trading Act, it is now important to introduce emissions trading for road transport at the European level as well. This will support the market take-off of electromobility and, at the same time, provide effective incentives to bring climate-neutral fuels such as electricity-based e-fuels onto the market. It remains a major challenge to establish emissions trading as the guiding instrument of European climate policy also in the sectors not yet covered, in order to set clear investment signals along the entire value chain and thus develop the entire transport sector towards sustainability.

Emissions trading and CO₂ price

Only cross-sectoral emissions trading with a “CO₂ cap” is capable of ensuring the achievement of climate policy goals in the long term. CO₂ emissions can be saved, where this is the most cost-effective option, only with such emissions trading. With a uniform CO₂ price signal, all actors in the supply chain – from raw materials to fuel to recycling – will be equally involved in achieving the climate targets.

Our Traffic – Mobile in the City and Countryside

The automotive industry is committed to the goal of sustainable mobility. The mobility of the future must be climate neutral, conserve resources, be safe and be efficient in terms of area. The aim is to provide people with affordable mobility that is geared to their needs – both in the city and in the countryside. The demands of the economy on the transport system of

the future must also be taken into account. Reliable and efficient freight transport is a cornerstone of competitiveness in Germany. Sustainability in transport will not be achieved by working against passenger cars and trucks, but only by working with them. Road transport will remain an indispensable pillar in the transport system of the future.



Freight Transport

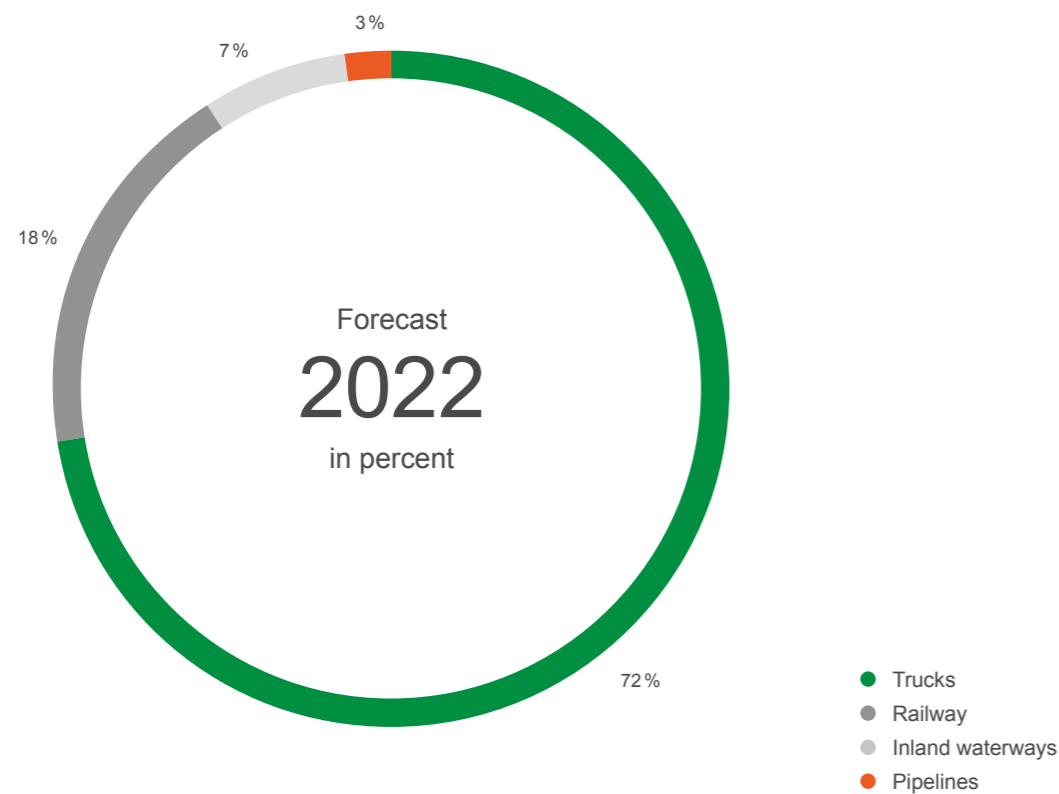
Road transport is by far the number one mode of freight transport. In Germany, trucks shoulder about 72 percent of the transport volume, railways account for a good 18 percent and inland waterways for about 7 percent. Trucks owe their importance, to a large extent, to their flexibility and network-building ability.

Trucks as the backbone

Only the trucks can reach any destination from the loading bay to the front door. They are therefore often indispensable for other modes of transport, such as rail, to take over the last mile. Trucks secure the delivery of supermarkets and thus reliably our daily supply, which they also proved during the coronavirus pandemic. Trucks generally have an advantage when transporting small consignment sizes and over

shorter distances. Linking road and rail generally only makes sense for distances of more than 300 kilometers. This results in a division of tasks between the modes of transport. Trucks are ideal for low-volume or low-weight transports and on shorter routes. Rail and inland waterways, on the other hand, are particularly competitive for transports with high volumes or high weights over long distances. A good example of this is the transport of brand-new vehicles. The German automobile industry uses rail for well over 50 percent of its transports of newly produced vehicles in the main run. Because of their system-related advantages and disadvantages, the modes of transport in freight transport are therefore far less in competition with each other than is usually assumed. Rather, they complement each other.

Shares of freight transport performance by mode of transport



Source: Intraplan, BAG

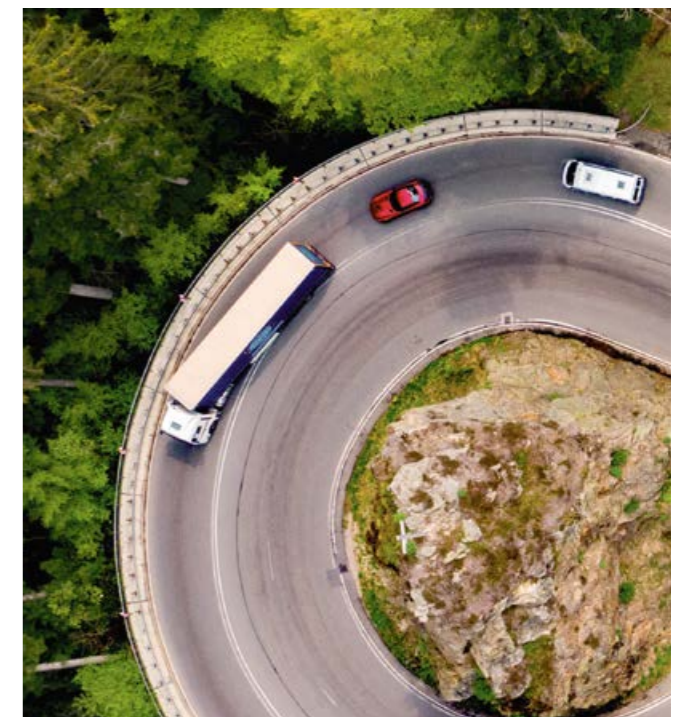
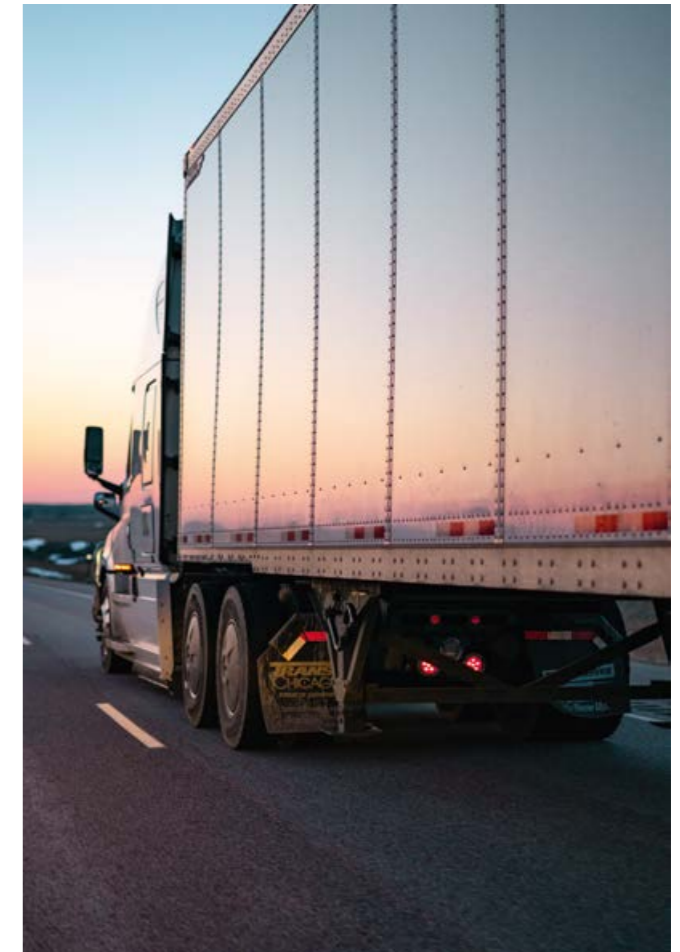
Decisive framework conditions

Trucks need suitable framework conditions so that they can fulfill their role as the engine of the economy. This includes, for example, a demand-oriented expansion of the road infrastructure and, not least, truck parking spaces along the motorways. Improving the parking situation could also counteract the increasing driver shortage, as this would improve working conditions. In addition to a generally improved appreciation of the performance of truck drivers, the removal of bureaucratic hurdles could also contribute to this, e.g. in the case of further training requirements or through the introduction of e-learning offers.

With regard to urban logistics, the creation of special delivery zones, which are exclusively available for deliveries at least at certain times of the day, could take into account the requirements of urban commercial transport. This could, for example, prevent stopping in the second row. The traffic flow and traffic safety could be improved in this manner. If necessary, digital reservation of these zones could also be made possible. In order to give the municipalities room to maneuver, it would make sense to amend StVO.

HGV toll with CO₂ component

The HGV toll also plays an important role in setting the framework for road freight transport in Germany. The amended EU Toll Directive, which came into force in spring 2021, now allows toll rates to be differentiated according to the vehicles' CO₂ emissions. As announced in the coalition agreement, Germany should quickly make use of this possibility. A CO₂ reference in the HGV toll can provide important incentives for investments in zero-emission and low-emission trucks and thus pave the way towards sustainable, prospectively climate-neutral and locally emission-free road freight transport.



Passenger Transport

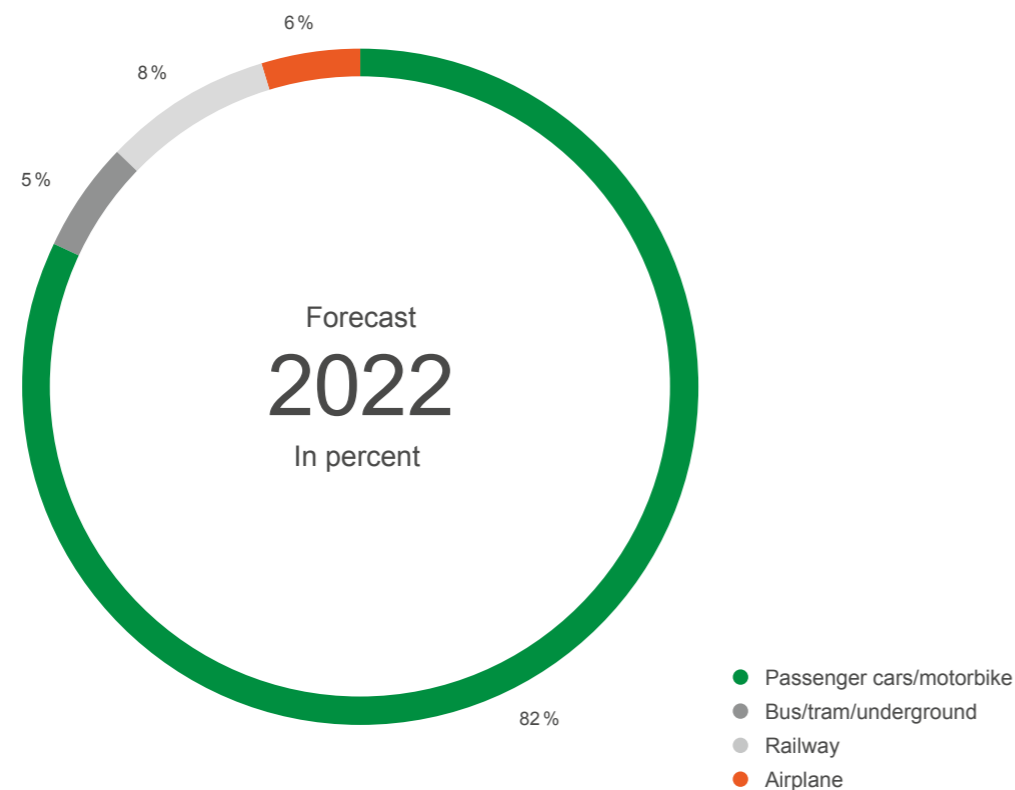
The car continues to be the most important means of passenger transport for people in Germany. It accounts for about 80 percent of passenger transport. Since car traffic declined significantly less than rail transport, local public transport or air transport during the coronavirus pandemic, the car share of passenger transport even rose to well over 80 percent in 2020/21.

Passenger cars – the number one means of transport in Germany

Almost 80 percent of German households have at least one car, almost a quarter have at least two. Especially in rural areas, owning a car is indispensable for many people; there, the share of households without a car is only 10 percent. But even in the city,

many people still rely on the car. The car density (number of cars per 1,000 inhabitants) in almost all major German cities continued to rise between 2010 and 2020. Cars also lead the way in the number of daily journeys. According to the latest representative survey “Mobility in Germany,” people use cars (including passengers) for about 57 percent of their daily journeys, 22 percent of journeys are made on foot, 11 percent by bicycle and 10 percent by public transport. There are definitely differences between urban and rural areas. While the car accounts for up to 70 percent of daily journeys in rural areas, in the large German cities it is only about 38 percent.

Shares of passenger transport performance by mode of transport



Source: Inraplan, BAG

Multi-modality as a target

Overall, it can be said that mobility has become more colorful and diverse in recent years, especially in urban conurbations. New forms of transport such as e-scooters have been launched, 3.4 million authorized users are registered with car sharing service providers in Germany. Many people are no longer committed to one means of transport, but decide on a case-by-case basis. The transport system will thus be characterized by a multi-modal mobility range. This will give people the opportunity to choose the most suitable offer for each route, each destination and each purpose of travel. To ensure this, other attractive mobility services must be created in addition to the private car and an efficient public transport system. Forms of shared mobility such as car and bike sharing or ride pooling can create alternatives to the private car that are suitable for everyday use. In this way, the perceived gap between public transport and private cars can be closed, and the mobility needs of those who only need a car from time to time can be met in a better manner.

Innovative solutions that enable mobility for all

The automotive industry is helping to drive the change towards sustainable mobility. It is making its contribution with innovative technologies and service innovations such as its own ride pooling services. The new offers help to further improve mobility for people, relieve the roads and create opportunities for a higher quality of stay in public spaces, especially in cities.

Moreover, electric mobility already allows for a locally emission-free and quieter use of vehicles. The advancing networking of vehicles with each other and with the infrastructure – such as communication between vehicles and traffic lights – can make traffic more efficient, smoother and even safer. “Automated valet parking” can help reduce the need for parking space because the space can be used more efficiently. With approaches such as “community-based parking,” vehicles themselves collect data on available parking spaces and inform each other about

them. This can significantly reduce the amount of traffic where people search for parking spaces. In the future, autonomous transport systems (“people movers”) could also complement existing public transport technologies as a cost-effective mobility solution.

Legal framework conditions as a basic prerequisite

Suitable political and legal framework conditions are also a prerequisite for the further development of multi-modality and the long-term establishment of new mobility offers on the market. User benefits, such as those provided by the Carsharing Act, help the market penetration of shared mobility offers. Therefore, municipalities should also make use of these opportunities, and all federal states should also create the corresponding legal basis for such user benefits. The amendment of the Passenger Transport Act in the previous legislative period of the German Bundestag was a first step towards making new mobility services such as ride pooling permanently possible in Germany. However, the implementation on the ground must take place such that it promotes services and does not regulate them away. The law must therefore be carefully evaluated and, if necessary, adapted again.

In any case, there is a need to adjust the tax framework. Fair taxation, for example in the case of value-added tax, will determine whether pooling transports can compete with other transports. The seamless linking of transport modes is also necessary for the formation of inter-modal chains, i.e. the use of several different means of transport for one journey. This applies both to transport data, but also physically, for example through the expansion of P+R services. According to estimates by the ADAC, the number of P+R spaces in the Berlin area alone would have to be doubled.

Looking at tomorrow's mobility as an overall concept

From the automotive industry's point of view, it is crucial that politicians embed all measures for shaping tomorrow's mobility, especially in urban areas, in an overall concept and build on the dialogue of all stakeholders. This should also apply to the closure of individual central roads in city centers. In this context, the effects on possible alternative routes should always be taken into account. An isolated closure of streets often does not lead to less car traffic, but only to its spatial displacement. The goal should also be to consider the various modes of transport together and to link them sensibly and intelligently. In doing so, it is important to develop concepts that are adapted to the respective local conditions. For example, the conditions in small and medium-sized towns are often different from those in large cities.

Buses as a pillar of regular transport

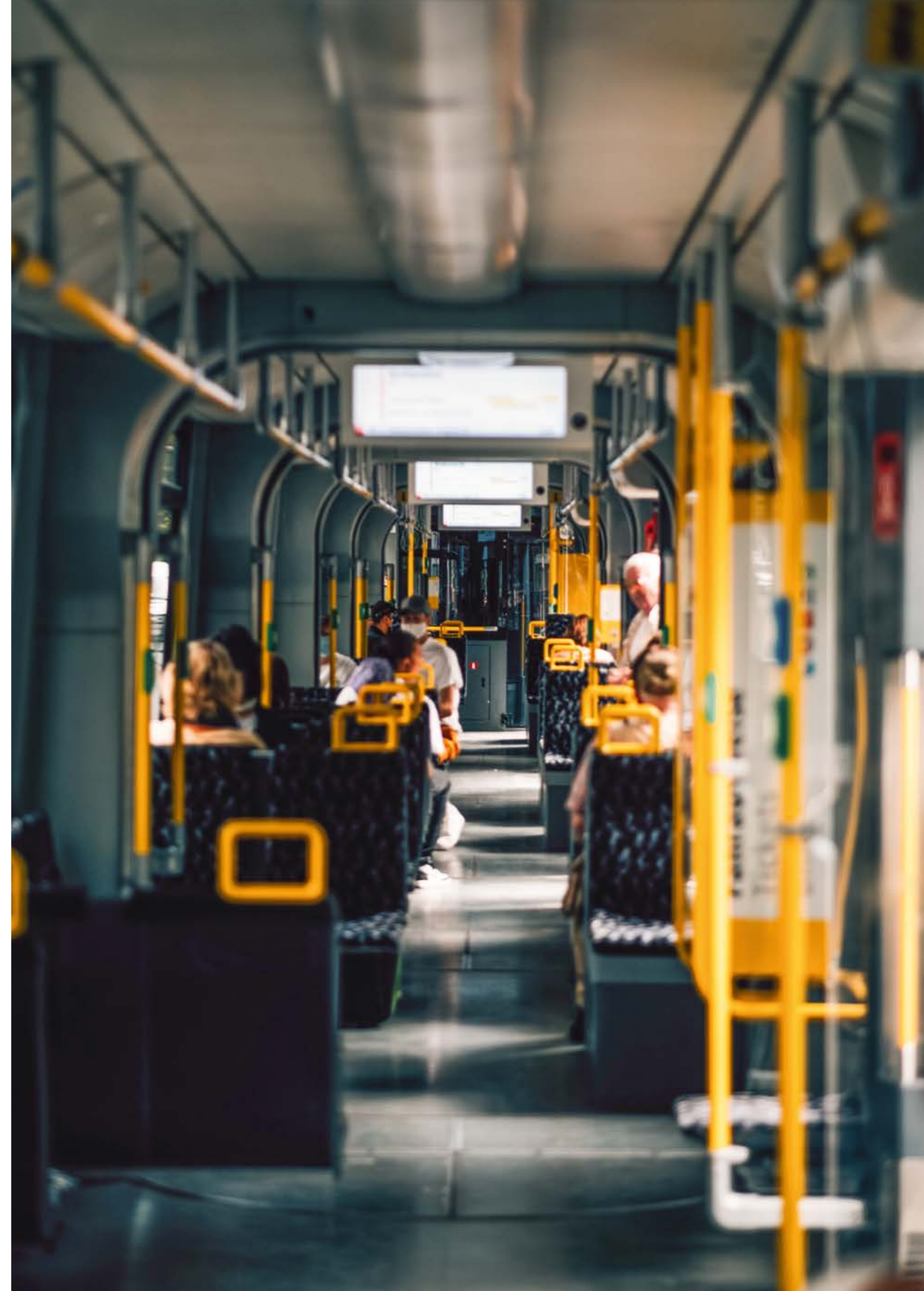
An indispensable component of a sustainable mobility system is public passenger transport. In this respect, buses play a central role. More than 40 percent of public transport journeys are made by bus, the rest by tram/subway and rail. The great strength of the bus is that it can also be used economically on routes with lower volumes. It is therefore often the only relevant means of public transport in rural areas, but also in the city it usually offers the most closely meshed service network. In long-distance passenger transport, long-distance buses have also offered a low-cost mobility alternative for many people in Germany since their market launch.

Platform for Urban Mobility – cities and the automotive industry in dialogue

The urban mobility of tomorrow requires the interaction of all parties involved. Therefore, the VDA launched the Platform for Urban Mobility (PUM) in 2017 in order to intensify the dialogue between cities and the automotive industry. The PUM is a recognition indicating that neither cities nor the automotive industry can manage the transformation alone. Therefore, cooperative solutions for tomorrow's urban mobility and logistics are to be developed and coordinated. The aim is to exchange visions and models with each other and to jointly identify fields of action. In this way, the PUM also wants to provide impetus for improving the framework conditions. In addition, the PUM sees itself as a forum for the exchange of best practice solutions. The topics addressed by the PUM include

electromobility, the use of public spaces in the city, new mobility services, the role of price signals, traffic management, connected and automated driving, and corporate mobility management.

**Plattform
Urbane
Mobilität**



Economic Performance and Markets

In most markets the pre-coronavirus level has not yet been reached again. The semiconductor shortage, logistics problems, and developments in the electricity and gas markets are having a hampering effect. The transition from combustion engines to electric engines is underway in many markets.

Current Automotive Economy: The First Half of 2022

While the shortage of primary products and raw materials determined the economy in 2021, resulting in production cutbacks – especially in the automotive industry – the economic situation in 2022 is different. Russia's war of aggression on Ukraine, which violates international law, has led to a change in the world situation that also has a significant economic impact.

The economic outlook for 2022 is becoming increasingly gloomy. There are increasingly more immediate factors that are noticeably burdening the economic environment – directly and in the form of increased uncertainty. The latter in turn has a dampening effect on consumption and investment behavior. The high producer and consumer prices demand a more restrictive course from central banks, interest rates have already been raised in the USA as well as in the euro area, and further interest rate steps will follow.

The war has also opened up new supply bottlenecks, especially in the energy sector. Coronavirus restrictions, although no longer affecting economic activity to the same extent as in the past two years, continue to pose an economic risk. This is shown by the example of China with its rigid zero-Covid course. The breadth and versatility of the stress factors is giving rise to new discussions and, at the same time, suggests that the tense situation is unlikely to be resolved in the short term. In addition to high inflation, the looming energy crisis in Europe poses a significant economic risk to the EU as a whole.

While, according to preliminary figures from Eurostat, the eurozone recorded slight quarter-on-quarter growth of 0.7 percent in Q2/2022 (EU: +0.6 percent), GDP in the United States fell for the second quarter in a row, according to the US Department of Commerce (Q2/2022: -0.9 percent with respect to Q1/2022). The Chinese economy grew more weakly than expected in Q2/2022 (+0.4 percent with respect to Q2/2021), mainly due to the rigid Covid measures. After extensive easing of the coronavirus restrictions in the Chinese metropolitan regions, the Chinese economy recently showed signs of recovery. The zero-Covid strategy and the ailing real estate sector remain a cyclical risk for the Chinese economy.

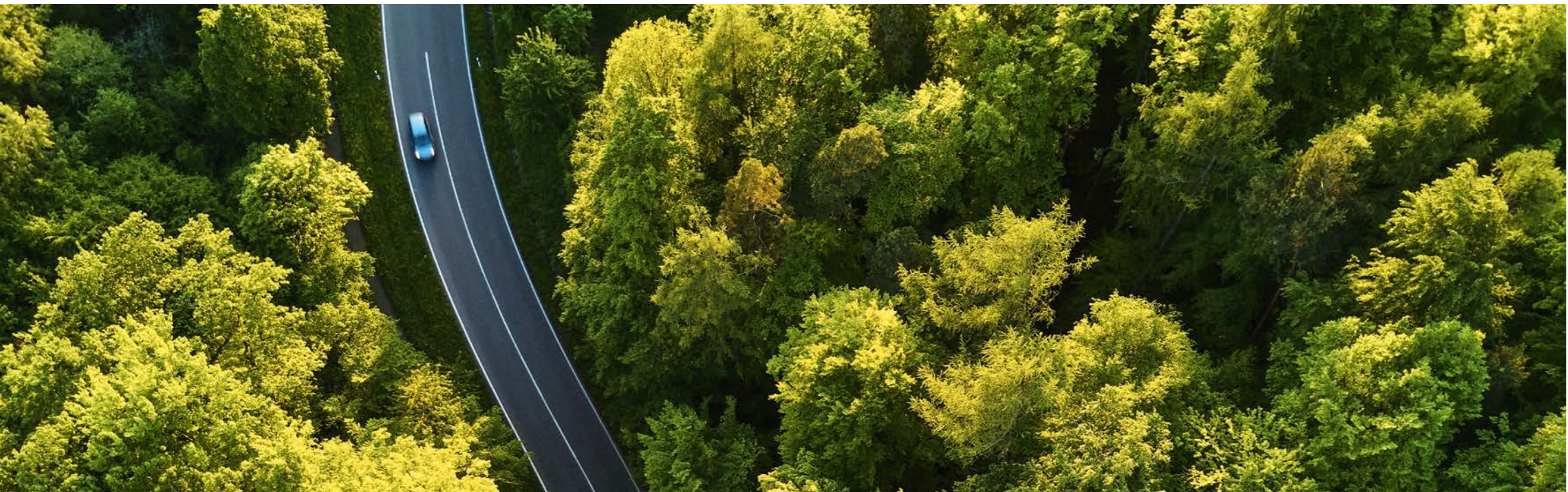
According to the Federal Statistical Office, the German economy grew slightly in the second quarter of 2022 (+0.1 percent with respect to Q1/2022). Concerns about a gas shortage in autumn/winter, price developments and persistent supply-side bottlenecks are weighing on the economy and further cloud the economic outlook for the rest of the year. Nevertheless, the German labor market continues to develop robustly. Although unemployment continued to rise in July compared to the previous month, this is mainly due to the inclusion of Ukrainian refugees in the labor market statistics since June. The Ifo Institute also reported that the shortage of skilled workers rose to an all-time high in July. According to the report, 49.7 percent of the companies surveyed in July – 44.5 percent

of those in the manufacturing sector – said their businesses were being affected by a lack of qualified personnel.

Like the economy as a whole, the development of the global motor vehicle market is subject to a high degree of uncertainty. Although the supply chain problems of the past year have eased somewhat, they continue to lead to supply-side bottlenecks, and various locations are still experiencing short-term production stoppages in mid-2022. At the same time, given high energy prices and inflation, as well as concerns about a deterioration in the economic situation, there is a growing risk that market volumes will be increasingly constrained by the demand side in the future. The supply-side problems are turning into demand-side problems. According to Gesellschaft für Konsumforschung (GfK), consumer sentiment in Germany continued its downward slide. For August, the consumer climate reached a new all-time low. The buying propensity indicator also fell to its lowest value since October 2008.

The sales figures so far reflect the current difficult situation: In the United States, light vehicle sales fell by 18 percent in the first half of the year, and in Europe (EU27, EFTA and UK), passenger car sales after the first six months were 14 percent below the level of the same period last year. All of the five major European individual markets recorded double-digit negative growth rates: In Germany and Spain, 11 percent fewer new passenger cars were registered in H1/2022, in the United Kingdom 12 percent, in France 16 percent and in Italy 23 percent compared to H1/2021. With just under 781,900 new registrations, passenger car sales in the total Western European market (EU14, EFTA and UK) in July were 10 percent below the previous year's level (values are based on preliminary data from the respective national associations). It was already the thirteenth consecutive month of negative sales growth rates in Western Europe. Compared to the pre-crisis month of 2019, Western European new car registrations in July of the current year are 34 percent lower. Similarly, US





light vehicle sales were unable to break the negative trend in July, recording their twelfth consecutive double-digit decline (-12 percent compared to same month last year). While the Chinese passenger car market had developed dynamically in Q1/2022 with +9 percent compared to Q1/2021, sales slumped in April (-43 percent compared to the same month last year) as a result of the rigid coronavirus lockdowns imposed by the Chinese government in some metropolitan regions as part of its zero-Covid strategy. However, the Chinese passenger car market was able to stabilize in May and achieved a significant increase of 42 percent again in June. China thus recorded an increase of 4 percent in the first half of the year (compared to H1/2021). In contrast to the US and Western European markets, the Chinese passenger car market again recorded a significant increase in July (+40 percent compared to the same month last year). This is clear evidence indicating that the Chinese government's strong demand-boosting measures are now materializing.

The geopolitical tensions, the difficult economic situation, the high degree of uncertainty and the ongoing disruptions in the supply chains also caused tensions in the international commercial vehicle markets (commercial vehicles over 6 metric tons) in the first half of the year: European market for heavy commercial vehicles (EU27, EFTA and UK) recorded a decline in new registrations of 2 percent in the first half of the year compared to the same period last year, while the US market for heavy commercial vehicles recorded a decline of 6 percent. Meanwhile, the correction in the Chinese heavy commercial vehicle market continued in the first half of 2022 (H1/2022: -62 percent compared to H1/2021). The fading investment cycle caused sharp market declines. While the US heavy commercial vehicle market was able to break the negative trend of the previous months in July (+6 percent compared to the same month last year), the Chinese market for heavy commercial vehicles continued to be clearly in

the red at the beginning of the second half of the year (July 2022: -41 percent compared to the same month last year).

After domestic car production suffered double-digit declines in March and April due to the outbreak of war in Ukraine and the associated shortages of primary products from Ukraine (-30 and -14 percent, respectively, compared to the same months of the previous year), it recovered somewhat in May and June (+22 and +16 percent, respectively, compared to the same months of the previous year). However, the significant increases in May and June could not fully compensate for the declines of the three preceding months at the end of the first half of 2022 (H1/2022: -3 percent compared to H1/2021). Meanwhile, positive development continued in July.

The global market for electric vehicles: China remained by far the most important e-market in the world in H1/2022, with 2.483 million

new e-cars registered (+117 percent). For comparison: Europe (EU 14, EFTA and UK) totaled 1.125 million (+9 percent), less than half that. The USA ranked behind with sales figures of 419 thousand (+46 percent). In June, all European markets (Europe total -7 percent) except the Netherlands (+14 percent) were in the red due to chip shortages and a weak PHEV market. The Scandinavian markets Norway (-23 percent) and Sweden (-20 percent) were the weakest. With the exception of South Korea (-4 percent), the non-European markets were all clearly up, led by China with +132 percent.

The Automotive Year 2021

German Market

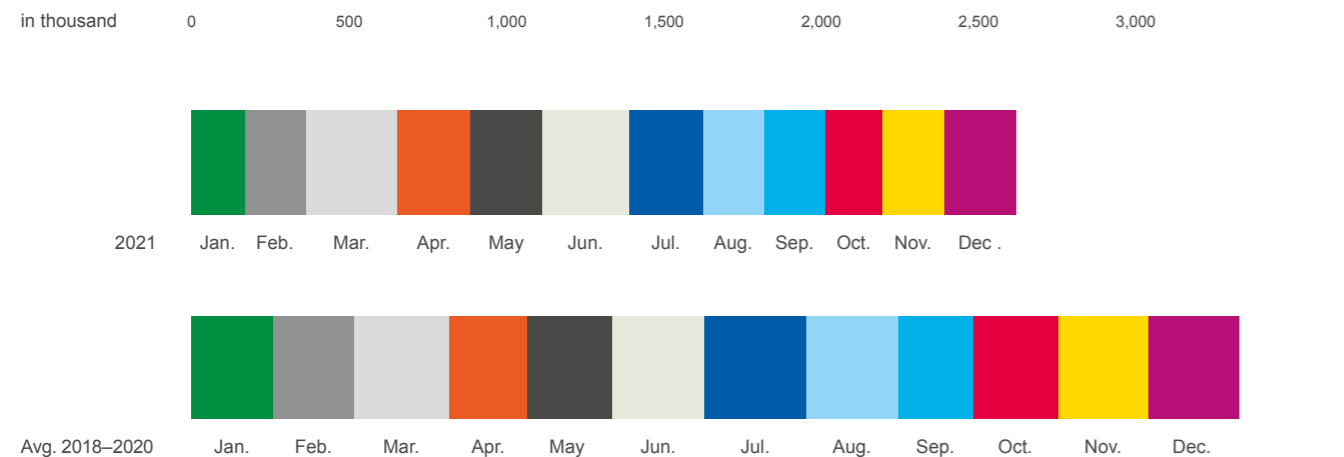
Passenger Car Market in Germany

In 2021, the German passenger car market fell to its lowest level in reunified Germany. With 2.6 million new registrations, the market closed 10 percent below the previous year's level. It was the second double-digit decline in a row: In 2020, the market volume – triggered by the coronavirus pandemic – had already fallen by 19 percent to 2.9 million new vehicles. After a weak start in January and February 2021, high growth rates were achieved from March to June. However, this was mainly also boosted by the low registration figures from 2020. At that time, strict government measures had been enforced in the course of the first coronavirus wave, which temporarily paralyzed the passenger car trade. In contrast, the reduction in value-added tax, which

expired at the turn of the year 2020/2021, blunted the development of the passenger car markets, as there was a noticeable preferential effect. This ensured that customers bought their new vehicles in 2020 and not in 2021. In the second half of the year, the base effect from the low new registration figures of the first coronavirus wave faded out and, at the same time, the bottlenecks in the supply chains began to have a more marked impact on the markets. The shortage of semiconductors especially caused a short supply and resulted in a significantly declining market. While new registrations were still up by 15 percent in the first half of the year, they fell by 28 percent in the second half.

Passenger car sales in Germany

Monthly new registrations as of 2021 and average of 2018 to 2020



Source: KBA

Group of holders

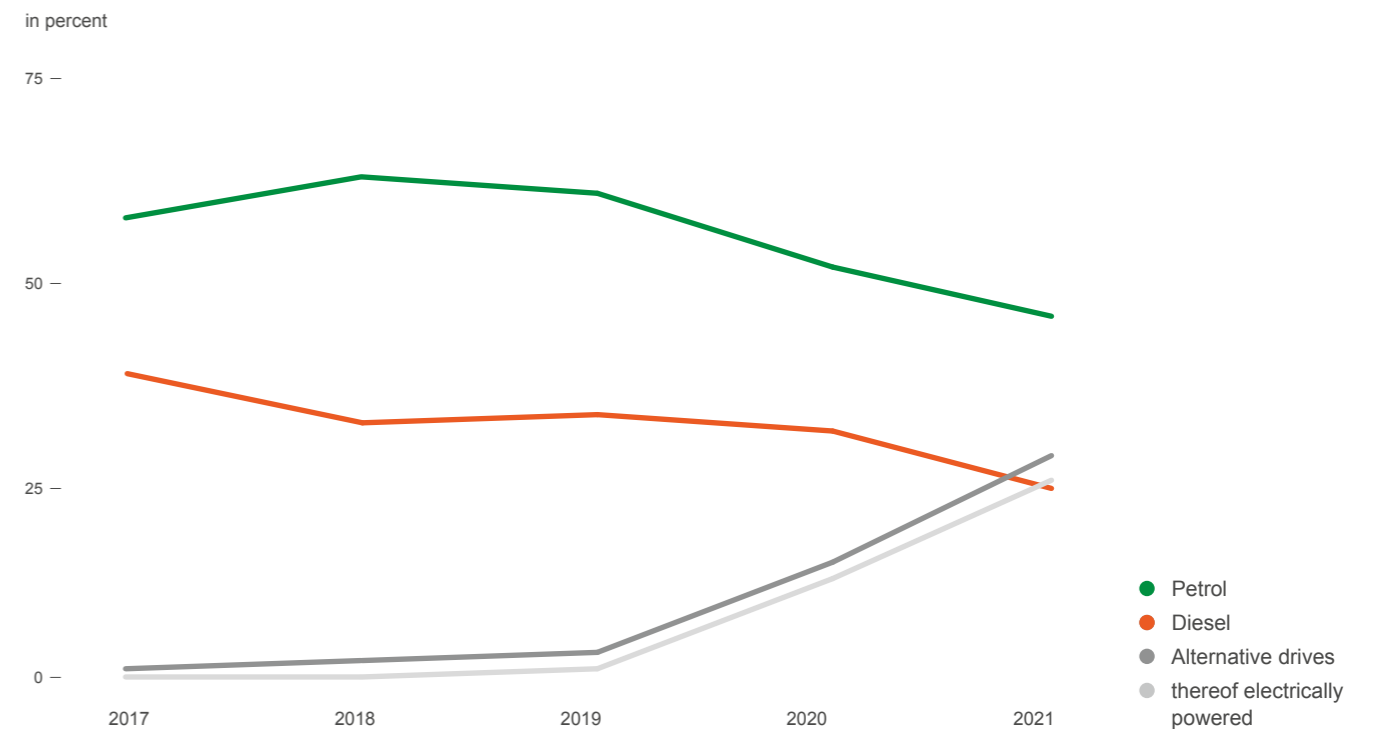
New registrations by group of holders in 2021 mirrored the development from the second half of 2020. While new registrations by commercial owners increased slightly by 4 percent in 2021, new registrations by private owners decreased significantly by 7 percent. Among other things, the reduced VAT in the second half of 2020 also had an effect here, which led to clear preferential effects among private keepers. The difference is due to the fact that private owners react more strongly to the reduced VAT.

Drive types

The change in power trains was also clearly visible in new car registrations in 2021: While the number of petrol and diesel cars sold again fell significantly, the volume of new registrations of passenger cars with alternative drives rose by almost 390,000 vehicles. The growth dynamic was particularly strong for purely electrically driven passenger cars (BEV, +83 percent) and plug-in hybrids (PHEV, +62 percent). In the course of the year, however, the dynamics of new registrations of electric passenger cars (BEV, PHEV and fuel cells) dropped significantly. In the first half of the year, they increased by 233 percent, but in the second half of the year the increase was only 23 percent. The base effect due to the expired VAT increase as well as the shortage of supply due to the semiconductor shortage and the long delivery times also had a braking effect.

New passenger car registrations by drive type

Development of market shares



Source: KBA

Manufacturer countries

The vehicles of German group brands continue to be highly popular with customers. Last year their market share was 67.7 percent. In absolute terms, 1.8 million new vehicles with the “German logo” were registered. With 243,900 newly registered vehicles, French manufacturers continue to be very popular among importers. At 14 percent, their market volume shrank somewhat more than the market as a whole. Their market share fell slightly from 9.7 to 9.3 percent. With 216,200 new vehicles, Japanese manufacturers sold slightly fewer passenger cars than in the previous year. Their sales declined by 12 percent, so that their market share fell to 8.2 percent (previous year: 8.4 percent). Korean manufacturers achieved slight growth to 174,000 new vehicles in 2021. Their sales thus increased by 2 percent. Their market share rose significantly from 5.9 to 6.6 percent. At 89,000 passenger cars, sales of vehicles from Italian manufacturers fell by 7 percent. Their market share rose slightly from 3.3 to 3.4 percent.

Vehicle segments

Despite the overall weak year, the largest segment among new registrations, SUVs or off-road vehicles, was able to expand its dominant position with growing new registrations. The volume of new registrations increased by 2 percent, but was still 170,000 units below the record level of 2019. The segment's market share rose from 31.8 to 36.1 percent. Microcars also made a significant leap, with their share rising from 5.0 to 6.4 percent.

Commercial Vehicle Market in Germany

Heavy commercial vehicles

In Germany, a total of 72,500 heavy commercial vehicles over 6 metric tons were newly registered in 2021. Compared to the previous year, the market thus grew by 6 percent or by almost 4,400 units. The heavy commercial vehicle market in Germany thus recovered somewhat, after new registrations in 2020 had slumped by 25 percent compared to 2019. However, the 2019 level was still undercut by 21 percent in 2021. At that time, the highest sales volume since 2008 was achieved with 91,400 newly registered heavy commercial vehicles.

At +35 percent, the second quarter was the strongest growth quarter in 2021. This is firstly due to the easing of the coronavirus infection situation at that time, which was associated with the far-reaching withdrawal of infection control measures. Secondly, new registrations of heavy commercial vehicles had plummeted in Q2/2020 due to the coronavirus pandemic and the resulting uncertainty in the markets. After growth in the first half of 2021, the German market for commercial vehicles over 6 metric tons shrank by almost 6 percent in the second half of the year compared to the previous year's level. At -9 percent, the fourth quarter developed worse than the third quarter at -3 percent. As with the other commercial vehicle markets, the supply chain problems were evident here. The segment over 16 metric tons recorded an increase of 10 percent in new registrations. This means that a level of just under 55,600 units was reached in this segment in 2021. The share of commercial vehicles over 16 metric tons in total new registrations of heavy commercial vehicles over 6 metric tons was 77 percent in 2021. This represents a slight increase compared to 2020, when the share of the heavy-duty segment over 16 metric tons had been 74 percent.

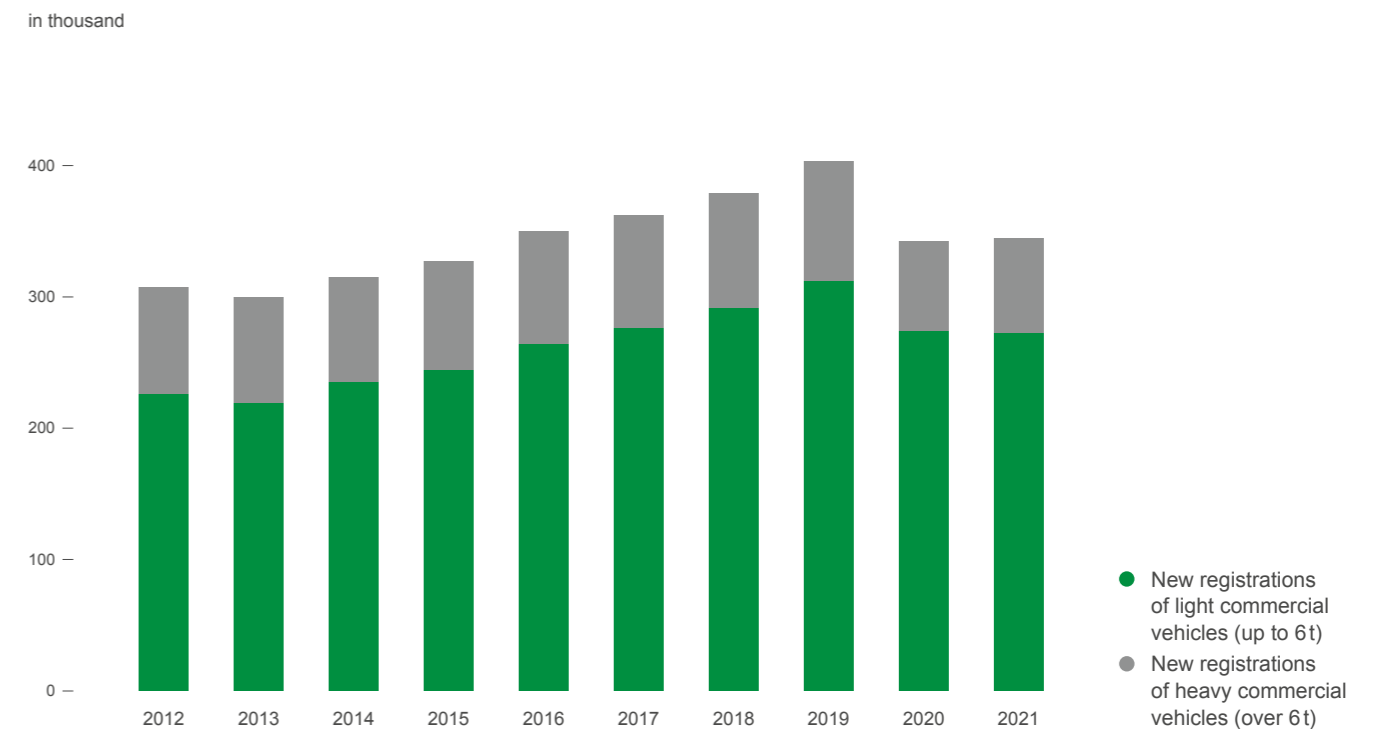
Light commercial vehicles

The German market for light commercial vehicles recorded a slight decline in 2021. It developed differently from the German market for heavy commercial vehicles and also from the majority of the Western European markets for light commercial vehicles. New registrations of commercial vehicles up to 6 metric tons fell by 1 percent to 272,200 units. Compared to the pre-coronavirus year of 2019, new registrations of light commercial vehicles even fell by 13 percent. In 2019, the market for light commercial vehicles exceeded the mark of 300,000 units for the first time since the reunification. Like the German market for heavy commercial vehicles, the

German market for light commercial vehicles saw positive growth in the first half of the year (+23 percent), but dropped in the second half (-18 percent).

Commercial vehicle registrations in Germany

New registrations of light (up to 6 t) and of heavy commercial vehicles (over 6 t)



Trailers and Buses

German bus market

The positive trend in the German market for buses over 8 metric tons continued last year. With 5,742 new registrations, the high level of the previous year was again slightly exceeded. This corresponds to the highest value since 1993. The bus market has thus grown by a third since 2012. One key force behind this was the liberalization of long-distance buses in 2013.

In order to make urban transport more environmentally friendly, the economic stimulus package of June 2020 promotes the conversion of bus and truck fleets to alternative drive systems, especially e-buses, and also the charging infrastructure for e-buses.

The new registrations in 2021 show that the funding is bearing fruit and that alternative drives are gaining in importance. The share of battery-electric buses rose to 9 percent (previous year 6 percent), hybrid buses now account for 22 percent (previous year 19 percent). At the same time, the share of buses powered by diesel engines fell from 75 percent to 68 percent.

German trailer market

After the German trailer market had already reached a new record level in 2020 despite the coronavirus pandemic, new registrations of trailers also increased in 2021 and again reached a new high. In total, a good 341,500 trailers were newly registered in 2021.

This is an increase of just under 2 percent compared to the previous year. One of the reasons for the positive development is that semi-trailers broke their downward trend of the past two years. New registrations of semi-trailers increased by 9 percent to just under 32,300 units in 2021. This meant that semi-trailers accounted for 9 percent of all new trailer registrations in Germany.



