

Future Mobility in Germany

ISSUE 2022/2023

Germany is recognized the world over for its outstanding automotive industry and excellence in engineering. From Asia to the Americas, German cars embody highly cherished values of innovation, reliability, safety, and design.

The World's Automotive Hub

The automotive industry is the largest industry sector in Germany, generating turnover of almost EUR 411 billion in 2021. This is more than a seven percent increase in annual turnover compared to the year 2020. The automotive industry remains the strongest and most export-driven industry in Germany – with export volume of almost EUR 274 billion. Innovation is a key priority – 72.6 percent of companies have introduced innovative products to the market in the past three years – with R&D spending just below EUR 50 billion in 2021. German automotive companies are responsible for around one third of global auto industry R&D investment, with similar investment levels forecast for 2022.

Innovation Leader

Germany is Europe's leading production and sales market. The country's excellent R&D infrastructure, complete industry value chain integration and highly qualified workforce create an internationally peerless automotive environment. Almost ninety percent of the workforce are engaged in ongoing R&D activities, allowing the sector to develop the new technologies that address tomorrow's mobility needs.

Changing Mobility Market

The global auto industry is in a period of radical transformation due to e-mobility and connected and automated driving technology developments. More than 135 years after inventing the automobile, Germany remains the world's automotive innovation hub – leading the way forward to a new mobility era.

Germany's Automotive Industry in Numbers

Manufacturing Leader

24%

of domestic industry revenue directly generated by the automotive industry (2021)

3.1 million

passenger vehicles produced – almost 30% of all passenger cars in the EU (incl. UK and EFTA)

Auto R&D Nation

1/3

of global R&D spending made by Germany OEMs

134,225

highly skilled R&D personnel

Export Success

20%

of global auto exports from Germany

77%

auto export rate

Source: VDA, Stifterverband, Destatis 2022

Electric Mobility in Germany

Germany's internationally leading automotive industry is showing the electric mobility way ahead. The sector is responsible for around one third of all electric mobility and hybrid propulsion patents globally.

Demand for electric vehicles is rising as range and performance improvements drive uptake levels and battery costs continue to fall. By the end of 2021 there were more than one million electric vehicles registered. Germany now officially has more than 1.3 million electric vehicles on its roads. The government is expecting more than two million electric vehicles by 2023. This is supported by infrastructure of around 51,200 AC and more than 9,100 DC charging stations.

Electric Mobility Innovation Leader

Significant efforts are being made in the area of battery and cell research – particularly in the area of material and process technologies for lithium-ion systems that will lead to a new generation of high-energy and high-performance battery systems. German automotive manufacturers have increased their range of available electric vehicles. German automotive society ADAC has identified 97 series with more than 230 model variations.

Electric Mobility Policy Support

Germany's Federal Ministry for Economic Affairs and Climate Action will continue the electric vehicle subsidy program to stimulate uptake in the electric vehicle market.

The focus is being put on subsidizing vehicles which have a proven impact on climate protection. From January 1, 2023, battery electric vehicle (BEV) purchases as well as fuel-cell vehicles with listed prices of up to EUR 40,000 will receive a so called "environmental bonus" (*Umweltbonus*) of EUR 4,500. Vehicles with a listed purchase price between EUR 40,000 and EUR 65,000 will still receive a bonus of EUR 3,000. From January 1, 2024, all battery electric vehicles and fuel cell vehicles with a listed purchase prize of up to EUR 45,000 will receive a bonus of EUR 3,000. From September 1, 2023, on only private persons are eligible for electric vehicle subsidies.

The government is investing EUR 500 million into extending the public charging infrastructure, to mention the tender for 1,000 fast-charging locations supported by EUR 2 billion and other public charging infrastructure funding.

Electric Mobility Act

Legislation like the Electric Mobility Act already grants special privileges to electric vehicles – including the lowering or waiving of fees and exemptions from certain access restrictions – to normalize the owner structure of the electric passenger car market. All BEVs are also exempt from the motor vehicle tax for 10 years until 2030.

Electric Mobility Advances in Germany

Market Development



Electric vehicles
1,300,000



German OEM
e-models
>70

Infrastructure Rollout



Public charging
infrastructure
DC Charging
>9,100
AC Charging
>51,200



Private charging
infrastructure
Wallboxes
~900,000

Autonomous Driving in Germany

Germany's automotive sector is planning to revolutionize the market again – with a number of digital test beds and forecast regulation changes.

With German companies leading the way in autonomous drive technology patents, a new market of 58 million units is forecast for 2030. Gradual but steady implementation to everyday use will ensure consumer acceptance and exploit the vast opportunities for safety, comfort and businesses.

