

MARKETS

GERMANY

Insights into Europe's Biggest Economy 3 / 24

FROM NOT NOW TO NO-BRAINER

Germany is embracing AI as the technology
to drive economic growth.

DISTRICT HEATING
An ancient idea is back in
vogue with the expansion
of municipal heat networks

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NORTH, SOUTH, EAST & WEST
Germany's border regions are
hot property for international
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Closing the solar circle
The market for recycling outmoded
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FOCUS

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Artificial Intelligence will reconfigure the future in Europe's largest economy.

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on the basis of a decision by the German Bundestag



“The rise of AI will have multiple and far-reaching implications and create a whole spectrum of opportunities.”

Dear Reader,

“Strong economic infrastructure, high-quality R&D, skilled workforce, government support and funding, industry collaboration...” Those are the first five answers you get when you ask a leading generative artificial intelligence chatbot: “What are the advantages of Germany as an AI business location?”

Far be it from me to disagree. We featured the topic of AI in an issue of *Markets Germany* not so long ago, but the sector is developing so fast and so furiously that we think it merits another in-depth look. Industry giants like Amazon and Microsoft are making massive investments in AI infrastructure in Germany. But smaller, innovative international companies like the US-Polish firm Digica are also expanding into and within Germany, as we explore in our main feature.

The rise of AI in Europe's largest market will have multiple and far-reaching implications and create a whole spectrum of opportunities. New data centers are being built in many corners of Germany, not just the traditional data hub of Frankfurt. They will require enormous amounts of sustainable electricity to run and generate a lot of waste heat, which will need to be put to good use. One potential solution is to feed it into district heating networks, another topic we cover in this issue.

International cooperation will be key to mastering this fast-developing situation. Germany has more direct neighbors than any other EU country, with businesses that are looking to their nearest trading partner for future solutions and R&D collaborations—so this edition also examines the unique strengths of Germany's many border regions. We hope it makes for a good read!

Dr. Robert Hermann, CEO
Email: invest@gtai.de

Publisher: Germany Trade & Invest Gesellschaft für Außenwirtschaft und Standortmarketing mbH, Friedrichstraße 60, 10117 Berlin, T. +49 30 200 099-0, F. +49 30 200 099-111, office@gtai.de, www.gtai.com

Executive Board: Julia Braune, Chairwoman/CEO, Dr. Robert Hermann, CEO

Director Corporate Communications: Andreas Bilfinger

Managing and Content Editor: Eva Forinyak

Editor: Jefferson Chase

Editorial Team Kammann Rossi/wortwert: Imogen O'Rorke, Christoph Hus, Jürgen Jehle

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MAJOR PLAYER

Kevin Peters heads the German subsidiary of US pharma company MSD.

KEVIN PETERS: SVP & MANAGING DIRECTOR, MSD GERMANY

For over 130 years, the US-based pharmaceutical company MSD has been dedicated to curing cancer and other diseases with innovative healthcare solutions. In addition to a highly effective vaccine for human papillomaviruses (HPV)—a family of viruses that cause warts and can lead to certain types of cancer—the company has developed vaccines and drugs for example against Ebola, HIV and cardio-metabolic disorders. It also conducts advanced cancer research, with one of the largest development programs in the industry across more than 30 tumor types.

Kevin Peters manages MSD's German Human Health Business, one of the company's largest locations worldwide. Before taking the role last year, the Briton held various positions at MSD in Switzerland, Thailand, China and Korea. All told, he's worked for the company for 27 years. With his global

experience, he now wants to help shape the healthcare sector in Germany. "I am particularly motivated by our mission to save and improve people's lives with innovative medicines and vaccines," he says.

Germany is not only a big market, but also a vital R&D location for the company, which reinvests around 25 percent of sale revenues in research. "Germany has always been strong in clinical research: excellently trained scientists and doctors, world-class research and healthcare facilities, and agile clusters of science, start-ups and industry."

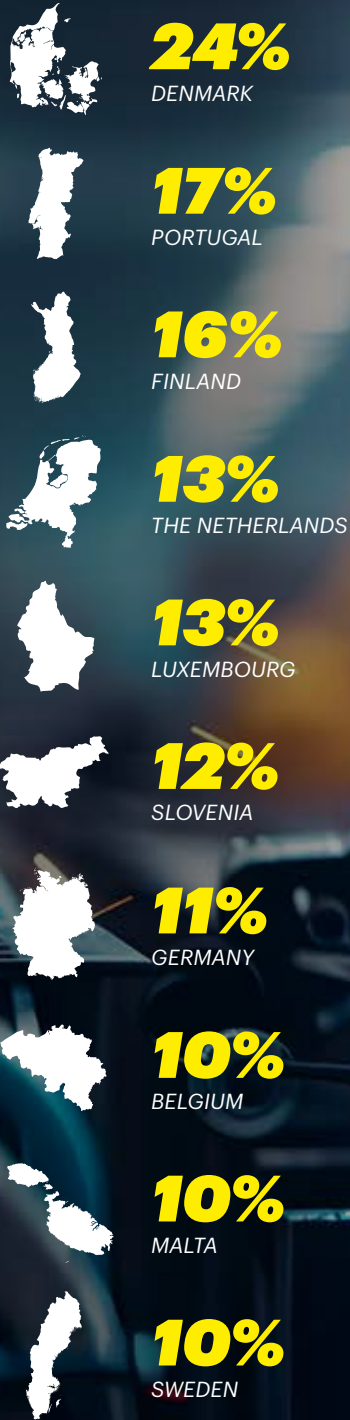
With its brand-new legislation designed to speed up and reduce bureaucracy in the approval of clinical trials and licensing procedures, Germany is reinforcing its status as a leading research location in Europe, and MSD could further expand its role as a driver of innovation.