Asia

Passenger Car Markets in Asia

Chinese passenger car market

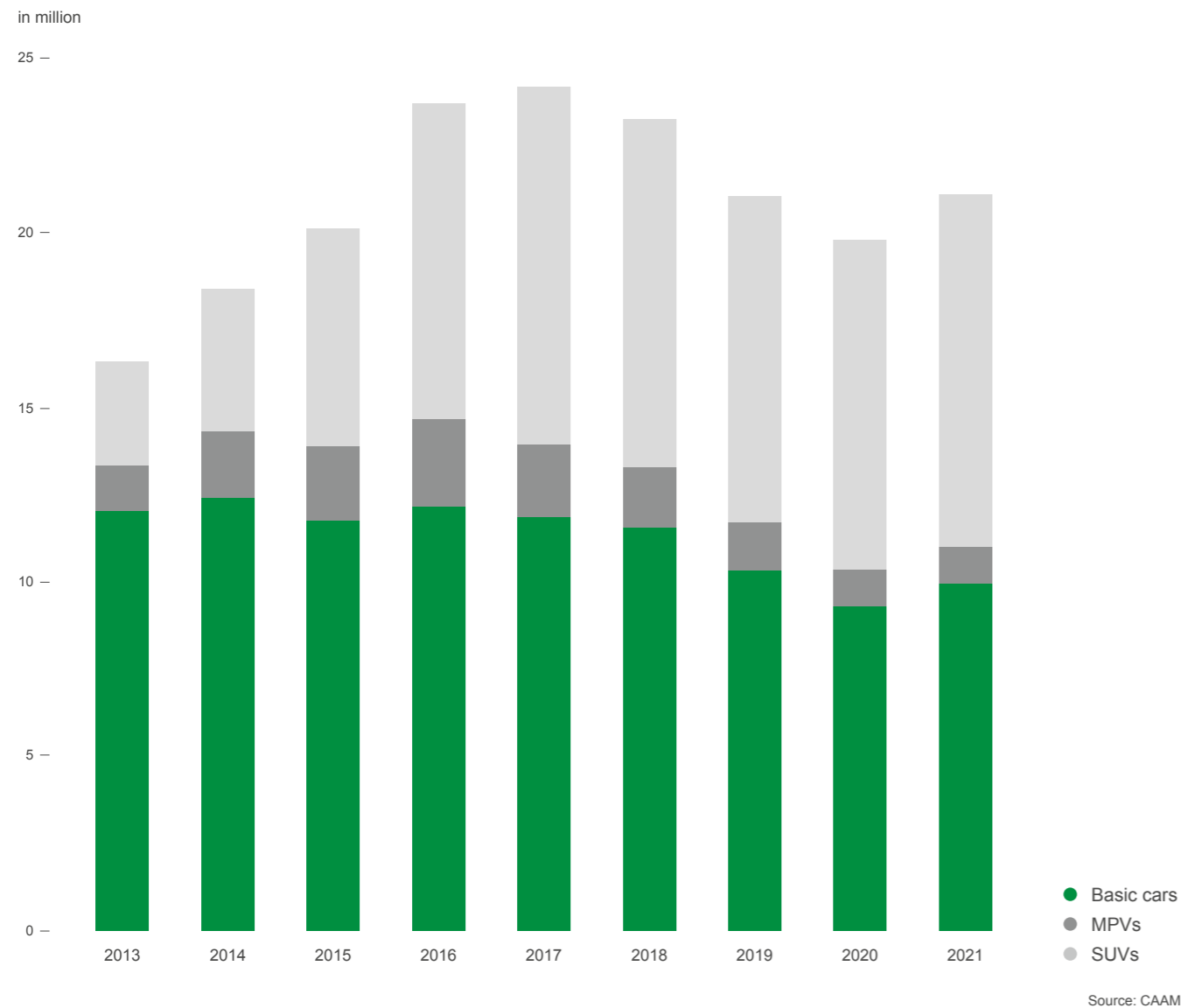
The Chinese passenger car market is the world's largest automotive market, accounting for nearly 30 percent of global car sales. In 2021, China was one of the pillars of the global passenger car market, with growth of 7 percent. A total of 21.1 million new vehicles were sold despite difficult circumstances. Unlike the other major sales markets, Europe and the USA, the market volume in China has thus already returned to the pre-coronavirus pandemic level. While the decline in the previous year was comparatively small, the rebound in 2021 had quite a strong effect. It was the first market growth in the Middle Kingdom since 2017. This was favored by the low sales figures from spring 2020. At that time, the coronavirus pandemic had also led to massive distortions in economic activities starting from China. As a result, sales in the first quarter grew by 76 percent compared to the previous year's level. In the further course of last year, however, the recovery slowed down noticeably – negative growth rates were recorded in each of the second to fourth quarters (Q2: -1 percent, Q3: -12 percent, Q4: -2 percent). On the one hand, this was due to the increase in business in the previous year and thus the higher comparative value: The Chinese government had supported the automotive business in the previous year on a regional

level with a variety of support measures. On the other hand, the difficulties in the automotive supply chains, especially the shortage of semiconductors, significantly curtailed the vehicle supply for customers. In addition to a more limited choice of vehicles, buyers also had to put up with significantly higher waiting times for their new vehicles. After German manufacturers were able to increase their market share to 24.6 and 24.4 percent in 2019 and 2020, respectively, it fell to 20.4 percent last year. Overall, this meant sales of a total of 4.3 million new vehicles. Despite the increase in the overall market, this was a decline of a good 510,000 passenger cars. The semiconductor crisis in particular hit German manufacturers exceptionally harshly.

The electric vehicle market in China continues to grow significantly. With 3.3 million new electric passenger cars, China was again by far the largest single market worldwide. Their sales increased by 168 percent. They thus reached a share of almost 15.8 percent of the total market. In the previous year, it was 6.3 percent. In 2021, battery electric passenger cars (BEVs) accounted for around 82 percent of the electric passenger cars market. They were able to grow slightly disproportionately by 174 percent compared to the previous year. Sales of plug-in hybrids (PHEV) were 143 percent higher than in 2020. The improved model range as well as government subsidies had a clearly positive effect on the development of sales here. The share of German OEMs in the Chinese electric vehicle market was 6.5 percent last year (previous year: 9.2 percent).

Passenger car sales in China

Segment structure



In terms of segment structure, the overall picture of the previous year was further reinforced in 2021. The SUV segment, which has enjoyed increasing popularity in recent years, was once again at the top of the list. Their sales grew by almost 7 percent to 10.1 million units. The number of SUVs sold was only higher in the record year 2017, when 10.3 million vehicles of this segment were sold. In 2021, their share of the total

Chinese automotive market was 48 percent. With an increase of 7 percent as well, the basic car segment grew to a total of 9.9 million units. The minivan segment stagnated at the previous year's low level of 1.1 million vehicles. Recently, noticeably fewer minivans were sold in 2012.

Japanese passenger car market

Japan's automotive market recorded another year of negative earnings in 2021. Despite the comparatively low level of 2020, when the coronavirus pandemic also led to significant market declines in the Japanese market, a minus of 4 percent was recorded in the company's balance sheet at the end of the year. This meant total sales of only 3.68 million new vehicles. It was already the third year in a row in which the Japanese passenger car market declined. In the first half of 2021, the market volume still grew by 12 percent due to the low year-on-year comparison. At the beginning of 2020, sales were negatively distorted by the coronavirus pandemic and an increase in VAT in late autumn 2019. However, market volume in the first half of 2021 was 2.04 million new vehicles, almost 11 percent lower than the same period in 2019. In the second half of 2021, sales declined by 18 percent. Measures to contain the spread of the coronavirus, which led to significant restrictions on public life, especially in the run-up to the 2021 Summer Olympics in the Tokyo area, had a significant impact here. In the second half of the year, the difficulties along the value chains also had an increasing impact on the market in the form of a shortage of vehicles.

South Korean passenger car market

The South Korean passenger car market dropped by 10 percent in 2021, with a market volume of 1.5 million new vehicles. The global semiconductor shortage and the ongoing coronavirus pandemic had a negative impact. In addition, the good sales performance in the previous year created a negative base effect in 2021. In 2020, excise taxes were temporarily reduced from 5 percent to 1.5 percent in the first half of the year and to 3.5 percent in the second half. In the course of 2021, positive growth was thus only achieved in the first two months. In the ten months from March, the South Korean market was consistently below the previous year's level.

Indian passenger car market

The Indian passenger car market grew by 24 percent to 3.0 million vehicles in 2021. This means that the pre-coronavirus level has already been reached again. However, this had already remained well below the record level of 2018 in 2019 due to a crisis in the shadow banking sector, which accounts for a large share of automobile loans in India. High growth rates were achieved in the first half of 2021 in particular. This was due to the base effect resulting from the exceptionally low sales figures in the wake of the first coronavirus wave in 2020. For example, no vehicles were sold in India in April 2020. The persistently low interest rates also ensured that the financing conditions were stable in 2021. Overall, growth in the first half of the year was 88 percent. In the second half of the year, the Indian passenger car market could not completely escape the internationally prevailing supply difficulties in automobile production. High inflation and significant price increases in the automotive sector also hampered growth. As a result, significant declines had to be recorded from September onwards. Overall, 7 percent fewer passenger cars were sold in the second half of the year than in the second half of 2020. Last year, the Indian passenger car market was larger than the German passenger car market for the first time when viewed over the entire year 2021.

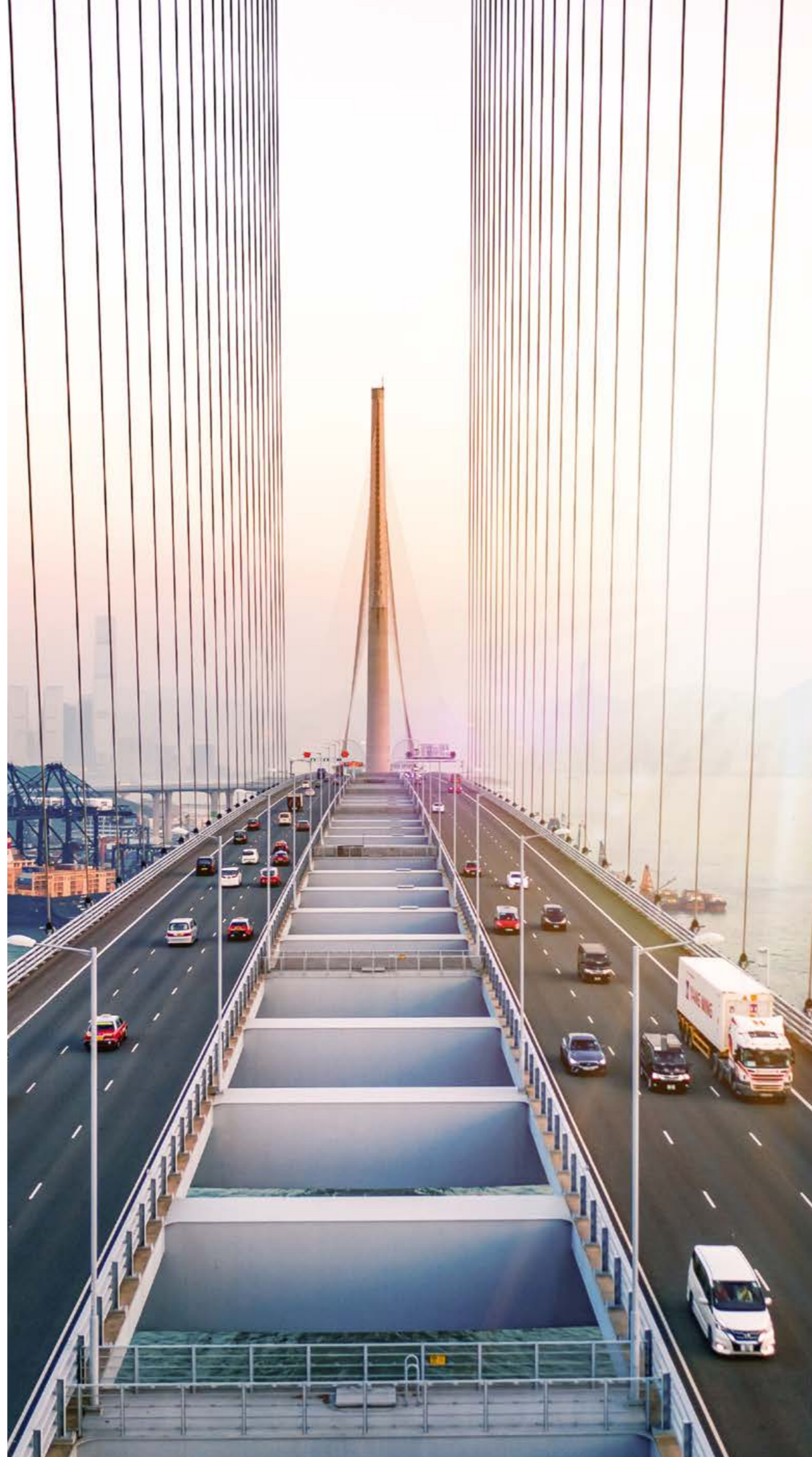
Commercial Vehicle Markets in Asia

Chinese commercial vehicle market

With an increase of 37 percent, the truck business in China was able to buck the trend in the rest of the world in 2020 and record an enormously dynamic development. Last year, however, an expected correction set in on the Chinese commercial vehicle market. After an initially strong first quarter and an already significantly weaker second quarter, the Chinese commercial vehicle market collapsed in the second half of 2021. With double-digit declines across the board since the middle of last year, the Chinese market shrank by 14 percent in 2021, corresponding to a decline of a good 251,200 trucks. This was a countermovement in 2021, after a government fleet renewal program and the new China VI emissions standard introduced nationwide in mid-2020 had contributed to strong positive growth in 2020. Notwithstanding last year's decline, China remains by far the world's largest truck market with a sales volume of more than 1.54 million units.

Indian commercial vehicle market

In 2021, India recorded the largest growth among the world's major commercial vehicle markets, with an increase of 81 percent. In 2020, it had still recorded the sharpest decline. Despite the strong growth in 2021, India was unable to reach its pre-crisis level of nearly 259,900 units. Sales of around 228,100 trucks in 2021 were still 12 percent below the 2019 level. Despite the Delta wave that hit India with full force in spring 2021, the second quarter was the fastest-growing quarter in 2021 at +527 percent. However, in terms of absolute sales levels, it was the weakest quarter of the past year. The high growth rate in Q2 was primarily due to the fact that the Indian commercial vehicle market had briefly slumped in Q2/2020 in the wake of the mandatory introduction of the Bharat VI emission standard, rendering this quarter with an incredibly low basis for comparison.



Europe

Passenger Car Markets in Europe

Passenger car market EU27, EFTA and UK

The European new car market (EU27, EFTA and UK) has experienced a turbulent 2021. At the start of the year, significant declines were recognized in January and February after a strong year-end spurt in 2020. Subsequently, the monthly results were very positive until the middle of the year. The low result of the previous year due to the coronavirus pandemic favored very high growth rates in some cases. From the middle of the year onwards, a slowly improving comparative level in the previous year and the difficult supply situation, triggered in particular by the shortage of semiconductors in production, had a negative impact on market activity. Specifically, the market grew slightly by 1 percent in the first quarter. In the second quarter, new registrations rose by 66 percent compared to the previous year. In the third and fourth quarters, 23 percent fewer passenger cars were registered in Europe than in the same period of 2020. Overall, the market volume of the European market in 2021 fell to 11.8 million new vehicles – around 2 percent less than in the previous year. It was the lowest volume of new registrations since we started collecting data in 2003.

The aggregate we observe here comprises a total of 31 countries (27 EU countries + EFTA (Switzerland, Norway, Iceland) + UK). Of these, 21 countries ended the year on a positive note. Of the five major markets – Germany, France, the UK, Italy and Spain – only Germany had a negative rate of change in new registrations in 2021.

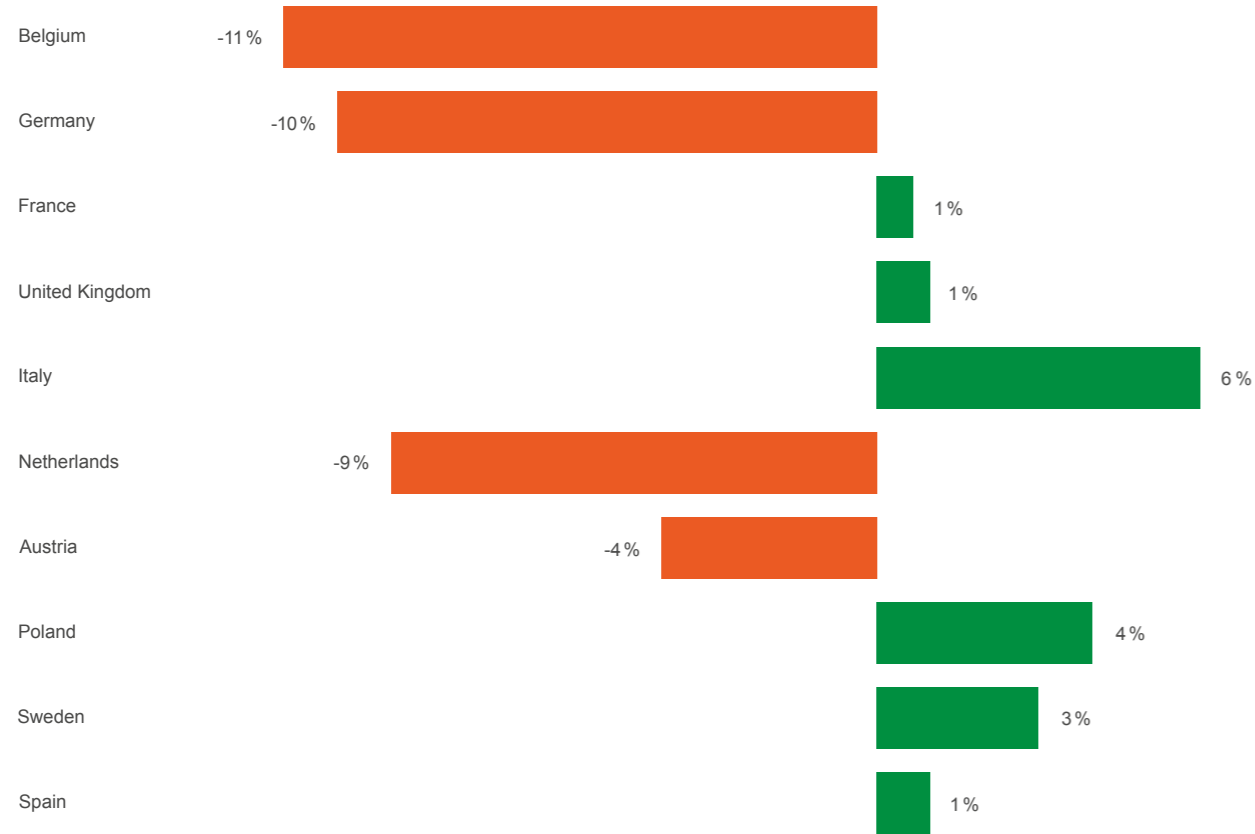
The second largest car market in Europe in 2021 was France. With 1.7 million new registrations, this represents an increase of 9,000 units compared to the previous year (+1 percent). The French passenger car market was thus only able to recover very slightly from the pandemic decline of the previous year. The semiconductor shortage had a decisive effect. Although restrictive measures were taken time and again during the year to hinder the spread of the coronavirus, these were nowhere near as drastic as in 2020, when, for example, car dealerships had to remain closed in March and April.

The UK passenger car market was almost as big as the French market last year, with just 12,000 fewer units newly registered in the United Kingdom. With 1.6 million new vehicles, the market was 1 percent larger than the previous year, but it was still the lowest market volume since 1992. Private owners were the

New passenger car registrations in Europe

Selected countries – change from 2020 to 2021

in percent



Source: ACEA

central source of market growth in 2021. Their new registrations increased by 7 percent. In contrast, fleet and company registrations declined by 4 and 5 percent, respectively.

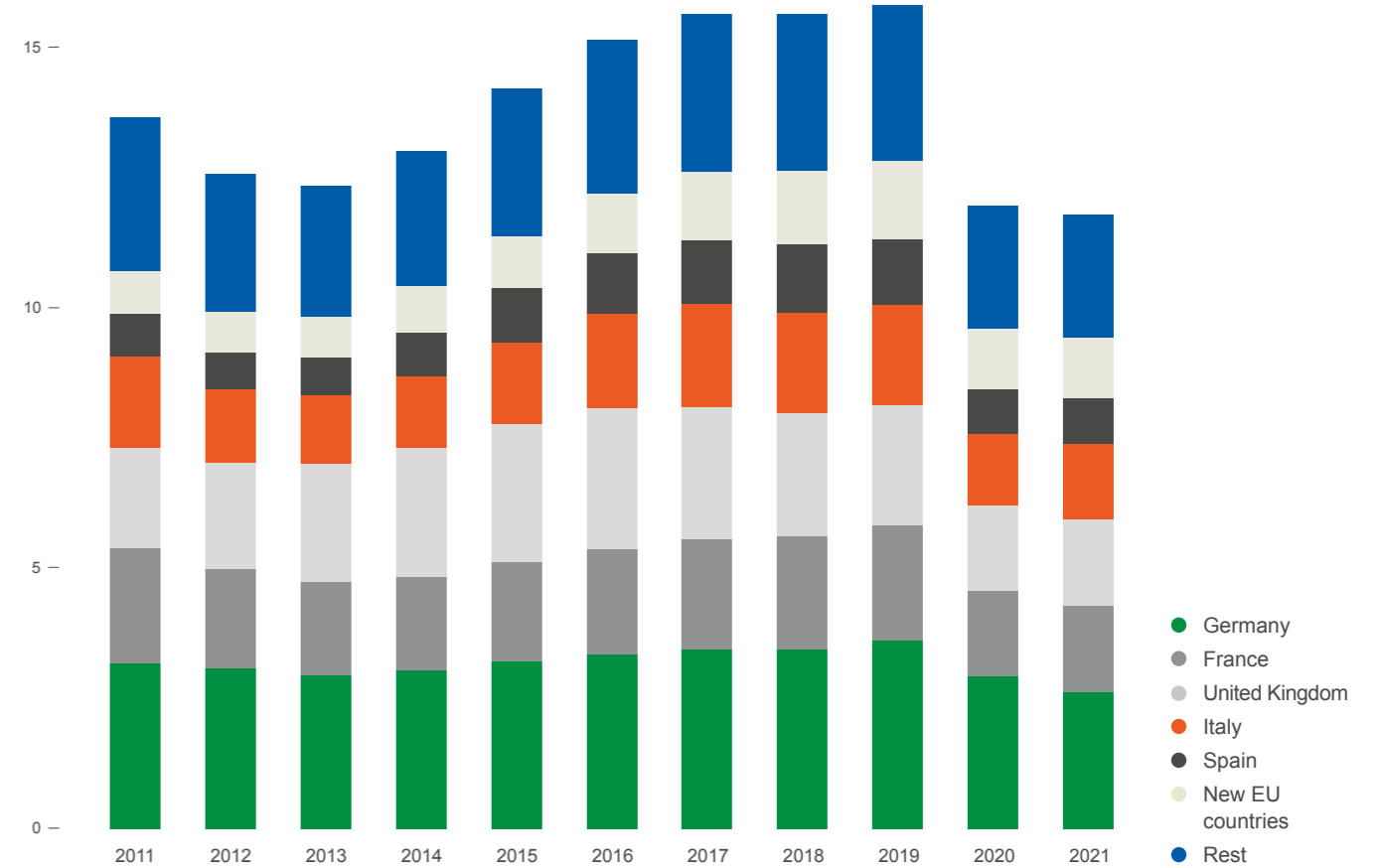
The Italian passenger car market achieved the highest growth among the large individual markets in Europe last year. With 1.5 million units, the volume of new registrations grew by 6 percent. While new registrations increased by 51 percent in the first half of the year, they declined by 28 percent in the second half. Towards the end of the year, not only the shortage of semiconductors but also the expired purchase incentives had a negative impact on demand. Previously, vehicles with low CO₂ emissions were subsidized. The subsidy is to be reinstated in the course of 2022.

Last year, the Spanish market registered a total of 859,500 new passenger cars, only 1 percent more than in the previous year. The comparative level in Spain was particularly low, as the market slumped by 32 percent in the pandemic year 2020. In particular, the weak demand from private owners had a muting effect on the development in 2021 (-13 percent). Companies (+2 percent) and landlords (+59 percent) were able to report growing business. Among the volume segments, small SUVs in particular were able to make gains, with their market volume increasing by 18 percent compared to the previous year.

New passenger car registrations in Europe

Selected countries and regions EU27, EFTA and UK

in million



Source: ACEA

In the Eastern European countries, the majority of the automotive markets performed positively in 2021. In the twelve countries that have been members of the EU since 2004 and 2007, respectively, new registrations grew by 2 percent last year. However, with a total volume of almost 1.2 million passenger cars, they were still significantly below their record from 2019. At that time, 1.5 million new passenger cars were registered in the twelve countries. The largest single market by far among the Eastern European countries remains Poland. In Germany's eastern neighbor, 446,600 brand-new passenger cars were registered last year – an increase of 4 percent. In the Czech Republic, sales increased for the first time since 2017: 206,900 new passenger cars were registered, 2 percent more than in the previous year. The

Eastern European markets still have plenty of growth potential for the coming years. On average, there are 533 passenger cars per 1,000 inhabitants here. In comparison, in the EU14 countries, the passenger car density is 566 vehicles per 1,000 inhabitants.

Passenger car market in Russia

The Russian light vehicle market grew by 4 percent last year, reaching a market volume of 1.7 million new vehicles. Especially in the months of April and May, when nationwide lockdowns were in force in the previous year, enormous, triple-digit growth rates were achieved. In the second half of the year, however, negative results were recorded throughout. The prevailing international disruptive factors prevented a more significant upturn in 2021 as a whole: semiconductor shortages, logistics problems and interrupted supply chains. Although Russia's upward trend in inflation over the course of 2021 had a negative impact on light vehicle sales, rising prices for energy exports were a supporting factor.

The market share of the German group brands declined slightly in 2021. After standing at 20.1 percent in 2020, 19.2 percent of new cars were sporting the logo of a German manufacturer last year. This corresponds to a volume of 320,000 vehicles.



Heavy Commercial Vehicle Market in Western Europe

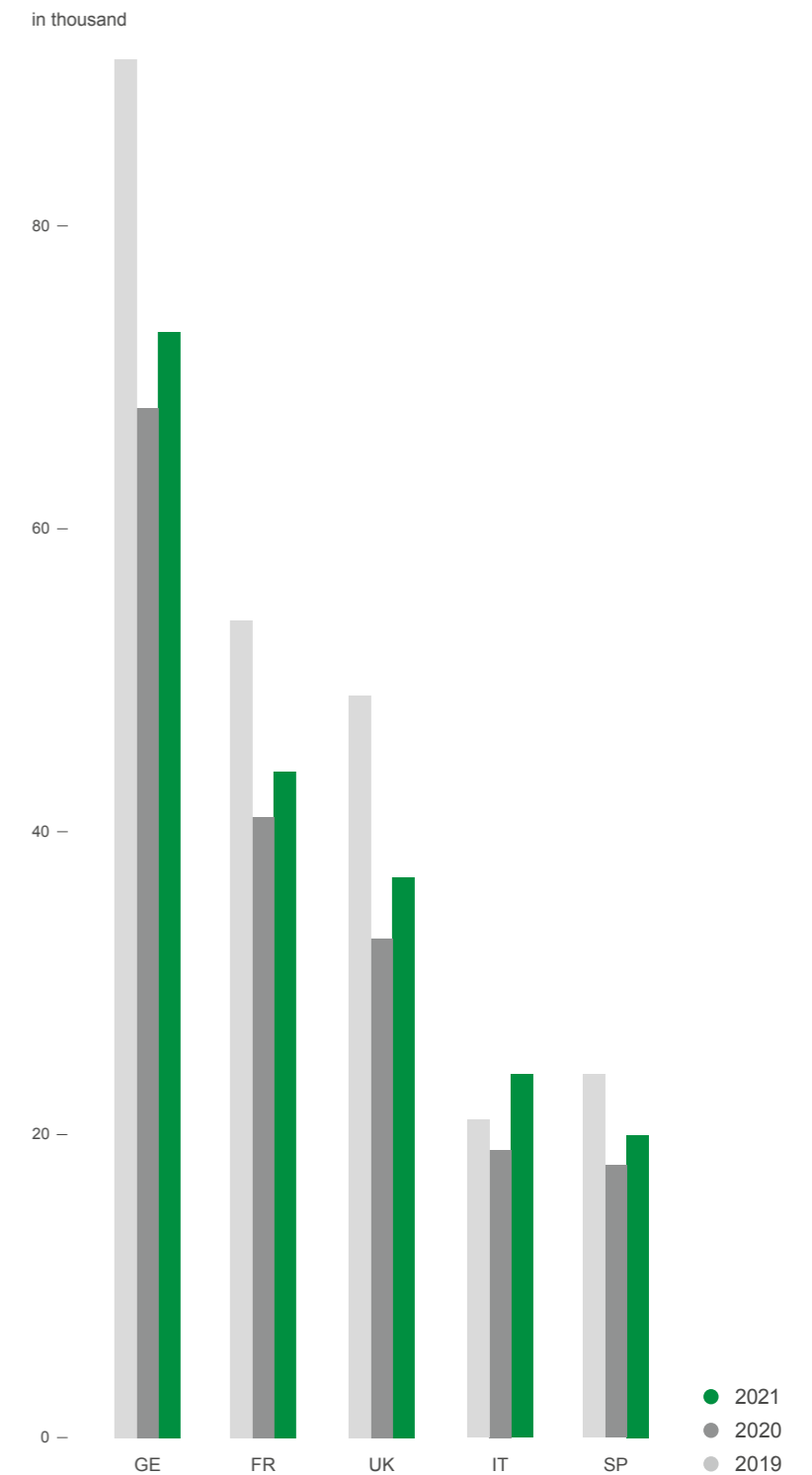
After a 26 percent slump in new truck registrations in 2020 to the lowest level since 2014, Western European markets for heavy commercial vehicles recovered somewhat in 2021. They increased by just under 10 percent compared to 2020. This corresponds to a sales volume of around 251,700 units. This was still 18 percent or 54,900 trucks below the pre-crisis level of 2019. However, with more than 306,500 newly registered trucks, 2019 had also been the highest-volume year since 2008.

Among the five largest Western European markets, Italy achieved the largest increase in 2021 with +26 percent to 24,300 units. Italy thus achieved the highest level of new truck registrations since 2008, when just under 32,000 trucks were registered. Italy was thus the only country in the European top five to exceed the pre-crisis level of 2019 (+13 percent compared to 2019). The United Kingdom and Spain followed with an increase of +13 percent and +10 percent, respectively, compared to 2020. In the two largest European markets, Germany and France, new truck registrations in 2021 increased by 6 percent each to 72,500 and 43,600 units, respectively.

The Western European market did not fully realize its recovery potential in 2021. This was directly related to the more difficult economic conditions, such as global supply chain issues and the resulting shortage of materials. In the first half of 2021, the Western European vehicle market for heavy commercial vehicles had still managed to grow significantly compared to 2020 (+27 percent). In the second half of the year, the shortage of primary products then dampened the recovery noticeably (-4 percent).

Truck sales over 6t in Western Europe

New registrations in selected countries



America

Passenger Car Markets in America

USA

Light vehicle sales in the USA rose by a good 3 percent last year to 14.9 million units. A clear rebound after the market decline in 2020 (-15 percent) thus failed to materialize. Growth was particularly strong at the end of the first quarter and the beginning of the second quarter, when the low year-on-year comparison due to the coronavirus pandemic favored high growth rates. In the second half of the year in particular, however, the market recovery was clearly limited by the impaired supply chains. As a result of bottlenecks along the entire value chain, especially for semiconductors, the supply of vehicles was severely limited. This meant that the favorable macroeconomic situation and the good financing conditions had little impact. In 2021, the trend towards larger vehicles observed in recent years (worldwide) continued in the US light vehicle market. Light truck sales increased by almost 5 percent to close to 11.6 million units, while sales of basic cars fell by 2 percent to just over 3.3 million vehicles. This means that 77.7 percent of all vehicles sold last year belonged to the light truck segment. The largest single segment within light trucks and the biggest winner in recent years were CUVs (cross-utility vehicles/crossovers), the segment we generally call SUV in Germany. CUV sales increased by 7 percent to around 6.7 million units in 2021. This gave them a market share of just under 45 percent and once again made them the largest single

segment in the US market. The SUVs, equipped with larger exterior dimensions and off-road characteristics compared to the CUVs, came to a market share of just under 10 percent. Their sales rose by 15 percent to a good 1.4 million units. Sales of pickup trucks reached a volume of 2.7 million vehicles (-4 percent) and a market share of 18 percent. Finally, 0.7 million vans were sold in the USA as the last subsegment among the light trucks (+1 percent; market share: 5 percent).

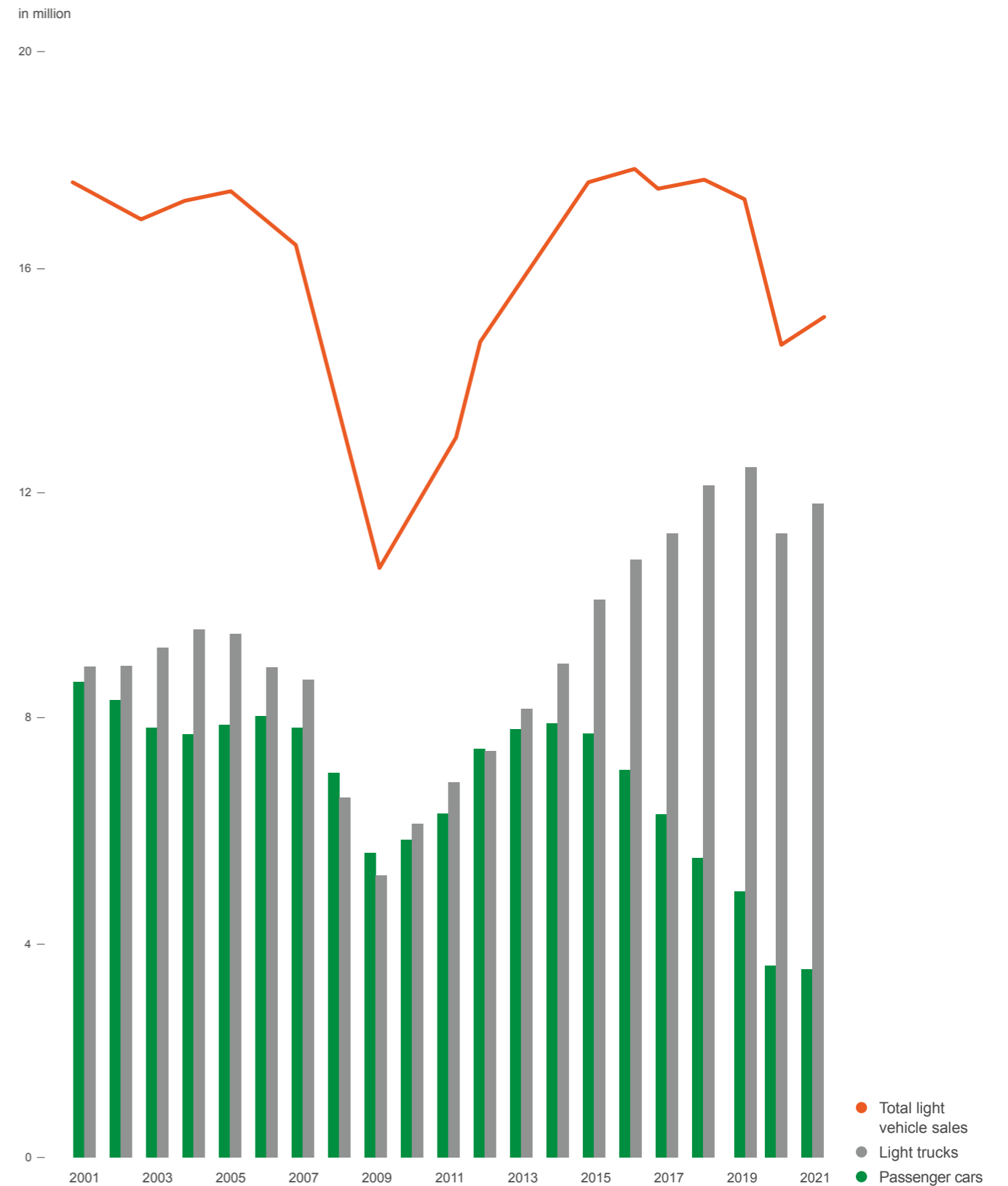
The German manufacturers were again able to expand their market share in the USA last year. They sold a good 1.3 million light vehicles (+11 percent). In the light truck segment their sales rose particularly strongly by 22 percent to almost 918,000 vehicles. In the shrinking basic car segment, sales declined by 6 percent to 42,000 units, slightly more than in the segment as a whole (-2 percent). Their market share rose to 9.0 percent in 2021 (2020: 8.3 percent).

Mexico

The Mexican light vehicle market recorded a slight increase in 2021 after the harsh losses of the 2020 pandemic year. Vehicle sales increased by 6 percent compared to the previous year, again just exceeding

Light vehicle sales in the USA

Development of the segments



the one-million-units mark. Sales in the classic basic car segment were down 3 percent at 510,700 vehicles. The light truck segment, on the other hand, could recover somewhat and gained 18 percent; 497,500 light trucks were sold. This means that 50.6 percent of all sales in the past year were in the light truck segment. Despite the increase last year, the Mexican market is 600,000 units behind the record year of 2016.

Canada

The light vehicle market in Canada grew in 2021 for the first time since 2017. Sales rose by 8 percent to a level of 1.7 million units. However, basic car sales were more than a third (-35 percent) below 2019 levels at 320,000 units of passenger cars. Light truck sales increased by 9 percent year on year to 1.3 million vehicles in 2021. The share of light trucks (CUVs, SUVs, pickups and vans) in the overall market reached a new high of 80.7 percent, well above the light truck share in the US (77.7 percent) and Mexico (50.6 percent).

Mercosur

Light vehicle sales in Mercosur grew slightly by 3 percent in 2021. While about 2.3 million light vehicles were sold in 2020, nearly 2.4 million new vehicles were sold last year. The recovery from the effects of the coronavirus pandemic was thus very slow. The Brazilian market in particular only grew by 1 percent. The South American lead market accounts for 84 percent of light vehicle sales in Mercosur. Argentina follows in second place, with 14 percent of the annual new vehicle volume sold in Mercosur.

As in the previous year, the market volume in the Brazilian light vehicle market in 2021 was just under 2.0 million vehicles and thus further below the volume of the crisis year 2016. Apart from 2020, the last time fewer vehicles were sold on the Brazilian light vehicle market was in 2006. Brazil was hit particularly hard by the coronavirus pandemic in 2020; 2021 was also characterized by high uncertainty due to the pandemic. The inflation rate increased significantly and hovered around the 10 percent mark throughout the second half of the year. This led to several interest rate hikes by the Brazilian central bank in the course of the year and consequently to worsened financing conditions for consumer loans. Despite high growth rates in the first half of the year (H1: +32 percent), which were caused by the base effect and corre-

spondingly low new registration figures, the market was only able to close the year just above the previous year's level. This was due to the weak development in the second half of the year (H2: -19 percent), which was characterized by difficult economic conditions and a complicated supply situation triggered in particular by the semiconductor shortage.

The second largest market in Mercosur developed somewhat better. In Argentina, the market volume grew to 334,400 light vehicles. This was 7 percent more new vehicles than in the previous year. The Argentinian market thus continued to recover, albeit slowly, from the effects of the severe economic crisis that kept Argentina firmly anchored in 2018 and 2019. Market volume in Argentina in 2021 was around 550,000 units below the record level of 2017.

Mercosur's third largest market, Uruguay, saw significant growth in 2021. With 48,800 light vehicles sold, sales grew by 41 percent and reached the highest level since 2017. However, the sales record of 2013 (57,000 light vehicles) is still a long way off.

Commercial Vehicle Markets in the USA

After falling to its lowest level since 2016 in 2020, the US heavy commercial vehicle market recovered somewhat last year. For the full year 2021, the American commercial vehicle market achieved a plus of 13 percent. This corresponds to a sales volume of almost 461,600 units. At +16 percent, the heavy-duty segment (class 8/>15 metric tons) developed somewhat stronger than the medium-duty segment (weight classes 4-7/6.3-15 metric tons) at +10 percent. However, the heavy-duty segment had shrunk significantly more than the medium-duty segment in 2020. The level of 2019, which with just under 527,100 trucks sold was the highest-volume year since 2006 (544,600 units at that time), was still undercut by a good 12 percent in 2021 despite double-digit growth.

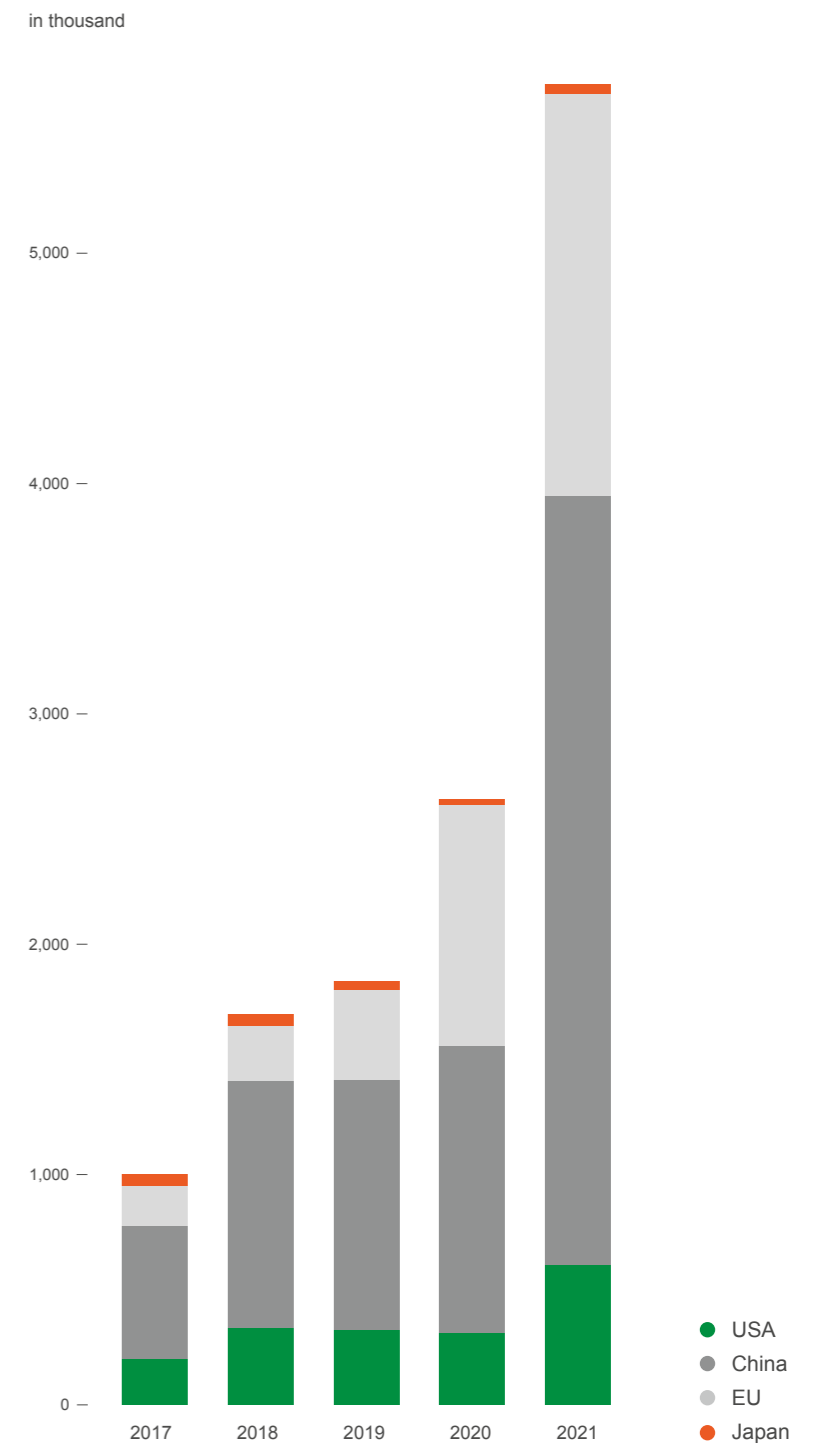
Electric Mobility in International Comparison

In 2021, the global advance of electric mobility in new passenger car registrations continued. While around 2 million electrically powered passenger cars were registered globally in both 2018 and 2019, the figure was already over 3 million units in 2020 and around 6.5 million vehicles last year. This means that one in nine passenger cars sold globally now has an electric drive (BEV, PHEV or FCEV). Of these, 4.5 million units – almost 70 percent – are purely electric BEV vehicles. The fuel cell (FCEV) plays only a minor role with 15 thousand units. The rest are plug-in hybrids (PHEV). The transformation from the combustion engine to the electric motor, which is necessary in view of the ambitious UN climate goal, is thus in full swing in the automotive industry. It should be noted that the development in the various markets is quite heterogeneous. In general, it can be said that there is a more or less pronounced relationship between prosperity and penetration of the market with electric passenger cars. In addition, incentives and legal requirements, e.g. regarding CO₂ limits, play an important role.

The largest electric passenger car market in 2021 was China by a wide margin. With 3.34 million units (+168 percent compared to the previous year), more than every second electric car was sold there. This is mainly due to the sheer size of the Chinese market, but at 15.8 percent, the electric sector's share of sales is lower than in Europe (EU, EFTA and UK), where it is 19.2 percent. BEVs dominate with a share of 82 percent of all passenger e-cars. China is focusing on successively reducing the government's customer subsidy, which amounted to a maximum of around 2,000 US dollars in 2021. At the same time, the minimum electric vehicle quotas for locally producing manufacturers are increasing.

Electric mobility international

Sales of electric passenger cars (BEV, PHEV, FCEV) in the most important markets



Sources: WardsAuto, CAAM, Fourin, IHS Automotive

Germany was already in second place worldwide in 2021 with 681,900 (+73 percent) newly registered electric passenger cars. Three out of ten e-cars sold in Europe were thus attributable to the German market. An electric sector's share of 26.0 percent was achieved. This means that electric cars are now more popular than diesel passenger cars (including mild hybrids), which accounted for 25.5 percent last year. Plug-in hybrids play an important role with a share of 48 percent of all new e-car registrations. A large share of the success of electric mobility is due to the subsidy, which amounts to a maximum of 9,000 euros and has received an additional boost through the government innovation premium in June 2020.

With a volume of 607,100 electric light vehicles (+97 percent), the US market was in third position in 2021. The market penetration of e-cars was 4.1 percent. One reason for the low share, besides low fuel prices, is the subsidy, which amounts to a maximum of 7,500 US dollars and is capped on a manufacturer-specific basis, so that two manufacturers are already ineligible for the tax credit. Seven out of ten newly registered e-cars are BEVs. Electric mobility



plays only a very minor role outside California, which is responsible for two out of five e-cars sold in the US.

In Asia, electric mobility does not yet play a significant role outside of China. In South Korea, 81,500 passenger e-cars were sold last year (+123 percent), which was 5.5 percent of the total market. A special feature of South Korea is that with 8,500 FCEVs (+47 percent) more than half of all electric fuel cell passenger cars worldwide are registered here. Japan is still at the beginning of the transformation with 46,400 e-cars (+54 percent) and an e-market share of 1.3 percent. Almost half of these vehicles are PHEVs. Japan meets the CO₂ limits mainly due to its high share of full hybrids. The market share of the German group brands for electric passenger cars was maintained at 49 percent in Europe in 2021, also due to new BEV models. In the USA, 12 percent of all electric light vehicles sported the distinctive mark of a German brand, which was two percentage points more than in 2020. In China, the German market share fell by two percentage points to just under 7 percent.

The range of e-models is decisively determined by German group brands in many markets: In Belgium, Sweden, South Korea and Germany, German companies even accounted for more than half of the e-models.

In the light commercial vehicle segment, electric drives are mainly used in the city delivery-van segment, where a long range plays a comparatively minor role. The front-runner in new registrations of commercial vehicles under 3.5 metric tons – as with passenger e-cars – is Norway with an electric sector's share of 17.0 percent. It is followed by Sweden with 7.6 percent, Canada (4.9 percent), Germany (4.8 percent) and the Netherlands (4.7 percent). In the USA (3.4 percent) and China (2.5 percent), electrified transport vehicles play a minor role.

German Automotive Industry



German Passenger Car Production in International Comparison

Domestic passenger car production

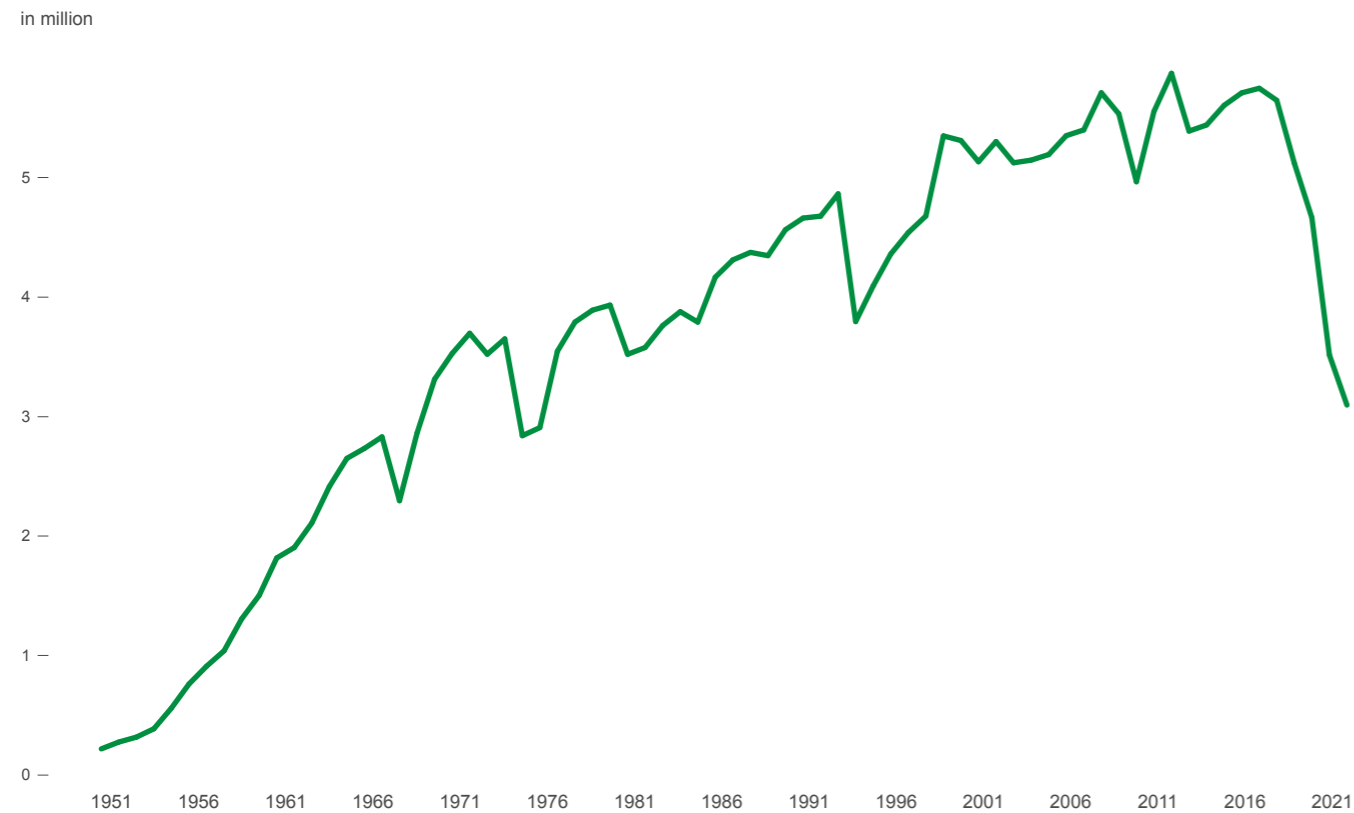
After the slump in domestic production with the production standstill in April 2020 in most domestic plants, production in the last quarter of 2020 had returned to pre-pandemic levels. From the beginning of 2021, however, there was a new setback: The global semiconductor shortage caused production figures to decline. The background was the rapidly increasing demand for chips due to working from home, home schooling and generally flourishing tele- and entertainment communications. As the expansion of manufacturing capacity in the semiconductor sector is rather slow due to the complexity of the multilayered processes, the automotive industry was massively affected by this last year. Production could not keep up with the rising demand, which was reflected in record order backlogs.