Digital Test Beds

Germany's Federal Ministry for Digital and Transport is supporting the trialing of new technologies in a number of digital test beds to unlock the potential of digital mobility. The planned test beds allow the promotion of automated and connected driving technologies in designated zones. Real-world driving data will be made available to the industry; policy makers can evaluate the efficacy of digital transport

policy in a controlled scenario; and the general public experience digital mobility technologies first hand. Planned digital test beds include the Digital Highway Test Bed in Bavaria, digital test beds in cities, and the cross-border Franco-German Digital Test Bed.

Making Autonomous Driving a Reality

Germany's Bundesrat has adopted the Act on Autonomous Driving, thereby paving the way for the regular operation of autonomous vehicles on German road – making Germany the first country in the world where this is possible. Autonomous driving scenarios foreseen in the act include the transportation of people and/or goods in the first and last mile, shuttle traffic, people movers, HUB traffic, and demand-oriented offers in off-peak times. Dual mode vehicle use, for automated valet parking for example, should also be possible.

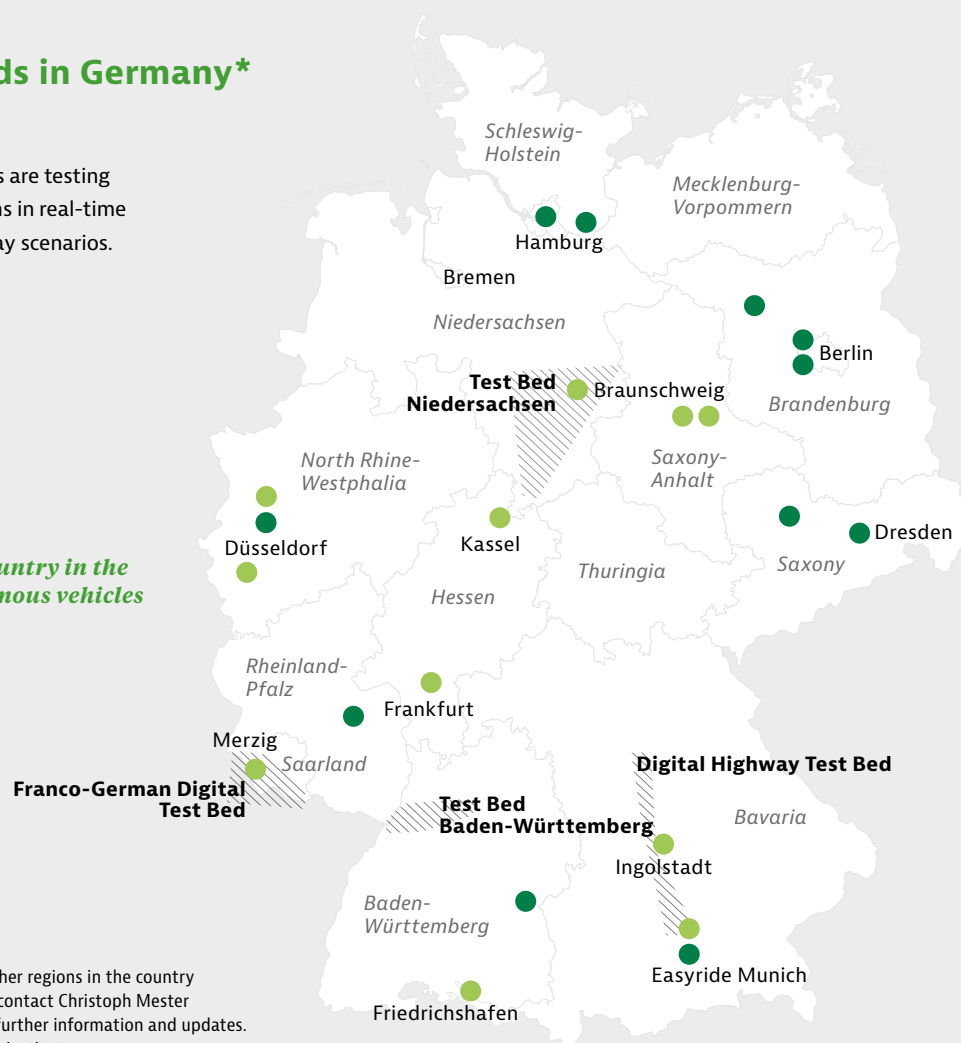
Digital Test Beds in Germany*

New technology trials

Germany's digital test beds are testing digital mobility applications in real-time regional, urban and highway scenarios.

- Regional
- City
- ▨ Highway

Germany is the first country in the world to allow autonomous vehicles on public roads.