Quick facts

NAME	Kevin Peters
JOB TITLE	SVP & Managing Director MSD Germany
QUALIFICATION	BSc hon. Physiology, Newcastle University
COMPANY NAME	MSD Sharp & Dohme GmbH
MAIN LOCATIONS	New Jersey (USA), more than 100 countries worldwide
INDUSTRY	Pharma
STAFF	68.000+ worldwide
CLIENT BASE	Hospitals, medical practices, universities and others (e.g. 12 of the 17 vaccines officially recommended in Germany).

USE OF AI IN THE EUROPEAN UNION

Proportion of companies in various EU countries that employ AI



Source: European Commission, 2023

€116 bn

Projected German GDP growth by 2030 due to AI

Source: Amazon Web Services

68%

Share of German companies that could improve turnover by using AI

Source: Amazon Web Services

AI IN ACTION: A robot arm controlled by artificial intelligence performs a precision task on a production line. When combined with robotics, AI has the potential to transform Europe's manufacturing landscape. That's why Germany is betting big on the technology.



FROM NOT NOW TO NO-BRAINER

Germany's "wait and see" attitude toward artificial intelligence has given way to a conviction that AI is a must-have. AI is now central to the development of Europe's largest economy, as the tale of one Polish-American company's German expansion shows.

It's not often you hear a CEO describe his own company as a "dinosaur." But Rafal Janczyk's firm Digica works in artificial intelligence, and in AI things are moving very fast indeed.

Founded in March 2017 by Janczyk, a Polish IT specialist, in Silicon Valley, Digica has already completed well over 200 projects and trained more than 3600 machine-learning models in the process. Those models cover a bewildering variety of AI software solutions for automotive, defense, e-commerce, finance, life science, security and transportation. Digica's clients now include both major international companies and innovative start-ups. And now Janczyk's company is coming to Germany.

Sitting in Digica's temporary German headquarters at the AI Campus, Berlin—a smart hub for new AI companies in the German capital's

THE BOTTOM LINE

Virtually every sector will benefit from the AI revolution, and despite some early skepticism, Germany is now fully on board with the technology. More and more German companies are looking for solutions, so demand is at an all-time high.

Tempelhof district—Janczyk says moving to Berlin was a "no-brainer," and not just because Digica has a development team just a few hundred kilometers over the border in Łódź, Poland. → **see p. 28 North, South, East and West** "The scale and size of the German economy was very alluring," he says.

Five years or so ago, due to general skepticism about digitalization, AI didn't generate as many business opportunities as it could have. But that situation has reversed.

"This was a painful lesson for many companies and also for the government, so now that AI is happening, you can suddenly see Germans saying: 'Yes, AI is important—we must invest,'" Janczyk explains. "Germany does have the tendency to think everything over twice or three times before making a decision, but I have definitely noticed a determination not



"GERMANY HAS A STRONG PRESENCE IN CLIMATE CHANGE SCIENCE."

MIKA PFLÜGER, MD of Climate Resource Germany

FDI PERSPECTIVE: CLIMATE RESOURCE PROVIDES VITAL DATA ANALYSIS IN GERMANY

Climate Resource is an up-and-coming research company that provides world-class, data-driven climate science to all sorts of clients. The Australian company headquartered in Melbourne now has teams in Berlin and Hanover as well as Vienna.

Germany proved an ideal location for Climate Resource to "hang out its shingle," not least because of the country's central location in Europe.

"Germany has a strong presence in climate change science, which led us to seek and find specialists in Germany," says Mika Pflüger (photo), the company's managing director in Germany. "We have employed three people in Germany directly from Australia so far, but now we find that access to the European market is easier if we have a German subsidiary."

Climate Resource builds and maintains climate models, software and datasets that are widely used by the scientific community around the world. Clients include multilateral organizations, government, commercial organizations, NGOs, universities and other research organizations.

In addition, the company's employees help advance climate science by contributing to leading international journals and authoring assessment reports by the Intergovernmental Panel on Climate Change (IPCC).