The German location was particularly hit hard by this. This was due to the strong focus on premium products, which, just like the vehicles with electric drives, require an above-average number of chips – for example for assistance systems, screens and control units. In the year as a whole, domestic production of 3.1 million passenger cars therefore suffered a 12 percent decline and was the lowest since after the oil crisis in 1975. This means that production has lost over 2 million units since 2018 alone. Towards the end of last year, production volumes stabilized somewhat again, but it was not yet possible to catch-up due to the chip shortage.

An important method of retaining jobs in 2021 was to continue to work short-time. This again affected a six-digit number of people in the automotive sector from June to November due to the shortage situation in semiconductors, but declined significantly in December.

Passenger car production in Germany

Long-term production trend



Structural factors are also behind the renewed decline in production. For example, the upswing in electric mobility, which finally made its breakthrough last year with a 20 percent share of domestic production and a 64 percent increase, goes hand in hand with a move away from combustion engines. Both petrol (-4 percent) and diesel engines (-19 percent) will see declines in 2021. This hits German manufacturers particularly hard, as they hold an impressively strong position in diesel vehicles specifically. The success in the field of electric mobility cannot yet fully compensate for the somewhat higher volume declines in combustion engines.

In addition, the production of small and compact cars in Germany has been declining for many years. The main reason for this is the very high labor costs, which stem to a large extent from the considerable additional wage costs.

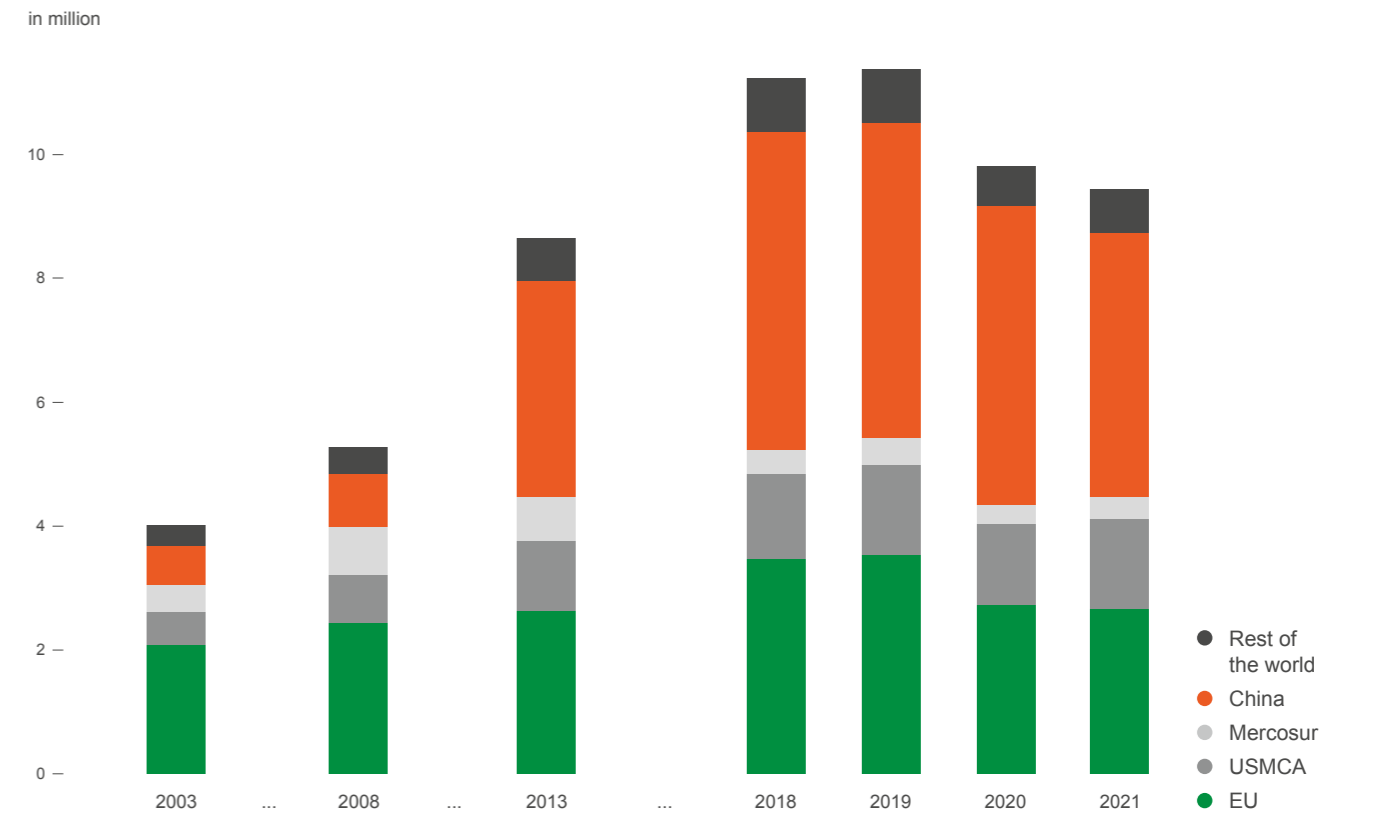
Foreign production of passenger cars

The year 2021 also proved to be challenging for the foreign locations of German passenger car manufacturers. However, the decline of 6 percent to 12.54 million was much more restrained than in the previous year, which was marked by the outbreak of the coronavirus pandemic in spring 2020 with almost global production stoppages. In the past year, the overshadowing issue was the shortage of semiconductors, which was also compounded by strains on world trade due to pandemic lockdowns in Asia. Practically every fifth new car across the world featured the company logo of a German group brand.

An analysis by continent shows that the different regions were affected to varying degrees. China, the largest location with a 45 percent share of German foreign production, was hit the hardest. There, the German OEM's foreign passenger car production fell by 11 percent to 4.36 million units in 2021. A shortage of semiconductors had already become appar-

Foreign passenger car production of German group brands

Production by country or region



ent here at the end of 2020. Another negative factor was that the German manufacturers were unable to maintain their moderate market share in the dynamic e-car segment.

In Europe, foreign production fell by 2 percent to 3.03 million passenger cars in 2021. This corresponds to a decline of almost 950,000 vehicles compared to the record of 2019. Demand would have allowed for significantly higher production, but the limited supply of semiconductors did not allow for higher production volumes. Among countries, the Czech Republic held on to the top spot with 680,000 units (-9 percent), just ahead of Spain (+3 percent to 678,000 passenger cars).

Foreign production in America increased last year by 12 percent to 1.81 million vehicles. In the USA, a record 0.87 million passenger cars came off the production lines, 18 percent more than in the previous year. The majority of these were SUVs. This was supported by the 5 percent expansion of the US light truck market and the global increase in demand for high-quality SUVs.

The transformation from combustion engine to electric drive is also reflected in the foreign involvement of German manufacturers. Last year, 761,000 passenger e-cars (+74 percent) were produced outside Germany, which is significantly more than the number of e-cars produced in Germany. The momentum is currently coming mainly from BEVs, where growth of 126 percent to 374,000 units was recorded. PHEV production rose by 42 percent to 387,000 units.

The coronavirus crisis has prompted German OEMs to manufacture three quarters of all their passenger cars abroad. A key element of success has been the focus on premium models. The premium share has increased significantly from 20 percent to 47 percent since 2006. The global positioning of German OEMs is also manifested in the fact that they now manufacture 4.5 million premium passenger cars abroad, twice as many as at home.

International passenger car production

Last year was also marked by the effects of the coronavirus pandemic, which continued to lead to local lockdowns, which in turn also had a negative impact on passenger car production. However, these direct effects of the pandemic were overshadowed by its indirect consequences. Here, the automotive industry was faced with a nexus of unfavorable circumstances. On the one hand, global demand for semiconductors increased significantly because working from home and home schooling ensured that telecommunications including the internet as well as the use of computers and consumer electronics were greatly expanded. At the same time, the complete production shutdown in many countries in April 2020 and the relatively slow production ramp-up afterwards meant that the automotive industry lost importance as a customer of the semiconductor industry and found itself in strong competition with the other consumers demanding chips. To make matters worse, the transformation from conventional power trains to electric motors require increased demand for chips, especially power semiconductors, and put additional pressure on the market. As the planning and construction of new chip factories requires a long lead time, the chip shortage has had a negative impact on production volumes to date, especially in Europe.

These circumstances have led to only a very moderate rebound in 2021, with global production growth of 2 percent to 67 million cars – following the decline in production in 2020 by almost one-sixth. Global production capacity is significantly higher: In 2017, production was still more than a quarter higher at 85 million. Previously, global passenger car production had grown by an average of 5 percent per year from the financial crisis year 2009 to 2017.

The only reason for the growth in global passenger car production last year was that the world's largest production location, China, was able to expand its passenger car production by 7 percent to 21.0 million units. China was thus the only major location to again exceed the pre-crisis level of 2019. This is mainly due to the fact that the 2020 pandemic in China was contained very early. Of the three other major Asian automotive countries, India performed best. It realized a 26 percent increase to 3.6 million units in 2021, overtaking Germany and now almost back to pre-pandemic levels. In South Korea, which had held up quite well in 2020, the production began to crumble, falling

by 2 percent to just under 3.2 million units. Japan lost another 5 percent to 6.6 million units. Here, the downward trend has been permanent since 2019.

In the three USMCA states, production stagnated last year at 12.9 million light vehicles and remained slightly below the level of 2011. Differentiating between vehicle types shows that the trend towards light trucks, especially SUVs, has continued with an increase of 6 percent, while passenger cars recorded a renewed slump of 21 percent. Meanwhile, four out of five light vehicles manufactured here are light trucks. The USMCA is the SUV production hub of the world.

Last year, the Mercosur countries made up for part of the 2020 production decline. Production rose by 16 percent to 2.5 million light vehicles.

Europe suffered most from the semiconductor shortage. Passenger car production had to be cut back by 5 percent further to 13.4 million units, 27 percent below pre-coronavirus 2019 levels. This indicates that Europe is facing major challenges, especially in this transformation phase, in order to successfully survive as a production location.

Passenger Car Exports from Germany

In 2021, passenger car exports fell by 10 percent to 2.374 million vehicles. This was the lowest volume since 1996. Compared to 2017, exports fell by around 2 million vehicles. Again, the semiconductor shortage is a major reason why there was no rebound in 2021. In addition, global trade suffered from the blockade of the Suez Canal by a freighter as well as from the fact that container ships were stuck for long periods of time due to coronavirus measures, especially in Asian ports. At the same time, the German automotive industry remains very dependent on exports: The export ratio rose again last year by more than one percentage point to 76.7 percent.

However, the trend towards on-site production has not abated in 2021, and the decline in foreign production by German manufacturers was significantly lower at 4 percent compared to exports. Production abroad is now four times higher than German exports.

An important factor for the success of cars “Made in Germany” abroad continues to be high quality, for which adequate prices are also paid. The long-standing trend towards premium models will continue to strengthen in 2021. They already account for 76 percent of all passenger car exports (previous year: 70 percent). The shares are heavily geared to the market: 63 percent of passenger car exports to Europe are premium, 93 percent to America and even 95 percent to Asia. The increasing premium share together with the trend towards SUVs and off-road vehicles, which now account for 30 percent of exports, has led to an increase in foreign sales despite falling unit numbers.

The decline in passenger car exports to Europe by 18 percent to 1.33 million units was particularly pronounced last year. Exports to the important European countries were down by double digits across the board. The UK imported only 285,800 passenger cars (-27 percent) from Germany in the first year following Brexit. This means that German exports to the United Kingdom have fallen by 64 percent or half a million

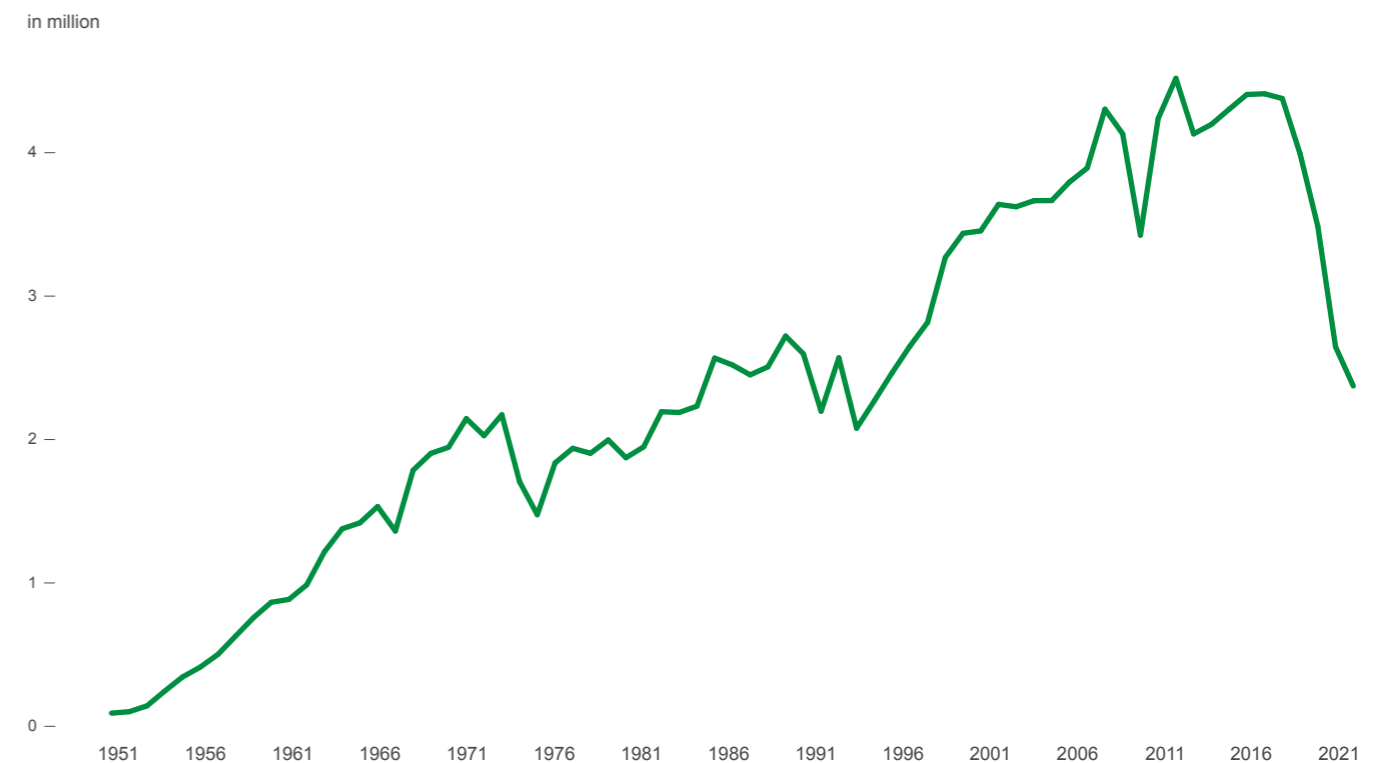
passenger cars since the 2016 referendum. In Italy, the decline last year was 15 percent at 142,000 units. France was third in Europe with 136,700 units (-13 percent).

Asia was able to somewhat mitigate the clearly negative trend in passenger car exports. At 587,300 units, the previous year's result was exceeded by 1 percent. The most important Asian export partner was China with an increase of 6 percent to 269,400 units. This was followed by South Korea, which, after the significant increase in the previous year, now recorded a decline of 20 percent to 113,500 units.

Exports to America also increased slightly by 3 percent to 377,600 units. The most important partner here was the USA with 300,700 vehicles (-1 percent). This means that US exports have more than halved since 2015. This development can be explained by the fact that German OEMs are increasingly turning to manufacturing vehicles for the US market directly in the USMCA region.

Passenger car exports from Germany

Long-term development





Sales of the German Automotive Industry

German automotive manufacturers

After a strong first half of the year in terms of sales (+31 percent), material bottlenecks and the resulting production hindrances had a negative impact on revenues in the second half of 2021 (-9 percent). Nevertheless, the OEMs were able to close the past year with an overall increase in sales of 7 percent. This corresponds to a sales volume of a good 318.1 billion euros. The companies benefited from good foreign business (+12 percent). Almost three quarters of the annual sales were generated there. Domestic sales, on the other hand, fell by 3 percent compared to 2020. Total sales developed significantly better than domestic production because the companies increasingly focused on high-margin vehicles (premium and electric vehicles).

Suppliers

While the German automotive industry as a whole generated a 9 percent increase in sales in 2021, HG III even increased its sales by 13 percent to almost 79.7 billion euros. This was the strongest growth since 2010. This almost reached the pre-crisis level of 2019 (then: 80.0 billion euros).

Both domestic and foreign sales showed a positive development last year compared to the previous year, with foreign sales (+16 percent) growing more strongly than domestic sales (+10 percent). Although domestic sales still accounted for 56 percent of total automotive supplier sales in 2021, the development of the last decade shows that foreign business has

gained in importance: Compared to 2011, the share of foreign sales has increased by 8 percentage points to 44 percent in 2021.

Trailers and superstructures

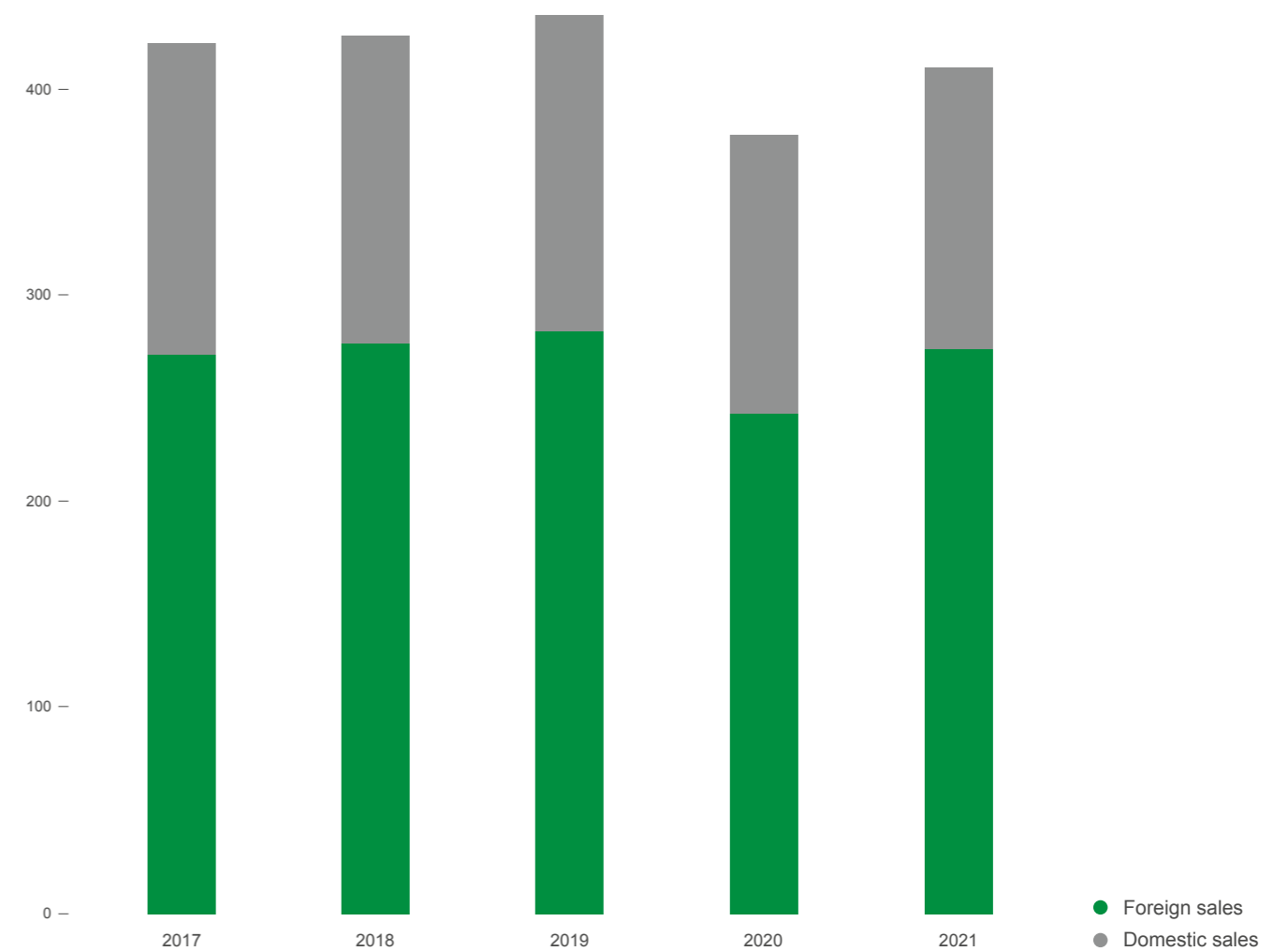
After the second decline in a row, the sales of manufacturers of car bodies, superstructures and trailers in 2020 had fallen to the lowest level since 2015. In 2021, however, HG II managed to break the trend: With a plus of around 19 percent to just under 13.1 billion euros, HG II significantly increased its sales compared to 2020. This not only surpassed the re-

sults of the two previous years, but was also the best result since records began in 1993. Foreign sales in particular recorded a significant increase of +29 percent. In the two previous years, however, this had also developed more weakly than domestic sales. Proportionally, domestic (51 percent) and foreign (49 percent) sales contributed to a similar extent to the total sales achieved in 2021.

Sales development in the German automotive industry

Domestic and foreign sales

in billion €



Employment in the German Automotive Industry

In contrast to sales, the number of employees in the German automotive industry declined in 2021. The first effects of the transformation to electric drives already seem to be making themselves felt here. On average last year, 786,100 people were employed in the companies producing motor vehicles and motor vehicle parts. This corresponds to a decline of about 3 percent or 22,800 employees compared to the previous year. After an eight-year growth period with record employment during the boom in 2018, employment had already reached a flatline in 2019 and had fallen for the first time in 10 years in 2020. Nevertheless, the number of people employed in 2020 still remained above the 800,000 mark on average. Last year, however, it fell below this mark for the first time since 2015. The manufacturing groups were affected differently by the decline in employment: The

manufacturers of parts for motor vehicles recorded the largest decline in employees at -3 percent. The largest manufacturer group in terms of employment, the manufacturers of motor vehicles and engines or OEMs, recorded a similar percentage decline of around -3 percent. This reduced the number of employees in HG III to 290,800 persons and to 457,100 persons in HG I. In contrast, the manufacturers of car bodies, superstructures and trailers were able to increase their number of employees in 2021 by about 1 percent compared to the previous year and employed an average of 38,200 persons in 2021.

Employees in the German automotive industry

Average employment per year

in thousand



Source: Federal Statistical Office

Labor Costs in the International Automotive Industry

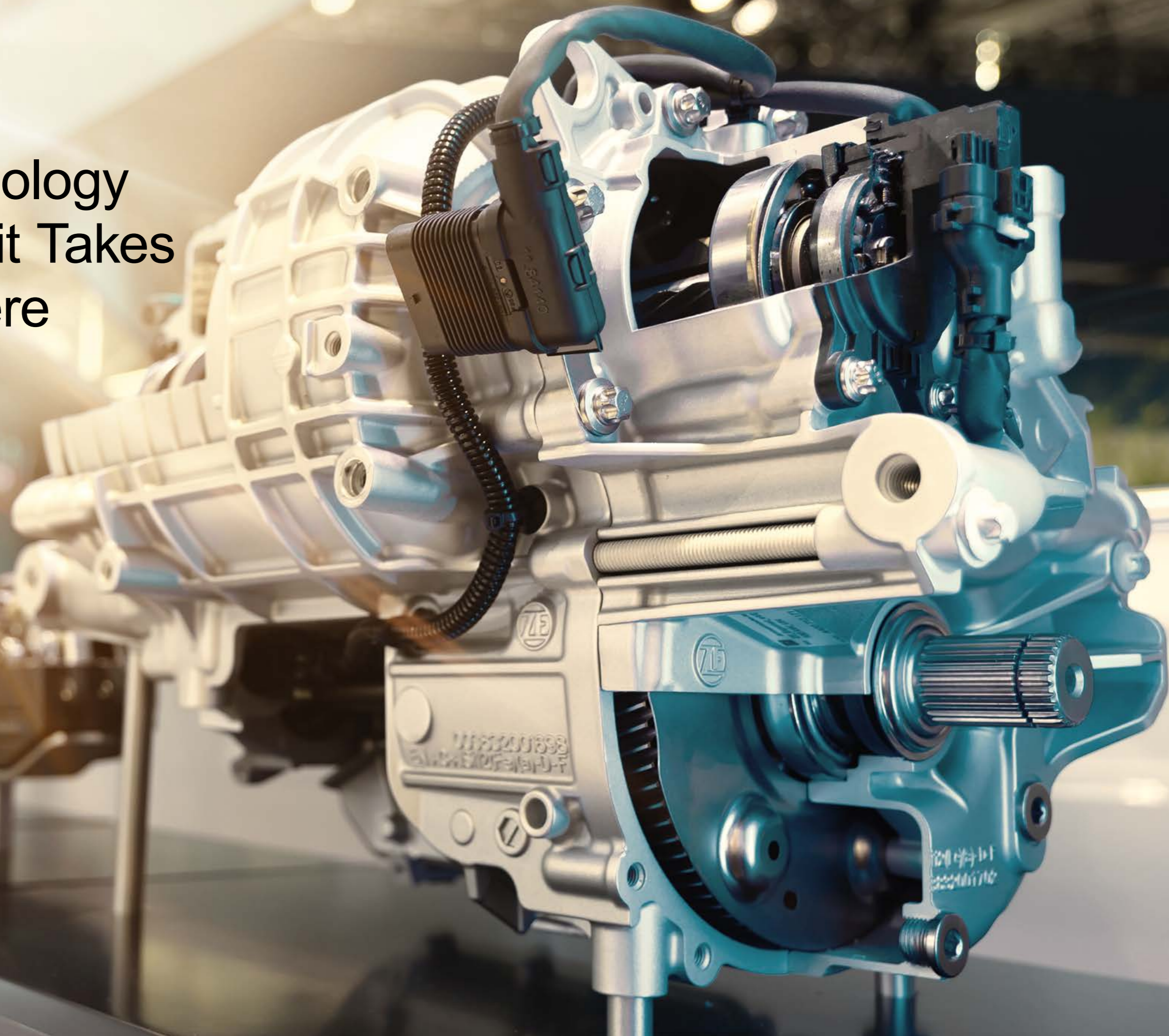


The high quality and increasing complexity of modern passenger cars manufactured in Germany, which is reflected, among other things, in sophisticated assistance systems and increasing digitalization, has its price. Added to this is the structural change towards electric mobility, which is in full swing. In order to remain interesting for the highly competitive skilled workers, automotive companies in Germany must offer attractive remuneration. In 2021, Germany will therefore continue to have the highest labor costs in the automotive industry in an international comparison, at 57 euros per hour. With an increase of 1 percent last year, the gap to Sweden, whose labor costs increased by 7 percent to 47 euros, has narrowed again somewhat. Nevertheless, labor cost increases in the last ten years have been above average in Germany at 25 percent. There is thus a danger that Germany will lose the competitiveness it regained through wage restraint in the course of Agenda 2010.

Austria follows in third place with 44 euros (+1 percent), ahead of Belgium with 43 euros (+1 percent). Belgium is the only EU member state in which labor costs have fallen since 2011 (-2 percent). France ranks fifth with 42 euros (+1 percent). This is followed by the Netherlands with 41 euros (+4 percent). In the United Kingdom, labor costs have risen by 5 percent to 36 euros in 2021. However, labor costs are still below the 2015 value. The Brexit referendum had led to a significant devaluation of the pound in 2016/2017. At the bottom of the personnel expenses table are Eastern European countries with labor costs between 9 euros (Romania) and 19 euros (Slovenia). These emerging automotive nations have shown high increases of between 43 percent (Slovenia) and 93 percent (Romania) since 2011, so that labor cost levels are gradually converging with the other EU countries. In Portugal, labor costs have risen by 4 percent to 16 euros in 2021 and lie between Slovakia (16 euros) and the Czech Republic (18 euros).

The Technology and What it Takes to Get There

The German automotive industry continues to lead the global market in many sectors. The technology and parts made in Germany are used in a multitude of vehicles from many manufacturers all over the world. For the industry in Germany to remain at the forefront of innovation, we have to meet a number of prerequisites. And yet, in many such areas, the development is heading in the wrong direction.



The Evolution of E-mobility



Germany is one of the lead markets for electromobility

The German automotive industry is pushing ahead with its electric offensive. In the first half of 2022, 306,000 e-cars were registered in Germany. This means that every fourth new car already had an electric drive. German corporate brands led the way with a market share of 59 percent. The drivers are battery-electric passenger cars, which already account for 55 percent of all new e-car registrations (+13 percent). Three of the top 4 manufacturers in the domestic e-car market are German companies. Currently, there are already around 80 e-models on offer, and by 2024 this number will almost double to around 150 models. On June 1, 2022, the stock in Germany was around 1.4 million electric cars. The innovation dynamics of the automotive industry can

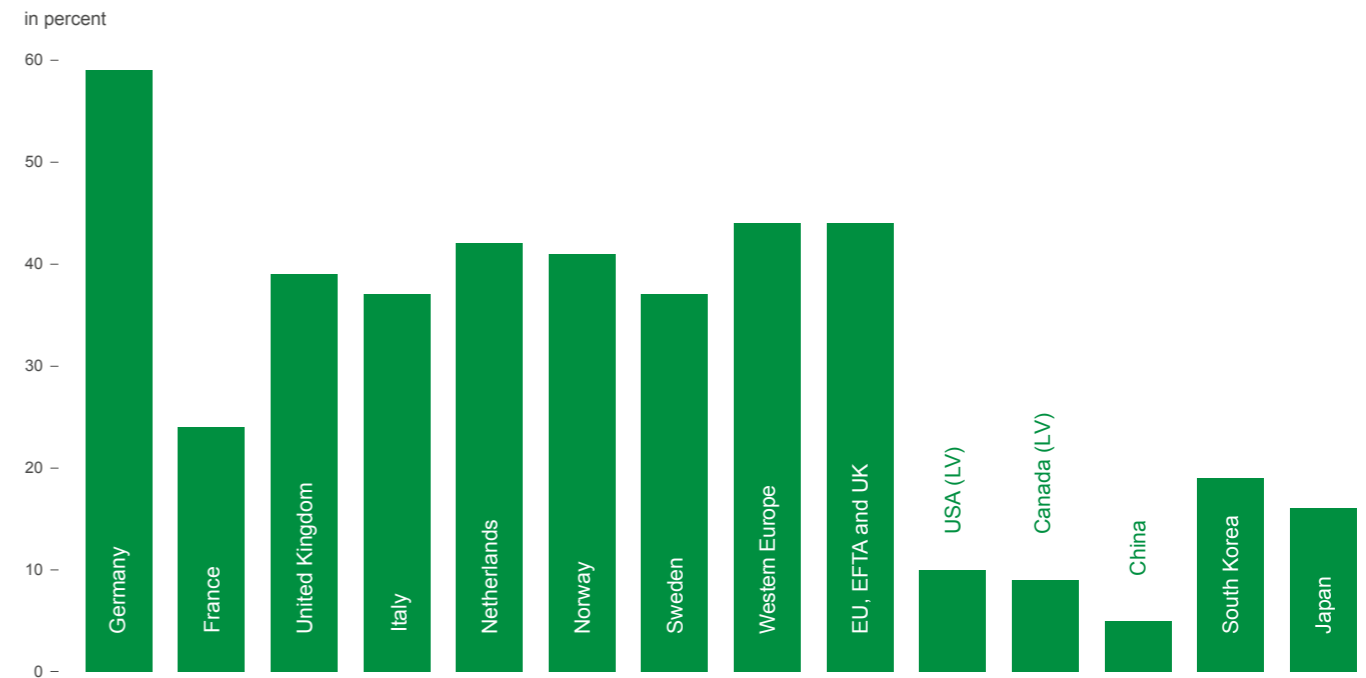
also be seen in the patent statistics: More than half of the patents registered for e-drives come from suppliers and manufacturers in Germany.

International electric mobility

The German Group brands are leaders in many important electric car markets. In Europe (EU, EFTA and UK), they achieved a market share of 44 percent last year. In addition to the domestic market (58 percent), they were particularly strong in the Netherlands (43 percent), United Kingdom and Norway (both 39 percent), Italy (37 percent) and Sweden (36 percent). In France (24 percent), South Korea (20 percent) and Japan (16 percent), the market shares are somewhat lower due to the automotive industry based there. There is still potential in the USA (9 percent) and China (5 percent).

Electric car market shares of German group brands

January to July 2022



Source: KBA, S&P, WardsAuto, Fourin

Electric models registered in markets July 22

Market	Number of models	Out of which German	German share
Belgium	186	95	51 %
China	494	45	9 %
Germany	164	82	50 %
France	254	112	44 %
United Kingdom	201	90	45 %
Japan (June)	59	26	44 %
Canada	71	25	35 %
Netherlands	222	108	49 %
Norway	178	80	45 %
Sweden	195	93	48 %
South Korea	46	25	54 %
USA	67	20	30 %

Source: S&P, KBA, Fourin, WardsAuto

The 15-point Plan of VDA



The German automobile industry agrees that the ambitious CO₂ target for 2030 must be achieved primarily with electric cars (BEV, PHEV). However, the automobile industry cannot manage this transformation alone.

Many players must play their part. Ambitious targets are needed to bring electromobility forward even faster in Germany. For this purpose, the VDA has given a 15-point plan for the future to the Federal Government:

1. Record investments

The automobile industry is committed to the Paris climate protection targets and is investing 220 billion euros in the area of research and development in the years 2022 to 2026 alone, above all in electromobility including battery technology and digitalization. And by 2030, the automobile industry will also invest at least 100 billion in the conversion of plants in Germany. Unlike the state, companies must also earn back the investments. Therefore, creating the right location and framework conditions is an important prerequisite for the success of the transformation and thus also a necessary condition for achieving the climate protection goals.

2. Accelerate the expansion of charging stations

By 2030, Germany needs more than one million charging points for e-cars and e-transporters (electric light commercial vehicles). To achieve this, more than 2,000 new charging points must be installed per week. However, only about 300 to 350 are currently built per week on public land. A nationwide high-speed program with concrete targets for the federal states and municipalities is needed to catch up. The same is needed for the EU as a whole.

3. Charging while working

The expansion of charging points at employers' premises must be accelerated with a separate program to promote the installation of charging points at companies. This requires a well-funded support program from the German Federal Government. The planned funding program of the German Federal Government should be realized quickly.

4. Charging at home

Electric cars (e-cars) must be able to be charged at the place of residence. This will be helped by a further expansion of the program for the promotion of wall charging stations and an additional subsidy program for the already legally required installation of charging points in underground garages and multistoried car parks, retroactively and in all new buildings.

5. Charging while shopping

The expansion of charging points in retail outlets must be accelerated. This requires an even larger program of support and the abandonment of the requirement that charging points in retail car parks must be usable 24/7.

6. Price guarantee

Charging electricity must always be 100 percent green electricity and permanently cheap. For this purpose, charging electricity must be exempt from the EEG levy and electricity taxes.

7. Europe guarantee

Citizens also want to use their e-cars to travel to other European countries, for example on holiday. It is just as natural for goods and merchandise to travel by e-truck across Europe. The German government must also contribute at the European level to massively increasing the speed of the development of the charging infrastructure and to ensuring that all European states have a reliable charging infrastructure. The European Commission must not refuse responsibility for this task.

8. Support buyers of e-cars

The purchase of low-CO₂ vehicles (passenger cars and light commercial vehicles) must continue to be supported. The environmental bonus should therefore be backed by the German Federal Government with adequate financial resources beyond 2022.

9. Smart payment at the charging station

We want citizens to be able to apply their contract at every charging station (contract-based charging). We also reject the German Federal Government's plan to equip all new charging points with outdated and no longer necessary technologies such as card readers. This requires a change to the charging station ordinance before the end of this legislative period.

10. Fast charging rate

In order to reduce the number of necessary charging points, we recommend further increasing the proportion of fast charging points. This saves space, is generally more economical and increases customer benefits. The electricity grid must also be expanded accordingly for this purpose in order to be able to provide the necessary power.

11. Making truck transport fossil-free

The switch to e-trucks must be promoted more strongly and the infrastructure for e-trucks must be built up quickly with charging points along the main transport axes and in the depot. This requires an ambitious expansion plan from the federal, state and local governments as well as expanded funding programs from the German Federal Government. But the amendment of the Electromobility Act (Elektromobilitätsgesetz) is also an important milestone in the legal framework: Commercial vehicles over 3.5 metric tons must be included in the Electromobility Act.

12. Making electromobility sustainable

We need to develop business models in the battery sector for the establishment of take-back and recycling structures in order to reduce the dependence on imports of raw materials. One possibility, for example, is to reduce the export of used vehicle traction batteries.

13. Research, development and more qualification

Many companies in the automotive industry and especially among the suppliers have to reorganize production and retrain their workforces. This has considerable consequences for the employees concerned. In addition to the great efforts of the companies concerned, the German Federal Government needs support programs for development and qualification.

14. Turning electric cars into electricity storage units

The drive batteries can serve as storage units for the electricity grid. For this, the appropriate legal requirements and financial incentives for e-car owners must be defined quickly. In this way, e-car owners can be "grid-serving" and profit from it.

15. Annual report on e-mobility

The tasks for the expansion of the charging infrastructure and the funding programs are distributed among several federal ministries, the federal states and municipalities and the European Union. Starting in 2022, the German Federal Government should present an annual report to the public on the expansion of the charging infrastructure in Germany, the funding programs and the status of target achievement in all other fields of action. The EU Commission should do the same for the whole of Europe.



Prerequisites for Achieving the Goals

The German automotive industry is shaping the transformation of mobility towards climate-friendly, low-emission or zero-emission mobility through the development of innovative technologies and solutions as well as greater efficiency. Electromobility plays a central role in this process, particularly in the passenger car segment, but market participants in the commercial vehicle segment are also increasingly looking at battery-electric vehicles. However, it is also clear that in addition to battery-electric and hydrogen-powered mobility, low-CO₂ and CO₂-neutral fuels, will also make an important contribution to decarbonizing transport in the future. Therefore, in the interest of climate protection, it is important to pursue a technology-open approach to drive systems and fuels and at the same time, to consistently promote the development of the corresponding charging and refueling infrastructure. With its electromobility offensive in 2020, the German automotive industry has taken a decisive step towards making innovative products, services and solutions for electromobility available worldwide. The challenge for Germany as a business location in the coming years is, above all, to strengthen and expand the existing value chains in a dynamically changing international competitive environment. In addition, there is the safeguarding of jobs. The basic prerequisite for this is that policy-makers ensure that THG reduction targets and paths can be planned.

A systemic approach is still necessary for the success of electromobility in Germany. This includes an intelligent sector coupling of the hitherto separate classical subsystems of vehicle, transport and energy with regard to integration into the electricity grids, digitization and a ramp-up of the hydrogen market.

Germany's goal must be to successfully shape the transformation of mobility. In concrete terms, this means: The climate protection targets in transport are met, Germany can assert itself as a lead provider and lead market for electromobility, and German industry can secure its leading positions in climate protection technologies in transport. To ensure that this succeeds, the VDA, together with other industry associations, has drawn up recommendations for accompanying framework conditions. Central elements include:





Ensure market ramp-up of electromobility

- Existing subsidies for electric vehicles (passenger cars, light commercial vehicles) and for fleet conversion in the market ramp-up phase should be tailored precisely to the needs of the market, and further ramp-ups should be closely monitored and adjusted as necessary
- Increase the attractiveness of electric vehicles and their economic integration through adequate legislation within the framework of the EEG (Renewable Energy Sources Act) and the EnWG (Energy Industry Act) (e.g., self-consumption, grid integration)
- Promote plug-in hybrids as an instrument of transformation, taking into account the optimization of the electric range with appropriate charging power with maximum green electricity

Create framework conditions for the market ramp-up of low-CO₂ and CO₂-neutral commercial vehicles

- Further promote the development of CO₂-neutral vehicles for use in heavy-duty transport (FCEV, BEV)
- Promote procurement of BEV trucks and FCEV trucks
- Promote the expansion of hydrogen refueling infrastructure (FCEV trucks) and charging infrastructure (BEV trucks) in depots and along the main traffic routes
- Create attractive framework conditions for fleet conversion similar to the incentives for passenger cars in the market ramp-up phase, e.g. tax relief for traction current and hydrogen (e.g. tax-financed reduction of the EEG levy in the short term, reform of the EEG in the medium term) and continuation of the exemption from truck tolls

Ensure the sustainability of electromobility

- Enable the use of vehicle traction batteries in second life applications, e.g. for the storage of renewable energies
- Develop business models for the establishment of take-back and recycling structures to reduce dependence on imports of raw materials, e.g. by reducing the export of used vehicle traction batteries
- Develop systems with minimum recycling standards for vehicle traction batteries, e.g. analogous to the CEN 50625 series for WEEE
- Create clear legal definitions of target values for recycling and recovery rates for selected important battery materials, e.g. for vehicle traction batteries
- Policy-makers are invited to support the setting of standards for the calculation of CO₂ footprints for relevant elements such as recyclates, primary materials and battery systems
- Develop regulatory requirements to provide relevant information across the life cycle (e.g. origin, recycled content, CO₂ footprint, battery condition, etc.), for example through battery passports and dataspace

Secure and expand employment in Germany

- Create jobs, e.g. in the field of battery cell production, battery recycling
- Impart IT skills, e.g. in vocational training, in specialized companies, in further training in companies
- Develop curricula at colleges and universities in engineering degree programs
- Support in-company further training, e.g., through modular employee qualification on electromobility
- Develop cross-sectoral transfer programs from innovation to application through suitable cross-sectoral transfer clusters

Fit for the future – strengthen innovations

Consistently continue research and development along the entire electromobility value chain (BEV, FCEV). Important points:

- Enable SMEs and start-ups in particular to innovate, e.g., by extending tax incentives for research and expanding joint industrial research
- Further develop key technologies, especially drive technology, materials research and recycling, microelectronics, power electronics, networking and digitalization in vehicles, connected and automated driving (VAF), plug & charge
- Strengthening production research, including in the area of new mobility and green hydrogen

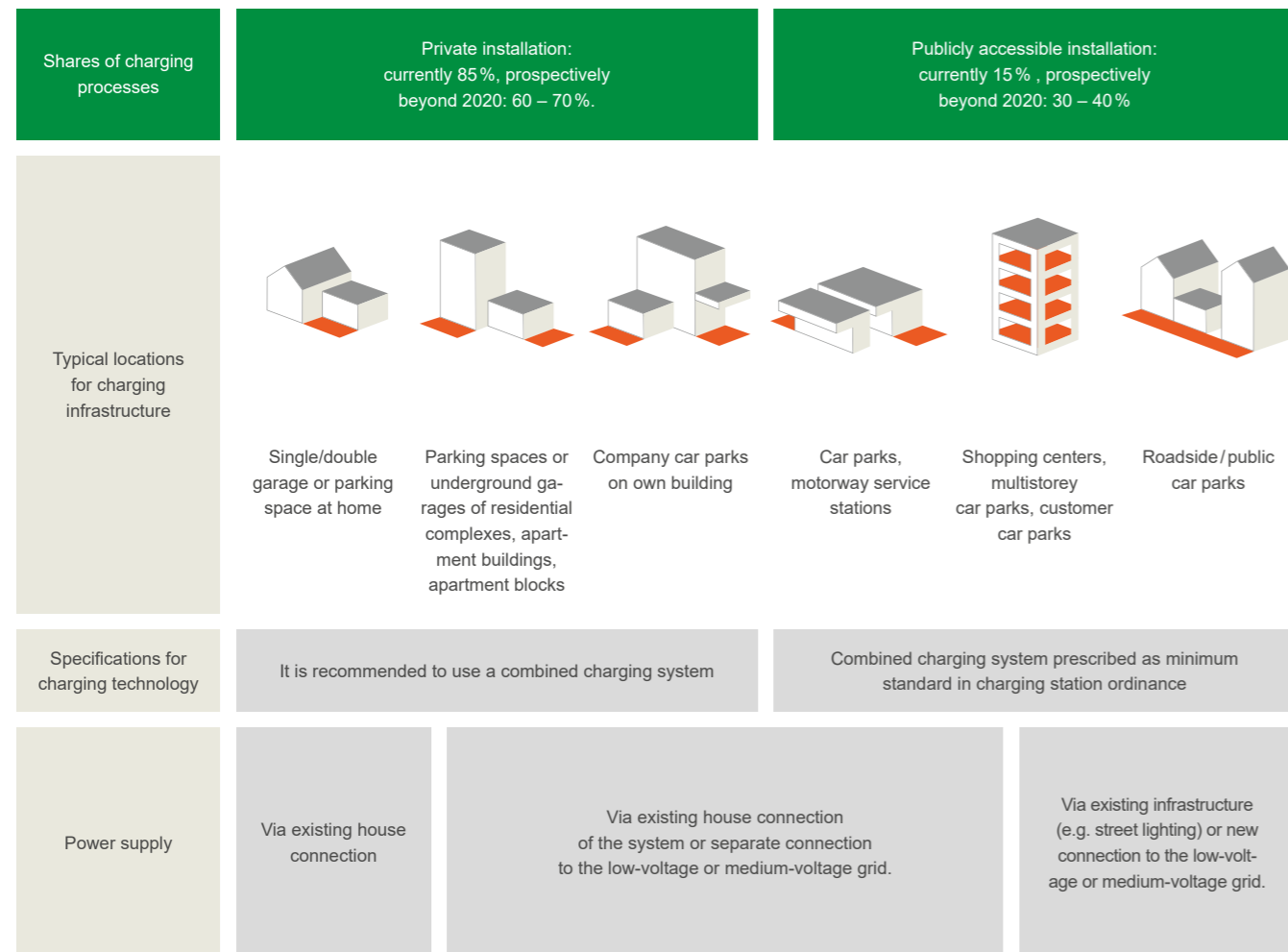


Charging Infrastructure: Expansion from Filling Stations to Retailers

To cover the charging needs of 15 million electric vehicles in 2030, a demand of one million public charging points is expected, which can be described with four different charging scenarios: charging on the motorway during holiday trips and business trips at service stations and car parks, recharging while shopping at nearby car parks, fast charging at petrol station charging points in towns and cities, and roadside charging with daytime and night-time usage profiles. The absolute number of public charging points required depends on user behavior,

the possibility of charging at home and at work, and the availability of fast charging points with high charging capacities.

Important players in the construction of and access to charging infrastructure are the municipalities, retailers, parking space providers and petrol station operators. They have the necessary space and can provide the users of electric vehicles with customer-oriented offers with convenient charging solutions and thus make a significant contribution to the success of electromobility.



Source: VDA

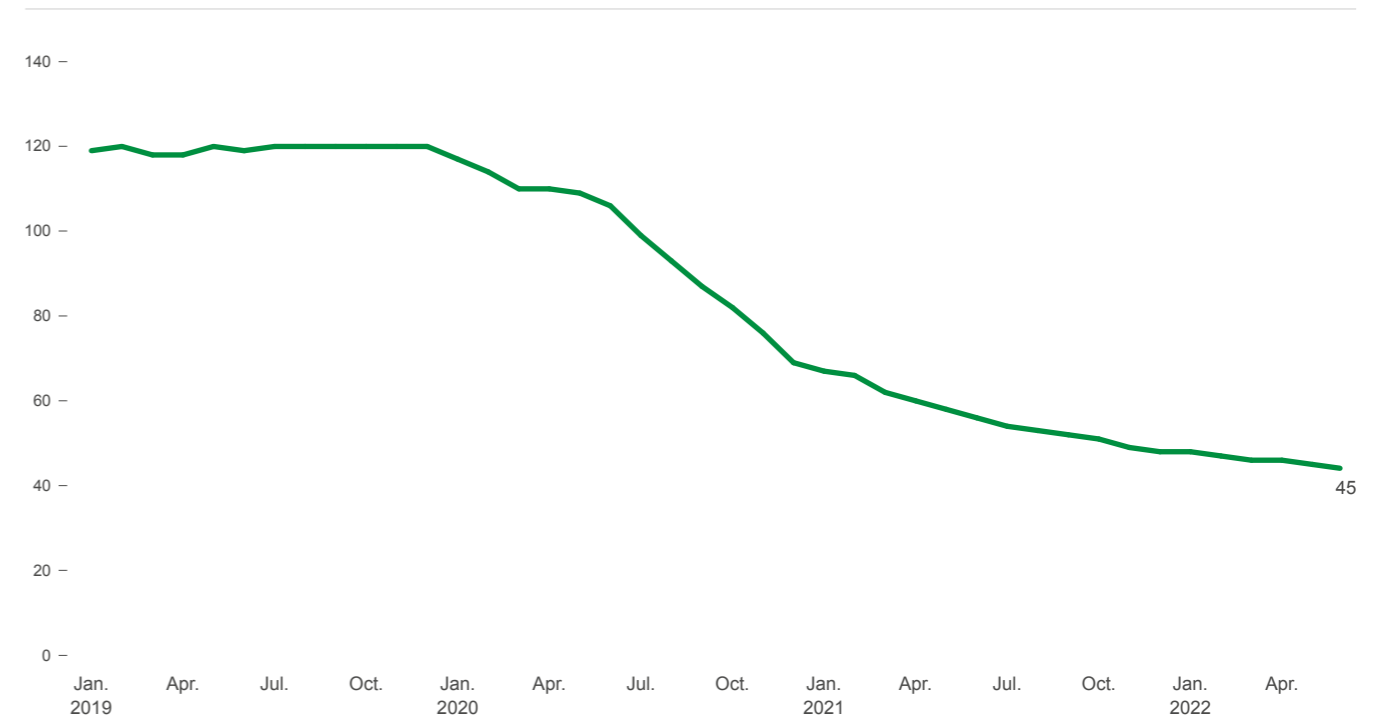
It is crucial that the installation of the charging points takes place in proportion to the ramp-up of electromobility and that the expansion precedes the demand by two years. This is the only way to create the urgently needed consumer confidence in a reliable and sufficient charging infrastructure.