*Additional digital test beds in other regions in the country are planned in the future. Please contact Christoph Mester (christoph.mester@gtai.com) for further information and updates. Source: Federal Highway Research Institute 2022

Automotive Industry Trends

Carbon-emission reduction targets, smart traffic management, and the government's electric mobility initiative are major drivers for future mobility growth.

Automotive engineers in Germany are hard at work developing autonomous technologies for future mobility concepts as well as improving battery technologies, enhancing smart driving concepts, car connectivity, and adapting lightweight materials and electronics for future mobility needs.

Tomorrow's Autonomous Technologies

As safety risks due to machine error is the main concern for customers, safe autonomous drive technologies and applications are major factors driving the connected car market and acceptance of autonomous vehicles. A new generation of radar, camera and lidar sensor technologies monitoring the car's environment enable the vehicle to react in a swift and independent fashion. Increased deployment of autonomous technologies will see collision avoidance, danger warning, and independent parking system solutions as well as "well-being" functions like driver drowsiness detection increasingly become standard. Real-time traffic and highway assistant solutions will develop over time to become pilots, thereby paving the way towards highly automated (2025) and autonomous cars (2030). It is expected that highly and wholly automated and autonomous cars will enjoy market share of around 20 percent by 2035.

Car Connectivity

The car of the future will be significantly shaped by the developments made in the "Internet of Things." Vehicle connectivity will significantly change the industry into previously unheard levels of automation, vehicle management and in-car entertainment – or car-to-X communication to be more precise. A recent study ranks the most innovative OEMs worldwide according to connected cars applications. Three German OEMs are among the top ten at the top of the list.

Smart and Comfortable Driving

The advent of individual vehicle intelligence and safety is complemented by smart interaction and communication with other road users and real-time data servers. These mobility management developments support increased driver awareness and more fuel-efficient driving. Enhanced vehicle management solutions (e.g. monitoring and reporting) help reduce utilization costs while entertainment and home integration functions (e.g. head-up display and voice control applications) effectively transform the car into a living room on wheels. When in the car these smartphone-like services will be further enhanced by national 5G rollout. According to the Centre of Automotive Management, a number of German auto producers already count among the most innovative "connected car" manufacturers.

Energy Efficiency

The transformation of mechanics to mechatronics is essential to fulfill the European Union emission targets. Zero-emission mobility will be a prerequisite by 2035, with average emission of new cars already to be reduced by 55 percent by 2030. Key automotive electronics fields of activity are electronic control units including motor and battery control units to regulate fuel and electricity supply, cylinder activity, and exhaust control. Germany has been transitioning to sustainable mobility for decades using a holistic approach including ICE downsizing, public charging infrastructure rollout and, more importantly, establishing 46 percent of electricity supply from renewable resources to provide a home for clean electric mobility.

Battery Technology Improvements

Battery performance is critical to market acceptance. The battery system determines vehicle efficiency and counts as the single vehicle element with the greatest wealth creation share (direct share of value added of up to 40 percent). Between 60 and 70 percent of this value can be directly attributed to the battery cell – making it a key element in the value chain as well as the central element of the vehicle. Battery technology developments are having a significant effect on electric vehicle total cost of ownership as R&D and production costs fall. This is helping to increase the attractiveness of electric vehicles as the cost-competitiveness gap between ICE vehicles is dramatically reduced. Developments made to date in first- and second-generation cells and battery systems have helped create energy density levels of around 200 Wh per liter for today's battery packs. Energy and power density levels will continue to improve, with further marked developments expected in terms of safety (crash resistance) and service life.

Lightweight Material Construction

Lightweight construction is a key enabling technology for manufacturing the cars of tomorrow and addressing the challenges of digital transformation, electric mobility and energy and resource efficiency. McKinsey reports that vehicle manufacturers will need to increase lightweight component levels from 30 percent to 70 percent by 2030 in order to compensate for electric drive weight increases, more efficient engine technology and CO2 reduction goals. Germany, like no other country in Europe, boasts a lightweight construction cluster network that covers the complete industry value chain.

Best Practice Example: CATL

Germany Trade & Invest provides a range of inward investment services to international investors. After careful consultation with the individual investor, a support program of consultancy and information services is drawn up to help set the stage for investment success. Here we provide a typical example of the services provided to a recent investment project.

“By bringing the most advanced lithium-ion battery technology to Germany and developing the local production capacity, CATL is offering even better product solutions and faster response times to our customers.”

Dr. Robin Zeng, Founder of CATL
www.catlbattery.com

Company Information

Established in 2011 in Ningde, Fujian Province, China, Contemporary Amperex Technology Ltd. (CATL) focuses on R&D, production, and sales of battery and energy storage systems. CATL went public in 2018 and generates revenue of almost EUR 2 billion with 15,000 employees. With 12 GWh of shipments it is the leading lithium-ion battery supplier for automotive applications and has established numerous contracts with German OEMs. Together with support from Germany Trade & Invest (GTAI), CATL sought a cell and battery production site in order to satisfy growing demand from European markets.