3

Employees in Germany

196

Number of countries on which Climate Resource provides future emissions projections

273

Years covered by Climate Resource's historical emissions dataset

CLIMATE MODELLING The research company Climate Resource uses Big Data together with AI to create simulations of a fast-changing climate. It advises governments on how to respond to climate-change related risks and opportunities.

to miss out on the AI boom. They might have missed the first train, but they won't miss the next one." And the good news is, the initial skepticism means there is now additional room for growth.

Digica's expansion story was almost derailed by the coronavirus pandemic. "We had a team of 25 people and many customers, and then Covid started, and we almost went bankrupt," recalls Janczyk. Luckily, the company was already strong enough to attract significant investment from a UK investor. "This meant I could spread out wings," he says. "So from a team of 25 people we grew to almost 100 just within two years."

The courage to use AI

Digica's business development strategy in Europe offers a useful snapshot of future of AI in Europe's largest economy. The company is currently focused on attracting two main types of clients: companies in medtech and in defense. Both are sectors where Germany has many major players and where there is growing interest in finding AI solutions to gain a competitive advantage.

"These are two very different fields, but they are the two that have enough data, enough money and enough courage to use AI," says Janczyk. "They are very determined to put AI into use cases and into production."

Germany, like many European countries, is currently bolstering its defense budget—and it is Janczyk's conviction that a significant part of that will be funneled into developing intelligent defense systems.

"This is what we do super-effectively: provide radar technologies with AI systems, which are so much more accurate in identifying potential threats," he says. "If you train and adjust the models well, you can distinguish between drones and different flying objects with a much higher accuracy."

Another one of Germany's main draws for companies like Digica is the strong manufacturing sector here. This, too, is an area where there are big players with money and ambition, and where processes can be significantly streamlined by machine learning tools.

"Manufacturing in Germany is on a super-intense level," says Janczyk. "But all the automation that was introduced years ago can be

improved by adding the AI factors." He points to one tool that Digica developed for a major German steel manufacturer: an AI model to detect cracks in steel as it is cooling down, rather than waiting until cooling is finished. This potentially saves hundreds of thousands of euros in costs and energy.

At the moment, Janczyk is the company's only employee in Berlin—but he won't be for long. Digica is beginning to recruit talent from throughout Germany. "If you look at the school system here, they produce enough people with good skills," he says.

FOUR POINTS THAT MAKE GERMANY A HIGHLY ATTRACTIVE LOCATION FOR AI



WORLD CLASS
RESEARCH INSTITUTES



EU REGULATION AS A
SEAL OF QUALITY



MAJOR COMPANIES
THAT NEED AI



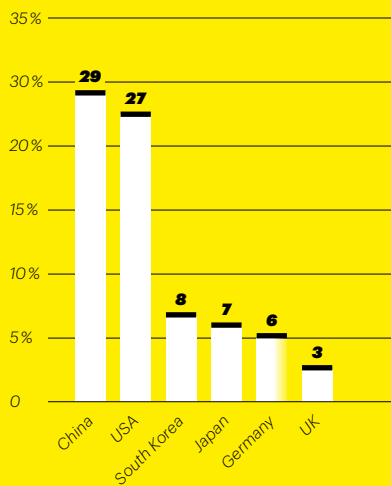
A THRIVING
START-UP AND SME ECOSYSTEM

Big projects for specific needs

Digica's expansion into Germany is part of a wider trend. Some of the world's biggest players are investing big in the country's digital business future, of which AI is now an integral part. In June 2024, Amazon announced it was putting a further EUR 10 billion into its German operations, taking its total investment in Europe's biggest economy to EUR 77 billion since 2010. Amazon knows better than anyone how big the potential here in Germany is—because it's done the research. According to a recent study by Amazon Web Services (AWS) and Strand