For the electrification of heavy goods transport with a predicted transport performance of 30 percent in 2030, the development of public high-performance charging infrastructure on the long-distance transport axes is imperative. Ensuring the charging needs of

heavy goods vehicles and buses in long-distance traffic – even at peak times – is the basic prerequisite for switching from diesel engines to electric drives.

However, the current installation figures for charging infrastructure do not adequately support the ambitious goals of the German government for the ramp-up of electromobility. Important levers to be tightened in this case include the acceleration of approvals, the assumption of responsibility by municipalities, adapted funding programs and further progress in industrialization and grid connections.

Publicly accessible charging points per 1,000 e-cars

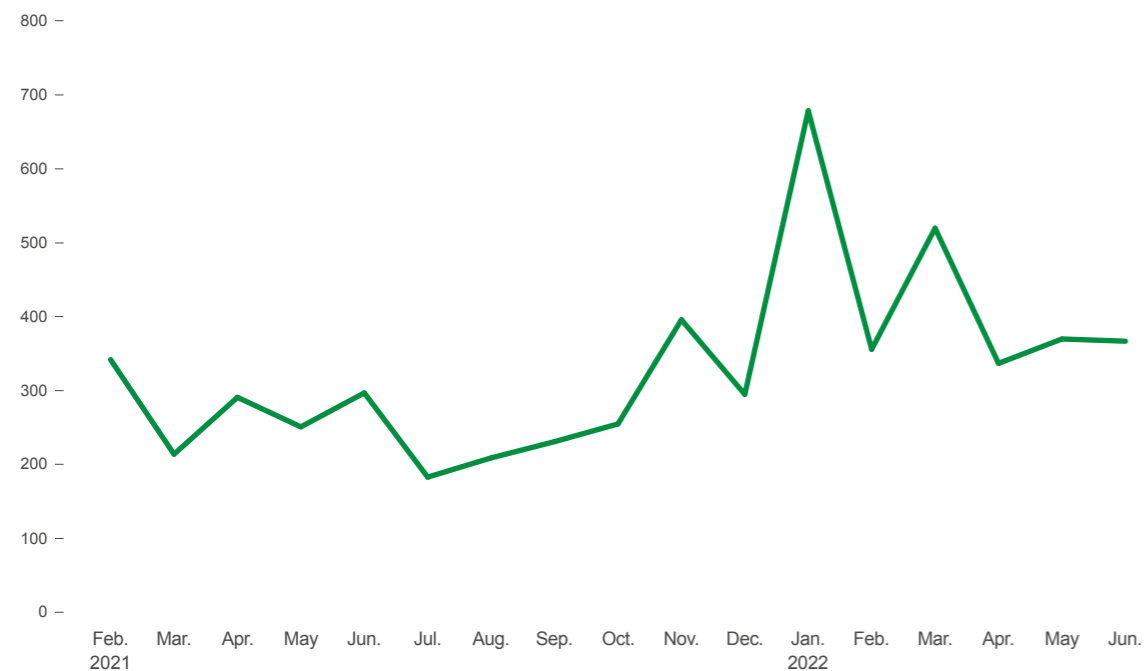


Source: BNetzA

On June 1, 2022, 62,000 charging points were registered with the Federal Network Agency (BNetzA) in Germany, 9,395 of which were fast charging points. With an estimated population of 1.39 million e-cars

on June 1, there are now 45 public charging points for every 1,000 e-cars or, to put it another way, 22 e-cars for every one charging point.

New publicly accessible charging points per week with notification



Source: BNetzA

The expansion of the charging infrastructure cannot keep up with the remarkable market ramp-up in e-mobility. The consequence: More and more vehicles have to share one charging point, currently 22 electric cars per charging point. This poses the risk that charging needs will be increasingly poorly and locally insufficiently covered. Long waiting times and frustration

are the consequences. To reach one million charging points in 2030, the construction of around 2,000 public charging points per week would be necessary. To achieve this goal, the current rate of expansion would have to be increased more than sixfold. The VDA is calling for a faster and more ambitious expansion and is campaigning for this.

The VDA E-charging Network Ranking

In June 2022, the VDA published its E-charging network rankings anew. The VDA E-charging network ranking is a statistical evaluation that is based on the official data of the Federal Office for Motor Traffic and the Federal Network Agency. Whatever is reported here is included in the evaluation, which shows the progress of charging infrastructure expansion in cities and districts throughout Germany. The VDA e-charging network ranking lends weight to the demand for a more ambitious expansion of the charging infrastructure and has been commented upon many times by regional as well as national media.

Gap between charging infrastructure and e-car stock continues to grow

One of the results of the ranking: Germany still has, and increasingly has, a lot of catching up to do when it comes to expanding the publicly accessible charging infrastructure for electric vehicles. The gap between the charging infrastructure and the number of e-cars has continued to grow.

On May 1, there was an average of around 22 e-cars per publicly accessible charging point in Germany. In the last VDA charging network ranking, as of October 1, 2021, there were 21 e-cars and on May 1, 2021 there were 17 e-cars – so the delta is growing.

The ranking is divided into three areas: The T-value indicates how many e-cars have to share a publicly accessible charging point. The district of Groß-Gerau (Hesse) is a new front-runner. A look at the federal states revealed the following order for the T-value: Saxony, Saxony-Anhalt, Thuringia, Mecklenburg-Western Pomerania and Hamburg. Schleswig-Holstein is at sixth place, followed by Berlin and Lower Saxony. Bavaria leads the second half at ninth place. It is followed by Brandenburg, Baden-Württemberg, Bremen, Hesse, Rhineland-Palatinate, North Rhine-Westphalia and Saarland. The differences between the federal states are large, but of course there are also structural differences in the federal states: In leading state of Saxony, there are 13.8 e-cars per charging point, in Saarland 28.1 e-cars.

A-value for attractiveness

The A-value represents the basic attractiveness of the charging network in the district or city. For this purpose, the number of publicly accessible charging points is put in relation to all cars registered in the district or city. In terms of the A-value, the city of Wolfsburg once again managed to defend its top position. The district of Groß-Gerau follows in second place. Ingolstadt is in third place.

S-value for fast charging network

The S-value shows how many e-cars statistically have to share one fast charging point. Fast charging points are particularly important for longer distances or when the charging break should be as short as possible, for example when travelling or shopping. With regard to the fast-charging infrastructure, a statistical evaluation at the level of the federal states is useful. The national average for the S-value is 146.1. Or in other words: In Germany, the average of electric cars per fast charging point is 146.1.

Thuringia, Saxony-Anhalt, Saxony and Mecklenburg-Western Pomerania lead

The first four places are occupied exclusively by the eastern German states of Thuringia, Saxony-Anhalt, Saxony and Mecklenburg-Western Pomerania. They are followed by Brandenburg, Rhineland-Palatinate, Lower Saxony, Schleswig-Holstein and Bremen, five more federal states that have a better ratio of fast-charging points to e-cars than the national average. In contrast, Bavaria, Baden-Württemberg, Hamburg, Berlin, Saarland, North Rhine-Westphalia and Hesse have more e-cars per rapid charging point than the national average. It shows that the differences between the federal states are also large in terms of fast charging infrastructure. In Thuringia, there are 57.5 electric cars per fast charging point, in Hesse this figure is 209.1.

Internal Combustion Engine and Exhaust Gas Regulation

The combustion engine will remain important for years to come. This will be the case for new vehicles – increasingly with hybridization – but especially for the existing fleet. For climate protection reasons, it is therefore essential to reduce consumption even further and gradually replace fossil fuels with non-fossil alternatives.

The combustion engine is also being consistently developed further in order to further improve air quality. The goal is to achieve the lowest possible pollutant emissions, because new combustion engines will remain in operation for many years to come and should pollute people and the environment as little as possible. However, it must be possible to meet new exhaust emission standards.

Despite the strong increase in sales of battery electric vehicles, those with combustion engines still dominate the roads. And this will not change in the foreseeable future. In 2021, more than 2.6 million passenger cars were newly registered in Germany, of which about three quarters were pure combustion engine vehicles and of the remaining quarter, about half were plug-in hybrids, i.e., vehicles with both an electric and a combustion engine. These vehicles will remain in use for many years and will only gradually be replaced by new purely battery-electric vehicles. In heavy goods transport, the use of vehicles powered by internal combustion engines is still much higher.

In addition, new vehicles with combustion engines will continue to be sold in the future. This need not be a disadvantage for

the climate, as long as they are powered by renewable fuels. In the medium term, advanced bio-fuels and synthetic fuels produced from renewable electricity will come into play. In addition, special hydrogen combustion engines also offer themselves as an almost completely emission-free drive option in the long term.

New vehicles with combustion engines will probably remain available in the EU until at least the middle of the next decade – and probably much longer outside the EU. This means that the further development of this technology remains an important concern for the automotive industry. In addition to further reductions in consumption, the focus is also on reducing pollutant emissions.

Ever-stricter exhaust emission standards as technology drivers

From 2015 onwards, the progressively stricter Euro 6 exhaust emission standard was not only accompanied by significantly stricter limit values and the regulation of new exhaust components – above all, a road measurement procedure was introduced. This means that compliance with exhaust emis-

sions must be proven not only on the test bench and the conditions of the WLTP, but also in real road driving, as occurs in “real” traffic. This has led to a 95 percent reduction in emissions compared to the previous emissions stage. The EU Commission now wants to add a sixth stage to the exhaust emission standard for passenger cars: Euro 6e. There will be even more stringent requirements for measurement technology and proof of cleanliness. Euro 6e shall come into force by 2027 at the latest.

At the same time, the EU Commission is working on new Euro 7 legislation for passenger cars and heavy commercial vehicles, which will bring significant intensification at three levels:

1. The limit values will become significantly stricter.
2. The measurement and driving edge conditions covering representative driving will be significantly expanded.
3. The evaluation and monitoring methods will be extended

Exhaust emission standards must remain achievable

The EU Commission has confirmed that the regulation of vehicles with internal combustion engines will be demanding but achievable, and is pushing the limits of what is feasible with new technical developments. However, from today's perspective, the draft requires some adjustments to ensure that it can be met. After all, the accumulation of the significantly tightened marginal and ambient conditions in combination with significantly lowered limit values and new limit value settings, especially for CH₄ and N₂O, calls into question the legally secure feasibility of such a regulatory construct.

There is a risk that compliance could only be achieved with the most expensive drive technologies (e.g., PHEV technology). There is a risk of serious user restrictions in order to

comply with the strict legislation in this case as well. Such user restrictions include, for example, the temporary throttling of engine power or the need for a system preheating time before the vehicle can drive off for the first time after ignition start. There is also a risk of user restriction for trailer operation.

The legislation would therefore make the vehicles complex and expensive, and would also increase fuel consumption and the risk of the vehicles becoming unattractive compared to today's Euro 6/VI vehicles due to the expected user restrictions.

The VDA continues to seek discussion on the feasibility of Euro 7. On the one hand, this is about the actual technically achievable emission level; on the other hand, we are increasingly pointing out that a legal requirement must also be verifiable and conformity must be guaranteed during development by means of appropriate internal test procedures. This will continue to require certain borderline cases against which a vehicle type can be inspected.

In addition, there is the time component, because the development of Euro 7 will probably drag on into 2024, so that the originally envisaged introduction date of 2025 is no longer tenable. In addition, Euro 7 collides with the introduction dates of the last Euro 6 emission stage. The EU commission has held out the prospect of a first Euro 7 discussion proposal for the end of November 2022.

The Fuel Cell

In order to successfully implement the energy transition, the prerequisite must be created to efficiently store and transform renewable energy. Fossil hydrocarbons must be gradually replaced by regenerative alternatives.

Areas of Application

Hydrogen can be produced cleanly from renewable energies and can be stored in large quantities. With hydrogen, it is possible to separate energy production and energy use in space and time.

Hydrogen, as an energy carrier, is not only available for transport, but its application can be linked with other industrial sectors and heat generation in households. Green hydrogen is the basis for a green refinery and hydrocracking processes, an indispensable storage medium for volatile renewable electricity and an activator for sector coupling. This is because hydrogen is needed in industry, in the heat and energy sector and in the transport sector. It can be assumed that between 8,000 and 12,000 peta-joules of e-fuels (including the use of pure hydrogen) will be needed across Europe to achieve a climate-neutral transport sector. This corresponds to a share of energy sources in the transport sector of over 80 percent.

In order to achieve the EU-wide CO₂ fleet targets in 2025 and 2030, all vehicle manufacturers are focusing on electric-battery mobility, mainly because of the short-term targets. However, the fuel cell remains in the focus of the automotive industry, because the use of a fuel cell makes it possible to safely cover long distances with a small battery compared to a battery-electric vehicle. Hydrogen propulsion will therefore play an important role, especially in automotive application areas that can so far only be covered by internal combustion engines. In this context,

the German Federal Government has developed a National Hydrogen Strategy and underpinned it with an action plan that will be continuously developed.

The Federal Cabinet adopted the National Hydrogen Strategy on June 10, 2020. In addition to the climate policy aspects, hydrogen technologies are also about many sustainable jobs, new value creation potentials and a global market worth billions. The goal for Germany is to maintain its global pioneering role in hydrogen technologies. After the change of government last year, the German government wants to relaunch this strategy: being even more ambitious and even more binding.

Several demonstration projects on the way

In the meantime, several series-production vehicles are on the road and several demonstration projects are underway. The technology with hydrogen and fuel cells is not only suitable for passenger cars, but also for heavy vehicles that travel longer distances. Several large cities are also currently demonstrating impressively that hydrogen as a fuel for local public transport can be a clean answer to the high particulate matter, exhaust gas and noise pollution that often occurs in conurbations. A challenge primarily remains in the industrialization of the fuel cell and the storage system.

Compared to battery technology, the fuel cell is characterized by a very low dependence on raw materials (only Pt, >97 percent recyclable). The fuel cell is also relevant for Europe in terms of industrial policy.

The hydrogen filling station network in Germany has grown to 93 stations (as of March 2022). In the medium and long term, work must be done on a dense Europe-wide H₂ filling station network that takes cars and trucks equally into account and provides liquid H₂ in addition to compressed hydrogen. Hydrogen cars should be able to refuel at up to 700 bar and commercial vehicles at up to 350 bar. This requires the strengthening of joint European initiatives such as Hydrogen Mobility Europe. However, hydrogen is not only important in the transport sector, but also in the energy, industry and power sectors. Therefore, it would generally make sense to build up an efficient hydrogen production and infrastructure from motorways to private households.

Hydrogen Infrastructure

Hydrogen vehicles also play out those advantages that are often decisive for haulers and many car users only if there is an adequate refueling infrastructure. Therefore, a rapid and nationwide expansion must take place if green hydrogen mobility is not to remain the future, but is to become the present.

Whether for passenger cars or trucks, whether for use in the fuel cell or the internal combustion engine, when hydrogen is used as a fuel in vehicles, a dedicated transport and distribution infrastructure is required. First, the hydrogen must be transported from the production site or landfall by pipeline or truck to the filling station. Alternatively, it can even be produced directly on the site. This is followed by intermediate storage at the filling station, for which different systems exist. Hydrogen is either stored in gaseous form in pressure tanks or in liquid form in deep-frozen containers. In addition, there are further distinctions in the design of the intermediate storage tanks, for example horizontal cylinders, high tanks or directly on a swap trailer. Among other things, the storage method used depends on the intended sales volume. Subsequent refueling can be done in two ways: For smaller delivery quantities to passenger cars and light commercial vehicles, very high pressure of around 700 bar is suitable. If larger quantities are to be refueled, for example buses and trucks, a low pressure level of around 350 bar is more suitable.

A great opportunity for climate-neutral freight transport

The Hydrogen mobility has two decisive advantages: Compared to charging a battery-electric vehicle, refueling times are comparatively short. And due to the high energy density of hydrogen (relative to its own weight), comparatively high ranges and payloads are made possible. Therefore, the use of hydrogen offers similar flexibilities, ranges and performance profiles as the use of conventional drives. For this reason, commercial vehicle manufacturers and suppliers in particular also see opportunities in the use of hydrogen to make long-distance transport with trucks and buses CO₂-neutral in the medium to long term.

There is a shortage of filling stations

The biggest obstacles to the breakthrough of hydrogen mobility are the still limited availability of green hydrogen in sufficient quantities and the lack of refueling facilities. Therefore, a core network of hydrogen refueling stations must be established for road freight transport as soon as possible. Plans for the development of the hydrogen refueling infrastructure should provide for the availability of refueling stations with a minimum capacity of 2 metric tons of hydrogen per day with at least 700 bar in the entire TEN-T network with a maximum distance of 100 kilometers by 2027. Adequate supply of liquid hydrogen should also be taken into account. The operators of commercial vehicles and passenger cars will switch to hydrogen only if there is a reliable network of hydrogen filling stations at least on motorways, important rural roads, in cities and at intersections in the medium term, and if adequate green hydrogen is available there.

Digitalization

Tomorrow's mobility also springs from innovations that are not associated with the automobile alone: Artificial intelligence unlocks the door to automated driving – which is safer and more efficient than ever before.

Digital platforms facilitate the combination of a wide range of mobility services – tailored to fit every situation. New communication technologies enable the exchange of data between people, vehicles and infrastructure. In this way, vehicle data is turning into an important source for new services and business models related to the automobile.

The companies in the automotive industry have been emphatically accelerating the digitalization of vehicles – from passenger cars to trucks and buses – for years now. They are training their employees and also investing large sums in the billions in the digitalization of production facilities. In the age of the Internet of Things, car manufacturers and suppliers are banking heavily on automated production processes – for real-time monitoring and control in manufacturing, for example.

In so doing, the companies in the automotive industry are ensuring their competitive edge and substantiating their innovative prowess. It is therefore all the more important that the political conditions are established that will lead the digital transformation of the automotive industry to a successful conclusion. A comprehensive digital infrastructure is a basic prerequisite for the digital future of the country.

The driving force behind the mobility of tomorrow

In the future, vehicles will offer many functions through digitalization that will benefit not only the driver, but also other people using the roads, as well as cities and municipalities, commercial sectors, health care, security and even the energy grid. Today, for example, a modern vehicle already generates 25 gigabytes of data within just one hour.

Digitized vehicles network with their surroundings and other modes of transport, they exchange data, take over more and more of the driving operation, they

can be better shared and enable intelligent traffic routing. These vehicles temporarily turn from a car into a mobile office and a family room when travelling. They can store and release electricity and thus stabilize the grid. Today's vehicles are fully networked; their functionality can be individually configured and continuously expanded. Fully networked mobility ensures sustainable mobility and strengthens climate and resource protection.

More efficiency, more comfort, more safety and more benefits for society as a whole – this is the new role of the automobile in the digitalized world. As such, lifecycle management plays an important role as well. After all, the effectiveness of security measures can change after the development phase over the entire life cycle of the product.



Software and Data

More cybersecurity – an unrelenting task

As such, it is essential to protect both vehicle and user data as well as other vehicle functions against unauthorized access and manipulation. To ensure that possible cyberattacks do not affect driving safety and that suitable protection mechanisms can be integrated, corresponding threats must be taken into account at an early stage in the development cycle of new vehicle models.

Cybersecurity is a western component throughout all levels of the vehicle that will render this possible. The automotive industry is constantly making upgrades to cybersecurity in response to new threats and is constantly developing measures for improved security. In order to secure the area of digitalization, which is important for Germany as a business and automotive location, the Federal Office for Information Security (BSI) and the German Association of the Automotive Industry (VDA) work closely together on cybersecurity issues.

Key role of software

Software already plays a key role in vehicles today. And it will become even more important in the future, as numerous functions are likely to be added. For

example, users can add functions “on demand” at any time. In addition, the vehicles are always kept up to date via software updates – even without a visit to the workshop with “over-the-air updates.”

Software is therefore a growing influence on how customers view their cars. A car's operating system and its networking with the digital world are becoming factors that differentiate it from the competition. They are the basis for ever more powerful assistance systems, all the way to autonomous driving, which make driving even safer and more comfortable. To put it simply: The automobile is becoming a fully electrically powered “mobile device,” in other words a smart mobility companion fit for the future.

For a safe and fair use of data

The VDA has developed the ADAXO concept (Automotive Data Access, Extended and Open) for a secure and fair use of data along the entire “value chain,” from data generation in the vehicle to new data-based services for the customer (see ADAXO article).

Digital strategy of the German Federal Government

On August 31, 2022, the German government published its digital strategy. The strategy brings together the political priorities from the government's point of view and is intended to form the overarching framework of digital policy until the year 2025. The central fields of action also include mobility, which is gaining more of a digital character. Among other things, the government has set itself the goal of expanding the mobility data ecosystem. When it comes to automated, autonomous and connected driving, the German government is looking to be benchmarked on whether it has made the breakthrough from pilot procedures and projects into practical use or real-life applications by 2025.

The VDA is following the discussion on the digital strategy with great interest and is contributing its own proposals. This is because the progressive digitalization of the automotive industry and its products requires close monitoring of further implementation as well as a careful review of the relevant legal framework conditions.

Automated Valet Parking

World premiere at IAA MOBILITY 2021 in Munich: parking, washing and charging – all automated and driverless. Trade fair visitors and interested parties had the opportunity to experience a piece of future-oriented inner-city mobility in a unique demonstration.

Automated Valet Parking – AVP in short – was the headline of the joint project, which the Verband der Automobilindustrie e. V. (VDA) (German Association of the Automotive Industry) developed together with ten partners.

Automatic parking and washing

Searching for the right parking space and paying at the machine can be exhausting and time-consuming. Automated Valet Parking, as a fully automated and driverless parking system, takes care of these tasks and additional services such as charging or washing. With the AVP type 2, there is now an overarching standard. This enables all-encompassing interoperability between the vehicle systems of different manufacturers and the intelligent car park infrastructure.

Automated parking was expertly explained to a wide audience on the 1,800-square-meter “stage” of Parkhaus West he Trade Fair Center Messe München. Here we once again explain in brief what could be experienced live on the site:

Step 1: Arrival

As an AVP user, you can conveniently search for AVP car parks and reserve a parking space in advance via your mobile phone or navigation device. The various functions of the AVP are integrated into the digital ecosystem of the vehicle provider. After the vehicle driver has been reliably guided to the car park by the navigation device, the car park’s camera system automatically recognizes the vehicle on arrival and allows it to enter.

Step 2: Drop-off and automated parking services

The AVP user then parks their vehicle in the drop-off zone and selects the desired additional services, such as charging or washing. From this point onwards, the AVP infrastructure is in constant contact with the car park and the vehicle. Controlled by the car park’s cameras, the vehicle drives fully automatically to the selected parking space. The car moves completely

safely and autonomously, even through tight curves. In the event of mixed traffic such as people or other vehicles, it immediately stops reliably. In the meantime, the AVP user has already left the car park through a nearby exit and is on the way to their actual destination. The AVP user has forgotten their wallet in the vehicle or would like to load groceries in the meantime? No problem, because the AVP user can see on an app where their vehicle is currently parked – and the AVP user has access to the vehicle at all times. In addition, the AVP user has a continuous overview of the costs and status of the vehicle’s services.

Step 3: Pick-up

To pick up the vehicle in the pick-up zone, the AVP user can either set a time in advance or call the vehicle spontaneously with just a few clicks. In the pick-up zone, the AVP user then receives their car safely and comfortably and can continue their journey.

Step 4: Departure

The payment process runs digitally in the background. The camera system authenticates the vehicle and lets the AVP user drive out without a ticket.

Many advantages with AVP

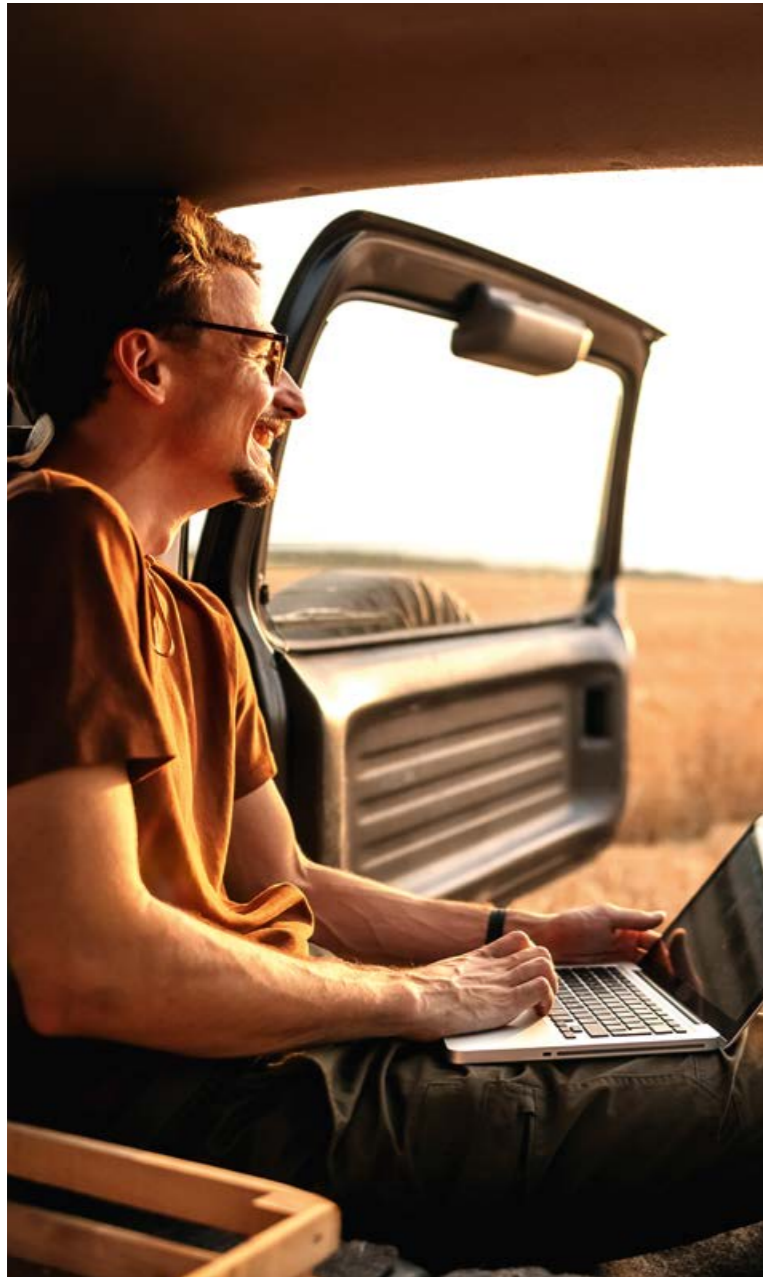
With AVP type 2, drivers have a convenient solution for parking and additional services. The AVP type 2 user has additional time for important tasks and can rely on the security of the intelligent infrastructure.

AVP type 2 offers car park operators greater flexibility in parking space utilization and better quality in customer service. Installation costs and efforts are low.



Data Platforms

All data from different data sources is compiled, retrieved, monitored and securely exchanged on one platform.



In Germany, the “Mobility Data Space” (MDS) has emerged from a joint activity of science, business and public administration to create the basis for new multimodal mobility services. The objective is to generate a “one-stop shop” for mobility data. It is crucial that all the players involved in mobility take part: ranging from vehicle manufacturers to car-sharing services, from public transport operators to software manufacturers for navigation systems, from research institutions to bike-sharing providers.

The MDS is intended to stimulate greater competition for innovative, environmentally friendly and user-friendly mobility concepts by providing all users with equal and transparent access to data. In keeping with the principle of “Security by Design,” the concept is decentralized, i.e. data exchange will only take place between the contractual partners, and only a data catalogue will be stored on a central platform.

In addition to the data provided by its users, the MDS provides access to the data offerings of the national mobile library, such as roadworks information or local weather situations. The national access points for the provision of mobility data are currently being harmonized across Europe.

There is also a data ecosystem, “Catena-X”, which focuses primarily on the supply chain. Catena-X was initiated by the automotive industry, IT companies, technology suppliers and many other partners. The goal of this resilient and collaborative data ecosystem is to enable a digital flow of information across the entire value chain.

For example, with regard to end-to-end digital documentation, the integral CO₂ footprint can be determined or traceability can be provided

in accordance with the Duty of Care Act for the Supply Chain. A standardized, sovereign data exchange and the possibility to use cross-company applications offers all companies – from SMEs to corporate groups – investment security and bolsters their competitive edge in the long term. Companies that are connected to the data space can reach their entire business partner network via it.

The Mobility Data Space as well as Catena-X are based on system architectures that are based on preliminary work of the Gaia-X domain and the International Data Space Association (IDSA). Ensuring data sovereignty and security is thereby crucial. Likewise, it is important that these open source solutions are always interoperable. Thanks to the open architecture, the data ecosystems can be connected to other markets at any time and thus tap into further new business opportunities.

The expectations of data platforms are high; in addition to ensuring technical interoperability for data exchange among stakeholders, the question of a common European data economy and mobility vision has not yet been fully addressed.

The MDS and Catena-X thus represent approaches to networking products and processes in the automotive industry. With the MDS, for instance, digital services can be networked with the product vehicle, while with Catena-X all relevant players in the production and logistics chains are connected.

In collaboration with Catena-X:

- On an equal footing: All partners share equal rights and sovereignty. All participants have non-discriminatory access to the data ecosystem.
- Based on trust: The solution provided and the governance are both convincing and provide a basis for trust in the community.
- Transparent: The foundations of the Catena-X ecosystem are based on open source solutions that are available to all in a completely transparent fashion.
- Standardized: It embraces open (industry) standards.
- Certified: Catena-X will assess and certify services and applications.

ADAXO – Information Interface

Mileage, range, battery status – Modern cars generate large data volumes every day. This provides not only car manufacturers but also the supplier industry and other interested companies with valuable insights into the vehicles and enables them to develop new products not only faster but also in a more customer-oriented way.



Of crucial importance is how the generated data is made accessible. The VDA has given extensive thought to precisely this issue – and with the ADAXO concept presents a contemporary and future-proof procedure for the exchange of vehicle-generated data between all parties involved. ADAXO is the abbreviation for “Automotive Data Access, Extended and Open” and means something like “extended and open vehicle data access.”

The role of vehicle-generated data for the future of the automobile industry

The automobile industry is investing large amounts in data-driven business models and connected vehicles. Great opportunities arise from the use and exchange of data, such as in autonomous driving, car sharing or intelligent traffic management. All these innovations are based on data produced by vehicles. It is therefore all the more important to find a uniform regulation for how the market accesses this information.

What is behind the ADAXO concept?

The automobile industry has agreed that vehicle-generated data should be made available via a single internet-enabled interface. If several interfaces are present in a vehicle, this increases security risks and access difficulties. Recommendations on what this interface should look like are provided by the ADAXO concept.

ADAXO is not a platform from which data can be extracted. Rather, it is about the technical possibilities and basic principles with which third parties can access the data. The aim is to make relevant vehicle data available to several market participants at fair conditions.

Which data is important for the industry and what it is needed for

Modern vehicles generate approximately 25 gigabytes of data material every hour – the wealth of information is correspondingly large. This includes simple data such as mileage, speed, location and rpm. Vehicle manufacturers (OEMs) and suppliers evaluate the state of charge of batteries or the available range of e-cars as well as driving and braking behavior. With this information, they can further develop the technology and the vehicles in a targeted manner, but interested companies can also use it to offer completely new data-driven services.

Today, millions of vehicles in Europe are already connected in this way to servers of major vehicle manufacturers. The key strength of the concept is its openness with regard to the type and amount of data that can be transferred, which opens up a wide variety of innovative application possibilities. Data can also be made available to insurance companies, financing companies and public institutions such as federal and

state authorities or the EU. The VDA is convinced that the process will be interesting for business models and applications in the future.

Consumers benefit

It is useful for vehicle owners if parameters from the areas of service and maintenance are recorded – they can check the condition of their car via an app or on the display in the dashboard. If abnormalities or problems occur, such as a decreasing tire pressure, a warning message appears.

In vehicles with the current state of technology, fatigue detection analyses the person’s facial expressions and eye movements and sounds an alarm if they are no longer fit. In addition, in the future a vehicle could measure how the person behind the wheel is feeling: Circulatory problems or heart failure could then be detected at an early stage via special sensors on the steering wheel. Such health screenings while driving could soon make a significant contribution to road safety.

ADAXO also stands for data protection and cybersecurity

Data protection is a top priority for the automobile industry. First of all, consent to share sensitive data is requested from vehicle owners. In addition, the interface is standardized as per the ISO guidelines. This means that data access is governed by appropriate business-to-business or other agreements, while at the same time complying with the European Union's General Data Protection Regulation.

These specifications also increase cybersecurity for the providers and the buyers of the data. Additionally, a single interface is less complex. The automobile industry wants to protect vehicle users and passengers from additional and insecure extensions that are subsequently implemented in the vehicle and where responsibility is not clearly regulated.

How the technical forwarding of data works with ADAXO

ADAXO is based on the "Extended Vehicle" concept presented by the VDA in 2016. Then and even today, it was about the secure transmission of vehicle-generated data to the servers of OEMs. The idea behind this is the provision as well as electronic transfer and use of the data via a single web interface, also called "ExVe-Web interface." Such an interface is available in all modern vehicles. In the application, the data is forwarded by means of ExVe to a neutral third-party web interface, i.e. to a virtual data room.

The VDA therefore sees no need to store the data itself in a separate location and offer it to third parties via intermediate steps, as this would involve extreme and costly effort. With ADAXO, the automobile industry is concentrating on the direct forwarding of data.

ADAXO is the further development of the NEVADA concept

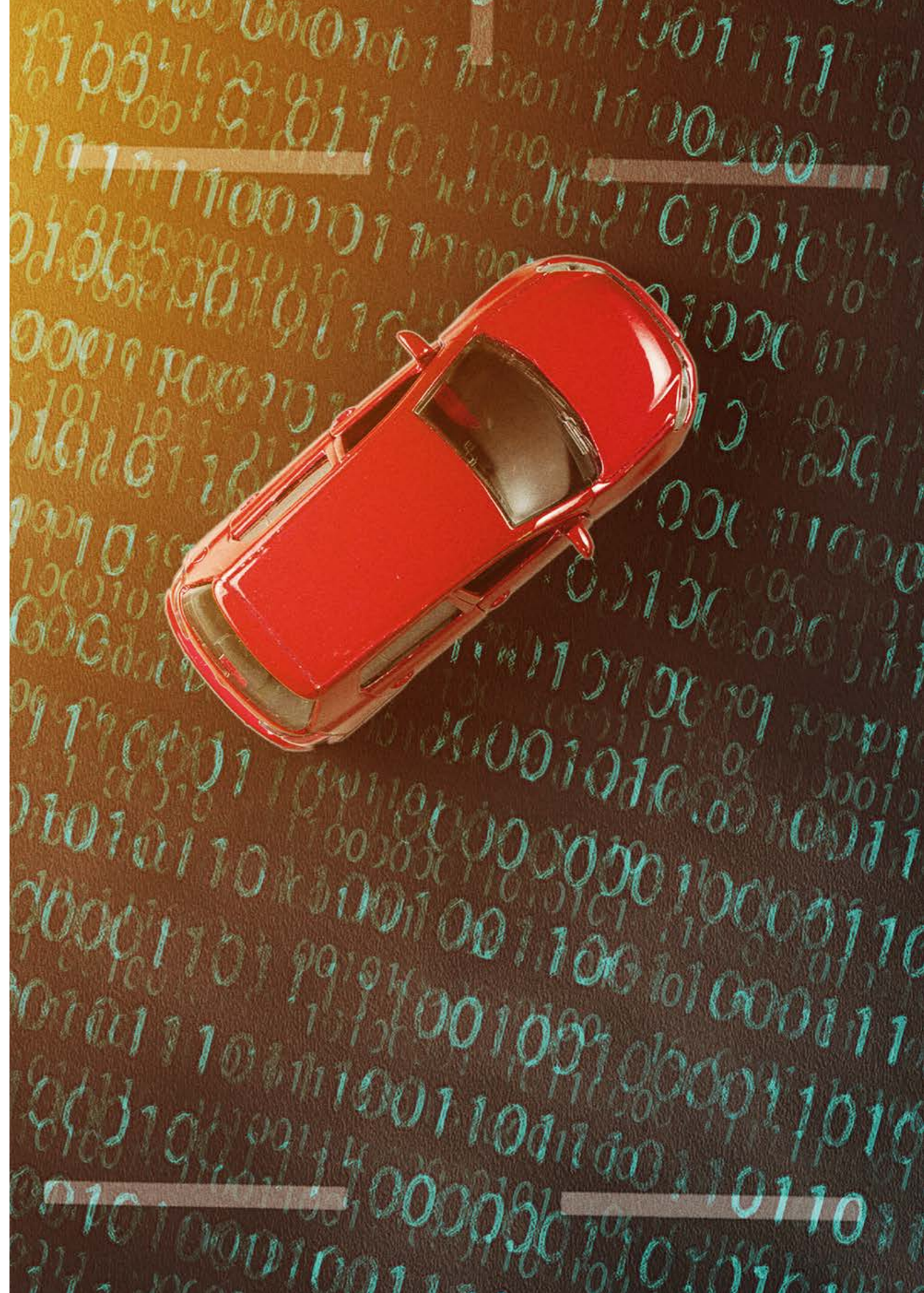
It is always important for the VDA to react to market developments. The central approach with NEVADA was to make data available to different parties via so-called neutral servers. In the course of time, new initiatives have emerged at European level, such as the so-called

data rooms, and the automobile industry had to respond to all these developments, also in order to have a concept that could stand up to political discussion.

The use of ExVe has been reliable for years. Since the automobile industry is convinced of the principle of a single interface, ADAXO is also based on it. The new challenge was to re-describe the field after the data was extracted. Today, a data room is a very general but powerful construct that needs to be evaluated differently along the entire value chain. In the expanded concept, the extracted data is now offered to various players on fair terms. While an OEM uses the data, it is simultaneously available to other buyers via a contractually regulated business-to-business relationship.

Here are the policy-making decisions that are next on the agenda concerning vehicle-generated data

The goal of the European Commission is to control the exchange of data within the sectors more strongly and to promote it more than before. The VDA expects a draft of sector-specific regulation for the automobile sector, i.e., for access to vehicle-generated data, in autumn this year. The European Commission has already called for comments from various stakeholders, associations and interest groups. With our ADAXO concept, the automobile industry has developed an excellent basis for further political discussion.



Closed-loop Economy and Battery Recycling



By far the greatest environmental impact of the automobile industry is caused by the usage phase of vehicles. With the ramp-up of alternative drive technologies, the CO₂ hotspots are however shifting to the upstream chains (materials, production).

Circular Economy: The Automobile Industry as a Pioneer

The German automobile industry's strategy to reduce its CO₂ footprint goes far beyond the product's usage phase – and considers the entire life cycle of a vehicle from raw materials, through production to recycling.

This holistic approach to all stages of the value addition chain and their environmental impact is reflected in the automobile industry's "Design for Sustainability" strategies and is continued in the debate on the further development of the circular economy. The goal of a circular economy is to simultaneously reduce the use of resources and the volume of waste. This can be achieved through reuse and recovery, recycling of products and raw materials as well as through resource-efficient product design (eco-design).

The fundamentals of the closed-loop economy are deeply rooted in the automotive industry

Resource conservation	Particularly in vehicle construction, material efficiency plays a major role due to the above-average material costs. Material efficiency strategies include resource-saving product design, optimized production processes, material-saving warehousing and internal recycling.
Durability	Vehicles are designed to operate for more than 200,000 kilometers. Some of them are on the road for more than 20 years, making them one of the longest-lasting consumer products. At the same time, the owners of the vehicles change frequently.
Reparability	Customers are supplied with new and remanufactured vehicle service centers for up to 15 years after the end of a vehicle's production. Comparable offers do not exist for other consumer products.
Recyclability	At the end of its life, a vehicle is at least 85 percent recyclable. This is a top value compared to other consumer products. With IDIS (International Dismantling Information System), the automotive industry provides dismantling companies with a free, central, easy-to-understand information platform. IDIS is today's blueprint for many other consumer product information platforms.
Recycling	One third of a vehicle already consists of secondary materials.

The foundations for a successful automobile circular economy are laid in the products. However, this can only be the starting point of the automobile circular economy. According to the Ellen MacArthur Foundation's "Circularity Gap Report," the global circular economy was just under 9 percent in 2020. Doubling circularity would be enough to close the emissions gap, according to the Circularity Gap Report.

Current political initiatives, such as the revision of the Old Vehicles Directive or the development of a circular economy strategy, currently offer the opportunity to strengthen important framework conditions for a successful automobile circular economy.

Further information on the topic can be found on the VDA website, keyword [Future of the Automobile Circular Economy](#).

Battery Recycling: Electric Car Batteries

With a view to the ramp-up of electromobility, battery recycling is coming into focus. A strong driver of the discussion is the tight market for the required battery raw materials lithium, cobalt and nickel and the associated supply risk. The automotive industry is already reacting to these risks at a very early stage. In addition to classic purchasing instruments to secure the availability and quality of critical raw materials (e.g. raw material hedging, long-term supply contracts, diversification of the supply network), the automotive industry is working on their reduction and substitution (e.g. cobalt) and on increasing the share of recycled materials.

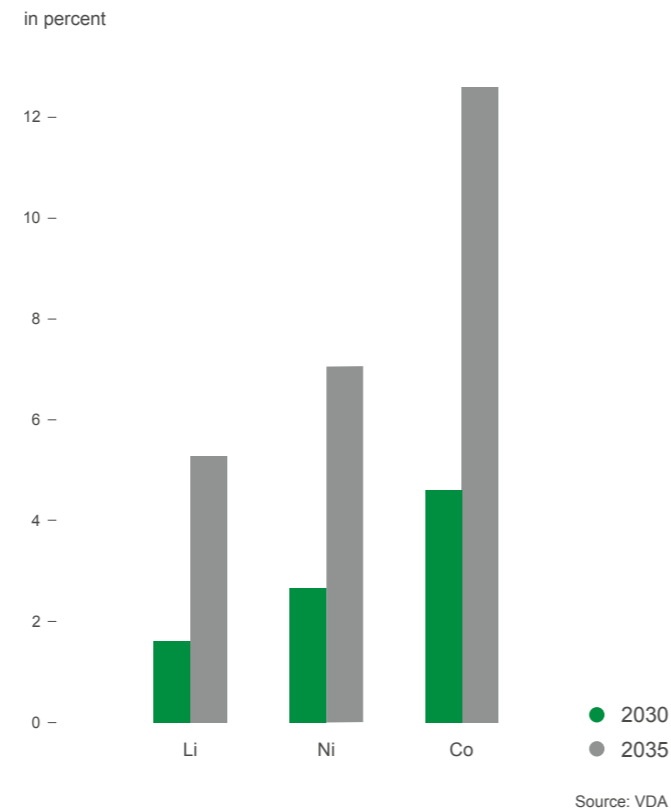
However, the potential of recyclate use in batteries for electric vehicles is limited (see figure). The share of the total market for battery raw materials will remain in a single-digit percentage range in the coming years – because the demand for battery raw materials will be many times higher than the supply of recycled materials due to the enormous ramp-up of electric vehicles.

The time span between the initial registration and the recycling of a vehicle must also be taken into account. Some of today's vehicles are in use for more than 20 years before they are recycled. Electric vehicles will also reach this age – we are already assuming 15 years on average.

Recycling technologies and capacities usually follow the product. As was initially the case with lead-acid batteries, recycling processes for lithium-ion-based traction batteries will continue to evolve and recycling capacities will be continuously built up. This development can continue to be supported by specific research and development programs of the German government.

Meeting demand through recycling

without LFP Recycling



In addition, the entire value addition chain must be further developed. One example of this is Catena-X, which is also supported by the German Federal Government. In this consortium, companies from the automotive, IT, chemical and recycling industries are working together to advance the interplay between the different value chains, using the example of the traction battery, through the smart use of IT.



Energy and the Climate

Electro-fuels are the only way to achieve climate targets, because they make it possible to make the existing fleet climate-neutral. The worldwide potential of renewable energies can also be used in Germany and Europe and comprehensive climate protection can be implemented cost-effectively.

E-fuels in the Carbon Footprint

On the way to climate-neutral road transport, renewable fuels are needed in addition to electromobility with green electricity. Only they can include the large existing fleet with combustion engines in the climate protection efforts and thus make it possible to reach the climate targets in the first place. Even if the German government achieves its target of 15 million electric vehicles in Germany by 2030, more than 30 million passenger cars are still likely to be dependent on liquid fuels at that time. If these fuels are not provided, to a considerable extent, from renewable sources, the Climate Protection Act's target of 85 million metric tons of CO₂ emissions in transport per year will clearly be missed. Only if electromobility and renewable fuels complement each other can the goal of climate neutrality in transport be achieved. In addition to advanced biofuels produced from biogenic residues and waste materials, this requires in particular electricity-based synthetic fuels, so-called electro-fuels, or e-fuels in short.

Harnessing the global potential of renewable energy

E-fuels produced from renewable electricity are largely climate-neutral. With their help, the large potentials of renewable energies that are available in many regions of the world, such as the wind of Patagonia or the sun of Africa and Australia, can be harnessed. However, the renewable electricity produced there at extremely low cost can hardly be transported directly to Germany to charge electric vehicles. It can however be synthesized into hydrogen by means of electrolysis and then, in combination with CO₂, which is extracted from the air, for example, into e-fuels. This so-called Power-to-X or PtX technology is what makes the green electricity from the gas regions storable and transportable in the first place. The e-fuels produced can then be easily transported to customers via existing infrastructures and used in all existing vehicles with combustion engines. High electricity

yields and plant utilization make up for the efficiency losses in the conversion of electricity to liquid fuels and allow production costs of one to two euros per liter.

Active and energetic action is needed

As part of the "Fit for 55" package, the VDA is advocating a quota of 30 percent renewable fuels in 2030, in addition to supporting measures for the ramp-up of electromobility. This would create an international market that makes renewable energies from other regions of the world available for mobility in Europe. E-fuels thus increase the room for maneuver in the energy system and ensure greater security of supply through a broad diversification of the energy supplier structure. In addition, development policy goals can be pursued in cooperation with emerging and developing countries, as it were, and income and prosperity can be created there.

The "Climate Paths 2.0" study by the Bundesverband der Deutschen Industrie (BDI) (Federation of German Industries), prepared in cooperation with the VDA, describes ways to achieve a climate-neutral energy system. The import demand for e-fuels for road transport in Germany calculated in the study amounts to 35 terawatt hours in 2030 with a stock of 14 million electric vehicles. If we fail to meet this target, we will need correspondingly larger quantities of e-fuels. The investments required for this are huge and have considerable lead times. The VDA therefore calls on the political actors at federal and EU level to create a framework that will get these investments underway promptly and reliably.

Energy Partnerships

Climate protection and energy security are the goals of the energy partnerships that Germany maintains with a large number of partner countries worldwide.

But the exporters of renewable energy also benefit, which contributes to economic development there and makes the partnerships sustainable in the long term. The German government should ambitiously develop this approach further.

Germany is heavily dependent on energy imports. This is particularly true of the transport sector, since about 98 percent of domestic consumption of crude oil is covered by imports. But other sectors are also highly dependent on imported energy sources.

Moreover, a large part of the imports come from a small number of supplier countries. This makes Germany, with its energy-intensive industries and complex supply chains, vulnerable in the event of external disruptions to energy supply.

Since Germany will remain dependent on energy imports for the foreseeable future, the German government has launched a number of energy partnerships and dialogues. They are intended to make the energy supply more secure in the long term by diversifying the supplier structure, pooling importer interests and promoting technology exchange. Last but not least, renewable energy is to be made accessible, thus making an important contribution to climate protection, since Germany

will not be able to supply itself entirely from its own renewable energy sources even in the long term. So far, more than 20 partnerships have been sealed, thus taking important steps towards greater energy security and successful climate protection.

Focus on synthetic energy sources

Energy partnerships have a strategic role to play in the import of climate-neutral energy from a broadly diversified supplier base. They make the worldwide potential of renewable energies available in Germany and Europe. However, renewable energy is mostly in the form of electricity, which can only be transported over medium distances by cable. Within the framework of the energy partnerships with North Africa, such a transport could be organized via cable, much like the transport of gases produced with the help of renewable electricity (e.g. hydrogen, methane) via pipelines. Renewable energy from more distant partner countries in South America, South Africa or Australia, however, must be transported by ship, which requires the conversion of electricity into chemical energy carriers. The first step in this process is the electrolytic production of hydrogen. However, since this is difficult to transport, its further processing into synthetic energy carriers such as methane, synthetic crude oil or fuels (e-fuels) using PtX technology seems necessary. These can easily be transported, stored and distributed in existing infrastructure. The very high utilization rates of wind power and solar plants in the partner countries make up for efficiency disadvantages of conversion into synthetic energy sources and allow for far lower production costs than would be the case if they were produced in Germany, where this only appears to make sense on a small scale anyway due to limited potential.