Germany Trade & Invest Support

GTAI was involved from the point of site identification, having prior involvement with CATL in the establishment of offices in Munich in 2014 and the opening of an R&D facility in Berlin in 2017. GTAI's experts provided the full range of services including practical advice on a number of labor, energy, and logistics cost-related issues as well as tax and incentives information. GTAI also established specific location proposals according to CATL's specific criteria, provided site analysis support and organized site visits.

Location Factors

The most important criteria for the site selection in Germany were the availability of qualified and loyal labor, secure investment environment, excellent infrastructure, proximity to the customer base and the energy transition towards renewable energy sources thereby facilitating more sustainable cell production. It is the company's first factory outside of China and Germany was in competition with a number of other European countries for this significant factory investment. CATL's EUR 240 million investment decision for the Ger-

CATL Project Specifications

Company	Contemporary Amperex Technology Ltd. (CATL), China
Industry	Battery production and energy storage
Investment objective	Construction of manufacturing facility to realize global expansion strategy
Investment location criteria	<ul style="list-style-type: none"> • Highly qualified and loyal workforce • Secure investment environment • Excellent infrastructure • Proximity to customers • Energy transition
GTAI support	<ul style="list-style-type: none"> • Full range of GTAI services including strategic advice, advice on labor, energy, and logistics costs • Tax, legal and incentives information • Location proposals • Site visit organization
Selected location	Erfurter Kreuz, Thuringia
Investment volume	EUR 240 million

man state of Thuringia will result in the creation of one of the largest lithium cell factories in Europe, creating some 600 jobs in the region over the next four years. It is the largest single foreign direct investment project supported by GTAI and the largest Chinese greenfield investment project in Germany to date.

Location Advantages

CATL's decision to settle in Germany will bring it closer to German and other European carmaker brands, providing a major boost for the region and the further development of electric mobility in Germany. CATL Chairman Dr. Zeng believes the investment will increase opportunities across industry for CATL products and provide a strategic customer relations boost. As customer inquiries are picking up quickly, CATL is currently considering expanding the planned production capacity of 14 GWh to more than 100 GWh.

→ **Contact our mobility specialists to explore the individual investment opportunities available to your business in Germany's fast-moving electric mobility sector.**

stefan.dibitonto@gtai.com

christoph.mester@gtai.com

Our Support for Your Business in Germany

Germany Trade & Invest (GTAI) is the foreign trade and inward investment agency of the Federal Republic of Germany. We advise and support foreign companies planning to expand into the German market and assist German companies seeking to enter global markets.

Investor Consulting

Our Investor Consulting division of specialist industry teams provide international investors in all sectors with comprehensive consultancy services specific to each individual investment project. Services include:

- Market and industry reports
- Market entry analyses
- Business and tax law information
- Funding and financing information

All investment-related services are provided entirely free of charge and all enquiries are treated with the utmost confidentiality.



Contact us

Christoph Mester

Mechanical & Electronic Technologies
Christoph.Mester@gtai.com



Stefan Di Bitonto

Mechanical & Electronic Technologies
Stefan.DiBitonto@gtai.com



Stay informed about Germany



Visit us online at
www.gtai.com



Follow the latest investment news on Twitter
[@gtai_com](https://twitter.com/gtai_com)



Sign up for our free Markets Germany magazine
www.gtai.com/markets-germany-subscribe



Find out more about German industry at our YouTube channel
www.youtube.com/user/gtai

Imprint

Publisher: Germany Trade and Invest
Gesellschaft für Außenwirtschaft und Standortmarketing mbH
Friedrichstraße 60, 10117 Berlin, Germany
T +49 30 200 099 0, invest@gtai.com

Executive Board: Dr. Jürgen Friedrich, Chairman/CEO,
Dr. Robert Hermann, CEO

Editor: William MacDougall, GTAI

Layout: Danielle Röbbenack, GTAI

Print: Kern GmbH, 66450 Bexbach, www.kerndruck.de

Picture Credits: Cover: ©GettyImages/Westend61;
portraits: ©GTAI Illing & Vossbeck Fotografie

Notes: All rights reserved ©Germany Trade & Invest, July 2022

Reproduction, in whole or in part, only permissible with express prior authorization. All market data provided is based on the most current market information available at the time of publication. Germany Trade & Invest accepts no liability for the actuality, accuracy, or completeness of the information provided.

Order Number: 21123/3

Supported by:



Federal Ministry
for Economic Affairs
and Climate Action

on the basis of a decision
by the German Bundestag