AI INNOVATION IN PATENTS

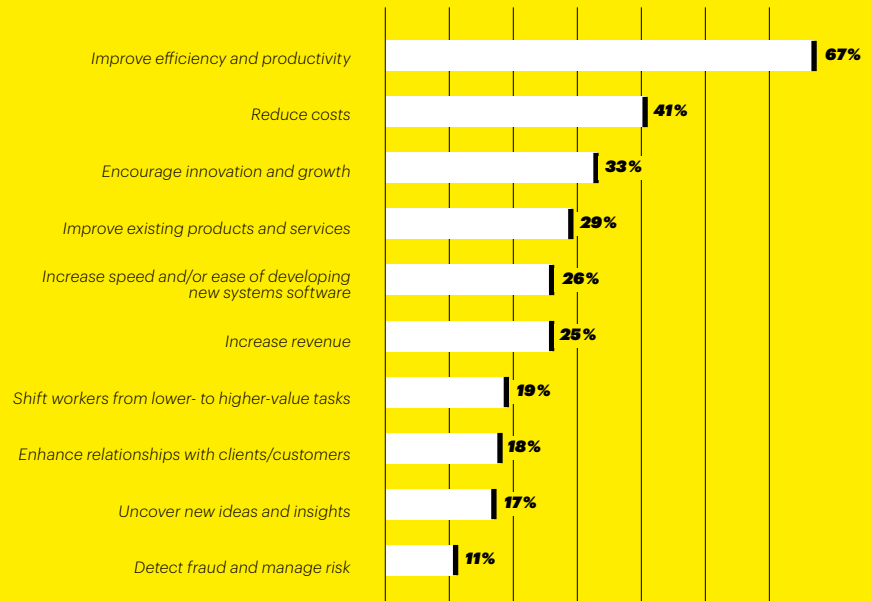
Country share of AI patents worldwide



Source: Commission of Experts for Research and Innovation (EFI), 2024

THE POTENTIAL OF GENERATIVE AI FOR BUSINESS

Key benefits German company executives hope to achieve through generative AI



Source: Deloitte, 2024

Partners, AI could add an additional EUR 116 billion to the German economy by 2030. The same study also found that 68 percent of German companies could improve their turnover by introducing AI technology.

Amazon has chosen Germany as the home of its AWS European Sovereign Cloud. This is essentially a vast data processing hub designed to help customers from the public sector and in highly regulated industries—for example, critical infrastructure operators—meet specific legal requirements regarding the location of data processing and digital operations.

Jonathan Weiss, MD at the Amazon Development Center Germany, says one of the main reasons Germany is so central to Amazon's plans is the strength of the research centers. "Amazon has been investing in the development of AI for decades, and our research and development centers in Berlin, Tübingen and Aachen play a central role in that. AI research is firmly rooted here," he says. "One of the main goals in Berlin is to make generative AI accessible to everyone via the Cloud."

Keeping the data in Europe

The European Sovereign Cloud promises to be a big driver of growth for Germany's AI sector, and Amazon is fully invested in its future.



"I have noticed a determination in Germany not to miss out on the AI boom."

RAFAL JANCZYK,
CEO of AI company Digica

"The AWS European Sovereign Cloud and the associated investments of around EUR 7.8 billion build on this long-term commitment to Germany," says Weiss. "We are investing significantly in new talent and local infrastructure to support the need for digital sovereignty." AWS enables customers to combine the large available AI language models with their own data to obtain customized solutions for their specific challenges. The focus is on processing large amounts of data while maintaining security.

That latter point is important. The European Union's AI Act is the world's first regulatory framework for artificial intelligence, and data security tops the list of priorities. As Asha-Maria Sharma, an expert in digital & service industries at Germany Trade & Invest (GTAI), explains (see interview on p. 10), legal requirements actually represent an advantage, since internationally recognized standards will ultimately create more trust in AI products. AWS already has teams in place working on meeting those standards, especially in Berlin.

"In our offices in the capital, many highly talented data scientists work together to achieve this," says Weiss. He highlights the generative AI assistant Amazon Q, developed in Berlin and available in Germany as of 2024. Amazon Q can generate code, test, debug, and has planning and reasoning capabilities that can transform and implement new code generated from developer requests.

All this international investment is already having noticeable effects on the local market, and AWS believes that the European Sovereign Cloud will trigger a multiplier effect for cloud computing in Europe more widely. "The AWS European Sovereign Cloud will drive the digital transformation of government and business, increase the number of cloud and digital pro-

2022

The year Mayday.ai opened its HQ in Darmstadt

300

Satellites Mayday.ai collects data from

35,000

AI-enabled cameras Mayday.ai collects data from

FDI PERSPECTIVE: MAYDAY.AI THRIVING IN GERMANY

In 2022, the centralized AI-based platform Mayday.ai opened the doors of its new German headquarters in Darmstadt, the deep-tech hub in central Germany—thanks in part to help from GTAI. The company says Germany was particularly attractive because of the satellite access offered by the European Space Agency.

The US company uses AI tech to provide interconnected early warning and two-way communication services using geostationary satellite imagery, camera imagery, audio and social media analysis.

That kind of innovation has a host of different applications, but perhaps the most important is disaster prevention. By leveraging all the information from a variety of sources, Mayday.ai can teach AI machines to recognize weather patterns and other factors that make natural disasters more likely.

Wildfires, for instance, which are becoming increasingly frequent because of the effects of climate change, can be detected more quickly using algorithms that parse data from satellites.

The company already has several major clients, including first responders and government agencies. Mayday.ai's innovations are supported by a number of international organizations, including the European Space Agency, the European Association for Remote Sensing Companies, and the United Nations Office for Disaster Risk Reduction.

DISASTER PREVENTION A night image generated by the National Oceanic and Atmospheric Administration's GOES-East satellite shows Hurricane Idalia approaching the west coast of Florida on August 29, 2023, bringing powerful winds and a potential storm surge of 10 to 15 feet to the Big Bend area.



WHERE IS GERMANY ON AI?