Everyone wins with energy partnerships

Through the production, conversion and transport of renewable energy, both sides of an energy partnership benefit. Germany gains access to climate-neutral energy from a variety of sources. The partner countries benefit from the extensive investments, as they can build up know-how and jobs and earn money through exports. Industrial follow-up settlements that want to use renewable energies (e.g. from the chemical industry) can also be attracted. The energy

partnerships can thus also serve as a development policy instrument by generating local income through industrialization and thus raising living standards.

It should be the goal of the German government to establish and deepen energy partnerships with as many suitable countries as possible. An international market for renewable energy, especially synthetic energy sources, can be created in this manner. The support provided by the H₂ Global System is also extremely valuable in this regard. The double auction model financed from federal funds bridges the difference between (still high) production costs and the revenues achievable on the market (contracts for difference) in the initial phase of market establishment. The German Federal Government should continue to design this instrument generously, as it paves the way for a cost-efficient supply of hydrogen-based, renewable energy.



Hydrogen Demand in Germany

The transformation to a climate-neutral industry requires huge amounts of hydrogen and thus also very large investments.

In particular, “green” steel is becoming the key for the automobile industry. However, the ambitious goals can only be achieved if politics and industry act just as ambitiously.

The energy transition requires the use of green hydrogen – i.e., hydrogen produced using renewable electricity – in large quantities. On the one hand, it serves as a buffer in the electricity system, in that it can be produced electrolytically and then temporarily stored when there is an oversupply of renewable electricity. Then, in times of a shortage of renewable energies, it can be converted back into electricity in gas turbines or fuel cells. Hydrogen is also need-

ed to generate heat, as a fuel for transport and for material use. The latter applies in particular to the chemical, basic materials and steel industries, where hydrogen can be used, for example, in the production of basic industrial chemicals and subsequently for the production of plastics, or as a reducing agent in the production of steel.

The hydrogen economy thus has significant implications for the automobile industry – not only through the potential use of hydrogen as a fuel during vehicle use and the associated adjustments to the product range, but also at virtually all stages of the automobile value addition chain. Steel production is of particular importance here. This is because it is currently responsible for a large part of the CO₂ emissions from vehicle production. So-called “green” steel produced with hydrogen therefore plays a key role in achieving the automobile industry’s ambitious climate targets.

Large quantities of hydrogen are needed

The “Climate Paths 2.0” study by the Bundesverband der Deutschen Industrie (BDI) (Federation of German Industries), prepared in cooperation with the VDA, quantifies the expected hydrogen requirements for a climate-neutral Germany by 2045. In order to successfully follow the transformation path to this goal, approximately 43 terawatt hours of greenhouse gas-neutral hydrogen will be needed as early as 2030 (industry: 24 terawatt hours, refineries: 8 terawatt hours, transport 10 terawatt hours). In addition, about 68 terawatt hours of electricity will be needed to operate the necessary electrolyzers. For comparison, in 2021, Germany produced just under 60 terawatt hours of fossil-based hydrogen for industry and a total of about 234 terawatt hours of renewable electricity. This shows how ambitious the interim targets until 2030 already are.

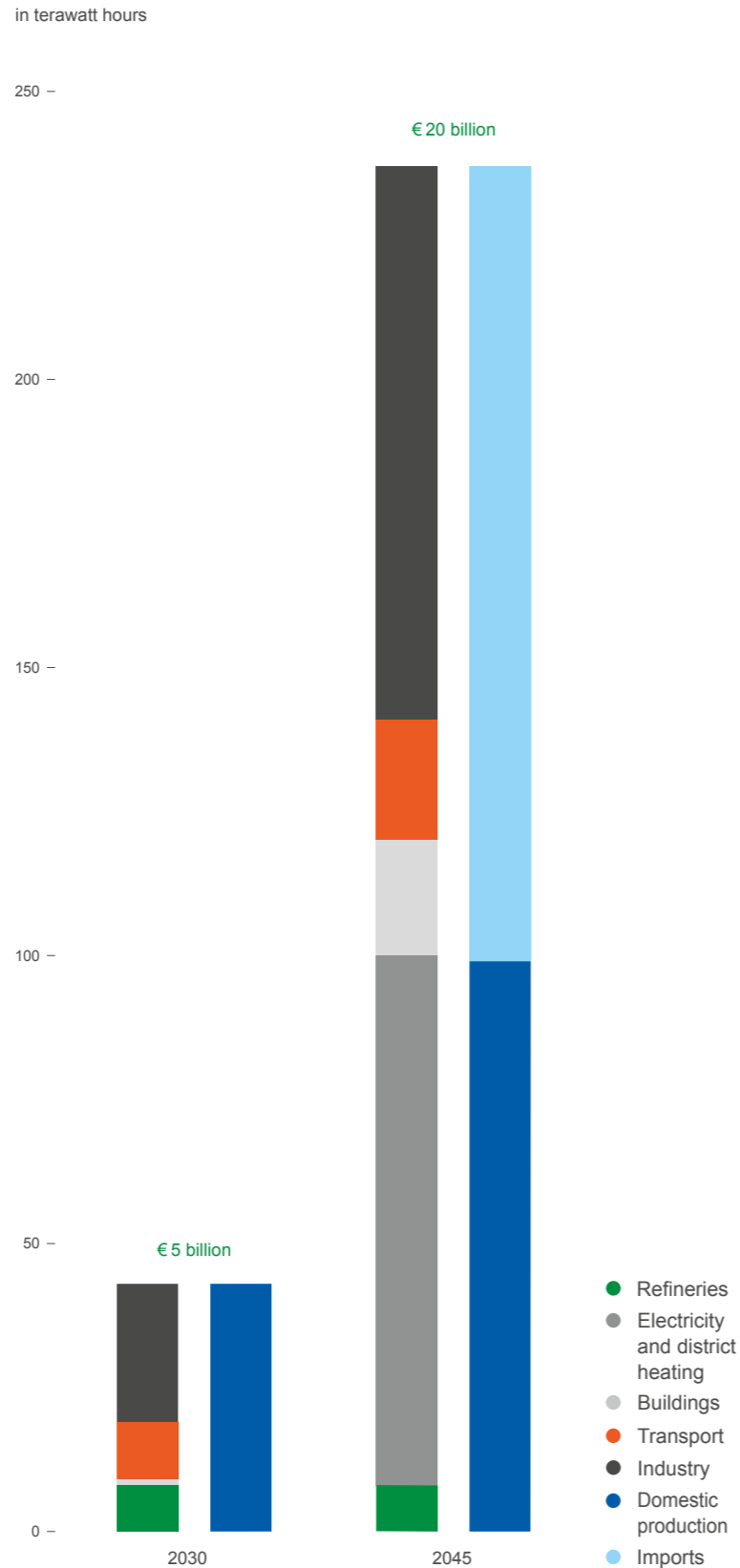
Until then, hydrogen will probably still be produced entirely in Germany. After that, production will have to increase more than fivefold by 2045. Total demand will then rise to about 240 terawatt hours (industry: 96 terawatt hours, refineries: 8 terawatt hours, transport: 21 terawatt hours), of which only a good 40 percent can probably be met from domestic production. The majority – almost 60 percent – will have to be imported from other European countries via pipelines.

High investments in a short period of time

In order to meet the demand for hydrogen, extensive investments are required, which will mainly take place in Germany by 2030. Subsequently, by 2045, more investments will also have to be made abroad in order to import hydrogen from favorable regions. To supply industry with hydrogen alone, about 6 billion euros will have to be invested in electrolysis plants by 2030. The conversion of a first third of the steelworks to “green” steel (direct reduction) requires another 10 billion euros. Added to this are renewable power generation plants and hydrogen networks connecting the production centers in the north with the consumption centers in the south.

Swift and ambitious political action is essential to achieve the goals in the short time remaining. A massive expansion of renewable energies, electricity and hydrogen grids and electrolysis capacities, as well as the conversion of the steel and chemical industries, must succeed simultaneously. In addition, the H₂ Global System should be generously equipped, which should enable the import of green hydrogen at sustainable costs by means of contracts for differences. If this succeeds, the automobile industry can also play its part in making Germany a climate-neutral industrial country.

H₂ demand



Source: BGC Klimapfade 2.0

Selected Research Projects

All the German car and commercial vehicle manufacturers, along with a number of suppliers and providers of mobility-related products and services, have joined forces in the FAT to conduct pre-competitive and joint research under the umbrella of the VDA.

Truck-Trailer Interface

Vehicle logistics has also long since recognized the potential of digitalization.

In order to be able to meet the requirements for ever-deeper integration into business processes as well as further pressure for efficiency, the vehicles used must become increasingly intelligent and provide their data in real time if possible. In addition to “classic” measurement data such as positions or temperatures, more complex data such as image information is also being added. Their transmission shows the limits of the existing interfaces and systems (CAN, ISO11992), which do not allow real-time processing with bandwidths of ~250 kBit/s. In order to meet technologies such as autonomous driving, the truck and trailer must be much more strongly networked as a complete vehicle than is the case today. In this context, strategic consideration must also be given to backward compatibility with existing vehicles as additional equipment.

Goal and vision

Since this problem affects the entire industry and there is no potential for differentiation between suppliers at this technical level, the VDA/FAT has set itself the goal of creating a common technical basis. The aim is an internationally recognized ISO standard that enables conceptual reliability as well as scaling in terms of costs. This should enable a data rate of 1 Gbit/s over a cable length of up to 40 meters.

Challenges and solutions

To achieve this goal, the project is broken down into subtasks. The derivation of the required throughput rates and the selection of a suitable technology have already been completed. The results are available in the FAT publication series 340.

The goal is now to develop both the physical layer and the layers above it in a standard based on the ISO/ Open Systems Interconnection model. Open Systems Interconnection – OSI in short – is a reference model for network protocols as a layered architecture.

Four subtasks are currently being pursued for this purpose:

1. Creating a basis for the design of cables and connectors

For the dimensioning of the connector and cable diameter, a forecast of the expected power consumption of the trailer in the coming years was created. This is based on component categories and their power consumption classes, as well as their concrete energy requirements based on vehicle equipment profiles.

The influence of “road trains,” consisting of several towed vehicles in combination, is also the subject of the analysis.

The analysis was completed in February 2022 and a 6 millimeter cable cross-section was derived. The power supply was to be provided by two redundant strands.

2. Enable 1000BaseT1 for cable lengths of 40 meters

The existing standards can only be used reliably up to cable lengths of 15 meters. In order to be used in heavy vehicles, cable lengths of up to 40 meters are necessary. For this, chip manufacturers must provide adapted transceivers in a commercially reasonable price range and thus quantity structure.

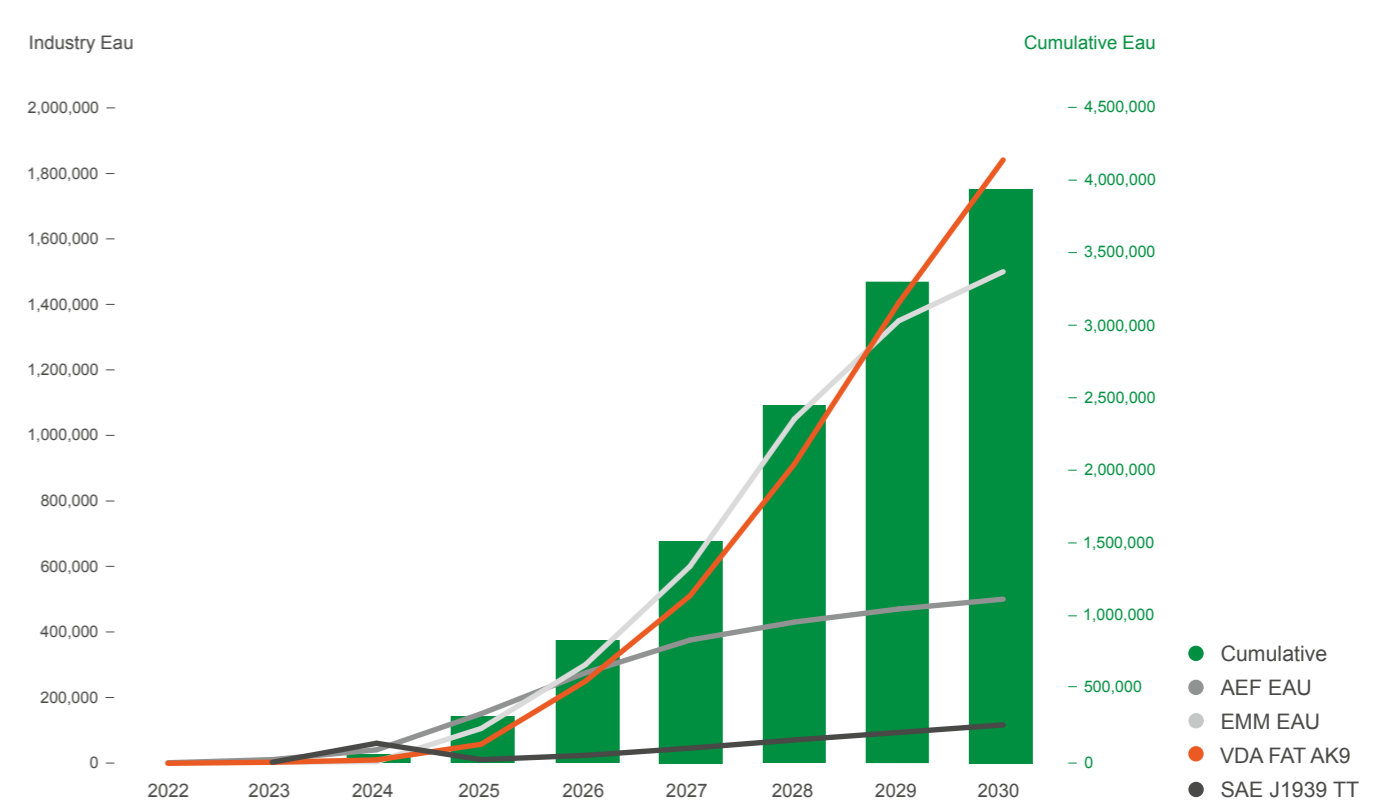
For this purpose, a demand forecast for the coming years has been prepared and cooperation with other associations such as the Agricultural Industry Electronics Foundation has been sought in order to achieve higher economies of scale across different industries globally.

There is great international interest in coordination and a joint approach has been made to chip manufacturers in the form of an open letter.



1000BASE-T1 type B PHY estimated annual usage

Estimates provided by each industry group



Source: VDA

3. Evaluating the new interface with regard to safety and cybersecurity requirements

The investigation will be carried out on the basis of two concrete use cases that exemplify different degrees of complexity.

- Advanced Driver-Assistance System, ADAS in short: reversing camera and reversing assistance system
- Highly Automated Driving, HAD in short: lane change when driving forward at high speeds

This thus represents a deepening of the previous high-level consideration.

4. Create an international standard (ISO) for broadband communication

In addition, standardization with maximum international reach is being sought. This should consist of two core segments and be based on established standards as far as possible:

- General basic infrastructure requirements and specifications
- Supplementary/deeper industry specifications

For this purpose, ISO project proposals (so-called New Work Item Proposal, NWIP for short) for specifications of the high-speed interface between truck and trailer are being drawn up with the support of the VDA Standardization Department.

GAIA-X 4 AGEDA

The architectures in today's vehicles are generally still based on decentralized or domain-centered architecture concepts, which place a strong focus on individual control units in each case. New applications and services, which may also be used or required only temporarily, are very difficult to implement with these vehicle architectures. This is especially true if external data sources and services are also involved, e.g. for a bidirectional exchange of information between vehicles and their infrastructure. The dynamic adaptation to new circumstances, such as the availability of new data sources or the use of specific vehicle functions by third-party applications, is hardly or not at all realizable in this case. The AGEDA project has therefore set itself the goal of developing a software architecture in the edge device vehicle that makes use of the concepts of the GAIA-X initiative and enables "by-design" data-driven applications and the dynamic adaptation of a vehicle with its functions over the entire life cycle of the vehicle.

Software architecture in the edge device vehicle

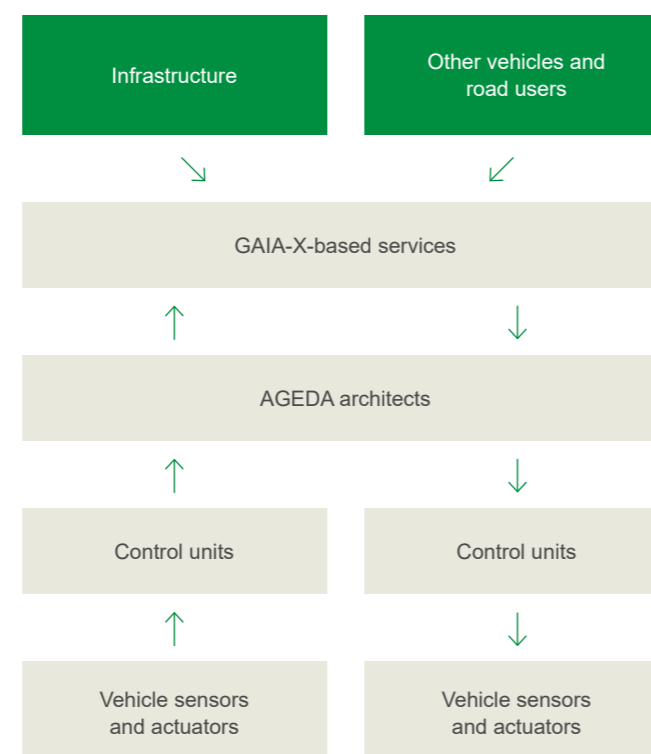
The project considers and implements use cases in which the networking of the vehicle and, in particular, the use of safety-critical data from the vehicle and the use of non-vehicle data for safety-critical functions create added value for vehicle manufacturers, vehicle users and the mobility system as a whole. The vehicle architecture to be developed in the project will natively support the networking of all vehicle functions with cloud-based services. It will make it possible to realize additional and completely new applications even after a vehicle has been delivered, enable the dynamic adaptation of the vehicle to new circumstances and thus make a decisive contribution to the rapid implementation of the mobility turnaround.

New development methods and approval procedures will enable a rapid transformation of mobility through the feasibility of highly automated driving functions. The interface from the vehicle or into the vehicle, not only for the exchange of data but also for the exchange of control commands, will enable completely new business models and thus mobility services.

In this way, the novel vehicle architecture opens up completely new markets, contributes to the creation of jobs and ultimately secures Germany and Europe as business locations. The use of GAIA-X as the basis for the exchange of the corresponding data ensures European data sovereignty.

The exchange of control commands

The core innovations of the project will be a reference implementation of a new type of vehicle architecture including sample implementations of networked mobility applications, which will be publicly demonstrated at a final event.



Use case – Collective Vision and Control

Collective Vision and Control addresses the possibility of joint perception of the environment, traffic situation and road condition by different vehicles and the infrastructure in combination with cloud-based service. The aim is to significantly increase efficiency and safety in road traffic and also to enable completely new functions in the context of smart city applications. This use case makes it possible to depict a technical cut-through from vehicle sensor technology via the AGEDA architecture to cloud-based services and back to vehicle actuation (see adjacent figure).

The use case complex is also relevant for industry and market introduction in that a transition path with different expansion stages could also be realized in the aftermath of the project, as shown below.

- Expansion stage 1:** Collective information collection: In this expansion stage, the sensors of vehicles could be used to collect information collectively, for example, to summarize it in a road condition map and to use it, for example, for demand-oriented road rehabilitation. In this expansion stage, data provision from the vehicle in particular would have to be implemented.
- Expansion stage 2:** Collective warning: In a further expansion stage, the information gathered collectively could not only be compiled offline for later use, but could also be fed very promptly to other vehicles to warn them of danger spots. In addition to the provision of data from the vehicle, the use of external data sources (e.g., traffic infrastructure, stationary research facilities) in the vehicle is also possible.
- Expansion stage 3:** Limited remote control: In this expansion stage, in addition to the provision of information to the vehicle, limited access to individual vehicle functions such as brakes or speed limiters would be realized in order to enable active traffic control, e.g., by automatically braking in front of danger spots.
- Expansion stage 4:** Remote control: In the last full development stage, it would then be possible to take over remote control of vehicles based on information from one's own and other vehicles, as well as cloud-based services. This could be necessary, for example, in special situations that cannot be solved by the automation of a vehicle alone.

Use case – physical internet

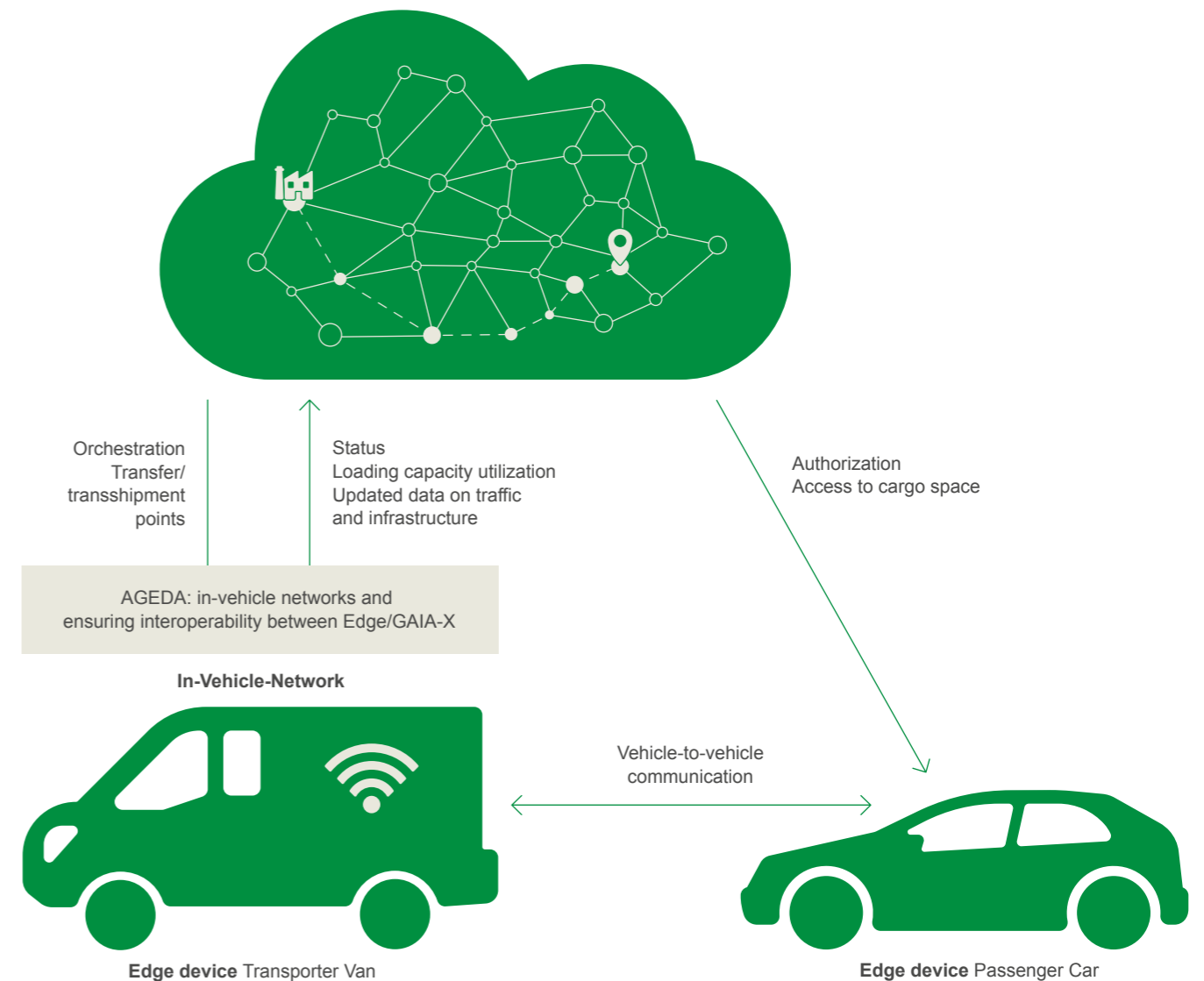
Physical Internet (PI) comprises the connection of vehicles as edge components in a cross-manufacturer cloud-based data ecosystem to implement the concept of a Physical Internet. Here, the transport method of data on the internet is transferred to the use case of the physical transport of goods in logistics. The route of goods through a logistics network is no longer predetermined a priori end to end, but is dynamically adapted during the transport of goods by an inter- or synchmodal and cloud-based routing algorithm to the current volume of goods, the currently available transport capacities, the current traffic situation and, if necessary, other parameters such as the road quality recommended for the transport of goods. In this context, the automatic detection of parcel shipments by means of suitable sensors, the calculation of remaining transport capacities and

the control of actuators required for the transport or transfer of goods are to be carried out within vehicles on the basis of in-vehicle networks and standardized interfaces. The latter are also necessary with regard to holistic dynamic routing for data exchange between the vehicle and the cloud as well as between the vehicles themselves.

A handover of consignments of goods should not only take place at fixed logistics hubs, but also at individually agreed handover points, which result from the first use case. Using various scenarios within this second use case complex, it will be possible, in particular, to shed light on business model-specific issues of the AGEDA architecture.

- **Expansion stage 1:** Expansion stage 1: Recording of transport goods by means of auto-ID procedures: In the first stage of development, potentially suitable auto-ID procedures are examined, by means of which transport goods including linked delivery information can be recorded at least semiautomatically and without manual scanning.
- **Expansion stage 2:** In-vehicle network: In this expansion stage, auto-ID procedures (possibly including the findings from GAIA-X 4 MoveID) and additional hardware components (especially sensors and actuators) as well as network technologies (e.g. Wi-Fi, Bluetooth LE, LoRa, Zigbee) are combined using standardized interfaces to form an in-vehicle network, by means of which the detection of available cargo space as well as the tracking and tracing of transport goods in vehicles can be realized.
- **Expansion stage 3:** Data pre-processing and forwarding to the cloud: In a further expansion stage, the data relevant for the transport of goods is first pre-processed in the vehicle itself and/or at fixed digital transfer points (edge computing) and forwarded via standardized bidirectional interfaces to the cloud for dynamic routing.
- **Expansion stage 4:** Dynamic routing of goods transport consignments: In this expansion stage, external data (for example, traffic situation, weather information) is analyzed in combination with current delivery information and used to dynamically determine handover points and orchestrate vehicles by means of a routing algorithm.

GAIA-X cloud routing



The basic idea for AGEDA was inspired in the FAT e.V. working group 31 "Electronics and Software" and supplemented by other partners. The AGEDA project, funded by the Federal Ministry of Economics and Climate Protection (BMWK), has a duration of 36 months and a budget of approximately 25 million euros. The project started on October 1, 2022.

The project consortium comprises 16 funded project partners (Hella GmbH & Co. KGaA, Volkswagen Group Innovation, Robert Bosch GmbH, Continental Automobile Technologies GmbH, AVL DiTEST GmbH, AVL Software & Functions GmbH, Elektrobit Automobile GmbH, IAV GmbH, ITK Engineering GmbH, SUSE Software Solutions Germany GmbH, Vodafone GmbH, Urban Software Institute GmbH, embeteco GmbH,

Institut für angewandte Informatik e.V., Hochschule Hamm-Lippstadt, Deutsches Zentrum für Luft- und Raumfahrt e.V.) and associated project partners (Otto GmbH & Co. KG, Forschungsvereinigung Automobiltechnik e.V., ARM Germany, Ford-Werke GmbH, T-Systems International GmbH, Mercedes-Benz AG). The project is managed by Hella GmbH & Co. KGaA represented by Steffen Herz. The scientific management is carried out by the chair of Prof. Dr. Achim Rettberg at Hamm-Lippstadt University of Applied Sciences and the coordination with the GAIA-X project family is carried out by Prof. Dr. Frank Köster of Deutsches Zentrum für Luft- und Raumfahrt (DLR) e.V. at the Institute for AI Security.



Economic Development of the Automotive Industry

So as to continue to live up to their leading position in technology, German automotive companies have invested an average of 5.6 percent of their sales in research and development in recent years. That adds up to 69 billion euros over the last three years.

The Condition of the Suppliers

Suppliers are driving the transformation of the industry. Existing business models are being put to the test. Alternative drives, digitalization, resilience of the supply chain and, last but not least, the supply of energy and materials at competitive prices are the major challenges.

Three quarters of the value added to an automobile originates with the suppliers. In 2021, the German automotive supplier industry consisted of just under 900 companies with a total of over 290,000 employees and a turnover of over 79.6 billion euros per year. The two largest automotive suppliers worldwide are German companies. And among the 100 largest global automotive suppliers, there are 17 German ones, accounting for about a quarter of the total turnover of this list. Worldwide, every third patent registered in the context of e-mobility is from Germany.

This series of facts impressively shows that German companies – especially many suppliers – are working strategically and with great commitment on the major technologies of the future. In order to continue to live up to their technological leadership, German automotive suppliers have invested an average of 5.7 percent of their turnover in research and development in recent years.

At the same time, the supplier industry was hit hard by the coronavirus crisis in 2020. Even before the lockdown measures in Germany and Europe, global supply chains were gradually being torn down because, for example, production was no longer taking place in China, but the assembly lines were still running in Europe. Many suppliers made enormous efforts to maintain supplies as long and as far as possible.

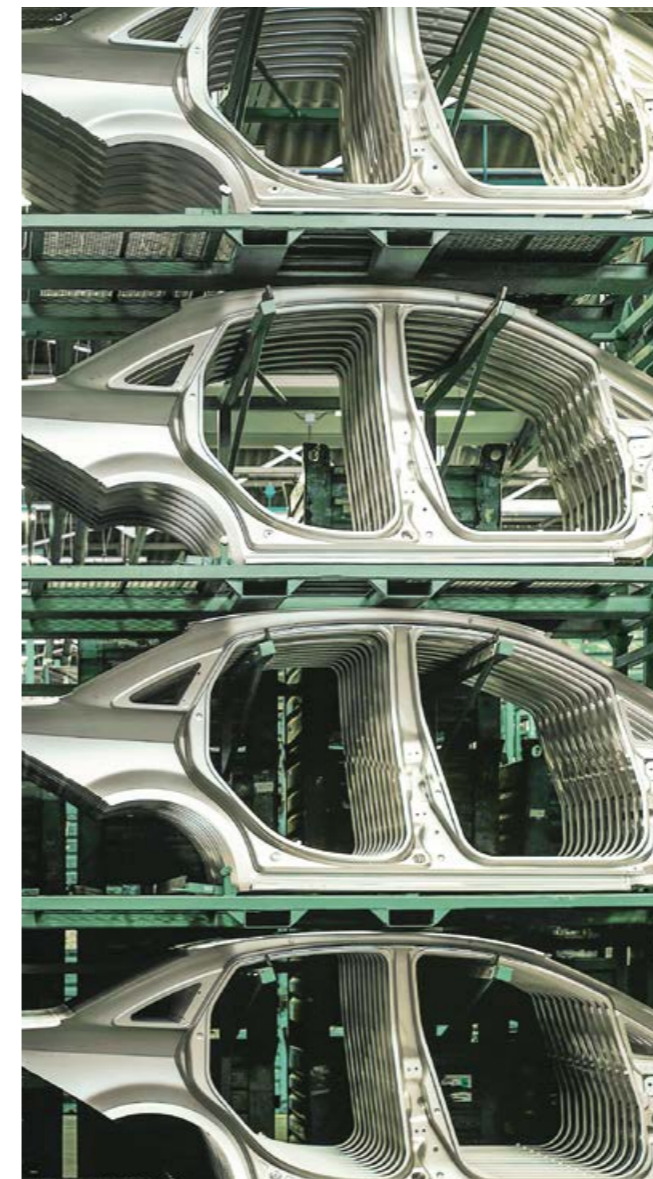
One thing is clear: suppliers are driving the transformation of the industry. Existing business models are being put to the test. Alternative drives, digitalization, resilience of the supply chain and, last but not least, the supply of energy and materials at com-

petitive prices are the major challenges of recent months. Each of these topics entails huge investments and high risks for liquidity – especially for the supplier landscape, which is dominated by medium-sized companies. Many companies, especially those whose business is linked to the combustion engine, are currently investing more in their future than they can earn.

It is essential for companies to remain competitive on a global scale

To be able to cope with this tour-de-force, manufacturing companies now need time, planning security and support. The political and economic framework conditions are crucial for a successful and sustainable transformation – for example, a rapid expansion of the charging infrastructure, renewable energies and training for skilled workers, but also an acceleration of planning and approval procedures and the reduction of bureaucracy, tax burdens and high energy costs.

The abolition of the EEG levy was therefore a step in the right direction. However, ancillary electricity costs are still far too high in international comparison. The next step must also be to lower the electricity tax in order to further reduce energy costs. Companies must remain globally competitive and the relocation of CO₂ emissions to non-EU third countries must be prevented.



According to current data, the German supplier industry has 3,700 locations across the world. Global production promotes growth and employment in the target markets. In addition, skilled jobs are created in Germany and Europe in research and development as well as in the organization and management of supply chains.

At the same time, long and ramified supply chains are prone to disruption: The war in Ukraine, the semiconductor crisis, the coronavirus pandemic or even a Suez Canal that was blocked for days have shown how unpredictable international supply chains can be and what far-reaching consequences crises cause. That is why more and more actors are asking themselves the question: Can the financial benefits of globalization still outweigh the costs of the risks in the future?

However, narrowing this question to a purely monetary consideration falls short in this context. By locating domestic suppliers in growth markets, not only personnel and transport costs or customs duties are saved. In particular, new business relationships and partnerships are created that increase prosperity in these countries and secure local jobs. International cooperation is usually a win-win situation for those involved. In the future, the German automotive industry will continue to develop only in a global interlinked division of labor, generating resources for research, development and sustainable production. Diversification of supply chains creates back-up options in the event of disruptions and leads to more, not less, resilience.



In a study carried out jointly by the VDA and the management consultancy Dun & Bradstreet, the VDA investigated how successfully large and medium-sized suppliers have positioned themselves globally in the last decade and the effect of this strategy on corporate success. It shows: In international comparison, the German medium-sized suppliers are world champions of globalization – two out of three companies have international locations. At the same time, they are actively strengthening the domestic market – more than one in two of the almost 700 new locations created between 2010 and 2020 are in Germany. In an international comparison, German medium-sized suppliers however rely less on specialization – while 35–50 percent of companies in overseas markets are specialized, this applies to only 15 percent in Germany. The study shows equally good growth opportunities for both strategies – diversification and specialization. Globalization and open markets will continue to be indispensable in the future, offering endless opportunities. The decisive factor is to focus on diversification and thus on the most balanced combination of efficiency and resilience.

The VDA supports its members in this difficult process in central committees and bodies, including the group of medium-sized companies and the young entrepreneurs' group, which is dominated by small and medium-sized companies. An annual highlight is Mittelstandstag, which in 2022 was able to take

place again as a face-to-face event for the first time since the start of the coronavirus pandemic. In this established format, the entrepreneurs discuss current economic policy developments as well as practical questions from everyday business life with top representatives from politics and science.

The EU taxonomy is already casting large shadows ahead and foreshadows an extraordinary reporting burden for suppliers. The VDA has set up a separate project group for suppliers and OEMs to monitor current developments, identify politically relevant issues and exchange experiences. Internationally, the VDA supports supplier companies of all sizes through joint stands at the world's leading trade fairs, regular round-table formats in the largest production countries such as China and Mexico, and a digital cooperation portal ([automotive-collab.com](https://www.automotive-collab.com)). Thus, small and medium-sized companies have the opportunity to meet with policy-makers on an international level through their association and to discuss issues of international markets and trade.

The Condition of the Car Manufacturers

The turnover of the OEMs amounted to around 318.1 billion euros in 2021. This is an increase of 7 percent compared to the previous year – and this despite the fact that passenger car sales declined by -12 percent.

According to the Federal Statistical Office, the manufacturers of motor vehicles and engines produce in a total of 92 plants throughout Germany. Regional cluster analyses show the extent to which OEM companies have ensured that suppliers also settle in their region and that regular automobile industry networks have developed there. These automotive clusters are mainly concentrated around the production sites of the large OEMs. Their locations are the nuclei of these networks and the driving force behind the overall economic development of their respective regions.

These manufacturers alone, which traditionally represent the group with the highest employment within the automotive industry, would account for around 457,100 of the total 786,100 direct employees in the sector in Germany in 2021. Compared to 2020, their employment volume has however fallen by -3 percent and is thus proportional to overall employment in the automobile industry.

This is essentially due to the global supply crisis with semiconductors, which began in the spring of 2021 and has since burdened automobile production across the world. However, the transformation towards electric drives may also have contributed to this to a certain extent. The consensus among automobile experts is that the transformation mentioned will be accompanied by a reduction in employment within the next 10–15 years. Just like the forecast, this reduction in employment will affect the suppliers much more than the OEMs.

Background: A large part of OEM value creation consists of integrating the parts supplied to them and, towards the end of the production process, the engine and body with each other. Therefore, a much smaller proportion of value creation and employment is dependent on the power train than is the case with suppliers, some of whom specialize in contributing to the powertrain.

The turnover of the OEMs amounted to around 318.1 billion euros in 2021. This is an increase of 7 percent compared to the previous year – and this despite the fact that passenger car sales declined by -12 percent compared to the previous year. The fact that the bottom line is still a revenue plus is mainly due to the fact that manufacturers have increasingly focused on high-margin vehicles from the premium segment and electric vehicles.

A study by "arbeitgeber-ranking.de" shows how much influence the industry has on future generations, especially in view of the great transformation towards climate-neutral mobility. It clearly shows that German OEMs are among the most favored employers of choice for pupils and students. Four German OEMs are among the top 10 employers of choice for pupils, as well as for students of computer science, economics and engineering.

The Condition of Commercial Vehicle Manufacturers

The companies are expected to operate with a high degree of flexibility. This in turn also translates into new technical solutions and growing digitization of production and sales.

Mobility is the prerequisite of our economic and social life, with the commercial vehicle being the backbone of freight and public passenger transport in Europe. It is just as hard to imagine today's logistics chains for the delivery of production plants, supermarkets or goods distribution centers without the truck as it is to imagine the bus for urban and rural passenger transport.

One out of four employees has a job in the commercial vehicle sector

The commercial vehicle sector in Germany is multifaceted and mostly made up of small and medium-sized enterprises. In addition to a few large companies, there are numerous highly specialized manufacturers of customized solutions. Taken as a whole, these companies represent a significant size for the German economy. Of the approximately 800,000 people employed in the German automotive industry, almost one in four work in or for the commercial vehicle sector.

The economic crises of the last two years, with the breakdown of supply chains and rising energy and raw material prices, on the one hand, and the increasing demands of environmental and climate protection, digitalization and customer requirements, on the other, are also presenting German SMEs in the commercial

vehicle sector with extreme challenges. A high degree of flexibility is demanded of the companies. This in turn also leads to new technical solutions and increasing digitalization of production and sales.

The targets set by the European Commission to significantly reduce greenhouse gas emissions in the next few years are already determining the development of new low-emission commercial vehicles for distribution and long-distance transport. Stringent fleet limits and high penalties for exceeding limits are driving manufacturers and haulers to use new drive concepts in commercial vehicles. In future, bus and trailer manufacturers will also have to balance their vehicles according to CO₂ emissions. The same applies to body manufacturers, who are therefore increasingly taking the aspect of climate neutrality into account in product development.

The manufacturers of trailers, bodies and buses, organized in manufacturer group II in the VDA, have had to report unsatisfactory business development in 2020 and 2021 due to the crises. The outlook for 2022 is also not very optimistic. A large number of new orders in 2020 and 2021 combined with delivery problems for primary products, semi-finished products and high raw material prices led to historically high order backlogs that were almost impossible to process.



Although a slow economic recovery was registered towards the end of 2021, the first and second quarters of 2022 again saw significant declines in production caused by the political and economic situation in Europe and restrictive anti-coronavirus measures in China. In March 2022, 90.1 percent of companies in the automotive industry complained about the shortage of intermediate products.

Germany has overcome an extreme drop in sales

After an extreme slump in sales in Germany of heavy commercial vehicles with a gross vehicle weight of more than 6 tons in 2020 (-25 percent compared to 2019), companies in the domestic market were able to increase their sales again by just over 6 percent in 2021 compared to 2020. Nevertheless, the figures were still significantly below the level of 2019.

In Western Europe, only 228,000 heavy commercial vehicles with more than 6 tons gross vehicle weight were registered in 2020. This was 26 percent less than the figure in 2019. In 2021, the market recovered slightly to 252,000 vehicles (up 10 percent on

the previous year) but, as in Germany, sales figures failed to match the years before 2020.

In 2021, new registrations of light commercial vehicles up to 6 tons in Germany were 13 per cent below 2019 levels. In the German market, only 272,200 vans were newly registered in 2021, which corresponds to a minus of one percent compared to 2020.

In the German trailer market, a total of 31,600 new semi-trailers and 26,400 new multi-axle trailers, each with more than 6 tons gross vehicle weight, were registered in 2021. This was an increase of 9 percent and 2 percent, respectively, compared to 2020. However, registration figures, especially for semi-trailers, were significantly lower than those in 2019 before the coronavirus pandemic.

Numerous problems in the supply chains, a lockdown in numerous regions of the world as well as pandemic-related production cuts led to significantly lower sales in 2020 and 2021.

In terms of revenue, German trailer and body manufacturers can look back on a mixed 2020. At 11 billion euros, revenues were below the level of the previous year – this corresponds to a decline of more than



9 percent. Domestic sales increased by 6 percent to 6.0 billion euros, while export sales fell by 12.5 percent to just under 5.0 billion euros. There was a short-term recovery in 2021, particularly in the second quarter of 2021. Manufacturers generated annual revenues of 13.1 billion euros (+19 percent) in 2021. However, continued supply chain disruptions, high raw material and energy prices, and rising inflation cloud the outlook for 2022.

Fortunately, the business performance of trailer and body manufacturers only had a short-term impact on the core workforce of companies in Germany. Generous regulations on short-time work allowed for the temporary release of employees and guaranteed a quick reactivation with the accompanying improving pandemic situation. In 2020, an average of about 38,000 employees worked for trailer and body manufacturers in Germany. Increasing internationalization of the often highly specialized German manufacturers of trailers and bodies continues to guarantee a high level of employment in Germany. The number of employees rose to approximately 39,000 at the beginning of 2022.

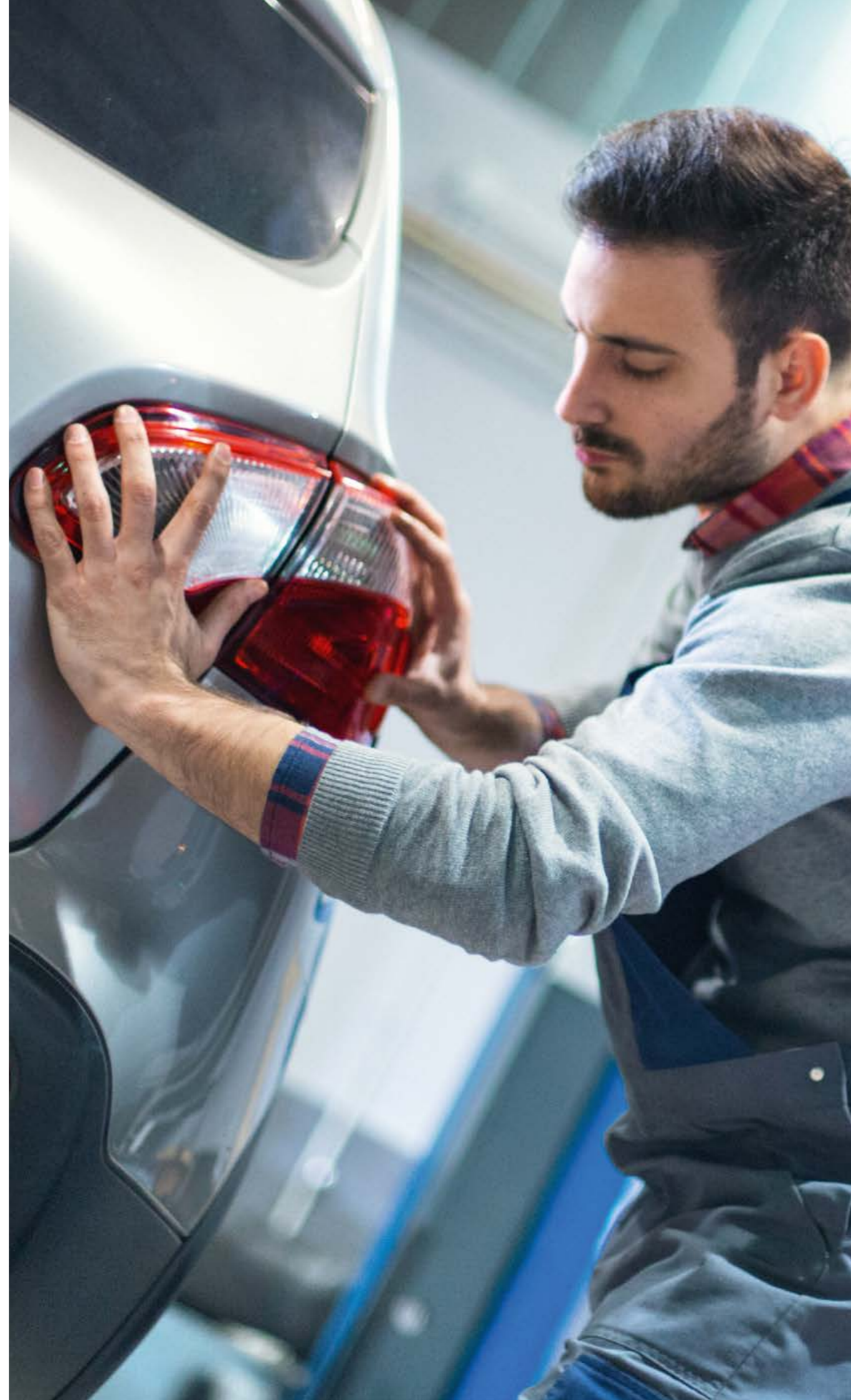
The German market for buses over 8 tons remained constant in 2020 and 2021, with 5,700 new buses registered in each year. However, the market environment was characterized by two opposing trends. On the one hand, more and more local public transport companies are focusing on renewing their city bus fleets. The share of battery-electric city buses is steadily increasing in Europe and Germany. On the other hand, the long-distance bus market in Germany was non-existent during these years due to the pandemic, and the number of newly registered long-distance buses in Germany dropped to well below 2,000 units. With increasing relaxation of contact restrictions, the long-distance coach market will also pick up again in 2021, even if it is not yet possible to predict when registration numbers will increase again as a result of the disrupted supply chains.

Aftermarket

The aftermarket business segment includes the maintenance and repair of vehicles as well as the sale of spare parts and services. With the transformation of the automotive industry, the complexity of this area is also increasing enormously – because service concepts and knowledge must be equally available for old and new technologies.

The average age of vehicles in Germany is now ten years, which leads to a wide range of different models and systems that the industry has to cover.

The upheavals caused by Covid-19 and the effects of the war in Ukraine have also left their mark on the aftermarket and have been reflected in committee work. An overview is given below:



Project group “Future of Sustainable Spare Parts Supply”

In order to be prepared for the challenges that will have to be overcome in the aftermarket as a result of the changes in the automobile industry, VDA Recommendation 9009 was already drawn up at the beginning of 2021. Triggered by the many factors that are currently also complicating the security of supply of spare parts, a follow-up assignment was given to the responsible project group. The members identified relevant key factors and designed solutions to optimize obsolescence management in the aftermarket. In addition, advice on implementation and anchoring in the companies was compiled.

Aftermarket packaging working group

A project was also continued here. A template for the standardized exchange of packaging data has already been published in VDA Recommendation 9008, and now the interface for this has also been described. In addition, the working group has prepared itself for the implementation of legal requirements in the EU and will subsequently work on new approaches to sustainable packaging.

Supply chain management working group

In 2007, Recommendation 4948 was developed for drop shipping, including the corresponding interface descriptions. The corresponding interfaces are still used extensively today. This year, the recommendation was extended to include order processing in the aftermarket and can be used more flexibly as a consequence.

Financial Services and Automotive Banking

In recent years, the automotive financial services and leasing companies have continued to be a strong sales driver for the German automotive industry. Moreover, the leasing companies have become indispensable as a key driver of the transformation towards greater sustainability.



The leasing sector is Germany's largest investor, generating an annual investment volume of 72.0 billion euros in 2021 at the last count. Leasing customers include medium-sized companies in particular. Passenger cars and commercial vehicles are the largest object group in the leasing business, accounting for 72 percent. Two out of five vehicles are leased.

The leasing sector is a strong sales driver and key driver of the transformation to more sustainability

After the coronavirus crisis, the biggest challenges facing the economy in Germany are digitalization as well as sustainability and climate protection. On the way there, the leasing business is of essential importance.

An important component of the economic stimulus package is the promotion of sustainable mobility. The "innovation bonus," i.e., the doubling of the Federal Government's share of the environmental bonus, applies to both the purchase and leasing of an e-vehicle. Leasing is an important financing instrument, especially in the field of electromobility. In 2020, companies planned to invest 35 percent and 34 percent, respectively, in electric cars and hybrids over the next two years.

Together with the BDL (Federal Association of German Leasing Companies), the VDA is working to strengthen the "leasing" financing instrument in order to provide medium-sized companies in Germany with a strong partner for the mobility turnaround and transformation towards greater sustainability.