Asha-Maria Sharma, digital & service industries expert at Germany Trade & Invest on the AI landscape in Germany, gives a rundown of the regulatory framework and political climate.

Some experts say Germany and Europe in general are lagging behind the United States when it comes to the artificial intelligence market. Would you agree?

ASHA-MARIA SHARMA: Germany might look like it's a bit behind, but the AI landscape has been evolving rapidly. In AI research and use cases in the manufacturing and health sectors, for example, Germany is a global leader. The challenge, as with all new technologies, is to find the right moment to commercialize.

There are a lot of things happening here. Since 2018 Germany has a national AI strategy that is constantly evolving. And there are unicorns in Germany too, like the generative AI specialist Aleph Alpha and the translation tool DeepL. The German AI industry association already has more than 400 member companies.

As German companies increasingly use AI solutions, there is still a lot of space for new products and services in the domestic market. At GTAI, we talk a lot to international mature start-ups and companies with AI products, and they are starting to see that, at various places along the value chain, there is a market for what they have to offer. There are a huge number of potential clients in nearly all industry verticals in Germany.

In May 2024, the EU introduced the AI Act, the world's first comprehensive regulatory framework for AI, which is now being transferred into the national law of all the

EU member states. What challenges and opportunities might this present for international companies?

AS: The rapid technological advancements have heightened concerns over personal data, human rights and democratic values when it comes to AI. The EU is not alone in regulating AI. The US also has some legislation governing risk management, and China, too, has come up with some administrative measures to cover AI. Governments are thinking about how to create a more harmonious framework.

The EU AI Act might be seen as a temporary hurdle by companies coming to Europe to develop their products, but it's still early days. Of course there will be more work to make AI compliant, but I think that in the long run this legislation will provide a kind of seal of approval. If their products are compliant, companies will be better able to sell them worldwide. Standards create trust.

What about the impact of AI on the labor market? Even though the technology is likely to generate a lot of business, many people fear that it will take away jobs.

AS: This has been a running subject of debate, but so far, we can't really see job losses. It's more of a shift. Implementing trustworthy AI through information and training will be helpful. In most cases, we see AI taking over the parts of jobs that are boring and repetitive.

And it generates a lot of new opportunities, as it creates a demand for AI specialists.

For Germany, I would say AI can be helpful because we're an aging society, so the workforce is not growing. And in industry there is an increasing number of automated processes in which machines can work under the supervision of people. I think this will help companies cut costs and stay competitive.

How much of a priority is AI for the German government?

AS: AI is absolutely at the heart of the German government's economic plans. Ten years ago, Germany started its Industry 4.0 initiative, meaning the digitalization of the manufacturing industry, and AI is another very important step of that process.

The government set up an AI strategy as early as 2018, and that strategy is itself adapting and developing. There are well-funded initiatives, skill development programs on different levels, centers to make AI more accessible to small and medium-sized companies, all with the aim of creating reliable and human-centered AI that can be accepted by both industry and the population.

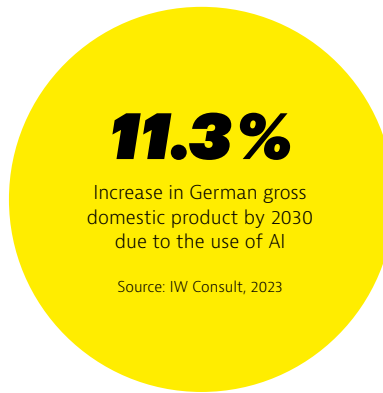
Asha-Maria Sharma is a digital & service industries expert at GTAI, covering AI, IoT and quantum computing.

asha-maria.sharma@gtai.de

professionals, drive renewable energy projects and have a positive impact on the communities where AWS is present,” says Weiss. AWS expects the European Sovereign Cloud alone to contribute EUR 17.2 billion to Germany’s GDP and create 2800 full-time jobs at regional companies by 2040. A bold claim—but one backed up by strong market research.

Microsoft’s contribution

Amazon is far from the only tech giant to have seen Germany’s potential in the AI sector. In February 2024, Microsoft announced its biggest investment in the country to date, with EUR 3.2 billion for Germany’s AI infrastructure. “We want to enable our German customers to benefit from AI in order to expand their global competitive edge,” says Microsoft Germany MD Florian Deter. “And the computing power of the cloud as an infrastructure is the basis for AI.”



Why invest in Germany? There’s one obvious answer, explains Deter: “The deep domain knowledge of German industry is a data treasure for a bright AI future in Germany. There are an incredible number of companies here, from medium-sized businesses to large corporations, that have built up an outstanding position.”

The Microsoft investment is destined for the regions of North Rhine-Westphalia (NRW) and Frankfurt, the latter being the largest and

most important German region for Microsoft’s Azure project. “We already have data centers here, and we want to expand their capacities to meet the increased demand,” says Deter.

Meanwhile, in NRW, there is a huge need for a new economic impetus as coal mining, historically a key local industry, is phased out. “The structural transformation of the economy gives us a unique opportunity to help create a win-win situation for the entire region,” Deter adds. “We are developing the nucleus for the emergence of a flourishing AI ecosystem that will benefit the economy, society and the state.”

Thinking of making a business investment in AI in Germany? We can help.

Asha-Maria.Sharma@gtai.de
GTAI Deputy Director,
Digital and Service Economy

HOW GTAI HELPED MICROSOFT EXPAND INSIDE GERMANY

North Rhine-Westphalia has welcomed Microsoft’s new AI-based data center to the region with open arms. The western German regional state was actively looking to transition local industry away from traditional coal mining, and the IT giant’s interest was a golden ticket.

GTAI senior consultant Oliver Wilken supported Microsoft’s EUR 3.2 billion expansion. “This was certainly a very big project for us,” he says. He admits that there were challenges to overcome. For example, “people like the benefits of cloud computing, but few want a data center in their backyard.” But GTAI used its expertise in liaising with business regional promotion agencies to find the right location.

“The issue of where to locate a data center is a great example of what GTAI does,” Wilken adds. “They require a lot of land and energy as well as proximity to internet hubs, which means a lot of coordination between the different players. We’re happy to help with that.”

With large areas of available space close to major population centers, North Rhine-Westphalia ticked all the right boxes, and the regional government helped convince local district administrations that the investment would be generally beneficial.



Marianne Janik, former CEO of Microsoft Germany, meets North Rhine-Westphalian State Premier Hendrik Wüst in Elsdorf, where Microsoft is planning to turn a former open-cast lignite mine into a new AI data center.

EUROPE'S DATA CENTRAL

Experts are expecting investment to pour into data centers in Germany in the coming years. Anna Klaft, chairwoman of the German Data Center Association, explains why Germany is such an attractive location and what investors need to know about the framework conditions for setting up here.



THE INTERVIEWEE

Anna Klaft is chairwoman of the German Data Center Association (GDA) and VP of Rittal. The association represents the interests of operators and service providers from the IT sector and technical infrastructure in Germany.

Germany—especially in comparison to eastern Europe. We also have a comparatively stable weather situation in Germany, with no forest fires or flooding in urban centers. This makes the construction and operation of data hubs safe and predictable.

Until a few years ago, Ireland was one of the most successful locations for data in Europe. What changed?

AK: Ireland basically ran out of electricity, causing political decision-makers to suspend the construction of new data centers. In 2022, for example, the construction of two Microsoft data centers and a Google construction project were halted. This won't happen in Germany.

Which German cities are particularly popular with companies that are currently investing in data?

AK: Due to its central location and its major internet hub, Frankfurt am Main and the surrounding area is a focal point. Berlin and the surrounding area are also popular because space is available there.

Ms. Klaft, your trade association predicts Germany is at the start of a steep data center investment curve. What is this based on?

ANNA KLAFT: We examined the German data center market for the first time in a study in 2024. It showed that data center capacities in Germany will increase from 1.3 to 3.3 gigawatts over the next five years. Based on this development, we expect companies to invest more than EUR 24 billion in the construction and expansion of data centers in Germany during this period. Current examples of this trend are the latest investments by Microsoft totaling EUR 3.2 billion and Amazon Web Services, which is putting EUR 7.8 billion into Brandenburg and a further EUR 8.8 billion into the Frankfurt am Main region.

Which part of the world are the investments coming from?