Residual debt insurance protects consumers against the risk of default

The new German government also plans to re-regulate residual debt insurance in such a way that the conclusion of the insurance contract and the conclusion of

the credit contract are to be decoupled by at least one week. The VDA takes an extremely critical view of this regulation project. For several years now, the design and brokering of residual debt insurance has been criticized by the public and especially by consumer protection organizations. For consumers, however, residual debt insurance is an important product with which they can easily insure themselves against various default risks such as death, accident, inability to work and/or unemployment.

As a result of the planned regulation project, the economic viability of brokering residual debt insurance in the context of vehicle financing will no longer be guaranteed. The associated encroachment on freedom of contract and competition threatens to be accompanied by a de facto ban on the sale of residual debt insurance.

The VDA will continue to advocate that residual debt insurance in the context of vehicle financing is an important insurance product that serves to protect the consumer.

Sustainable finance – resilient framework conditions for transformation

Our goal is climate-neutral mobility in line with the Paris climate targets. It is crucial that European climate policy simultaneously sets framework conditions for growth, prosperity and jobs. On the path to climate-neutral mobility, electromobility has priority alongside other alternative drive systems. For this purpose, the German automobile industry is investing massively in the transformation of its business model through research, development and production. In doing so, we face the challenge of not only decarbonizing our products and production processes, but also digitizing them at the same time.

To ensure the financing of this transformation, the implementation and application of the so-called EU taxonomy is of great importance. With the adoption of Regulation 2020/852 of June 18, 2020 (“Taxonomy Regulation”), the EU has given the go-ahead for a series of delegated, which will be adopted and implemented in the coming months, or which have already entered into force in some cases. The core of these measures are the legal acts to put the environmental goals of the Taxonomy Regulation and the resulting requirements for sustainability reporting in concrete terms. Both will have a direct impact on the willingness of institutional investors to invest.

In this context, it is important to adopt an approach that promotes the transformation of economic activities towards environmental sustainability instead of penalizing those that are still in a transformation process towards sustainability. This is of particular importance because companies in the automotive industry cannot usually switch to climate-neutral procedures, processes and plants in an ad-hoc manner, but the change takes place in stages, sometimes with short-term neutrality targets. This means that new systems and products will be developed and created at the same time, while existing plants and products will have to continue to be operated in part and continuously kept up to date with the best available technologies.

Electric vehicles will play a significant role in reducing greenhouse gas emissions in the transport sector, provided that the electricity required for charging is also generated from renewable or sustainable sources. The ability of the automotive industry to invest in the further decarbonization of mobility will have a decisive influence on the necessary transformation of mobility. However, an arbitrary assignment of sector levels to activity-specific screening criteria could cut companies off from the market for sustainable investments, hinder the transformation towards green mobility and constitute a violation of the underlying Taxonomy Regulation.

Preliminary note 45 of the Taxonomy Regulation rightly states: “Criteria should not unfairly disadvantage certain economic activities over others if the former contribute to the environmental objectives to the same extent as the latter.” The VDA therefore recommends that all economic activities within the meaning of category 3.3 of the delegated taxonomy act of companies that enable the “production of low-emission/free motor vehicles” can in principle be considered eligible for taxonomy.

An electric vehicle is more than four wheels on a battery with an electric motor. Rather, they are complex systems made up of software and many hardware parts that work together to deliver the final performance in terms of safety, comfort, usability, operating costs and emissions.

Therefore, the implementation of the EU taxonomy threatens to further distort the distinction between in-house production or vehicle assembly and component production by suppliers. Unfortunately, the descriptions in Annex 1 (Criteria for a significant contribution to climate protection) of the delegated act to the Taxonomy Regulation may lead auditors to distinguish between vehicle assembly (OEM) and component manufacture (supplier). The VDA therefore demands that all economic activities of companies within the meaning of category 3.3 of the delegated act that enable the “production of low-emission/free motor vehicles” can in principle be considered eligible for taxonomy. If a corresponding economic interpretation of category 3.3 is not supported in this way, the production of, and trade in, automotive parts should be included as a separate economic activity.

Automotive suppliers are responsible for up to 75 percent of the investments and value added related to electric vehicles. The implementation of the EU taxonomy will only efficiently channel capital into the decarbonization of the transport sector if similar screening criteria are applied to suppliers as to vehicle manufacturers, allowing them to access the market for sustainable investments on equal terms. The activities of suppliers must therefore also be covered by category 3.3.



Foreign Trade and Global Economy

It is not only the coronavirus crisis that has led to the self-evident nature of international value chains being increasingly questioned. Since Russia's war of aggression against Ukraine, the risks have increased significantly.

Geo-economic and geopolitical factors of influence require new risk assessments for the global automotive industry. The primacy of politics as well as the company's own corporate standards make strategy changes inevitable. Also due to increased requirements such as the Due Diligence Act (Supply Chain Sourcing Obligations Act – non-official table of contents (gesetz-im-internet.de), companies are analyzing their supply chains very closely.

An important goal for manufacturers and suppliers is to diversify supply chains. This applies to purchasing as well as sales markets. However, it will not be possible in the future to obtain all the necessary raw materials in Europe, which are primarily needed for the transformation to emission-free mobility.

International energy and raw materials partnerships

Therefore, the automobile industry will have to continue to rely on imports from third countries, especially when it comes to the production of batteries. Therefore, realistic analyses of the needs for raw materials and energy are crucial. International energy and raw material partnerships will become increasingly important in the future. It is the task of policy-makers to set the right framework conditions.



From the automobile industry's point of view, cross-border trade and investment contribute significantly to employment and prosperity both in the partner countries and in Germany. Thus, the economic success of German manufacturers and suppliers in other regions of the world makes it possible to secure competitiveness and employment in Germany and Europe. With over 2,500 production plants abroad, VDA members are active worldwide.

Diversify through improved market access – no compartmentalization

Also, the free democratic influence on the politics of other countries is greater when there are mutual interdependencies and trade agreements – the positive effects have clearly outweighed the negative in the past. The current crises must therefore not lead to Europe and other states sealing themselves off in the long term – despite all the necessary consequences in the short term. Unilateral measures such as sanctions must be targeted and have an impact on all countries involved.

In 2021, German manufacturers produced 3.1 million passenger cars in Germany and exported 2.4 million of them – which translates into an export ratio of 76 percent. More than half of the exports go to other EU member states. Among third countries, the USA is in the lead (in terms of units), followed by China and the UK.

It is necessary to expand the scope of the network of agreements

There is still potential in other important future markets. For example, India is ranked at the 60th place in the export statistics. Brazil ranks 40th with a 0.4 percent share of exports. The EU is planning free trade agreements with both regions, which would significantly improve the expansion of trade volumes. However, the negotiations are stalling – especially because the EU is also concerned with implementing more

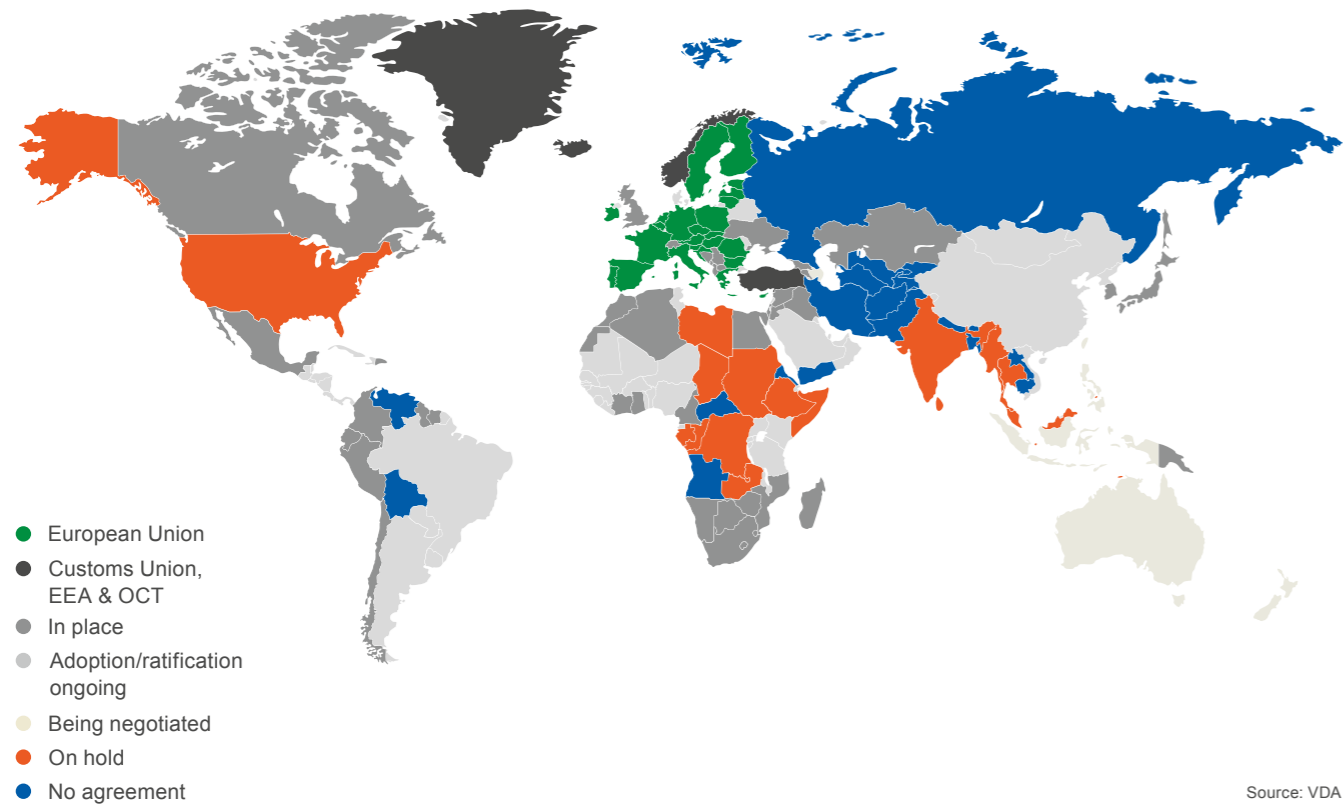
far-reaching standards in other areas, which is not always accepted by the trading partners without reciprocity. Against this background, we should make sure that we do not overburden trade agreements and that the requirements are implementable for our partners – also when it comes to taking sustainability goals into account.

High tariffs and other non-tariff barriers (NTBs) pose a challenge for Europe as a business location in many countries. Exports become more expensive or even impossible. It is therefore in the interest of Europe as a business location to reduce global customs duties and NTBs. The VDA supports its members in this by actively working to remove barriers to market access, whether through talks with trading partners or interventions with the German government, the EU or even the WTO.

The network of agreements must finally be implemented and further expanded. Too many agreements, such as the one with Canada or Mercosur, are "on hold": The EU should make every effort to improve access to other markets and conclude agreements.

The world's largest trade agreement, RCEP, cannot serve as a model, but it should serve as a wake-up call that the EU does not fall behind. In addition to the close shoulder with the US, the other regions of the world should not be ignored. Geopolitics, supply chain requirements and own business standards set the framework here. In addition to bilateral agreements, multilateral agreements are the best way forward.

EU trade agreements



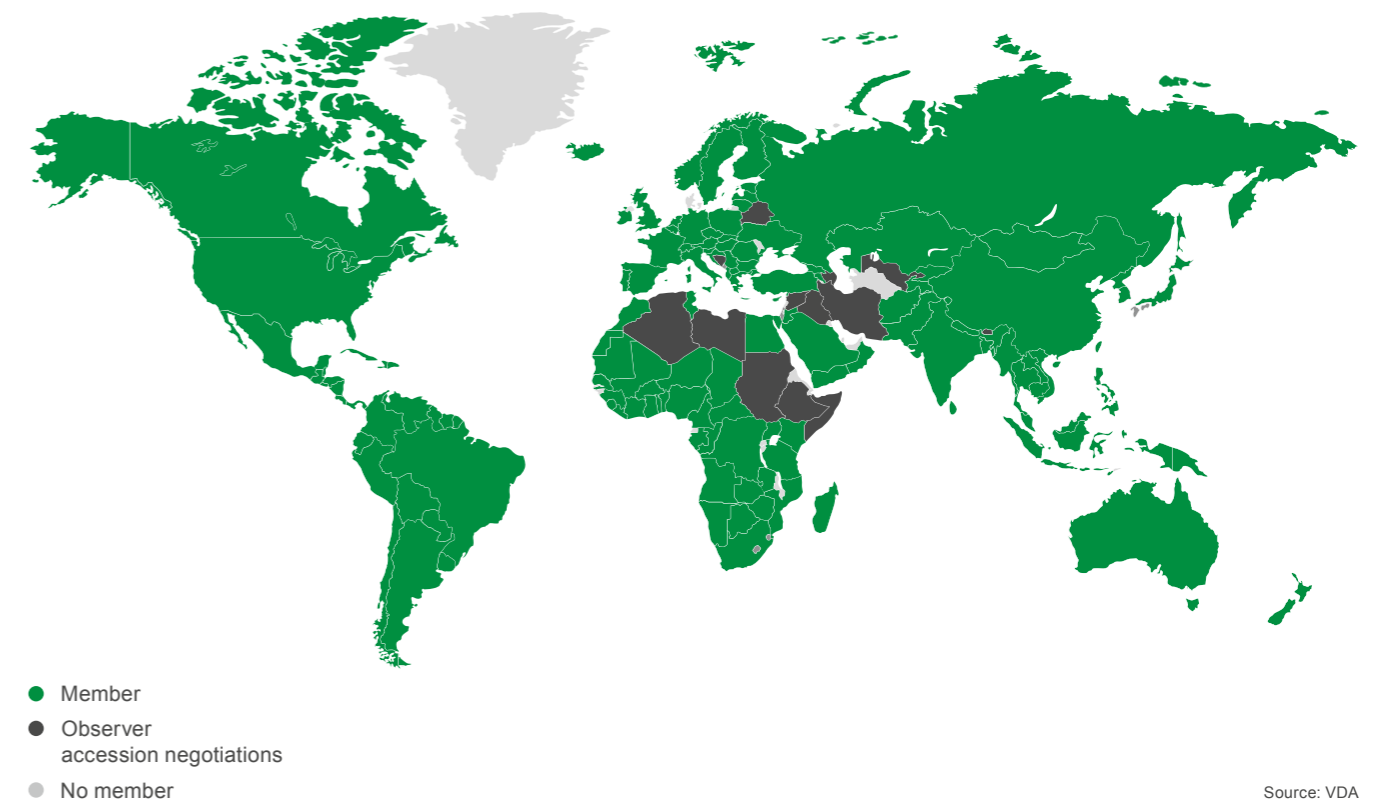
Strengthen WTO as guarantor of fair trade

The coronavirus crisis has rather strengthened protectionist tendencies across the world. At the same time, the trend towards local purchasing has clearly increased. However, the current geopolitical crises should not be taken as an opportunity to restrict international cooperation and cross-border value chains in the long term. Studies by the WTO and other inter-

national organizations, for example, have shown that globalization and trade, despite all the challenges, have predominantly brought prosperity and, above all, improved living conditions.

Protectionism and compartmentalization quickly lead to further conflict, as demonstrated by the trade disputes between the US, China and the EU. Constructive cooperation at multilateral and bilateral level is definitely preferable over going it alone.

WTO: 164 states to decide by consensus



That is why the German automobile industry also supports the work of the World Trade Organization (WTO) and its reform.

No other organization brings together as many trading partners as the WTO in Geneva. The WTO currently has 164 members and an additional 24 "observers." Since its foundation as the successor to the GATT in 1995, the world has overcome several crises and globalization has progressed further.

The world has changed and the WTO must also continue to evolve. It is built on consensus among members – which can also lead to significant cuts in its ability to function, as demonstrated by the crisis in the Court of Arbitration due to the failure of the USA to fill judges' positions. It is therefore important that a compromise is found with the US and other members that ensures the WTO's ability to function.

Overview of advantages and disadvantages of reshoring vs diversification/globalization

Strategy	Content	Possible advantages
Reshoring Onshoring/ Renationalization	Relocation of operational activities (production, purchasing, R&D) back to the region/country from which they were originally relocated abroad	Reduction of risks; creation of domestic jobs
Nearshoring	Relocation of production to a nearby or politically/economically close foreign country; back from "farshoring" or new as "offshoring"	Predominantly cost advantages
	Nearshoring as a return relocation	Reduction of risks (customs, pandemics, etc.) Similar qualification of workers; similar mode of operation; reduction of costs
	Nearshoring as a new relocation	Similar qualification of workers; similar mode of operation; reduction of costs
Offshoring	Relocation of overseas operational activities	Reduction of costs, avoidance of customs duties and other trade barriers, higher local acceptance
Farshoring	Special form of offshoring: Relocation of production to (spatially, politically, economically) more distant foreign countries	Reducing costs in low-wage locations, exploiting economies of scale, opening up new markets
Localization	Local concentration of production, often as a result of "local content requirements" (customs duties, etc.)	Avoidance of customs, tariffs and other market barriers, return to regional markets, reduction of transport and logistics costs
Globalization	Cross-border (global) enterprise	Competitive advantages through use of locational advantages, use of comparative cost advantages, avoidance of tariffs and other import barriers
Strengthening resilience	Latin words "resilire" means "to bounce back, rebound," resilience: ability of an ecosystem to return to its initial state after a disruption	Crises such as Covid-19 or trade conflicts can be countered and managed in a better manner
Diversification	Globalization with special attention to risks, expansion of production and purchasing to new products and new markets	Risk diversification; increased opportunities
Open strategic autonomy	The EU wants to take a leading role in international trade while reserving the right to defend itself against unfair practices by others	International trade and investment are still possible, unfair competition is more clearly countered

Possible disadvantages	Weighing
Higher costs; loss of market access opportunities for foreign production; loss of jobs (abroad and at home)	National and protectionist approaches endanger jobs, investment and peace; investments should be made where it makes economic sense and not be "forced"
Reduction of jobs in the home country or offshore	
Increased demand for personnel in the nearshoring country can lead to wage increases and weaken the cost effect	Only if economically sensible, e.g. due to increased risks offshore, not as a politically enforced measure
Increased demand for personnel in the nearshoring country can lead to wage increases and weaken the cost effect	Foreign investment secures jobs at home and abroad
Reduction of jobs in home country; legal uncertainty (e.g. in case of customs duties increases)	Foreign investments secure jobs at home and abroad, risks must be considered
Reduction of jobs in home country; higher complexity of processes	Foreign investments secure jobs at home and abroad, risks must be considered
If politically incentivized: not always higher productivity; loss of exports for home location Germany/EU	Localization should be based on purely economic considerations, not on high tariffs or other local content requirements
More difficult for SMEs to keep up with global players, risks of international supply chains (Covid-19, etc.)	Foreign investments secure jobs at home and abroad, risks must be considered
Higher costs due to measures required to increase resilience	Resilience measures help industry to cope with crises, costs must be considered
Possibly higher costs due to expansion of activities	Foreign investment safeguards jobs at home and abroad, risks must be taken into account and diversification serves precisely this goal
Tendency to compartmentalize and protective measures; negative backlash from other trading partners; risk: Spiral of conflicts	EU trade policy should not appear to have protectionist tendencies; rules-based trade should be constructively promoted. Counter-reactions where necessary and WTO-compliant



Customs and Export Control

The German automotive industry condemns Russia's invasion of Ukraine in violation of international law and supports the measures adopted by the EU. Our member companies are implementing the Russia sanctions and continuously reviewing their products and supply chains to ensure full compliance. Initial ambiguities in implementation due to inconsistent interpretation have been largely resolved with the support of the VDA.

The VDA is closely monitoring the current developments in the sanctions area and is campaigning for further clarification in order to provide companies with legal certainty and thus ultimately enable the sanctions to be implemented in a targeted manner.

Designing realistic rules of origin for battery cells

With the transition to electromobility, the share of value added in the automobile is also shifting. The value share of the battery is high and its origin is usually decisive for the place of origin under customs law. Fulfillment of the origin criteria is in turn important for claiming customs benefits in free trade agreements. Therefore, the availability of batteries and their raw materials in the EU is also of great importance from the perspective of international competitiveness. However, we are still far away from this in Europe.

Before the UK left the EU on December 31, 2020, both parties concluded the Trade and Cooperation Agreement (TCA), which provides a legal framework for trade relations between the two trading partners. For the automobile industry, the agreement contains rules of origin for hybrid and fully electric vehicles, which will be significantly tightened from 2024.

At the time of the negotiations, the battery industry had held out the prospect of building the necessary infrastructure in the European Union or the United Kingdom by 2024 in order to comply with the tightened rules of origin. Unfortunately, it is foreseeable that in particular the necessary localization of active cathode material within the European Union or the United Kingdom will not be completed by the end of 2023.

This would result in the threat of customs payments when exporting to the United Kingdom and thus impair the desired ramp-up of e-mobility. Despite the adverse effects of Brexit, the UK is a top export destination for fully electric passenger cars manufactured in Germany. By adapting the rules of origin in the trade and cooperation agreement to real developments, economic and environmental damage should therefore be averted in equal measure.

Overall, the challenges surrounding the rules of origin for battery-powered vehicles show how extensive the effects on value chains are. This makes it all the more necessary for Germany and the EU to create appropriate locational conditions. Open markets for products and investments are an essential component.

International Association Partnerships Africa and India



“PartnerAfrica” project with the African Association of Automotive Manufacturers (AAAM)

The association partnership between the African Association of Automotive Manufacturers (AAAM) and the VDA aims to support the development of the partner association and to jointly improve the framework conditions for the automotive industry on the African continent. The cooperation is funded by the Federal Ministry for Economic Cooperation and Development (BMZ) as part of the “Special Initiative (SI) Training and Employment.”

Whether vehicle financing, alternative drive systems, trade and logistics, location search or political framework conditions, the VDA and AAAM are cooperating in a wide range of areas. Working groups have been jointly initiated on these topics, in which representatives of the VDA, AAAM and member companies work together. Since Africa is home to around half of the 20 fastest-growing economies, the continent is becoming increasingly important – Especially with regard to geopolitical changes, commodity partnerships between Africa and Europe and the diversification of supply chains. Areas such as the digital economy or sustainable mobility also have high development potential. The automobile and logistics sector has a key position due to its sustainable value creation in supplier networks, assembly plants, distribution structures and pan-African trade relations, and offers great innovation, growth and job potential. Currently, the African automotive market is still comparatively small, with sales of about 1 million vehicles per year, but the partner association AAAM forecasts an increase to about 5 million vehicles per year by 2035.

Intra-African trade is promoted by the pan-African free trade area “African Continental Free Trade Area – (AfCFTA) launched in 2021. The main objectives of the AfCFTA agreement are to increase intra-African trade, further industrialization and build regional value chains. In the long term, the African Union is striving for a continental customs union and a single African market with free movement of goods, services and people.

As cooperation between Africa and Europe is of great importance, on the initiative of the VDA, AAAM and other partners, a total of twelve European and African automotive associations have signed a joint declaration of intent and agreed on future cooperation. In view of the European Union’s “Global Gateway Initiative,” the VDA’s commitment fits in well with the times.

VDA members benefit from the cooperation project, for example, through information offers, delegation trips and the establishment of contacts with relevant stakeholders on the African continent.

Through the project, the VDA has its own contact persons in Berlin, in the VDA-AAAM project office in Johannesburg, South Africa, and a contact person in Accra, Ghana. The project has been implemented in the first project phase since summer 2020 and currently runs until December 2023. The VDA is working intensively on a continuation of the project in order to further deepen the cooperation with the African



partners and to contribute to the development of a sustainable African automotive industry.

Association partnership India with the Automotive Component Manufacturers Association and the Society of Indian Automotive Manufacturers

India is an important and reliable partner both for the German automotive industry and for German development cooperation. As an emerging developing country and important growth market, India offers immense potential not only in the automotive sector, but also with regard to energy and raw materials partnerships. The rapprochement that took place in 2021 in the negotiations of an EU-India free trade agreement, mutual visits by high-ranking politicians and the established German-Indian government consultations have once again underlined the importance of German-Indian cooperation.

Today, German manufacturers and suppliers are already represented in India with more than 100 sites and production facilities, contributing to the sustainable development of the local automobile industry. Worldwide, India is the fourth largest passenger car market, and Germany is currently the fifth largest. In 2021, just over 3 million passenger cars were sold in India. Germany is India’s largest trading partner in Europe and is one of India’s ten largest global trading partners.

The VDA has been successfully cooperating with the two Indian automotive associations Automotive Component Manufacturer Association (ACMA) and the Society of Indian Automobile Manufacturers (SIAM) since 2005. Based on the “Indo-German Working Group on Automotive,” which was established over 10 years ago, and the traditional “IAA India Day,” the official association partnership, which has been in existence since 2017, sets new accents for cooperation: With the support of the German Federal Ministry for Economic Cooperation and Development (BMZ) and sequa gGmbH, the association partnership between VDA, ACMA and SIAM uses the potential in India to promote bilateral exchange between the players in the automotive industry, enable small and medium-sized enterprises to access the global market and improve the competitiveness of Indian companies.

Within the framework of conferences, workshops and joint studies, an intensive exchange on the future top-



ics of the industry, including in particular electromobility, alternative fuels, autonomous driving, digitalization and start-ups, is conducted with the involvement of member companies from both countries. In 2021 alone, the VDA, together with its Indian partners ACMA and SIAM, held 25 events on relevant topics of the industry dialogue. Free and fair trade between the two countries, the resumption of negotiations for a free trade agreement and resilience in supply chains are also topics of the partnership.

Despite positive developments, Indo-German cooperation in the automotive sector faces challenges, for example in the area of technical regulations. The current quality control regulations for safety glass and wheel rims require a labelling and audit procedure that doubles the certification effort in India. The VDA was able to lobby on behalf of its members for a postponement of the entry into force of various regulations. In addition, VDA members benefit from the cooperation project, for example through information offers, delegation trips and contacts with relevant stakeholders in India.

Through the project, the VDA has its own contact in Berlin and its own contact in the project office in New Delhi.

The cooperation with the sister associations ACMA and SIAM is in its second project phase until the end of 2022. The VDA is working intensively on continuing the project in order to further deepen the association partnership with India and to be able to make a contribution to climate protection and technological development together with its partners in India.

Guidance on Legal Framework Conditions



Digitization and the associated networking of motor vehicles have already triggered fierce competition for innovation, which not only affects the economic usability of data, but also access to the associated technologies, such as telecommunications.

The directive on representative actions for the protection of the collective interests of consumers, adopted by the EU at the end of 2020, must be transposed into national law by the member states by December 25, 2022. The directive leads to a certain need for adaptation of the German instruments of representative actions and class actions, even if this should only be done in the context of a 1:1 implementation.

The core question of transposition into national law is, above all, what requirements are placed on the legal standing of associations that do not sue for their own rights, but for representative collective interests of consumers, e.g. for compensation. The question of the narrowness and breadth of standing was also

a key factor in the negotiation of the EU Directive in Brussels and affects the protection interests of business to a large extent.

Expansion of collective redress through EU class action not sensible

Based on the position of the EU Council, the solution to the tension between consumer and business interests was sought by differentiating between “domestic” and “cross-border” association actions, whereby the place of action, i.e. the seat of the association bringing the action, is decisive for the delimitation. The seat of the company as well as the place of residence of the con-

sumer are irrelevant for standing. This could lead to a situation where the organizations that in principle have legal standing coordinate among themselves in which member state legal action is to be taken and possibly orient themselves on where the threshold for (national) legal standing is low (race to the bottom).

The criteria of the EU Directive for standing in the context of cross-border representative actions are at least similar to the requirements of the German Model Law of Arbitration. They are:

1. Twelve months of activity in the field of consumer protection (which makes ad hoc appointments more difficult),
2. solvency of the institution bringing the action,
3. independence from economic interests including a hedging concept and
4. extensive public information. However, according to the EU Directive, lower requirements for standing are possible for domestic collective actions compared to international actions.

The directive is limited to requiring safeguards to the extent that third-party funding of associational litigation is permissible under member state law. It is therefore conceivable that an American law firm, with the help of a British litigation financier, could provide financial support to a consumer organization, possibly to be founded on an ad hoc basis, in a member state where the right to sue is handled generously, in order to bring a national representative action there.

Draft Data Act – principles for the European data economy

The digitization of industry and its products, namely motor vehicles, which has been progressing for a long time, requires a careful examination of the legal framework conditions relevant here. Digitization and the associated networking of motor vehicles have already triggered fierce competition for innovation, which not only affects the economic usability of data, but also access to the associated technologies, such as telecommunications.

The VDA supports the data economy law approach of the Data Act (DA) now presented by the EU Commission, that consumers and other third companies must be able to access and use data. It makes sense to create a level playing field and to strengthen the role of the user. In recent years, the member companies of the VDA have already introduced systems and mechanisms that implement these basic objectives of the EU Strategy for Data – sharing available data with the customer and, if the customer wishes and consents, with third parties.

For example, the automotive industry (manufacturers and suppliers) has long declared its willingness, within the framework of its ADAXO concept (formerly NEVADA concept), to share data in motor vehicles in particular with third parties at the request of their customers, within the framework of IT technical feasibility and data security requirements.

Therefore, the approach of the EU Commission to create a “level playing field” (FRAND conditions for data access by third parties, exclusion of gatekeepers according to the definition of DMA) between all actors of the data economy by means of the DA corresponds to the fundamental interest of the automotive industry, but must be subjected to a review in the details of regulation with regard to systematics and expediency. However, the regulations of the DA should be adapted in order to generate the greatest possible added value for the automotive industry with its deep supply chains as well as for the users. The products of the automotive industry are only comparable with other equipment classes to a limited extent, as they have an extraordinarily high number of sensors and control devices that continuously generate large amounts of data.

From the VDA's point of view, this basically unlimited scope of application of the DA leads to legal uncertainty and thus to disadvantages for all those involved. It is therefore necessary to define the term "generated data" in such a way that it refers to available data that is available at interfaces provided by the extended vehicle for external communication (refer to ADAXO – see point 3 below). Functional data, which exclusively ensure operation, should not be included. Accordingly, the draft DA does not take into account the fact that companies do not always have all data available (either in editable form or in principle). Vehicles generate an enormous amount of data by means of a multitude of separate computers, control units and sensors, much of which is discarded directly after processing in the vehicle or in the sensor itself. For the industry, it can be assumed that such data is not recorded; otherwise, enormous data transport, storage and processing capacities would be required in the vehicle. This would result in a massive intervention in the product design. The manufacturer often does not have access to these sensor data, but also to a number of other data, because



they cannot be extracted and/or they are not extracted or further processed.

In order to achieve the fundamental goals of the DA, loopholes/circumvention possibilities must be closed so that European industry in particular benefits and does not lose out: The exemption in Article 2, Paragraph 2 and Recital 15 essentially privileges manufacturers of computers, tablets and smartphones, while the often European manufacturers of vehicles, medical devices, agricultural and industrial technology are disadvantaged. By requiring that only tangible products and not software are eligible as data providers, the already dominant providers of software do not face comparable obligations as manufacturers from the IoT sector, including the automotive industry. Conversely, the rule that tangible competing products are prohibited, but competing software is allowed, strengthens the already dominant providers of software. Software companies will create programs from the data (e.g. FAS/HAF), which they will offer to product manufacturers under typical software contracts (including extensive liability exclusions). The possibility of circumvention through data delivery from the user to the third party creates excellent opportunities for gatekeepers with their very broad customer base to secure, almost free of charge, the data that they have so far lacked in their portfolio.

Small and medium-sized companies in Europe are being pushed into the sidelines of competition

European SMEs, which are supposed to benefit from the Data Act, will not be able to come close to achieving this and will thus find themselves even more on the competitive sidelines.

The draft jeopardizes the protection of know-how and the confidentiality of trade secrets of the industry (in the case of the automotive industry, both manufacturers,



suppliers and manufacturers of trailers and bodies/SMEs); a corresponding protection clause is not intended. Although, according to the DA, the responsibility lies with the commercial customer to ensure that the data is not used against the rights holders, it is difficult to prove a data leak and the potential damage that has then already occurred can threaten the existence, especially of SMEs. The quantity and quality of the data collected by companies also risks suffering and thus Europe's lagging behind the USA and China further increases if access by third parties to confidential data is also made possible. It must therefore be ensured in the DA that data concerning business secrets does not have to be handed over.

Furthermore, the DA entails extensive new obligations for manufacturers of products. Companies in the automotive industry would be particularly affected with their networked vehicles and would be burdened with a considerable technical implementation effort. The DA's requirement alone that data should be made available to users continuously and in real time, if possible, would present the industry as data owners with quite considerable challenges in practice. In addition, many aspects of the Data Act itself also require greater clarity, as they currently leave too much room for interpretation, leading to legal uncertainty and a high risk of litigation.

The VDA relies on market-driven innovations, especially in the field of data use. The DA should rely on already established concepts such as ADAXO and, following the principle of proportionality, promote the market-based approach. The market economy principle of freedom of contract must be preserved so that companies and consumers can continue to shape the use of data in the competition for innovation.

EU IP Action Plan – framework for SEP licensing

The EU is also planning to regulate the licensing of standard essential patents (SEPs) for the first time as part of its 2020 IP Action Plan. SEPs are of crucial importance in the field of information and communication technology. The patents for the networking technology of motor vehicles are held by foreign companies in the telecommunications sector, which are contributing their technologies to the new radio standards such as 5G with patent protection. Therefore, these property rights are called standard essential patents (SEP). German manufacturers and suppliers are imperatively dependent on the use of SEPs, which must also be licensed for reasons of competition, both to suppliers and manufacturers. However, the SEP holders only grant the licenses to the vehicle manufacturers in order to obtain much higher license fees. German manufacturers and suppliers have already complained to the EU Commission and the Federal Cartel Office about this practice, which is questionable from an antitrust point of view. A decision on whether to initiate proceedings is still pending.

The VDA already advocated in 2017 that the license to an SEP or SEP portfolio must be offered by the patent holder on request to any participant in the supply chain who provides a unit implementing the SEP or SEP portfolio for a product that conforms to the standard. Conformity to the standard may be established, for example, by certification of the unit or a subsequent unit in the supply chain, although multiple certifications in the supply chain are not required. The license must be able to cover all preceding and succeeding stages of the respective supply chain and all usual forms of use of the unit in the standard-compliant end product, for example via a portfolio license.

No specific corporate criminal law required

In the current legislative period, the German government intends to introduce new sanctions law for companies. From the VDA's point of view, the intended reform of corporate sanctions law is not necessary and goes far beyond the existing and sufficient administrative offences law. Moreover, criminal law provides a well-functioning system of sanctions for individuals that is oriented towards the principle of guilt, the addition of which by a "corporate criminal law" leads to multiple economic and legal problems.

According to a draft bill already presented in 2020, a broad attribution of criminal offences to individual management persons was envisaged, without the organizational culpability of the company itself being relevant for this. However, companies that have an appropriate and active compliance organization must remain exempt from sanctions. However, compliance efforts would only be taken into account when assessing penalties. The draft also left open what is expected of the companies. The legislator should at least anchor the cornerstones of appropriate compliance in law. Against this background, the far-reaching sanction framework of up to 10 percent of the group-wide annual turnover should also be viewed critically. The corporate sanction will affect employees, suppliers, creditors and shareholders. Especially in the current economic crisis, where many industrial companies are facing losses that threaten their existence, a new sanction law would be a counterproductive signal from the Federal Government.



IAA

IAA MOBILITY 2021 – On Course for Success with a New Orientation

With a new concept at a new location, IAA MOBILITY 2021 has invited visitors to an international celebration of mobility – and that too under coronavirus hygiene conditions for the first time. More than 400,000 visitors from 98 countries are the best proof: IAA MOBILITY has reinvented itself – and is as successful as ever. The New York Times commented: What car shows may look like, if car shows have a future.



What will move us next

Those who walked through the streets of Munich from September 6 to 12 could see and even touch what will move us in the future. A total of 744 exhibitors and 936 speakers from 32 countries presented their products and visions for the future of mobility during IAA MOBILITY 2021. And not only on the exhibition grounds, but even in the middle of the city in some cases.

With a new concept at a new location, IAA MOBILITY has established itself as a platform that unites the most diverse modes of transport under one roof – be it the car, the bicycle or Urban Air Mobility. With more than 400,000 visitors from 98 countries, it now stands for the international celebration of connected, digital and climate-neutral mobility.

From now on, it is no longer just the industry experts who will be addressed. With the new format, the entire population is explicitly invited to debate different visions. Thus, the “Open Space” – the event area on several squares in Munich – quickly became a crowd favorite with a good 300,000 visitors. A big thank-you also goes here to the City of Munich and especially the Messe München.

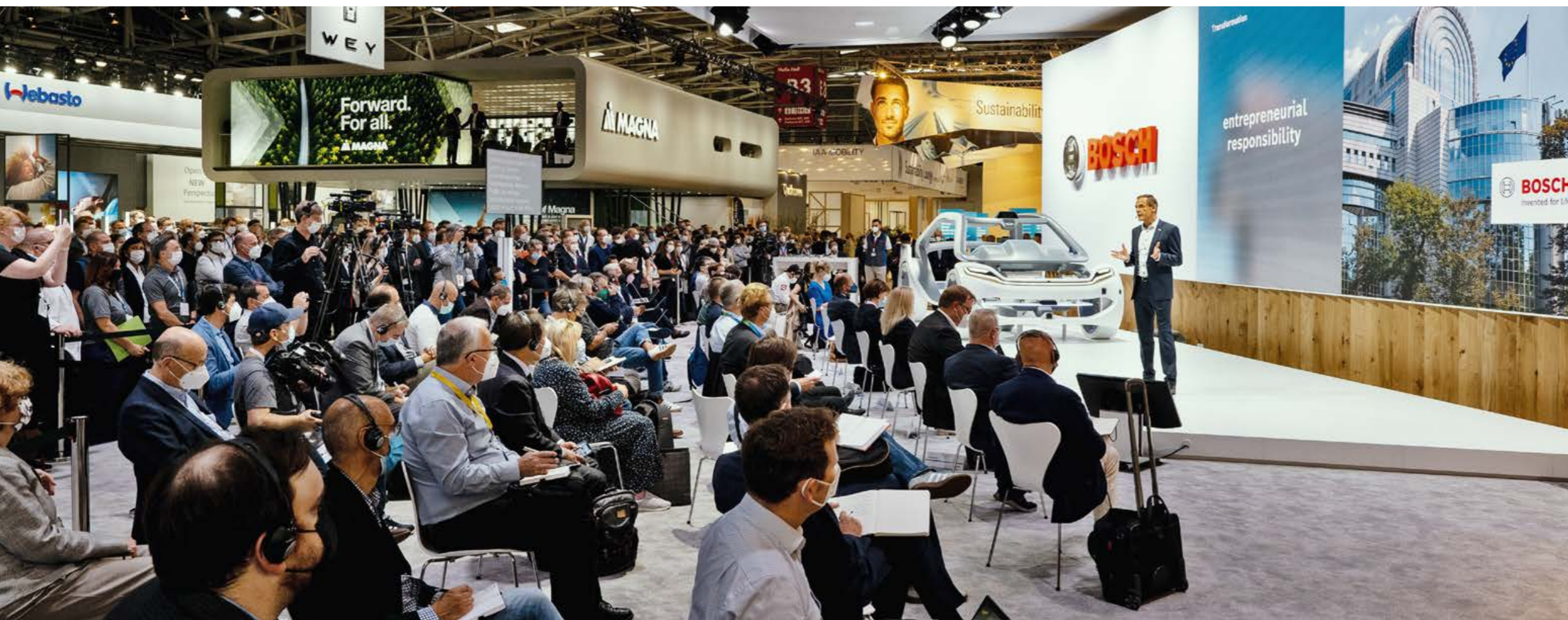
The protection and hygiene concept, with its sophisticated routing, consistent access controls also in the public areas, constant ventilation of the exhibition halls, adherence to the distance rules, wearing of mouth and nose protection as well as checking of the 3G status, made the event venues safe places for exhibitors, visitors and speakers.





The IAA Summit

The summit forms the content heart of IAA MOBILITY for all B2B visitors in nine halls on the exhibition grounds. In addition to numerous exhibitors, it offers stages and areas for international expert exchange. The stages of the IAA Conference, the Career Lounge and prominently placed start-up areas made IAA MOBILITY 2021 the most important meeting of the industry. A total of 611 exhibitors were on-site last year on 70,000 m² of net exhibition area. Over 107,000 visitors were welcomed to the exhibition grounds during the 7 days of the fair. Dr. Angela Merkel (former German Federal Chancellor), Hubertus Heil (former German Federal Minister of Labor & Social Affairs) and Gerd Müller (former German Federal Minister of Development) were among the visitors.



The IAA Conference

On four conference stages as well as the “Business Club House” and the “Sustainability Lounge,” international experts gave lectures and discussed their visions in more than 350 sessions. Dr. Angela Merkel, Cristiano Amon (Qualcomm), Dr. Herbert Diess (VW) and Pat Gelsinger (IBM) were among the top speakers. Future-relevant topics such as sustainability, diversity, rural and urban mobility, autonomous driving, artificial intelligence, electrification as well as mobility-as-a-service and cybersecurity were discussed on the stages.



The IAA Virtual Conference

At IAA, the entire program of the IAA Conference was broadcast live, and made available on demand until 30 days after the end of the event. This included all lectures, keynotes and panel discussions on the four stages as well as in the Sustainability Lounge and the Business Club House.

A total of 73,353 online views of the IAA Virtual Summit live content were recorded, with over 100 speakers in 261 sessions. The keynotes and panels made available on the IAA Mobility YouTube channel generated a further 2 million views.



The IAA Open Space

The city's most beautiful squares became a stage and a place of experience with the Open Space – free of charge for all citizens. Numerous exhibitors presented their product innovations and visions of the future from Königsplatz to Wittelsbacher Platz, Odeonsplatz, Residenz, Hofgarten and Marstallplatz to Max-Joseph-Platz. A total of 78 exhibitors were represented in the Open Space.

But there is more to it. With the "Citizens Lab," a citizens' platform was created for discussions and workshops on the mobility of the future. The enthusiasm for opening up IAA MOBILITY to the city center was so great that some areas had to be temporarily closed due to the large crowds.

The 78 exhibitors were obligated to make their presentation at the Open Space balance-neutral in terms of CO₂ emissions. For the calculation and offsetting of the emissions within the scope of the entire presentation, IAA MOBILITY gained an experienced partner for effective climate protection in "myclimate." This enabled a total of 2,214 tons of CO₂ to be offset and climate protection projects to be actively promoted.



Start-ups at IAA

One focus of the event was on the area of future innovation drivers: start-ups. Through resourceful networking events, such as 15 Table Captain Sessions and a Founders Day, the representatives of the 78 start-ups had the opportunity to introduce themselves to potential partners and investors.



The IAA Blue Lane

The Blue Lane was the connecting axis between the summit on the exhibition grounds and the Open Space in Munich city center. The approximately 12 km-long route also included a 5 km-long environmental lane, the first of its kind in Germany. All road users with an emission-free vehicle or at least three occupants, buses and taxis could use this signposted lane. This enabled the Blue Lane to make future and sustainable mobility solutions tangible for all road users as well as visitors in the middle of Munich. The project was supported and evaluated by the Mobility Department of the City of Munich, the Government of Upper Bavaria and Autobahn GmbH.

More than 7,500 test drives were offered on the Blue Lane in more than 250 sustainable vehicles as well as emission-free local bus transport. Over 15,000 people took up the test offer and transfer.



Bikes at IAA

We were particularly pleased with the development among the manufacturers of bicycles: On over 20,000 m², with 75 bike brands represented and 8,840 test rides on several test ride tracks, the newly developed area was a great success.

According to a survey, 42 percent of visitors were interested in this area. A good 20 percent of the visitors said they wanted to buy an e-bike.

IAA MOBILITY 2021 – A Success Story

744
exhibitors
from 32 countries



407,379
visitors from 98 countries



3,500
accredited journalists



936
international speakers
from 32 countries



137 billion
potential international
media reach



78
start-ups on 1,500m²



7,503
test drives



71%
of visitors younger
than 40



33,800
media clippings



2,214 t
of offset CO₂



75
bike brands

90,299 m²
of exhibition space



Wheel-In Test Drives



IAA TRANSPORTATION 2022 – New Name, New Focus, New Partners

The first IAA TRANSPORTATION ended extremely successfully. Organizers, visitors and exhibitors were very satisfied with the new concept, which this year covered the entire spectrum of transport and logistics.



Leading international platform for logistics and transport inspires in Hanover

With a concept, which this year represented the entire spectrum of transport and logistics for the first time, the IAA Commercial Vehicles of yesteryear has completely reinvented itself. The first IAA TRANSPORTATION: a great success.

“Following on from IAA MOBILITY, we have also successfully developed IAA TRANSPORTATION. From trucks to cargo bikes, from delivery vans to parcel drones, IAA TRANSPORTATION represents everything that moves in the field of logistics. The great response from exhibitors and visitors shows how right this new approach is,” said VDA President Hildegard Müller at the closure of IAA TRANSPORTATION in Hanover “Transport and logistics are the lifelines of our society and economy. With its new concept, IAA TRANSPORTATION has provided answers to the many challenges that are faced by the industry all over the world. In Hanover, it became clear: The industry is delivering what is needed for a sustainable future.”





Impressive presence, very high international attention

A total of 1,402 exhibitors from 42 countries and a total of 230 national and international speakers were represented at IAA TRANSPORTATION, presenting their technical innovations, developments and concepts for climate-neutral mobility. IAA TRANSPORTATION 2022 once again consolidated its position as the world's largest platform for the transport and logistics industry – around two-thirds of the exhibitors were international companies and visitors came from 72 countries.

More than 1,400 journalists from 57 countries visited IAA TRANSPORTATION. Exhibitors held 89 press conferences. International media from 97 countries accounted for 77 percent of the coverage. Posts on the company's own social media channels were viewed over 2 million times. Apart from Germany, there was very intensive coverage, above all in the USA, Canada, India, Japan, China and South Korea.



The IAA Exhibition

Vehicle manufacturers showcased the wide variety of electric and fuel cell-based power trains as well as hydrogen combustion engines. New trend: Replacement kits that can be used to replace the diesel drive in buses and trucks with a new battery drive. This concept additionally allows freight forwarders and local transport companies to modernize their existing vehicle fleets during ongoing operations.

Exhibitors of trailers and bodies showed electrified trailer axles and particularly lightweight trailers that reduce the energy requirements of the tractor unit. Bus manufacturers focused on the electrification of intercity buses and coaches.

And there was plenty to see. IAA TRANSPORTATION 2022 featured 1,402 exhibitors, about two-thirds of them international companies. Among them were 260 exhibitors of bodies, trailers and semitrailers, as well as around 600 suppliers. For the first time, 68 international start-ups were also represented in Hanover.

Likewise, six cargo-bike manufacturers presented their product innovations, making an important contribution to low-emission and urban-compatible logistics.



The IAA Conference: four days with various key topics

The IAA TRANSPORTATION conference program was divided into curated theme days on the main stage and an exhibitor program at the Industry Forum. It thus offered the perfect balance of substantive debate and B2B networking experience for all industry sectors of the transportation industry.

- **Logistics**, including the topics of supply chains, trucks, integration of rail and shipping, e-mobility, technological and digital innovations for the logistics chain
- **Trade**, including the topics of last mile, city logistics, vans, transporters, cargo bikes, delivery robots, digitalization, innovative solutions for retail and online trade, e-commerce
- **Infrastructure**, including the topics of charging infrastructure, expansion of data networks, digital infrastructure, long-distance bus transport, rail transport connections, 5G, energy, roads
- **Communal**, including the topics of public transport, buses, electrification, hydrogen, ride-sharing, ride-hailing, mobility as a service, municipal administration, digitalization





The IAA Experience

The new IAA TRANSPORTATION was extremely well received by visitors. Visitors were particularly enthusiastic about the range of innovations and new models on show, as well as the international character of the event. The opportunity to try out new products for themselves was particularly popular: Three quarters of those surveyed gave top ratings to the IAA test drives.

The crowds for the test drives as part of the IAA Experience were huge. Visitors were able to test the latest models under real-life conditions on the IAA Cargobike Parcours, while 61 commercial vehicles could be tried out on the IAA Test Drives – in a climate-neutral manner. A good 7,500 test drives were counted.

Positions

The VDA's specialist departments have issued "Standards" on important political and technical matters. The standards are developed in cooperation with the members, who define the VDA's positions in committees and working groups. Here are the most important topics of the previous year.

VDA German Association of the Automotive Industry

Position
Electrified Vans & Required Charging Infrastructure
Contributions and Recommendations of the Automotive Industry



#wirsindbereit

VDA German Association of the Automotive Industry

Automotive cooperation between Africa and Germany
Engine for innovation, growth and jobs



#wirsindbereit

Position Statement



#wirsindbereit

VDA German Association of the Automotive Industry


Position
ADAXO: Automotive Data Access – Extended and Open
VDA concept for access to in-vehicle data



#weareready

VDA German Association of the Automotive Industry

Position
US draft legislation for tax incentives to promote electromobility
November 2021



#weareready

VDA German Association of the Automotive Industry

Position
Re-introduction of Automotive Tariffs in Egypt
December 2021



#weareready


Executive summary
Access to in-vehicle data
December 2021



#weareready

VDA German Association of the Automotive Industry

Position
Revision of the Energy Taxation Directive (ETD)
How energy taxation can contribute to achieving climate-neutral mobility



#weareready

VDA German Association of the Automotive Industry

Position
EU Sustainable Finance Framework
Sustainable Transformation of Industry



#weareready

VDA German Association of the Automotive Industry

Position
EU Sustainable Finance Framework
Sustainable Transformation of Industry



#weareready

VDA German Association of the Automotive Industry

Position
Succeeding to
Basic principles of collaboration automobile manufacturer



#weareready



VDA German Association of the Automotive Industry

Position
Electrified Vans & Required Charging Infrastructure
Contributions and Recommendations of the Automotive Industry



#wirsindbereit

July 2021



VDA Verband der Automobilindustrie

Position
Leichte E-Nutzfahrzeuge und deren Ladeinfrastruktur
Beiträge und Empfehlungen der Automobilindustrie



#wirsindbereit

July 2021


Sauber. Sicher. Digital.