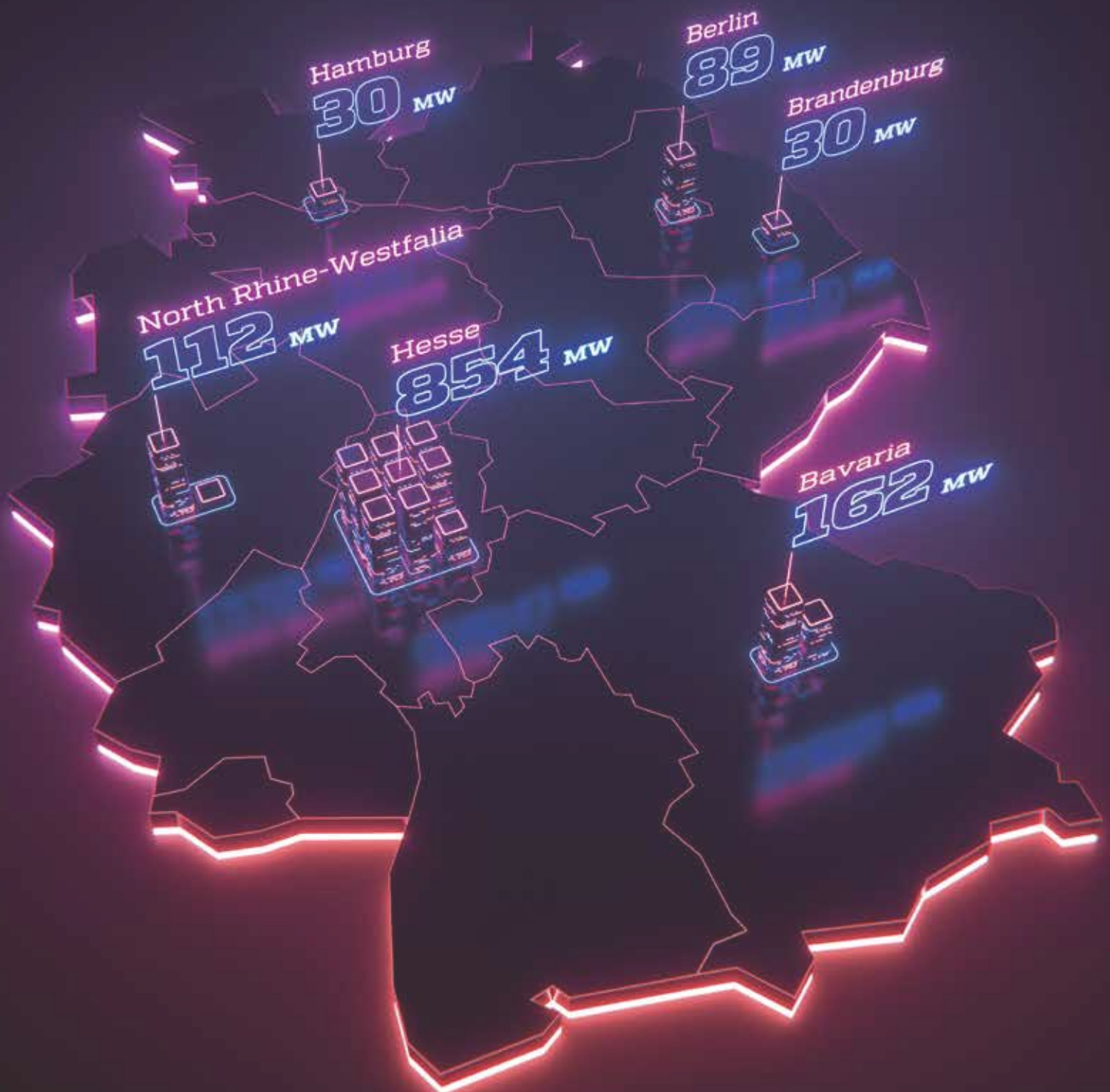
AK: When we talk about cloud applications, we are mainly talking about large tech companies from the US. However, investment is also coming from many other countries, including the UK and the Netherlands.

What makes Germany an attractive location for data center operators at the moment?

AK: There are several reasons. With the General Data Protection Regulation (GDPR), the European Union has special data sovereignty. Data center customers want their data to be stored securely, and providers within the EU can offer this due to the legal provisions. What makes Germany unique is that we have the world's largest internet exchange point in Frankfurt am Main, DE-CIX, which is geographically central and serves the whole of Europe. We are in a politically stable position in

MAPPING GERMANY'S COMPUTING POWER

Capacity of data centers in German federal states in MW (top five)



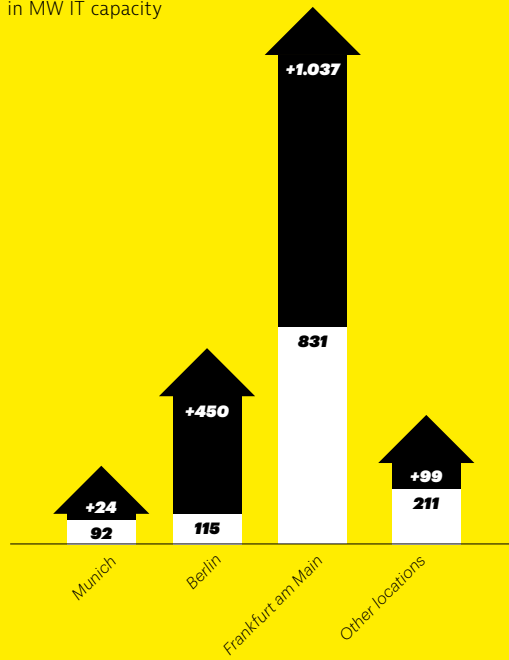
Source: German Data Center Association, 2024

DATA CENTER LEIPZIG Michael Freitag, group leader for data center management, checks server cabinets in the new data center the day the first regional internet exchange for the regional states of Brandenburg, Saxony, Saxony-Anhalt and Thuringia went live. The DE-CIX Leipzig is integrated into the world's largest neutral interconnection ecosystem and connects more than 2,500 network operators, internet service providers, content providers and company networks from more than 100 countries. The node, operated by fiber-optic network operator Envia Tel, is located at a multi-secured site with an independent power supply.