The automotive industry invests in research and development like no other sector. See a selection of the latest and most innovative inventions here.





May 2021

January 2022



VDA German Association of the Automotive Industry

Position
Automotive cooperation between Africa and Germany
Engine for innovation, growth and jobs



September 2021



VDA German Association of the Automotive Industry

Position
US draft legislation for tax incentives to promote electromobility
November 2021



#weareready

October 2021



VDA Verband der Automobilindustrie

Position
US-Gesetzesentwurf für Steueranreize zur Förderung der Elektromobilität
Oktober 2021



#wirsindbereit

October 2021



VDA German Association of the Automotive Industry

Position
The European Commission's Fit for 55 package
Position statement of the German automotive industry



#wirsindbereit

November 2021



VDA German Association of the Automotive Industry

Position

Revision of the Energy Taxation Directive (ETD)

How energy taxation can contribute to achieving climate-neutral mobility



#weareready

November 2021



VDA Verband der Automobilindustrie

Position

Revision der Energiesteuerrichtlinie (ETD)

Wie die Energiebesteuerung zur Erreichung klimaneutraler Mobilität beitragen kann



#wirsindbereit

November 2021



VDA German Association of the Automotive Industry

Position


Re-introduction of Automotive Tariffs in Egypt

December 2021



#weareready

December 2021




VDA German Association of the Automotive Industry

Executive summary


Access to in-vehicle data

December 2021



#weareready

December 2021




VDA German Association of the Automotive Industry

Position


ADAXO: Automotive Data Access – Extended and Open

VDA concept for access to in-vehicle data



#weareready

December 2021




VDA Verband der Automobilindustrie

Position

ADAXO: Automotive Data Access – Extended and Open

VDA-Konzept für den Zugriff auf fahrzeug-generierte Daten



#wirsindbereit

December 2021



VDA German Association of the Automotive Industry

Position

Artificial Intelligence Act

Proposal of the European Commission submitted on April 21, 2021



#weareready

February 2022



VDA German Association of the Automotive Industry

Position


Directive on Consumer Credits

Proposal of the European Commission submitted on June 30, 2021



#weareready

February 2022




VDA German Association of the Automotive Industry

Statement

Leading the Way in Autonomous Driving

Autonomous Vehicles Approval and Operation Ordinance (AFGBV) of the Federal Ministry for Digital and Transport (BMDV) and Relationship to Emerging EU Regulations



#weareready

February 2022



VDA German Association of the Automotive Industry

Position

EU Standardization Strategy

Comments from the automotive industry



#weareready

March 2022



VDA German Association of the Automotive Industry

Position

EU Sustainable Finance Framework

Sustainable Transformation of Industry



#weareready

May 2022



VDA German Association of the Automotive Industry

Succeeding together

Basic principles of collaboration between automobile manufacturers and their partners



#weareready

June 2022



VDA German Association of the Automotive Industry

Position

Draft EU Data Act of 23/02/2022

Regulation and private autonomy of the data economy



#weareready

May 2022



VDA German Association of the Automotive Industry

Comment

Revision of the ITS Directive

Proposal of the EU Commission



#weareready

May 2022



VDA German Association of the Automotive Industry

Position

Interim summary of the EU Commission's Fit for 55 package

Recommendations of the German automotive industry



#weareready

September 2022



Organization of the Association

In the last year and a half, the VDA has strategically repositioned itself. This pertains to the reorganization and modernization of the VDA office, the structure of the management as well as the financial architecture of the association, which was developed and adopted together with the members. It was important to take these steps in order to be in a position to lead the VDA into the future on a stronger footing.

Reorganization of the VDA

With the reorganization of the VDA office and management, which has been worked out and implemented over the last year and a half, and the new financial architecture of the association, which has been worked out and approved together with the members, the VDA has taken an important step towards making itself fit for the future.

Andreas Rade has been head of the Politics and Society business unit since January 1, 2022. His core competencies range from climate, transport, environment and sustainability, as well as tax policy and foreign trade to statistics and policy issues. In addition, Rade is in charge of the supervision of the producer groups II and III as well as for the office in China.

Dr. Marcus Bollig has headed the Product and Value Creation business unit since May 1, 2022. His core competencies range from the power trains of the future, electromobility and connected and automated driving to security and data. He is also in charge of homologation, standardization, production and manufacturing processes.

The Communications/Media/IAA and Association Management/Member Services divisions were merged. Since January 1, 2022, the combined business division has been headed by Jürgen Mindel, who, in addition to his previous tasks, is now also in charge of the association's economic issues and finances.



The Specialist Departments

The VDA is composed of various specialist departments. The staff in the offices in Berlin, Brussels and Beijing ensure that the interests of the German automotive industry are competently represented.

In this chapter the various specialist departments and their tasks are briefly explained. The specialist departments, i.e. Member Services, Standardization and Regulations, Research Association of Automotive Technology e. V. (FAT) and the Quality Management Center (QMC) are not discussed in detail, as they are each explained in separate chapters.

1. Brussels office

The decisions of the European Union have a strong impact on German industrial policy. For this reason, the three employees at the VDA's Brussels office adhere to and analyze the EU's automotive policy decisions and communicate them to the association. At the same time, in coordination with the European partner associations and VDA member companies, the colleagues lobby for the interests of the German automotive industry with the bodies of the European Union.

2. Beijing office

VDA China is based in Beijing and acts as a link between the German automotive industry and Chinese decision-making unit, market participants, associations and the German political representations in China. The aim here is to make the local regulatory framework and the Chinese market more transparent for German automotive companies. This is accomplished, for example, by the

team establishing contacts with authorities, associations and institutions and implementing corresponding projects.

3. Economic intelligence & Economics

The colleagues here can draw on well-founded expertise in the areas of data evaluation, the current economic situation and worldwide automobile forecasts. The task portfolio also includes the preparation of internal and external statistics as well as publications. In addition, the team maintains contacts with automotive associations, statistical offices and various research institutes.

4. Vehicle technologies & Ecosystems

When it comes to keeping an eye on and bundling the diverse interests of the automotive industry and communicating technical innovation and specialist topics within the association, this department boasts the expertise. It is subdivided into various specialist groups and coordination units. Each group works in a function-oriented manner and is in charge of its respective specialist topic along the development process. The coordination units take a holistic and cross-VDA view of innovations, incorporating technical developments as well as social, economic and ecological trends.

5. IAA MOBILITY and IAA TRANSPORTATION

IAA MOBILITY in Munich and IAA TRANSPORTATION in Hanover: The two trade fair events are coordinated and organized by the IAA team. The varied tasks include exhibitor acquisition, booth allocation and booth construction approval. The “IAA” working group deals with fundamental issues relating to IAA MOBILITY, while the VDA “IAA TRANSPORTATION” working group mainly focuses on IAA TRANSPORTATION. The team also deliberates over the calendar of events of Organization Internationale des Constructeurs d’Automobiles, the world association of car manufacturers.

6. Industry, Digital strategy & Policy issues

One of the team’s main tasks is to observe and evaluate the social and political discussions relevant to the automotive industry. Initiatives of all kinds, civil society discussions and government action at federal and state level are closely monitored in order to be able to introduce positions, assessments and analyses of the association into the political process at an early stage. Furthermore, the staff coordinates the strategic positioning of the sector’s core issues vis-à-vis politics and civil society.

7. Communication & Media

The communications team ensures the necessary presence with the media. The press office deals with current media enquiries and publishes interviews, statements and press releases. The digital editorial team and the member communication and brand team are in charge of the social media accounts, the VDA website in various languages, the internal member area, manage various websites, produce newsletters – e.g. the weekly newsletter “Insight,” take care of all publications, the corporate design, the annual reports and the visual language of the association. The Events team organizes all the important events for the VDA, ranging from members’

meetings to congresses, theme events to receptions and the appearance at the party conventions. The IAA Communications team designs and manages all national and international marketing and communications activities for IAA MOBILITY and the IAA TRANSPORTATION.

8. Human resources, Finance & controlling, IT & in-house services

The department is in charge of human resources, finance, controlling and IT. Some of the staff are involved in in-house services such as building, fleet and travel management, while others work in the mailroom and at reception.

9. Production, Logistics & Aftermarket

The department bundles and represents the interests of the automotive industry in the areas of production environment and supply chain. One of the main goals is the standardization of processes in the pre-competitive area. In this context, the interests of manufacturers and suppliers are equally taken into account on a national and international level. Each of the three disciplines is represented by a committee consisting of industry representatives from top management in the VDA.

10. Law & Compliance

The department is divided into the specialist areas “Law, Compliance and Legislative Analysis” and “Consumer Law and Automotive Financial Services.” With a focus on legal policy aspects, the team offers legal advice as well as association-internal legal analyses. We pay close attention to consumer-related legislation as well as framework conditions for the provision of sales financing. In the area of compliance, the department provides the guidelines on cartel law for the VDA’s committee work.

11. Traffic & Transport, Climate, Environment & Sustainability

As the name implies, the department is divided into three subject areas: “Climate, Environment and Sustainability” (first), “Transport Policy” (second) and “Transport Policy” (third). The staff of the first department deal with diverse aspects of environmental and climate protection with reference to the automotive industry. The main focus is on questions of CO₂ regulation for passenger cars as well as light and heavy commercial vehicles and the handling of end-of-life vehicles. The second team coordinates the representation of the interests of the automotive industry in transport policy – with the aim of creating optimal framework conditions for sustainable transport. The third team looks after around 70 member companies from the German trailer and body industry as well as bus and coach manufacturers, which are grouped together in VDA Manufacturer Group II.

12. Economic policy, foreign trade, SMEs & taxes

In order to be able to represent the diverse interests of the automotive industry appropriately, the department bundles the specialist (foreign) economic policy issues in the VDA. In addition, the colleagues coordinate the industry’s SME- and supplier-specific issues within the association as well as the monitoring of manufacturer-supplier relations. The department is divided into three specialist areas: “Economic Policy and Taxes,” “Foreign Trade, Trade and Customs” and “Corporate Policy and SMEs.” In addition to global trade policy, the Foreign Trade and Payments department is also in charge of the VDA’s international association partnerships with African and Indian partner associations.



Quality Management

German car manufacturers and their suppliers have had their own Quality Management Center (QMC) since August 1, 1997. The QMC is governed by the Quality Management Committee (QMA), which is the highest quality committee of the VDA.

The crises of the last three years have shown how important it is for the quality of systems, processes and products to maintain their usual stable, high level. Quality is the central principle throughout the entire product creation process – and thus affects all areas such as development, production and use by the customer.

Within the VDA, the Quality Management Committee (QMA) steers the quality activities of the German automotive industry. The aim of the QMA members is to continually develop the methods and tools of quality management so that they always meet the requirements of the industry. The top managers in the QMA and the experts in the project groups are all dedicated to applying and further developing the various quality methods at the highest level. In this context, they anticipate the megatrends of the automotive industry and ensure a high level of commitment to implementation in the value chain. In addition, the comprehensive QM methods and tools are used internationally.

The VDA Quality Management Center (VDA QMC) is concerned with developing new methods and techniques for quality management together with manufacturers and suppliers. The highest VDA quality body, the Quality Management Committee (QMA), defines the VDA quality standards and develops them further. The QMA is composed of representatives of the VDA, the car manufacturers and the suppliers and is regarded as a joint platform for the development and implementation of harmonized quality strategies and methods.

The QMC implements the decisions of the QMA in its capacity as the administrative office: Within the VDA QMC project groups, experts from the member

companies develop definitions, regulations and requirements for quality management in the automotive industry. The VDA QMC publishes and markets the results as standards in the so-called “Red Volumes.” The contents continue to be didactically prepared in the company’s own training and further training courses and are offered as VDA training courses. Employees of manufacturers and suppliers throughout the supply chain thus have the opportunity to receive training in the application of the quality standards. In addition to its own range of training and further education courses, selected qualified license partners offer VDA training courses throughout Germany and internationally.

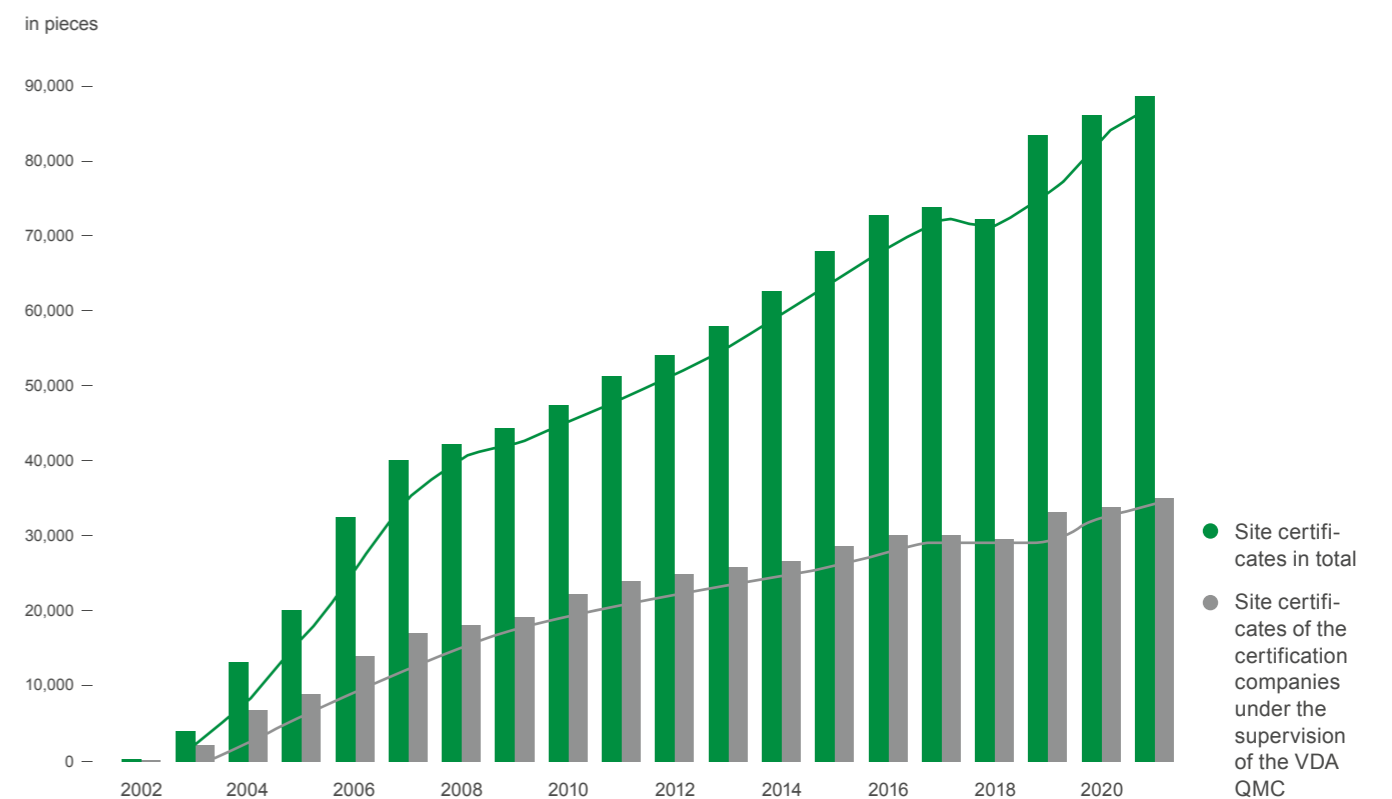
Furthermore, the VDA QMC is a contractual partner and, at the same time, a supervisory body for certification companies. The certification companies inspect the quality management systems of companies in the automotive industry worldwide according to special schemes of the VDA QMC or the International Automotive Task Force (IATF), of which the QMC is a member. They also award certificates for the corresponding implementations. Compliance with the processes and standards of the VDA QMC is usually a prerequisite for becoming a supplier to the international automotive supply chain.

Processing of VDA QMC publications, software and licensing partnerships

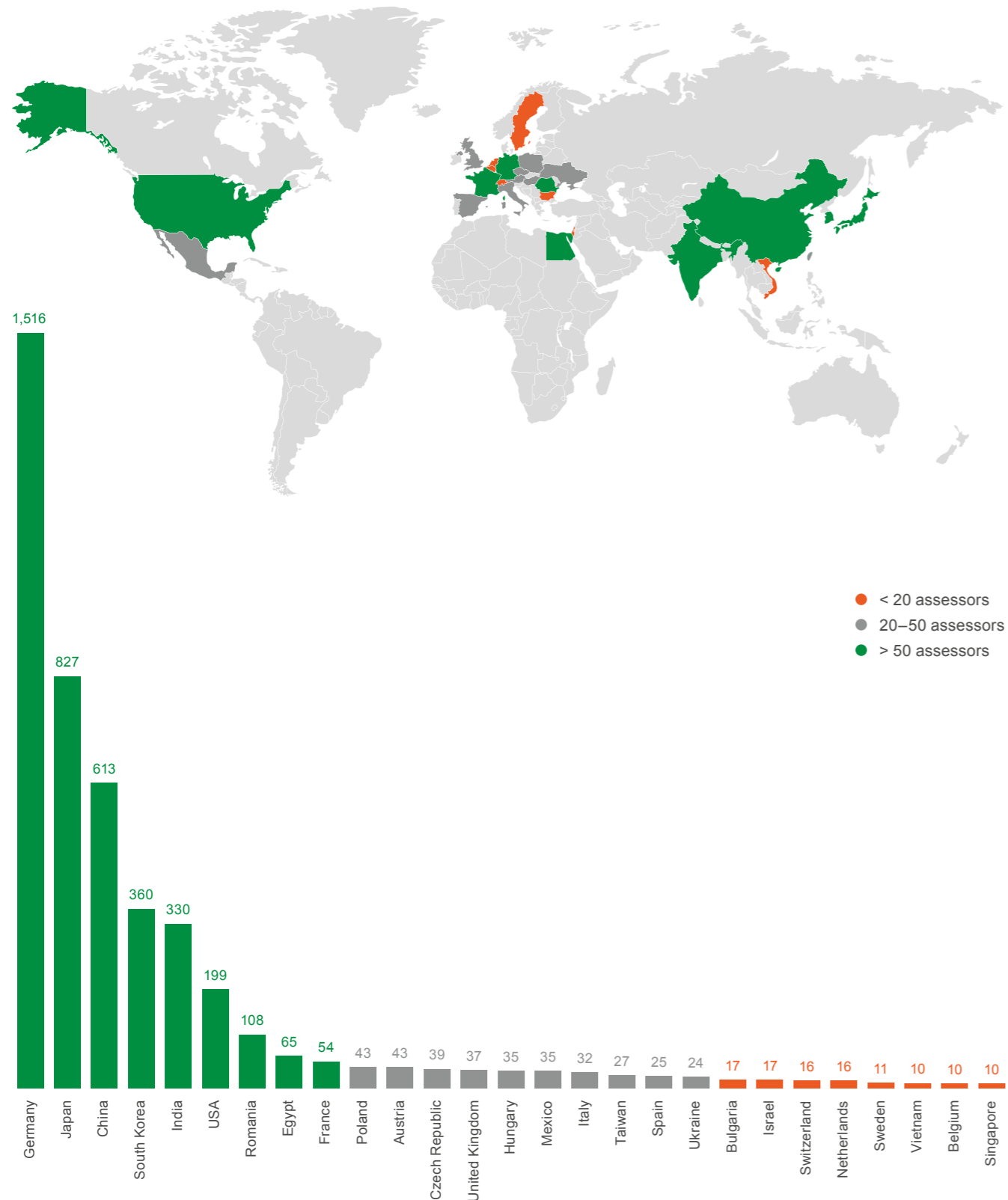
Publications in German and English	22.870 books
Top 5 VDA QMC publications 2021	
Volume 2 – PPF German	1,856
IATF 16949:2016	1,334
Product Integrity Volume in German	1,205
AIAG & VDA FMEA Handbook in German	1,019
Volume 6 Part 3 Edition	999
Publications in 16 additional languages (VDA QMC Portal)	17,949 books
License agreements	472 contracts
SW products	14,315 tools

Source: VDA QMC

Development of IATF-16949 site certifications



Development of Automotive SPICE certifications



Source: VDA QMC, KPI

The VDA QMC is continuously working on new quality standards for the supply chain. A good example of new innovative technologies is the industry-specific standard “Automotive SPICE®.” “SPICE” stands for “Software Process Improvement and Capability Determination.” This standard was derived from the international standard ISO/IEC 15504, which deals with the analysis, evaluation and improvement of processes in software-based system development.

Against this background, the new standard “Automotive Cybersecurity Management System Audit” (ACSMS) should also be mentioned: With the help of the VDA ACSMS standard, the systematic auditing of the cybersecurity management system can be carried out in accordance with the requirements of UNECE R-155. The standard is aimed especially at suppliers to the automotive industry who have to demonstrate a functioning cybersecurity management system to OEMs in order to obtain a certificate of conformity according to UNECE R-155.



Forms of Training and Further Education Offered by the VDA QMC

Open training courses

The VDA's training courses are conducted by highly qualified trainers throughout Germany, mainly in event hotels. The trainers are trained in the areas of methodological and social competence and impart in-depth specialist knowledge on the promotion of quality management. The training content is largely developed with the participation of the trainers in the VDA QMC working groups.

In-house training courses

The VDA conducts all training courses not only within Germany but also on-site at companies worldwide. The training courses can be booked by companies at a reasonable price. In addition to the usual program, the content also includes specific, individually designed quality management content. Especially from an economic point of view, in-house training courses are a worthwhile offer for companies: Already from a number of participants of six, an in-house training course can be significantly cheaper than the participation of all persons in open training courses.



Figure – The VDA's open training courses are offered throughout Germany.

Live online training

Learning in real time, independent of location and with maximum flexibility: The VDA also offers training courses in the usual quality as live online training courses. Participants can thus optimally integrate their further training into their daily lives – without the need for time-consuming business trips to the seminar venue.

Training courses with license partners

The VDA runs the events worldwide with the support of selected cooperation partners. Due to the constantly increasing demand for training, the VDA in Germany also works with competent licensees. The worldwide network is subject to continuous monitoring by the VDA QMC in order to guarantee a high level of quality in the license training courses. Thanks to the partners, the training courses can be offered in the relevant national language with qualified trainers at the usual local conditions.



Standardization in the VDA

Technical rules, norms and standards form an essential basis for product development. The Standardization and Technical Regulations Department coordinates the standardization work in the VDA and is also in charge of the Automotive Standards Committee of DIN.

The field of standardization is a cross-sectional task that plays an important role for all sectors of the economy and society. When it comes to technical regulation, the objective is to establish the current state-of-the-art technology as a competition-independent guideline – with the aim of determining basic requirements and test methods. Norms and standards thus form an indispensable element of product development and contribute to rationalization and quality assurance.

To reflect the importance of standardization, the VDA has concluded a contractual agreement with the German Institute for Standardization (DIN) on the sponsorship of the Automotive Standards Committee within DIN. This cooperation provides the association's members with optimum conditions for participation in standardization work.

Cooperation with Deutsches Institut für Normung e. V. (DIN)

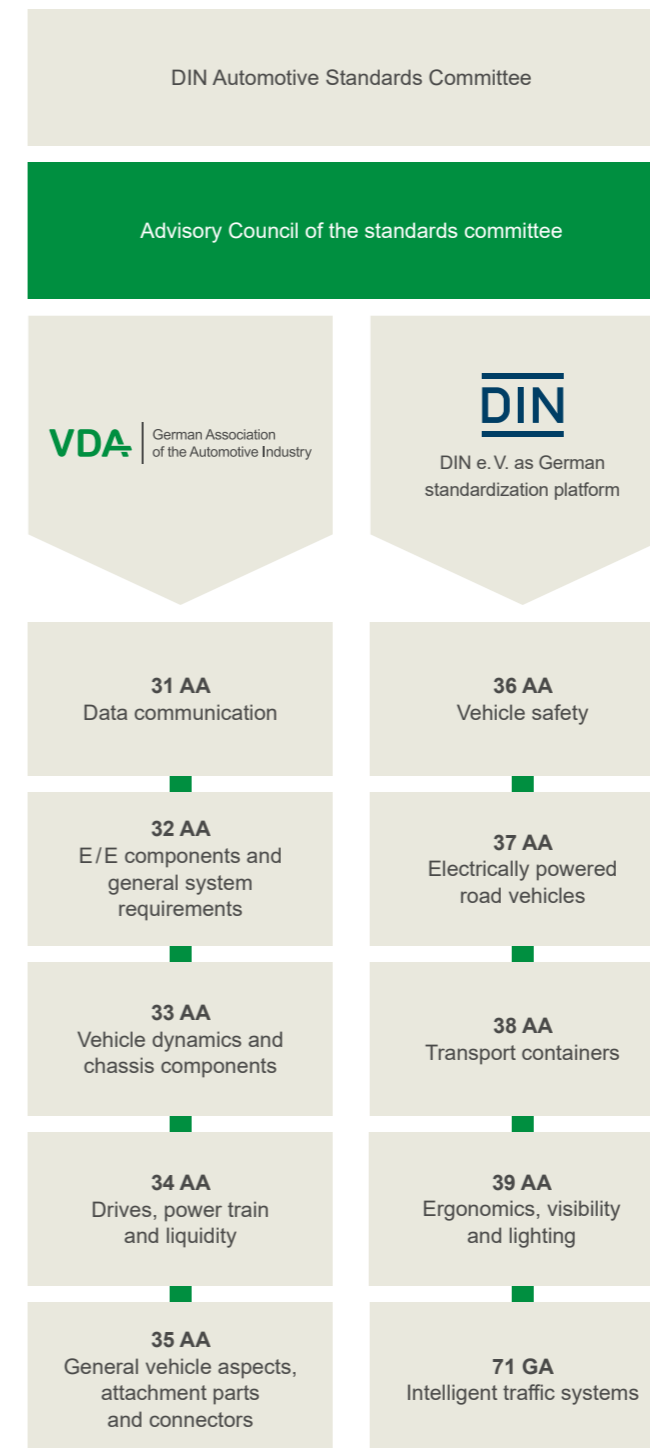
A key task of the VDA's Standardization and Codes Department is to support the committees of the Automotive Standards Committee (NAAutomobil). The DIN standards committee represents the national, regional and international interests of German industry in the field of automotive and networked mobility. Its remit includes the preparation of all standards relating to quality, compatibility, interchangeability, interfaces and safety for road vehicles in accordance with DIN 70010

(with the exception of agricultural tractors). In this context, sustainable mobility aspects and other modes of transport are also taken into account.

The key topics of standardization work in the VDA last year included automated driving, cybersecurity and alternative drive technologies.

Here is an example: ISO/SAE 21434 "Road vehicles – Cybersecurity engineering," a standard on cybersecurity, became a mandatory part of the type approval of motor vehicles by the United Nations Economic Commission for Europe (abbreviated: UNECE; WP.29) with UNECE Regulation No. 155. The regulation supports the implementation of the certification of vehicle manufacturers with regard to a cybersecurity management system (CSMS) as required by UNECE Regulation R155 "Cybersecurity Management Systems (CSMS)." The application of ISO/SAE 21434 is a building block in terms of a reference implementation of a CSMS to facilitate the required certification. Complementary to ISO/SAE 21434, ISO PAS 5112 contains guidelines on the management of an audit program, on the planning and implementation of management system audits, and on the competence and evaluation of an audit team.

Tasks of the Automotive Standards Committee



Key topics of standardization work in the VDA

In 2021, the VDA has also started to develop a specification for safety requirements and possible technical manifestations of safety concepts for steer-by-wire steering systems. Steer-by-wire refers to a system in which a steering command is transmitted exclusively electrically from a sensor (especially the steering wheel) via one or more control units to the electromechanical actuator that executes the steering command. As a basis for a future DIN standard, the companies involved carried out extensive preliminary investigations and test person studies. The development of the future standard will start in 2022.

A standard for rechargeable energy storage systems

Another important milestone for electromobility was the development of ISO 15118-20 "Road vehicles – Communication interface between vehicle and charging station – Part 20: 2nd generation network and application protocol requirements." The exchange of information between electric vehicles and charging infrastructure is indispensable for the problem-free effective charging of the energy storage units of e-vehicles, including the associated convenient billing systems. In addition, the safe operation of e-vehicles is supported by corresponding standards. With an amendment to ISO 6469-1 "Electrically powered road vehicles – Safety specification – Part 1: Rechargeable energy storage systems (RESS)," the experts responsible for the safety of battery systems have taken the risk of individual cell fires spreading to the entire battery system into consideration. The imminent publication of an amendment to this standard outlines the safety assessment options to this end.

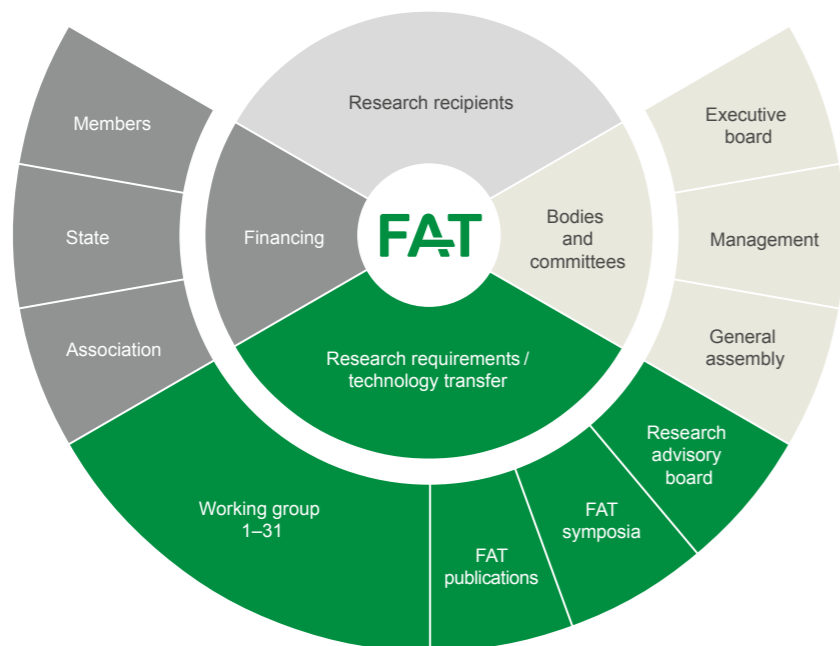
The Annual Report of 2021 published by the Automotive Standards Committee contains a complete overview of its committees and projects.

Research Association of Automotive Technology

FAT is a unique network of manufacturers and suppliers in the automotive industry as well as research institutions. The German automotive industry has always enjoyed groundbreaking and up-to-date results from its research.

In 1971, under the umbrella of the VDA, German car and commercial vehicle manufacturers as well as numerous suppliers and providers of mobility-related products and services joined forces in Forschungsvereinigung Automobiltechnik e. V. (FAT). The aim of the association is to conduct pre-competitive and joint research on sustainable mobility and energy concepts. The research results obtained are used as a basis for the development of new and optimized products and innovations. In the context of the research activities, fundamental questions are also answered, on the basis of which the constantly increasing demands on materials, environmental compatibility, automation and networking can be generated.

Establishment of the Research Association of Automotive Technology



The requirements of markets and companies are subject to certain dynamics. These changes and further developments flow into the research goals of FAT, so that the research teams can realign the goals as needed. The main areas of concern are subdivided

into five research clusters: 1. Safety and automated driving, 2. Digitalization and networking, 3. Environment and road traffic system, 4. Materials and methods and 5. Commercial vehicles.

Research focus

Cluster	Safety, automated driving	Digitalization, networking	Environment, road traffic system	Materials, methods	Commercial vehicles
Contents	<ul style="list-style-type: none"> Accident research Active/passive safety Post safety Automated driving Vehicle dynamics 	<ul style="list-style-type: none"> Electronics and sensors SW safety • Robustness and • Architecture 	<ul style="list-style-type: none"> Technical environmental research Energy management E-storage/control Climate/heating Alternative drives Road traffic system 	<ul style="list-style-type: none"> Lightweight construction Mixed construction CAE in conceptual design FE methods (plastics, bonding technology, metals, etc.) Multidisciplinary optimization Virtual validation 	<ul style="list-style-type: none"> Commercial vehicle emissions Commercial vehicle safety Commercial vehicle dynamics Commercial vehicle logistics and efficiency
Working groups	<ul style="list-style-type: none"> WG 2: Human being as a vehicle driver WG 3: Accident research / bio-mechanics WG 20: Vehicle dynamics 	<ul style="list-style-type: none"> WG 23: EMC WG 31: Electronics and SW 	<ul style="list-style-type: none"> WG 1: Car and environment WG 5: Air-conditioning WG 6: Aerodynamics WG 7: Optimization of the road traffic system WG 10: Battery systems WG 30: Electrical energy 	<ul style="list-style-type: none"> WG 17: Lightweight construction WG 25: Joining technology* WG 27: Simulation methods and virtual validation* 	<ul style="list-style-type: none"> WG 4: Tires of commercial vehicles WG 9: Vehicle dynamics for commercial vehicles* WG 22: Safety of commercial vehicles*

*Plus temporary project groups

Demand-oriented and dynamic

In FAT's subject-specific working groups, experts from the member companies identify current key topics in the industry and derive new research projects from them. Quick decision-making processes guarantee that projects are implemented in a timely manner. More than fifty German research institutions participate in the cooperation. In this way, FAT also promotes the next generation of academically qualified researchers. The German automotive industry has always enjoyed groundbreaking and up-to-date results from its research. Since its foundation, more than 350 research publications have been published.

In order to strengthen the German science and innovation system, it requires close cooperation between the Federal Government, the states, science and industry. FAT's Strategy Group on Research, Innovation and Funding Policy (FIF) takes a holistic approach to cooperation with the various partners, focusing on the transformation of mobility in terms of content.

Within the framework of strategic research planning and funding, a long-term, cross-thematic research roadmap has been developed, which currently extends to the year 2030. To this end, the German automotive industry has defined the key topics of its future research activities – and in doing so has taken into account innovation policy trends in the areas of climate protection, digitalization and social participation. There were seven thematic areas for which the need for action in research and innovation was identified.

It is necessary to take action in seven domains of research and innovation

Drive and vehicle

Energy sources and storage technology

Automated driving and networking

Production

Material and materials

Infrastructure

Mobility and logistics concepts

Research roadmap for the automobility of the future

In cooperation with representatives of the scientific community, these main areas of concern were examined in greater depth and compared with existing funding programs. Future funding needs were also discussed together with political players. This roadmap lays the foundation for the development of a national innovation partnership of the German automotive and supplier industry with the fields of science and politics.



Responsible Supply Chain Initiative



Together with 14 members, the VDA has founded the association “Responsible Supply Chain Initiative RSCI e. V.” The aim here is to establish sustainability more firmly in supply chains.

Sustainability and due diligence measures of companies along the global supply chains are of central importance for the German automotive industry. Legal regulations in this field already take up numerous measures of corporate responsibility in the supply chain. Companies in the automotive sector are aware of their responsibility to act sustainably and fairly.

Within individual working groups of the VDA, various aspects of sustainability in the supply chain have been discussed and promoted for years. The main focus is on social responsibility and human rights as well as occupational health and safety and environmental protection. In order to be able to shed more light on social aspects along global supply chains more decisively and collectively, the participating companies founded the Responsible Supply Chain Initiative (RSCI) e. V. association on their own initiative in October 2021. At the center of the association's work is the review and further development of sustainability performance along supply chains by means of on-site assessments and the corresponding tracking. As of today, 18 companies and associations are

involved in the initiative to verify and establish long-term social and environmental protection standards in supplier companies located worldwide.

An assessment program for continuous improvement

The self-developed assessment program facilitates the sharing of effort, costs and assessment results. This means that multiple audits in supplier companies can be avoided. Here is another advantage: Both clients and suppliers benefit in the long run from the standardized testing and exchange mechanism. Moreover, the aim is to create fundamental transparency about social aspects in supplier companies, to promote them and to raise them to a solid level. Therefore, the assessments take place directly at the production site. The program promotes supplier development and contributes to the continuous improvement of environmental protection and social justice worldwide. In addition, the program supports participating companies in meeting the requirements of legislators, customers and other external stakeholders. In this way, it makes a significant contribution to meeting the obligations of responsibility towards people and the environment.

For the implementation of the developed contents and processes, the RSCI association works together with an experienced program provider from the field of social auditing (Responsible Business Alliance). With the help of a web-based platform, it is possible for clients and suppliers to instruct assessments, which can be carried out both in the form of second party (by business partners) and third party (by external parties) assessments. For both forms of assessments, RSCI sets high quality requirements for auditors to ensure that the results are comparable and equivalent and are widely recognised within the membership.

In June 2022, the Responsible Supply Chain Initiative RSCI e. V. received the “German Award for Sustainability Projects” in the category “Supply Chain.” This appreciation highlights the following: The companies are on the right track when they establish due diligence and provide an important building block for compliance with legal regulations.



The Member Service

In the course of the structural reform of the VDA, the Member Service was founded as a new specialist department. The team bundles all services relevant to member companies. It also looks after new members from start-ups and companies in the digital economy.

The Member Service was founded at the beginning of 2021. Its central task is to support representatives of member companies with formal concerns regarding membership and professional participation in committees. In addition, the team provides support with questions about the use of various services or participation in events.

Membership comes bearing several advantages: Within a short time, the members receive the desired information and the contact to the intended and correct contact persons in the specialist departments. Independent of their associated manufacturer group, members' concerns are dealt with from one central point.

The Member Service was also set up to professionalize the acquisition of new member companies and target groups and to provide external companies with rapid access to the VDA network. Interested entrepreneurs are informed about the conditions of membership and the opportunities for participation in the association. The subsequent joining procedure is practically designed transparently by the core team and supervised step by step.

The team supports new members in finding their way around the association – for example through personal talks, onboarding webinars and special receptions at the IAA.

A variety of offers make it easier to gain a quick understanding of the complex structures of the VDA.

Another main concern of the newly created specialist department is the acquisition of new target groups. For example, companies in the digital economy and start-ups can help shape the future of vehicle mobility as part of the VDA, provided that the conditions set out in the statutes are met.

Acquiring new target groups

In 2021, the staff of Member Services supported a necessary reform of the association's financial architecture. In order to position the VDA for its current and future tasks, the member companies decided on a revised financing concept at an extraordinary general meeting. Thanks to these adjustments, the VDA can continue to be the "strong voice" of the German automotive industry in the future, despite increasingly complex challenges.

For the years 2022 and 2023, the Member Service has developed various measures to promote more exchange among VDA members. These include delegation trips, the Future Tech Day event format, a member portal with additional services and numerous opportunities for personal exchange.

The Members



The VDA brings together all the major companies in the automotive industry in Germany, manufacturers, suppliers and tech and start-up companies. They exchange ideas in numerous committees and working groups, formulate joint positions and thus shape economic policy developments in Germany and Europe.

Ordinary Members

I: Manufacturers group motor vehicles and their engines

ALPINA Burkard Bovensiepen GmbH + Co.

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www.alpina-automobiles.com

AUDI AG

Auto-Union-Straße, 85057 Ingolstadt
Postfach, 85045 Ingolstadt
Tel.: 08241-5005-0, Fax: 08241-5005-155
www.alpina-automobiles.com

Bayerische Motoren Werke AG

Petuelring 130, 80807 München
Postfach, 80788 München
Tel.: 089-382-0, Fax: 089-382-25858
www.bmw.de

Brabus GmbH

Brabusallee, 46240 Bottrop
Tel.: 02041-777-100, Fax: 02041-777-107
www.brabus.com

Daimler Truck AG

Mercedesstr. 120, 70372 Stuttgart
Tel.: 0711-17-0
www.daimler-truck.com

Dr. Ing. h. c. F. Porsche Aktiengesellschaft

Porscheplatz 42, 70435 Stuttgart
Postfach, 70432 Stuttgart
Tel.: 0711-911-0
www.porsche.de

Ford-Werke GmbH

Henry-Ford-Str. 1, 50735 Köln
Postfach, 50725 Köln
Tel.: 0221-90-0, Fax: 0221-90-12641
www.ford.de

Irmscher Automobilbau GmbH & Co. KG

Günther-Irmscher-Str. 14–22
73630 Remshalden
Postfach 11 27, 73624 Remshalden
Tel.: 07151-971-0, Fax: 07151-971-238
www.irmscher.de

Iveco Magirus AG

Nicolaus-Otto-Str. 27, 89079 Ulm
Postfach, 89070 Ulm
Tel.: 0731-408-0, Fax: 0731-408-3199
www.iveco.de

Mansory Design & Holding GmbH

Wunsiedeler Str. 1, 95682 Brand
Tel.: 09236-96820
www.mansory.com

MAN Truck & Bus SE

Dachauer Str. 667, 80995 München
Postfach 50 06 20, 80976 München
Tel.: 089-1580-0, Fax: 089-15039-72
www.mantruckandbus.com

Mercedes-Benz AG

Mercedesstr. 120, 70372 Stuttgart
Tel.: 0711-17-0
www.mercedes-benz.com

Mercedes-Benz Group AG

Mercedesstr. 120, 70372 Stuttgart
Tel.: 0711-17-0
www.daimler.com

Next.e.GO Mobile SE

Campus-Boulevard 30, 52074 Aachen
Tel.: 0241-47574-0
http://www.e-go-mobile.com

Opel Automobile GmbH

Bahnhofplatz 1, 65423 Rüsselsheim
Tel.: 06142-7-72500
06142-7-788924
www.opel.com

RUF Automobile GmbH

Mindelheimer Str. 21, 87772 Pfaffenhausen
Tel.: 08265-911-911, Fax: 08265-911-912
www.ruf-automobile.de

StreetScooter GmbH

Jülicher Str. 191, 52070 Aachen
Tel.: 0241-990023-28, Fax: 0241-990023-26
www.streetscooter.eu

Trasco Bremen GmbH

Zum Panrepel 24, 28307 Bremen
Tel.: 0421-458287-0, Fax: 0421-458287-1000
www.trasco-bremen.de

Traton SE

Dachauer Str. 641, 80995 München
Tel.: 089-3609870
www.traton.com

Volkswagen Aktiengesellschaft

Berliner Ring 2, 38440 Wolfsburg
Postfach, 38436 Wolfsburg
Tel.: 05361-9-0, Fax: 05361-9-28282
www.volkswagen.de

II: Manufacturers group trailers, bodies and buses

AluTeam Fahrzeugtechnik GmbH

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www.aluteam.de

Anhänger- und Fahrzeugbau

Meierling GmbH
Profilstr. 13, 58093 Hagen
Postfach 24 06, 58024 Hagen
Tel.: 02331-9582-0, Fax: 02331-9582-12
www.meierling.de

Bernard Krone Beteiligungs GmbH

Heinrich-Krone-Str. 10, 48480 Spelle
Tel.: 05247-7890207
www.krone.de

Brandt Kühlfahrzeugbau GmbH & Co. KG

Im Wied 9, Halle 9, 32683 Bartrup
Tel.: 05262-9490-0, Fax: 05262-5171
www.brandt-polarus.de

Bott GmbH & Co. KG

Bahnstr. 17, 74405 Gaildorf
Tel.: 07971-251-0, Fax: 07971-251-205
www.bott.de

Carnehl Fahrzeugbau Pattensen GmbH & Co. KG

Johann-Koch-Str. 13, 30982 Pattensen
Tel.: 05101-9198-0, Fax: 05101-9198-0
www.carnehl.eu

Christmann-Fahrzeugbau GmbH & Co. KG

Ludwig-Grebe-Str. 3, 35216 Biedenkopf
Tel.: 06461-89522-0, Fax: 06461-89522-22
www.christmann-fahrzeugbau.de

Dautel GmbH

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www.dautel.de

DHOLLANDIA Deutschland GmbH

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www.dhollandia.net

Doll Fahrzeugbau GmbH

Industriestr. 13, 77728 Oppenau
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www.doll-oppenau.com

Dr.-Ing. Ulrich Esterer GmbH & Co.

Fahrzeugaufbauten und Anlagen KG
Bahnhofstr. 18, 34298 Helsa
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Tel.: 05605-809-0, Fax: 05605-2799
www.esterer.de

EDER GmbH Fahrzeug- und Maschinenbau

Moorweg 5, 83104 Tuntenhausen
Tel.: 08067-9057-0
www.algema.de

Eggers Fahrzeugbau GmbH

Brunnenweg 3, 28816 Stuhr
Postfach 14 37, 28804 Stuhr
Tel.: 0421-89909-0, Fax: 0421-89909-15
www.eggers-fahrzeugbau.de

Erwin Hymer Group SE

Holzstr. 19, 8839 Bad Waldsee
Tel.: 07524-999-0, Fax: 07524-999-480
www.erwinhymergroup.com

EvoBus GmbH

Carl-Zeiss-Str. 2, 89231 Neu-Ulm
Tel.: 0731-1810004, Fax: 0711-1779045193
www.evobus.com

EWERS Karosserie- und Fahrzeugbau GmbH & Co. KG

Jahnstr. 21, 59872 Meschede
Tel.: 0291-9923-0, Fax: 0291-9923-99
www.ewers-online.de

F. X. Meiller Fahrzeug- und Maschinenfabrik GmbH & Co. KG

Ambossstr. 4, 80997 München
Tel.: 089-1487-0, Fax: 089-1487-1355
www.meiller.com

Fahrzeugbau Heinz Böse GmbH

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www.boese-fahrzeugbau.de

Fahrzeugbau Kempf GmbH

Rudolf-Diesel-Str. 4, 56470 Bad Marienberg
Postfach 12 20, 56464 Bad Marienberg
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www.kempf-fahrzeugbau.de

Fahrzeugwerk Bernard KRONE GmbH & Co. KG

Bernard-Krone-Str. 1, 49757 Wertle
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Tel.: 05951-209-0, Fax: 05951-2465
www.krone-trailer.com

Fliegl Fahrzeugbau GmbH

Oberpöllnitzer Str. 8, 07819 Triptis
Tel.: 036482-830-0, Fax: 036482-830-60
www.fliegl.com

Gerd Bär GmbH

Pfaffenstr. 7, 74078 Heilbronn
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www.baer-cargolift.de

G. Magyar GmbH

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www.gmagyar.de

GOFA Gocher Fahrzeugbau GmbH

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Goldhofer Aktiengesellschaft

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www.hundw-nutzfahrzeugtechnik.de

HAKO GmbH – Werk Waltershausen

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www.hmf.dk

Hüffermann Transportsysteme GmbH
Kampehler Str. 10, 16845 Neustadt
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Humbaur GmbH
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www.humbaur.de

HUTTNER Fahrzeugbau GmbH
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Tel.: 08191-91192-0, Fax: 08191-91192-22
www.huttner.de

idem telematics GmbH
Lazarettstr. 4, 80636 München
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www.idemtelematics.com

Junge Fahrzeugbau GmbH
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Karosseriewerk Heinrich Meyer GmbH
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89160 Dornstadt-Tomderdingen
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www.kiesling.de

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Tel.: 08285-88-0, Fax: 08285-88-7905
www.koegel.com

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www.kotschenreuther-fahrzeugbau.de

KRESS Fahrzeugbau GmbH
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www.kress.eu

Kuhlmann – Cars GmbH
Lembecker Str. 17, 46359 Heiden
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www.kuhlmann-cars.de

Langendorf GmbH
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Tel.: 02309-938-0, Fax: 02309-938-191
www.langendorf.de
Lindner & Fischer

Fahrzeugbau GmbH
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www.lindner-fischer.com

Martin Reisch GmbH Fahrzeugbau
Reischstr. 14, 86676 Ehekirchen-Hollenbach
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www.reisch-fahrzeugbau.de

MEUSBURGER Fahrzeugbau GmbH
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www.meusburger.ch

MSG VERWALTUNGS GMBH / ATLAS NORDHESSEN bopp fahrzeug- und baumaschinentechnik
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www.msg-info.de

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Tel.: 06531-503-0, Fax: 06531-7403
www.orten.com

Palfinger Tail Lifts GmbH
Fockestraße 53, 27777 Ganderkesee
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www.palfinger.com

Quantron AG
Koblenzer Str. 2, 86156 Augsburg
Tel.: 0821-789840-0
www.quantron.net

ROHR Spezialfahrzeuge GmbH
Ittlinger Str. 157, 94315 Straubing
Postfach 0101, 94301 Straubing
Tel.: 09421-7305-0, Fax: 09421-7305-80
www.rohr-nfz.com

SAXAS Nutzfahrzeuge Werdau GmbH
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www.saxas.biz

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www.sdg-modultechnik.de

SOMMER GmbH
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Sörensen Hydraulik GmbH
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www.soerensen.de

Spier GmbH & Co. Fahrzeugwerk KG
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Spitzer Silo-Fahrzeugwerke GmbH
Brühlweg 10, 74834 Elztal-Dallau
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www.spitzer-silo.com

III: Manufacturers Group Parts and Accessories

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Tel.: 08024-46041-00
www.3d-mapping.de

3M Deutschland GmbH
Carl-Schurz-Str. 1, 41460 Neuss
Postfach, 41453 Neuss
Tel.: 02131-14-2275, Fax: 02131-14-3134
www.3mdeutschland.de

ABC Umformtechnik GmbH & Co. KG
Kölner Str. 64, 58285 Gevelsberg
Tel.: 02333-799-0, Fax: 02333-799-299
www.abc-umformtechnik.de

Abt Sportsline GmbH
Johann-Abt-Str. 2, 87437Kempten
Tel.: 0831-57140-0, Fax: 0831-72666
www.abt-sportsline.de

Suer Nutzfahrzeugtechnik GmbH & Co. KG
Handelsstr. 5, 42929 Wermelskirchen
Postfach 1580, 42908 Wermelskirchen
Tel.: 02196-946-0, Fax: 02196-946-100
www.suer.de

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Volvo Busse Deutschland GmbH
Oskar-Messter-Str. 20, 85737 Ismaning
Tel.: 089-80074-0, Fax: 089-80074-190
www.volvobusse.de

WALTHER Nutzfahrzeugbau GmbH
Landsberger Str. 26, 04736 Waldheim
Tel.: 034327-625-0, Fax: 034327-625-125
www.walther-gmbh.com

Accumulatorenwerke HOPPECKE Carl Zoellner & Sohn GmbH
Bontkirchener Str. 1, 59929 Brilon
Postfach 1140, 59914 Brilon
Tel.: 02963-61-0, Fax: 02963-61-449
www.hoppecke.com

Accuride Wheels Solingen GmbH
Weyerstr. 112–114, 42697 Solingen
Tel.: 0212-701-1
www accuridecorp.com

ACPS Automotive GmbH
Bertha-Benz-Str. 2, 74379 Ingersheim
Tel.: 07142-9930-0
www.acps-automotive.com

ACPS Automotive Service GmbH
Regioparkring 1, 41199 Mönchengladbach
Tel.: 02166-943980-0, Fax: 02166-943980-100
www.oris-acps.com

WECON GmbH
An der Hansalinie 10, 59387 Ascheberg
Postfach 49, 59380 Ascheberg
Tel.: 02593-921-0, Fax: 02593-921-25
www.wecon.de

WEKA Fahrzeugbau GmbH
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33378 Rheda-Wiedenbrück
Tel.: 05242-5909-0, Fax: 05242-5909-49
www.weka-fahrzeugbau.de

Wilhelm Schwarzmüller KG
Haitzinger Str. 41, 94032 Passau
Tel.: 0851-9594-300, Fax: 0851-9594-340
www.schwarzmueller.com

Wilhelm Wellmeyer Fahrzeugbau GmbH & Co. KG
Auf der Wittenburg 88, 49196 Bad Laer
Tel.: 05424-2975-0, Fax: 05424-2975-75
www.wellmeyer.de

Wilke Fahrzeugbau GmbH
Otto-Hahn-Str. 6, 22946 Trittau
Tel.: 04154-8077-0, Fax: 04154-8077-79
www.wilke-fahrzeugbau.de

ACTS – Advanced Car Technology Systems GmbH & Co. KG
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www.acts.de

add solution GmbH
Brandgehaege 26, 38444 Wolfsburg
Tel.: 05308-40464-21, Fax: 05308-40464-25
www.add-solution.de

Adient Ltd. & Co. KG
Industriestr. 20–30, 51399 Burscheid
Postfach 12 05, 51388 Burscheid
Tel.: 02174-65-0, Fax: 02174-65-100
www.adient.com

Adient Components Ltd. & Co. KG
Hertelsbrunnenring 2, 67657 Kaiserslautern
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www.adient.com

Adval Tech (Germany) GmbH & Co. KG
Hans-Oetiker-Str. 1–5, 79346 Endingen
Tel.: 07642-9018211
www.advaltech.com

Aentron GmbH
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Dornierstr. 21, 82205 Gilching (Postanschrift)
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www.aentron.com

Ahlberg Metalltechnik GmbH
Igo-Etrich-Str. 7, 12487 Berlin
Tel.: 030-6832005-55
www.ahlberg-metalltechnik.de

AIGO-TEC GmbH
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www.aigo-tec.com

A. Kayser Automotive Systems GmbH
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Fax: 05561-7902-2160/2090
www.kayser-automotive.com

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www.akka-automotive.com

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www.alfmeier.de

ALLGAIER Automotive GmbH
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www.allgaier.de

Allison GmbH
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Tel.: 06233-3040-000
www.joiebaby.com
www.nuna.eu

ALLOD Werkstoff GmbH & Co. KG
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Tel.: 09843-98089-0
www.allod.com

Alois Kober GmbH
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www.al-ko.de

ALWA Dekotec GmbH & Co. KG
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www.alwa-dekotec.de

AMK Automotive GmbH & Co. KG
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www.amk-antriebe.de

Antolin Deutschland GmbH
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www.grupoantolin.com

Anton Häring Werk für Präzisionstechnik
Anton-Häring-Str. 1, 78585 Bubsheim
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www.haering-akademie.de

APCB Automotive Plastic Components Berlin GmbH & Co. KG
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www.apc-berlin.jimdo.com

Apex.AI GmbH
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www.apex.ai

APL Automobil-Prüftechnik Landau GmbH
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Apparatebau Kirchheim-Teck GmbH + Co.
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www.ak-teck.de

Aptiv Services Deutschland GmbH
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www.delphi.com

ArcelorMittal Tailored Blanks Bremen GmbH
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www.automotive.arcelmittal.com

Argo AI GmbH
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www.argo.ai

Assmus Metallveredlung GmbH
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www.assmus-gmbh.de

AST (Advanced Sensor Technologies) International GmbH
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www.ast-international.com

ATD-Service Gerhard Pfeifer
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www.adt-service.com

ATEQ Gesellschaft für Messtechnik mbH
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www.ateq.de

ATERA GmbH
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www.atera.de

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www.atotech.com

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www.lindenberg-ael.de

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www.autins.com

AUTOLIV B.V. & Co. KG
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www.autoliv.com

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www.automotive-ai.com

Automotive Lighting Reutlingen GmbH
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www.al-lighting.com

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www.autoneum.com/de

AVL Schrick GmbH
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www.avl-schrick.com

AVL Software and Functions GmbH
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www.avl-functions.com

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www.axaltacs.com

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www.baier-michels.de

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www.baselabs.de

BASF Catalysts Germany GmbH
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www.catalysts.basf.com

BASF Polyurethanes GmbH
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Postfach 11 40, 49440 Lemförde
Tel.: 05443-12-0, Fax: 05443-12-2201
www.pu.basf.de

Bender GmbH & Co. KG
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Tel.: 06401-807-0
www.bender.de

BENSELER Oberflächentechnik GmbH & Co. KG
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www.benseler.de

Benteler Automobiltechnik GmbH
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www.benteler.de

Bertrandt AG
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www.bertrandt.com

Best4Tires GmbH
Talstr. 1–3, 56316 Raubach
Tel.: 0171-3084601
www.reifengundlach.de

Bharat Forge CDP GmbH
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Postfach 14 42, 58243 Ennepetal
Tel.: 02333-796-0, Fax: 02333-796-388
www.bharatforge-gh.com

BING Power Systems GmbH
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www.bingpower.de

BJ Automotive GmbH
Hafenstr. 113, 59067 Hamm
Postfach 12 69, 59002 Hamm
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www.bjautomotive.de

Bock GmbH
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Postfach 11 61, 72632 Frickenhausen
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www.bock.de

Bode – Die Tür GmbH
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Tel.: 0561-5009-0, Fax: 0561-54943
www.schaltbau-bode.com

BÖGRA Technologie GmbH
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www.boegra.com

BOGE Elastmetall GmbH
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www.boge-rubber-plastics.com

BOHAI TRIMET Automotive Holding GmbH
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www.trimet.de

BORBET GmbH
Hauptstr. 5, 59969 Hallenberg
Tel.: 02984-301-0, Fax: 02984-301-110
www.borbet.de

Borealis Polymere GmbH
Haiminger Str.1, 84489 Burghausen
Tel.: 08677-977-0
www.borealisgroup.com

BorgWarner Cooling Systems GmbH
Planckstr. 4+6, 88677 Markdorf
Postfach 11 40, 88669 Markdorf
Tel.: 07544-969-0, Fax: 07544-969-220
www.borgwarner.com

BorgWarner Ludwigsburg GmbH
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Tel.: 07141-132-0, Fax: 07141-132-350
www.beru.com

BorgWarner Transmission Systems GmbH
Hockenheimer Str. 165–167, 68775 Ketsch
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www.borgwarner.com

BorgWarner Turbo Systems GmbH
Mannheimer Straße 85–87
67292 Kirchheimbolanden
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Tel.: 06352-403-5800, Fax: 06352-403-1866
www.borgwarner.com

BorgWarner Turbo Systems Engineering GmbH
Mannheimer Str. 85–87
67292 Kirchheimbolanden
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Tel.: 06352-403-0, Fax: 06352-403-2729
www.borgwarner.com

Bourns Electronics GmbH
Eschenstr. 5, 82024 Taufkirchen
Tel.: 089-809090-0, Fax: 089-809090-109
www.bourns.com

BPW Bergische Achsen Kommanditgesellschaft
Ohlerhammer, 51674 Wiehl
Postfach 12 80, 51656 Wiehl
Tel.: 02262-78-0, Fax: 02262-78-1516
www.bpw.de

Brain of Materials AG
Schwalmstr. 301, 41238 Mönchengladbach
Tel.: 02161-6865-0
www.brainofmaterials.com

Brembo SGL Carbon Ceramic Brakes GmbH
Werner-von-Siemens-Str. 18, 86405 Meitingen
Tel.: 08271-830, Fax: 08271-2127
www.brembosgl.com

BREMSKERL-REIBBELAGWERKE EMMERLING GMBH & Co. KG
Brakenhof 7, 31629 Estorf
Postfach 18 60, 31568 Nienburg
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www.bremskerl.de

Brockhaus Stahl GmbH
Kahley 10–18, 58840 Plettenberg
Postfach 3209, 58821 Plettenberg
Tel.: 02391-6067-0, Fax: 02391-6067-130
www.brockhaus.com

Brose Fahrzeugteile SE & Co. KG, Coburg
Max-Brose-Str. 1, 96450 Coburg
Postfach 13 53, 96403 Coburg
Tel.: 09561-21-0, Fax: 09561-21-1429
www.brose.de

Bühler Motor GmbH
Anne-Frank-Str. 33–35, 90459 Nürnberg
Postfach 45 01 55, 90212 Nürnberg
Tel.: 0911-4504-0, Fax: 0911-454626
www.buehlermotor.de

Carcoustics International GmbH
Neuenkamp 8, 51381 Leverkusen
Tel.: 02171-900-0, Fax: 02171-900-890
www.carcoustics.com

CARIAD SE
Berliner Ring 2, 38440 Wolfsburg
Tel.: 0561-490-2570
https://cariad.technology

Carl Stahl GmbH & Co. KG Gurt- und Bandweberei
Anhauser Straße 7, 89542 Herbrechtingen
Postfach 12 54, 89539 Herbrechtingen
Tel.: 07324-9604-0, Fax: 07324-9604-20
www.stahl-gurte.de

CCL Design GmbH
Lindgesfeld 26–27, 42653 Solingen
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www.ccl-design.com

CCL Design Stuttgart AG
Carl-Benz-Str. 4, 71154 Nufringen
Tel.: 07034-9340-0, Fax: 07034-9340-11
www.ccl-design.com

Celerity DRS GmbH
Lise-Meitner-Str. 40, 45659 Recklinghausen
Tel.: 02361-3068-49-14
www.celeritydrs.com

cellcetric GmbH & Co. KG
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Tel.: 07021-89-0
www.cellcetric.net

Cerence GmbH
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Tel.: 0221-35559-0
www.cerence.com

Clarios Germany GmbH & Co. KG
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www.clarios.com

Coats Thread Germany GmbH
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Computer Rock GmbH
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Tel.: 040-6963274-00
www.computerrock.com

Constellium Singen GmbH
Alusingen-Platz, 78221 Singen
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www.constellium.com

Contemporary Amperex Technology Thuringia GmbH (CATT)
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www.catl.com/en/

Continental AG
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www.conti-online.com

Cooper Standard Automotive GmbH
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www.cooperstandard.com

Corning GmbH
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www.corning.com

Coroplast Fritz Müller GmbH & Co. KG
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www.coroplast.de

Coventya GmbH
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www.coventya.com

CQLT Saargummi Deutschland GmbH
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www.saargummi.com

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www.csi-online.de

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www.culimeta-automotive.de

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www.cybex-online.com

Daikin Chemical Europe GmbH
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www.daikinchem.de

DBK David + Baader GmbH
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www.dbk-group.de

DBW Advanced Fiber Technologies GmbH
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Tel.: 05594-801-0, Fax: 05594-801-26
www.dbw.de

DELFINGEN DE – Hassfurt GmbH
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www.delfingen.com

DENSO Automotive Deutschland GmbH
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www.denso-europe.com

Desay SV Automotive Europe GmbH
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www.wallstabe-schneider.de

Diehl Metal Applications GmbH
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www.diehl.de

digades GmbH
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www.digades.com

Dörken Coatings GmbH & Co. KG
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www.doerken.de

Dometic WAECO International GmbH
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www.waeco.de

Donaldson Filtration GmbH
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www.donaldson.com

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www.dspace.com

EBK Krüger GmbH & Co. KG
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www.eberspaecher.com

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www.eb-bruehl.com

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www.eissmann.com

Elektrobit Automotive GmbH

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www.elringklinger.de

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www.ernst-hagen.de

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ETO MAGNETIC GmbH

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Tel.: 07771-809-0, Fax: 07771-809-9155
www.etogroup.com

European Trailer Systems GmbH

Im Moerser Feld 1f, 47441 Moers
Tel.: 02841-6070-700, Fax: 02841-6070-777
www.edschaTS.com

Eugen Klein GmbH

Parkstr. 27–29, 73734 Esslingen
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Tel.: 0711-38005-12, Fax: 0711-38005-49
www.klein-gelenkwellen.de

Exide Technologies GmbH

Im Thiergarten, 63654 Büdingen
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Tel.: 06042-81-0, Fax: 06042-81-538
www.exide.de

Expleo Germany GmbH

Wilhelm-Wagenfeld-Str. 1–3, 80807 München
Tel.: 089-608090-0
www.expleogroup.com

FAS GmbH

Käthe-Paulus-Str. 6, 85092 Kösching
Tel.: 08456-9231-200
www.fahrerassistenzsysteme.de

Faurecia Automotive GmbH

Nordsehler Str. 38, 31655 Stadthagen
Tel.: 05721-702-1333, Fax: 05721-702-1334
www.faurecia.com

Faurecia Autositze GmbH

Garbsener Landstr. 7, 30419 Hannover
Tel.: 05721-702-0, Fax: 05721-702-370
www.faurecia.com

Faurecia Emissions Control Technologies, Germany GmbH

Biberbachstr. 9, 86154 Augsburg
Tel.: 0821-4103-0, Fax: 0821-4103-350
www.faurecia.com

Federal-Mogul Aftermarket GmbH

Mörikestr. 120, 71636 Ludwigsburg
Tel.: 07141-48808-0
www.federalmogul.com

Federal-Mogul Burscheid GmbH

Bürgermeister-Schmidt-Str. 17
51399 Burscheid
Postfach 12 20, 51388 Burscheid
Tel.: 02174-69-0, Fax: 02174-69-1490
www.federal-mogul.com

Federal-Mogul Friction Products GmbH

Otto-Hahn-Str. 26, 65520 Bad Camberg
Tel.: 02264-89-0, Fax: 02264-89-292
www.federal-mogul.com

Federal-Mogul Holding Deutschland GmbH

Stielstr. 11, 65201 Wiesbaden
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Tel.: 0611-201-0, Fax: 0611-201-482
www.federal-mogul.com

Federal-Mogul Nürnberg GmbH

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www.federal-mogul.com

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www.federal-mogul.com

Feintool System Parts Jena GmbH

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www.feintool.com

Felss Group GmbH

Dieselstr. 2, 75203 Königsbach-Stein
Tel.: 07232-402-0
www.felss.com

FEP Fahrzeugelektrik Pirna GmbH & Co. KG

Hugo-Küttner-Str. 8, 01796 Pirna
Tel.: 03501-514-0, Fax: 03501-514-292
www.fepz.de

FERCHAU Automotive GmbH

Steinmüllerallee 2, 51643 Gummersbach
Tel.: 02261-40582-0, Fax: 02261-40582-19
www.ferchau.com/go/automotive

FEUER powertrain GmbH & Co. KG

Rothenburgstr. 27, 99734 Nordhausen
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www.feuer-pt.de

FEURER Febra GmbH

Klingenberger Str. 2, 74336 Brackenheim
Tel.: 07135-176-0, Fax: 07135-176-227
www.feurer.com

FEV Europe GmbH

Neuenhofstr. 181, 52078 Aachen
Tel.: 0241-5689-0, Fax: 0241-5689-119
www.fev.com

fischer automotive systems GmbH & Co. KG

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Tel.: 07443-12-5500, Fax: 07443-12-8666
www.fischer.de

Fischer & Kaufmann GmbH & Co. KG

Am Steinwerk 7, 57413 Finnentrop
Tel.: 02721-519-0, Fax: 02721-519-27
www.fiuka.de

FLABEG Automotive Germany GmbH

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Tel.: 0911-96456-0, Fax: 0911-96456-451
www.flabeg.com

Flex Automotive GmbH

Arthur-B.-Modine-Str. 1, 70794 Filderstadt
Tel.: 0711-80669-0, Fax: 0711-80669-204
www.flextronics.com

Flex-N-Gate Germany GmbH

Nördlicher Grünnauer Str. 21
86633 Neuburg/Donau
Tel.: 0841-49049-0, Fax: 0841-49049-49
www.flex-n-gate.com

Formel D GmbH

Schanzenstr. 6–20, 51063 Köln
Tel.: 0221 67006-0
www.formeld.com

Frauenthal Airtank Elterlein GmbH

Scheibenberger Str. 45, 09481 Elterlein
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www.fta-group.com

Freudenberg FST GmbH

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www.fst.de

FRIEDRICH BOYSEN GmbH & Co. KG

Friedrich-Boysen-Str.14–17, 72213 Altensteig
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www.boysen-online.de

Friedrich Graepel Aktiengesellschaft

Zeisigweg 2, 49624 Lönningen
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Tel.: 05432-85-0, Fax: 05432-2054
www.graepel.de

FRIGOBLOCK GmbH

Weidkamp 274, 45356 Essen
Tel.: 0201-61301-0
www.frigoblock.com

Fritz Winter Eisengießerei GmbH & Co. KG

Albert-Schweitzer-Str. 15, 35260 Stadtallendorf
Tel.: 06428-78-217, Fax: 06428-78-6211
www.fritzwinter.de

FTE automotive GmbH

Andreas-Humann-Str. 2, 96106 Ebern
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Tel.: 09531-81-0, Fax: 09531-81-3377
www.fte.de

Garrett Motion Germany GmbH

Böblinger Str. 17, 71101 Schönaich
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Gates GmbH

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www.gates.com

GEDIA Gebrüder Dingerkus GmbH

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www.gedia.com

Gelenkwellenwerk Stadtilm GmbH

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www.gewes.de

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www.gentex.com

Gentherm GmbH

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www.gentherm.com

Georg Fischer Automobilguss GmbH

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www.automotive.georgfischer.com

Georgsmarienhütte GmbH

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www.gmh.de

Gersfelder Metallwaren GmbH

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www.gersfelder-metallwaren.de

Gesenkschmiede Schneider GmbH

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www.gsa-aalen.de

Gestamp Umformtechnik GmbH

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www.gestamp-umformtechnik.de

gestigon GmbH

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www.gestigon.com

GIGANT GmbH

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www.gigant-group.com

GKN Driveline Deutschland GmbH
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www.gkndriveline.com

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www.graepel.de

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www.grammer.com

Graphmasters GmbH
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www.graphmasters.net

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www.gruener-systemtechnik.de

Gummifabrik Lubeca GmbH & Co. TeGu KG
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www.gummifabrik-lubeca.de

Hänsch Warnsysteme GmbH
Schützenstr. 21–25, 49770 Herzlake
Postfach 48, 49768 Herzlake
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www.fg-haensch.de

Haldex Brake Products GmbH
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www.haldex.com

Hanon Systems Deutschland GmbH
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http://www.hanonsystems.com/En

Hans Berg GmbH & Co. KG
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www.berg-kg.de

Harman Becker Automotive Systems GmbH
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www.mybecker.com

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www.harting.com

HBPO GmbH
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www.hbpogroup.com

HEAD acoustics GmbH
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Tel.: 02407-577-0
www.head-acoustics.com

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www.helag-electronic.de

HELBAKO GmbH
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Postfach 10 03 65, 42568 Heiligenhaus
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www.helbako.de

Hella GmbH & Co. KGaA
Rixbecker Str. 75, 59552 Lippstadt
Tel.: 02941-38-0, Fax: 02941-38-7133
www.hella.de

HellermannTyton GmbH
Großer Moorweg 45, 25436 Tornesch
Postfach 21 51, 25437 Tornesch
Tel.: 04122-701-1, Fax: 04122-701-400
www.hellermanntyton.de

HEMSCHIEDT Fahrwerktechnik GmbH & Co.
Leichtmetallstr. 7, 42781 Haan-Gruiten
Tel.: 02104-9685-0, Fax: 02104-9685-41
www.hemscheidt.de

Hengst SE
Nienkamp 55–58, 48147 Münster
Tel.: 0251-20202-0, Fax: 0251-20202-900
www.hengst.de

Henkel AG & Co. KGaA
Henkel Teroson Str. 57, 69112 Heidelberg
Postfach Nr, 69112 Heidelberg
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www.henkel.com

Heraeus Deutschland GmbH & Co. KG
Heraeusstr. 12–14, 63450 Hanau
Postfach 15 53, 63405 Hanau
Tel.: 06181-35-5462, Fax: 06181-35-165610
www.wc-heraeus.com

HERE Germany GmbH & Co. KG
Am Kronberger Hang 8,
65824 Schwalbach am Taunus
Tel.: 06196-589-300, Fax: 06196-589-333
www.here.com

Herth + Buss Fahrzeugteile GmbH & Co. KG
Dieselstr. 2–4, 63150 Heusenstamm
Postfach 13 52, 63131 Heusenstamm
Tel.: 06104-608-0, Fax: 06104-65075
www.herthundbuss.com

HEW-KABEL GmbH
Klingsiepen 12, 51688 Wipperfurth
Tel.: 02267-683-0
www.hew-kabel.com

Hexagon Purus GmbH
Otto-Hahn-Str. 5, 34123 Kassel
Tel.: 0561-58549-0
www.hexagonpurus.com

Hirschmann Car Communication GmbH
Stuttgarter Str. 45–51,
72654 Neckartenzlingen
Tel.: 07127-14-0, Fax: 07127-14-1060
www.hirschmann-car.com

Hirschvogel Holding GmbH
Dr.-Manfred-Hirschvogel-Str. 6,
86920 Denklingen
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www.hirschvogel.com

Hitachi Astemo Aftermarket Germany GmbH
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www.hueco.com

Hitachi Astemo Heilbronn GmbH
Theresienstr. 2, 74072 Heilbronn
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www.hitachiastemo.com

HJS Emission Technology GmbH & Co. KG
Dieselweg 12, 58706 Menden
Postfach 28 60, 58688 Menden
Tel.: 02373-987-101, Fax: 02373-987-105
www.hjs.com

HOERBIGER Antriebstechnik Holding GmbH
Bernbeurener Str. 13, 86956 Schongau
Postfach 12 41, 86952 Schongau
Tel.: 08861-2566-0, Fax: 08861-2566-2221
www.hoerbiger.com

HOERBIGER Elektronik GmbH & Co. KG
Justinus-Kerner-Str. 7, 72119 Ammerbuch
Tel.: 07073-9198-0, Fax: 07073-9198-140
www.hoerbiger.com

Hörmann Automotive Wackersdorf GmbH
Arthur-B.-Modine-Str. 2, 92442 Wackersdorf
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www.hoermann-module.eu

hofer powertrain GmbH
Ohmstr. 15, 72622 Nürtingen
Tel.: 07022-217884-0, Fax: 07022-217884-129
www.hofer.de

Honasco Kunststofftechnik GmbH & Co. KG
Werkstr. 3–7, 32107 Bad Salzufen
Tel.: 05222-9480-210, Fax: 05222-9480-280
www.honasco.de

Holzapfel Metallveredlung GmbH
Unterm Ruhenstein 1, 35764 Sinn
Tel.: 02772-5008-0, Fax: 02772-5008-66
www.holzapfel-group.com

Hornschuch Stolzenau GmbH
Große Brinkstr. 12, 31592 Stolzenau
Tel.: 05761-930-0, Fax: 05761-930-401
www.continental-industry.com/ de/Solutions/
Surface-Materials

HPP high performance production GmbH
Salinenstr. 38–44, 74177 Bad Friedrichshall
Tel.: 07136-9634-0, Fax: 07136-9634-230
www.boellinger-group.de

Huber Automotive AG
Industrie- und Businesspark 213.02,
73347 Mühlhausen
Tel.: 07335-9206-0, Fax: 07335-9206-292
www.huber-group.com

HÜBNER GmbH & Co. KG
Heinrich-Hertz-Str. 2, 34123 Kassel
Postfach 101920, 34019 Kassel
Tel.: 0561-998-0, Fax: 0561-998-1515
www.hubner-germany.com

Huf Baolong Electronics Bretten GmbH
Gewerbestr. 40, 75015 Bretten
Tel.: 07252-970-0
www.bh-sens.com

Huf Hülsbeck & Fürst GmbH & Co. KG
Steeger Str. 17, 42551 Velbert
Postfach 10 04 80, 42504 Velbert
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www.huf-group.com

HUNGER GmbH & Co. KG Werke für Fahrzeugbau
Chemnitzer Str. 61a, 09669 Frankenberg
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www.hunger-hydraulik.de

Hutchinson GmbH
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www.hutchinson.de

HYDAC ELECTRONIC GMBH
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www.hydac.com

IAC Group GmbH
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Tel.: 0211-44778-0, Fax: www.iacgroup.com

IAV GmbH
Carnotstr. 1, 10587 Berlin
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www.iav.de

IDEAL Automotive GmbH
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www.ideal-automotive.com

IFA Powertrain GmbH & Co. KG
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www.ifa-rotorion.com

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www.iinovis.com

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www.imat-uve.de

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www.infineon.com

INOTEC Barcode Security GmbH
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www.inotec.de

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Intel Deutschland GmbH
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iSi Automotive Berlin GmbH

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www.isi.com

Isolite GmbH

Industriestr. 125, 67063 Ludwigshafen a. R.
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www.isolite.de

ITW Fastener Products GmbH

Liegnitzer Straße 1, 58642 Iserlohn
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www.itw-fasteners.com

iwis mobility systems GmbH & Co. KG

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www.iwis.com

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www.erich-jaeger.de

Jahn Interprof GmbH

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www.jahn-interprof.com

Johann Borgers GmbH

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www.borgers.de

Johnson Matthey Catalysts (Germany) GmbH

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www.johnson-matthey.de

Jokon GmbH

Rosenbach 42, 53229 Bonn
Tel.: 0228-97764-0, Fax: 0228-97764-77
www.jokon.de

Jost-Werke Deutschland GmbH

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www.jost-world.com

JOYNEXT GmbH

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www.joynext.com

Joyson Safety Systems

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KACO GmbH + Co. KG Dichtungstechnik

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KAMAX Automotive GmbH

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www.kamei.de

Karosseriewerke Dresden GmbH

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www.kwdag.com

KAUTEX TEXTRON GmbH & Co. KG

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KBE Elektrotechnik GmbH

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www.kendrion.com

Kendrion Kuhnke Automation GmbH

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www.kendrion.com/automotive/passenger-cars/de/

Hugo Kern und Liebers GmbH & Co. KG

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www.kern-liebers.de

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www.kesseboehmer.com

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www.kht-fahrzeugteile.de

KICO GmbH

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Kiekert AG

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www.kienzle-argo.de

KIPP GmbH & Co. KG

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Tel.: 02371-211-0, Fax: 02371-211-212
www.kirchhoff-gruppe.de

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Postfach 70 10 47, 81310 München
Tel.: 089-7876-200, Fax: 089-7876-333
www.klueber.com

KLT Hummel-Plastic GmbH

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Postfach 41 45, 97409 Schweinfurt
Tel.: 09721-7666-0, Fax: 09721-7666-800
www.klt.de

Knauf Interfer Aluminium GmbH

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www.knauf-interfer.com

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www.gessmann.de

KNORR-BREMSE AG

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Postfach 40 10 60, 80710 München
Tel.: 089-3547-0, Fax: 089-3547-2767
www.knorr-bremse.com

Koch-CableTec GmbH

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Tel.: 07151-20774-0
www.koch-cabletec.com

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www.koe-chemie.de

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Königstr. 1, 76571 Gaggenau
Postfach 13 60, 76553 Gaggenau
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www.koenigmetall.com

Kohl & Hwang GmbH

Limburger Str. 19, 61462 Königstein/Ts.
Tel.: 06174-2555-11, Fax: 06174-2555-12
www.kohl-and-hwang.com

Konrad Hornschuch AG

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Tel.: 07947-81-0
www.skai.com/de/

Kontrol DE GmbH

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www.kontrol.tech

KONVEKTA AG

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www.konvekta.com

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www.konvekta.com

Kopernikus Automotive GmbH

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www.kopernikusauto.com

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www.kostal.com

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www.koyo.eu

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Tel.: 08638-9810-0
www.kraiburg-tpe.com

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www.kasiglas.de

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www.rheinmetall-automotive.com

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www.kolbenschmidt.de

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www.kuester.net

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www.kb-backhaus.com

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www.kwlz.de

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www.laepple.de

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www.lf-t.net

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www.leist.de

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www.leoni.com

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www.liangdao.de

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www.licostrucktec.com

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www.lisi-automotive.com

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www.bix.gmbh

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www.lawo.info

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www.magna.com

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www.behrgroup.com

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www.halla.com/en/index.jsp

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und Fertigungstechnik**

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www.magnetimarelli.com

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Martinrea Bergneustadt GmbH

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www.maswer.com

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www.matholdingsinc.com

Matrickz GmbH

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Tel.: 089-32668-700
www.matrickz.de

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www.mayser.de

MEKRA Lang GmbH & Co. KG

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www.mekra.de

Mektec Europe GmbH

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www.mektec.de

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Tel.: 02739-8957-0, Fax: 02739-8957-577
www.meleghyautomotive.de

Melexis GmbH

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www.melexis.com

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Postfach 9, 71561 Affalterbach
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www.mercedes-amg.com

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Tel.: 06151-72-0
www.merckgroup.com

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www.mertens-gruppe.de

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www.biebighauser.de

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www.mft-cunewalde.de

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www.miba.com/DE/Produktbereiche

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Michelinstr. 4, 76185 Karlsruhe
Postfach 21 09 51, 76159 Karlsruhe
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www.michelin.de

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Tel.: 03378-880-4611
www.microvast.com

mine&make GmbH
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Tel.: 0151-15628810
www.mineandmake.com

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www.mitsubishielectric.com

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Frankfurter Str. 60–68, 65760 Eschborn
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www.mobisparts.eu
www.mobistc-europe.com

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www.modis.com

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www.motherson-orca.com

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www.msi-motor-service.com

msg systems AG
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www.msg.group

MSSC Ahle GmbH
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www.ahle-federn.de

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98673 Auengrund OT Merbelsrod
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www.nidec-gpm.com

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Postfach, 41456 Neuss
Tel.: 02131-520-01, Fax: 02131-520-645
www.rheinmetall-automotive.com

Pierburg Pump Technology GmbH
Alfred-Pierburg-Str. 1, 41460 Neuss
Postfach 10 10 62, 41410 Neuss
Tel.: 02131-5230-01, Fax: 02131-5230-2050
www.rheinmetall-automotive.com

Pilkington Automotive Deutschland GmbH
Otto-Seeling-Str. 7, 58455 Witten
Postfach 13 09, 58403 Witten
Tel.: 02302-582-0, Fax: 02302-582-399
www.pilkington.com

Plastic Omnium Auto Components GmbH
Walter-Gropius-Str. 17, 80807 München
Tel.: 089-12177-0, Fax: 089-12177-150
www.plasticomnium.com

Plastic Omnium Auto Inergy Germany GmbH
Dornhofstr. 100, 63263 Neu-Isenburg
Tel.: 08781-209-0
www.plasticomnium.com

Porsche Engineering Services GmbH
Etzelstr. 1, 74321 Bietigheim-Bissingen
Tel.: 0711-911-84025
www.porsche-engineering.com

Power-Cast Zitzmann GmbH & Co. KG
Industriestr. 2, 96342 Stockheim
Postfach 12 62, 96339 Stockheim
Tel.: 09265-809-0, Fax: 09265-809-10
www.power-cast.com

Preh GmbH
Schweinfurter Str. 5–9,
97616 Bad Neustadt
Tel.: 09771-92-0, Fax: 09771-92-105
www.preh.com

PROFIL-Verbindungstechnik GmbH & Co. KG
Otto-Hahn-Str. 22–24, 61381 Friedrichsdorf
Postfach 48, 61371 Friedrichsdorf
Tel.: 06175-799-0, Fax: 06175-7794
www.profil.eu

Promotives GmbH
Reginbaldstr. 28, 81247 München
Tel.: 0178-5446166
www.promotives.de

PTV Planung Transport Verkehr AG
Haid-und-Neu-Str. 15, 76131 Karlsruhe
Tel.: 0721-9651-0, Fax: 0721-9651-699
www.ptvgroup.com

Purem GmbH
Homburger Str. 95, 66539 Neunkirchen
Postfach 11 24, 66511 Neunkirchen
Tel.: 06821-183-0, Fax: 06821-183-999
www.purem.com

Putsch GmbH & Co. KG
Jahnstr. 1, 70597 Stuttgart
Tel.: 0631-418-0
www.recaro-cs.com

PWG Profilrollen-Werkzeugbau GmbH
Industriestr. 4, 96524 Föriztal
Tel.: 036764-818-0
www.pwgnet.de

PWO Progress-Werk Oberkirch AG
Industriestr. 8, 77704 Oberkirch
Postfach 13 44, 77697 Oberkirch
Tel.: 07802-84-0, Fax: 07802-84-273
www.progress-werk.de

RAPA Automotive GmbH & Co. KG
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www.rapa.com

RECARO Automotive GmbH
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Tel.: 07021-93-5000, Fax: 07021-93-5339
www.recaro.com

redi-Group GmbH
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www.redi-group.com

Reflexallen Deutschland GmbH
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Fax: 0042-051-754-6033
www.Reflexallen.com

REHAU Automotive SE & Co. KG
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Tel.: 09283-77-0, Fax: 09283-1016
www.rehau-automotive.com

REINZ-Dichtungs-GmbH
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www.reinz.de

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www.rheinmetall-automotive.com

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www.rle.international

RMIG Nold GmbH
Am Katzloch 1, 64589 Stockstadt am Rhein
Tel.: 06158-821-0, Fax: 06158-821-200
www.rmig.com

Robert Bosch Automotive Steering GmbH
Richard-Bullinger-Str. 77
73527 Schwäbisch Gmünd
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www.bosch-automotive-steering.com

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70839 Gerlingen-Schillerhöhe
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www.bosch.de

Röchling Automotive SE & Co. KG
Richard-Wagner-Str. 9, 68165 Mannheim
Tel.: 0621-44055-0, Fax: 0621-44055-355
www.roechling-automotive.com

Roof Systems Germany GmbH
Albert-Einstein-Str. 14–20, 63128 Dietzenbach
Tel.: 06074-4833-0, Fax: 06074-4833-500
www.intevaproducts.com

Rosenberger Hochfrequenztechnik GmbH & Co. KG
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Tel.: 07321-9669-30, Fax: 07321-9669-66
www.rosenberger.de

RT-Lasertechnik GmbH
Ferdinand-Braun-Str. 2,
33378 Rheda-Wiedenbrück
Tel.: 02522-92039-0
www.rt-lasertechnik.de

RUD Ketten Rieger & Dietz GmbH u. Co. KG
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www.rud.de

Rupf Automotive GmbH
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www.rupf-industries.com

SAF-HOLLAND GmbH
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www.saf-achsen.de

SAINT-GOBAIN SEKURIT Deutschland GmbH
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www.saint-gobain-sekurit.com

Schaeffler Automotive Bühl GmbH & Co. KG
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www.schaeffler.de/content.schaeffler.de/de/index.jsp

Schaeffler Engineering GmbH
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www.schaeffler-engineering.com

Schaeffler Technologies AG & Co. KG
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www.schaeffler.com

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www.scheid-automotive.com

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www.scherdel.de

SCHERDEL Marienberg GmbH
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Postfach 22, 09491 Marienberg
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www.scherdel.de

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www.stplettenberg.de

Schmitter Group GmbH
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www.schmittergroup.de

SCHRAMM Coatings GmbH
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www.schramm-coatings.de

Schreiner Group GmbH & Co. KG
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www.schreiner-online.com

Schürholz GmbH & Co. KG
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www.schuerholz-stanzen.de

Schunk Sintermetall GmbH
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www.sintermetalltechnik.com

Schwering & Hasse Elektrodraht GmbH
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www.sh-elektrodraht.de

secunet Security Networks AG
Kurfürstenstr. 58, 45138 Essen
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www.secunet.com

SEEGER-ORBIS GmbH
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www.seeger-orbis.de

SEG Automotive Germany GmbH
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www.seg-automotive.com

SEGULA Technologies GmbH
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www.segulatechnologies.com

Selzer Fertigungstechnik GmbH & Co. KG
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www.selzer-automotive.de

Sero GmbH
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www.sero.de

SHW AG
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Postfach 3280, 73414 Aalen-Wasseraalfingen
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www.shw.de

Siemens AG
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www.siemens.com/automotive

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www.sika-automotive.de

Silver Atena GmbH
Dachauer Str. 655, 80995 München
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www.silver-atenade

siOPTICA GmbH

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Tel.: 03641-2337663
www.sioptica.com

SKF GmbH

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Postfach, 97419 Schweinfurt
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www.skf.com

SMARTRAC Specialty GmbH

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Tel.: 02265-9919-0, Fax: 02265-9919-11
www.smartrac-group.com

smk systeme metall kunststoff GmbH & Co. KG

Am smk-Kreisel 1, 70794 Filderstadt
Tel.: 0711-77866-0, Fax: 0711-7776658
www.smk-systeme.de

s.m.s, smart microwave sensors GmbH

In den Waashainen 1, 38108 Braunschweig
Tel.: 0531-39023-0
www.smartmicro.com

Snop Automotive Cologne GmbH

Eiler Str. 3g, 51107 Köln
Tel.: 02202-103-0
www.snop.eu

SPRINGFIX Befestigungstechnik GmbH

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www.springfix.de

Stabilus GmbH

Walersheimer Weg 100, 56070 Koblenz
Tel.: 0261-8900-0, Fax: 0261-8900-204
www.stabilus.com

Stahl- und Drahtwerk Röslau GmbH

Hofer Str. 16/17, 95195 Röslau
Tel.: 09238-809-0, Fax: 09238-809-716
www.roeslau-draht.com

STRÄHLE+HESS GmbH

Im Langen Löchle 4, 75382 Althengstett
Tel.: 07051-1302-0, Fax: 07051-1302-35
www.straehle-hess.de

SUMIDA flexible connections GmbH

Agathe-Zeis-Str. 5, 01454 Radeberg
Tel.: 03528-4040-30, Fax: 03528-4040-40
www.sumida-flexcon.com

SumiRiko AVS Germany GmbH

Karl-Winnacker-Str. 19
36396 Steinau an der Straße
Tel.: 06663-9128-0, Fax: 06663-9128-4100
www.avs.sumiriko.com

Superior Industries Production Germany GmbH

Gustav-Kirchhoff-Str. 10, 67098 Bad Dürkheim
Tel.: 06322-9899-6207
www.supind.com

SUSI & James GmbH

Walter-Bothe-Str. 12, 68169 Mannheim
Tel.: 06213188850
www.susianjames.com

Tajco Germany GmbH

Leinfelderstr. 60
70771 Leinfelden-Echterdingen
Tel.: 0171-5370-729, Fax: 0711-220474-90
www.tajco.biz

TD Deutsche Klimakompressor GmbH

Weißiger Str. 6, 02994 Bernsdorf
Tel.: 035723-94-300, Fax: 035723-94-600
www.tddk.de

Technoform Kunststoffprofile GmbH TKP

Otto-Hahn-Str. 34, 34253 Lohfelden
Tel.: 0561-9583-900, Fax: 0561-9583-921
www.tkp.biz

TECOSIM Technische Simulation GmbH

Gutenbergplatz 1, 65187 Wiesbaden
Tel.: 0611-20568421
www.tecosim.com

TE Connectivity Germany GmbH

Ampèrestr. 12–14, 64625 Bensheim
Tel.: 06251-133-0
www.te.com

Tekfor Holding GmbH

Hinterer Bahnhof 17, 77756 Hausach
Tel.: 07831-808-0, Fax: 0781-93222-105
www.tekfor.com

TENNECO GmbH

Luitpoldstr. 83, 67480 Edenkoben
Postfach 1 00, 67477 Edenkoben
Tel.: 06323-47-0, Fax: 06323-47-2666
www.tenneco.de

TESONA GmbH & Co. KG

Am Künkelhof 4, 99820 Hörselberg/Hainich
Tel.: 036920-7167-915, Fax: 036920-7167-950
www.tesona.de

Thales DIS AIS Deutschland GmbH

Werinherstr. 81, 81541 München
Tel.: 089-21029-9400
www.thalesgroup.com

Thermal Management Solutions DE Oberboihingen GmbH

Gustav-Wahler-Str. 1, 72644 Oberboihingen
Tel.: 0711-3152-0
www.thermansol.com

THOMAS MAGNETE GMBH

Innomotion Park 3, 57562 Herdorf
Postfach 12 60, 57557 Herdorf
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www.thomas-magnete.com

thyssenkrupp AG

ThyssenKrupp Allee 1, 45143 Essen
Postfach, 45063 Essen
Tel.: 0201-844-536-310
Fax: 0201-844-536-536000
www.thyssenkrupp.com

TI Automotive Holdings GmbH

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www.tiautomotive.com

TI Automotive Holdings GmbH

Dischinger Str. 11, 69123 Heidelberg
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www.tiautomotive.com

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www.tiautomotive.com

TireCheck GmbH

Schmelzofenvorstadt 33, 89520 Heidenheim
Tel.: 07321-947-8451
www.tirecheck.online

tmax Germany GmbH

Ölhafenstr. 28, 68169 Mannheim
Tel.: 0621-32235-0, Fax: 0621-32235-29
www.tmaxgroup.com

TMD Friction Services GmbH

Lüschershofstr. 80, 45356 Essen
Tel.: 0201-3609-0, Fax: 0201-3609-343
www.tmdfriction.com

TRIGO GmbH & Co. KG

Zum Panrepel 15, 28307 Bremen
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www.boellinger-group.com

Trocellen GmbH

Mühlheimer Str. 26, 53840 Troisdorf
Tel.: 02241-2549000, Fax: 02241-2549099
www.trocellen.com

Tucker GmbH

Max-Eyth-Str. 1, 35394 Gießen
Tel.: 0641-405-0
www.emhart.eu

Uedelhoven GmbH + Go. KG

Daimlerstr. 8, 85080 Gaimersheim
Tel.: 08458-3270-0
www.uedelhoven-studios.de

UKM technologies GmbH

Salzstr. 3, 09629 Reinsberg OT Neukirchen
Tel.: 035242-6561-115, Fax: 035242-6561-660
www.ukm-gruppe.com

Umicore AG & Co. KG

Rodenbacher Chaussee 4
63457 Hanau-Wolfgang
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www.umicore.com

Unikie GmbH

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www.unikie.com

U-Shin Deutschland

Zugangssysteme GmbH
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www.u-shin-ltd.com

Valeo GmbH

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www.valeo.com

Valeo Klimasysteme GmbH

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www.valeo.com

Valeo Schalter und Sensoren GmbH

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www.valeo.com

Valeo Telematik und Akustik GmbH

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Postfach 14 45, 61865 Friedrichsdorf
Tel.: 06172-767-0, Fax: 06172-72555
www.peiker.de

Valeo Thermal Commercial Vehicles Germany GmbH

Friedrichshafener Str. 7, 82205 Gilching
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www.valeo-thermalbus.com

Valeo Wischersysteme GmbH

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www.valeo.com

Valmet Automotive GmbH

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www.valmet-automotive.com

Vay Technology GmbH

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www.vay.io

VBG GROUP TRUCK EQUIPMENT GMBH

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www.ringfeder.de

Vector Informatik GmbH

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www.vector.com

Veoneer Germany GmbH

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Tel.: 089-262035-0
www.veoneer.com

VIA Oberflächentechnik GmbH

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www.v-i-a.de

Vibracoustic SE

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www.vibracoustic.com

Vimcar GmbH

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www.vimcar.de

Vitesco Technologies GmbH

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www.vitesco-technologies.com

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Voith GmbH & Co. KGaA

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www.voithturbo.de

Vorwerk Autotec GmbH & Co. KG

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VOSS Automotive GmbH

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www.wagon-nagold.de

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www.walloschke-gmbh.de

WAP Fahrzeugtechnik GmbH

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www.waptech.de

Webasto SE

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www.webasto.de

Weber GmbH & Co. KG

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www.weber-dillenburg.de

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www.weber.de

Wegmann automotive GmbH

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www.wegmann-automotive.com

WEGU GmbH Leichtbausysteme

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www.wegu.de

Weidplas Germany GmbH

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www.weidplas.com

WESTFALIA-Automotive GmbH

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www.westfalia-automotive.de

Whitford GmbH

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www.whitfordww.com

Wieland-Werke AG

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www.winckel.de

Winkelmann Powertrain Components GmbH & Co. KG

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www.winkelmann-automotive.de

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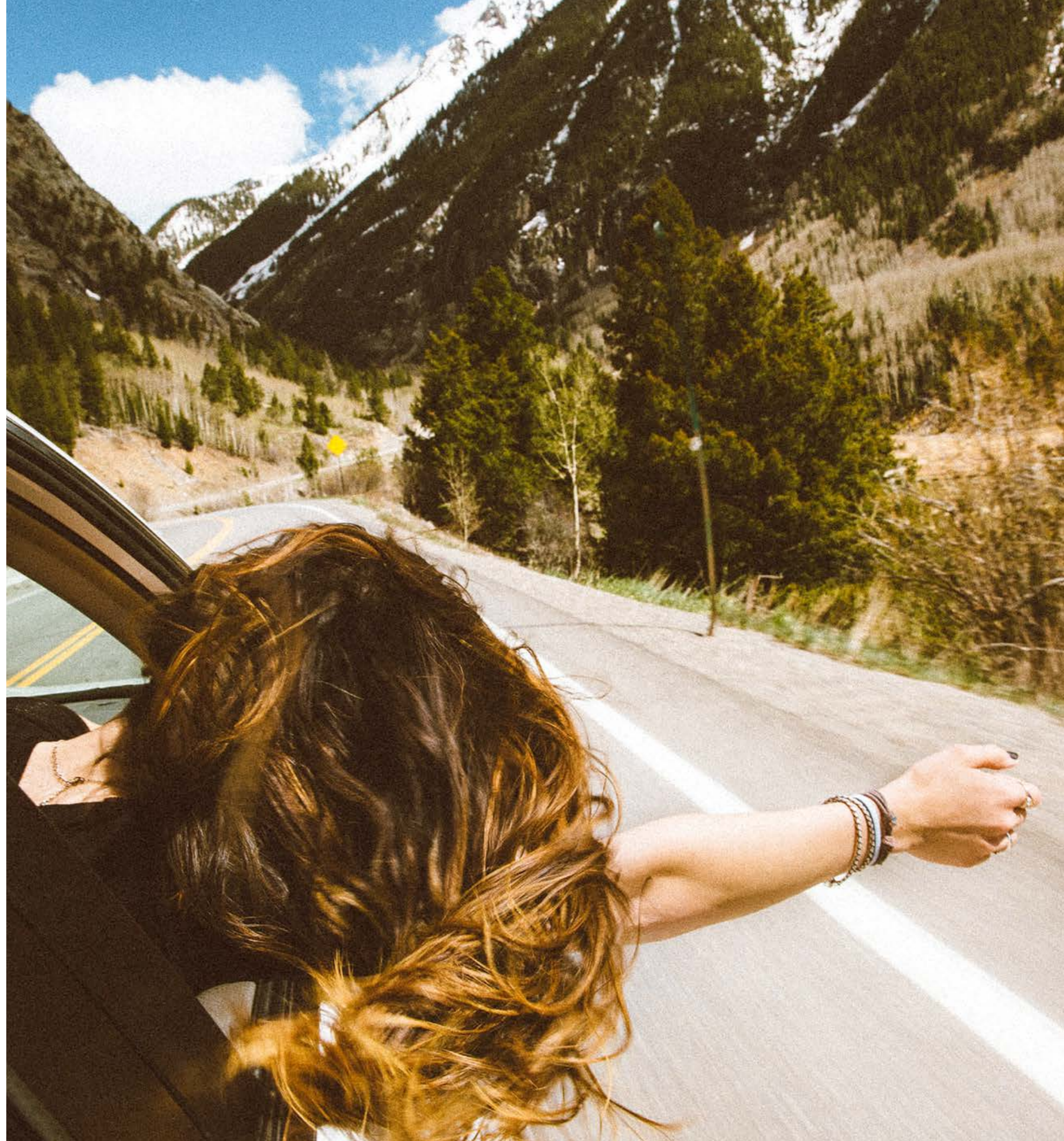
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