CURRENT DATA CENTER CAPACITY AND EXPANSION PLANS IN GERMAN METROPOLITAN REGIONS

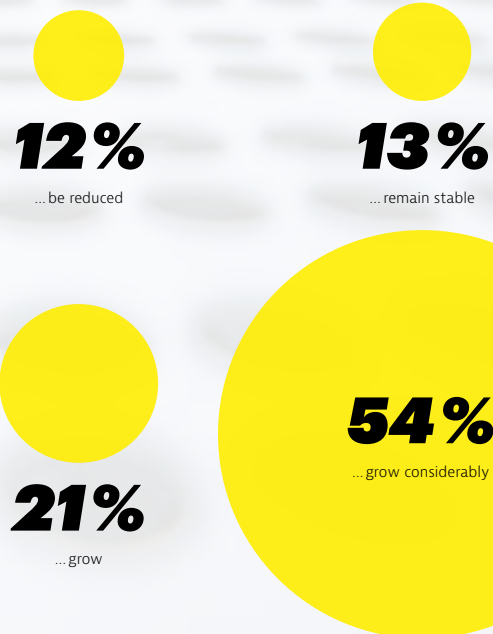
in MW IT capacity



Source: German Datacenter Association, 2024

EXPECTATIONS OF COMPANIES IN GERMANY THAT OPERATE THEIR OWN DATA CENTERS

The capacity of our data center will...



Source: German Datacenter Association, 2024

“MANY CITIES ARE LOOKING TO USE WASTE HEAT FOR HEATING NETWORKS”

ANNA KLAFT, *chairwoman of the German Data Center Association*

→ Which other locations will be important in the coming years?

AK: The Rhineland will be an interesting location in the future. Microsoft is investing EUR 3.2 billion there—the largest investment in Germany in the company’s history. What is exciting for the industry is that politics and business are working closely together in the Rhineland to develop the location as an AI stronghold. This is creating demand for data centers.

How can investors be sure they will receive local support for their project at their chosen location in Germany?

AK: I advise foreign companies to hire employees who speak German. Often this is an underestimated factor when it comes to communicating with local decision-makers and future neighbors. It is also important to talk not only about the positive aspects of the project, but also about possible disadvantages—and how they can be solved or avoided. Open communication is key. This is how companies avoid causing resentment among neighbors and the general public.

What positive examples do you know of?

AK: The small town of Hattersheim near Frankfurt am Main is a great example of how a data center can be integrated into a town. The mayor brought future operators and the population together from the outset and ensured that the data centers were integrated into the town’s heating concept. The waste heat from the data centers is fed into the local district heating network.

In 2023 new legislation was passed in Germany regarding the use of waste heat. What has changed?

AK: Data centers require a lot of electricity and also generate a lot of waste heat, which can be used in various ways. New centers in Germany will be obliged to use waste heat under the new law. New facilities opening from July 2026 onwards must use 10 percent of their waste heat. Data centers that go online a year later will have to use 15 percent of their waste heat and 20 percent will be mandatory for data centers from 2028 onwards.

How can data operators in Germany market their waste heat?

AK: Many German cities want to reduce the carbon emissions generated by the production of heat for district heating networks. Waste heat from data centers is considered a green source of heat because it is usually produced using electricity from renewable energy sources. Many cities are now looking to use waste heat for their heat networks.

How difficult is it in Germany to find good employees for operating data centers?

AK: In Germany, it’s comparatively easy for companies to find people with different qualifications—from specialists for planning and operations to engineers, other technical professions and well-trained business development people. This is another reason why Germany is ideally equipped for the coming years.



Want to find out more about expanding to Germany?

CONTACT

Isabel.Matos@gtai.de
GTAI Data Center Expert

INNOVATIONS

The global business community admires the spirit of invention that drives the German economy. Here we highlight some of the most intriguing trends and research projects.



A technician prepares material for electrolysis.

Photo: Fraunhofer IKTS

RED HOT ELECTROLYSIS

High-temperature electrolysis process makes its way to series production

The Fraunhofer Institute for Ceramic Technologies and Systems (IKTS) in Dresden has over 20 years' experience in the field of high electrolysis: using electricity to split water into O_2 and H_2 at temperatures of almost 1000 degrees Celsius. Together with the electrolyzer producer Thyssenkrupp Nucera, IKTS scientists are transferring the high-temperature electrolysis process to series production. To this end, IKTS has built a new pilot plant in the eastern regional state of Thuringia to this end.

"This high-performance technology will be another strong pillar of the CO_2 -free and thus climate-friendly energy mix of the future without fossil fuels," explains Werner Ponikwar, CEO of ThyssenKrupp Nucera.

Because these systems are comparatively expensive to produce, the technology is not established, but costs will inevitably come down as it matures. Moreover, the process offers several advantages over cold electrolysis. Instead of rare precious metals, less expensive materials such as ceramics can be used. It consumes less power because process energy is supplied in the form of heat (which makes it interesting for industries that generate a lot of waste heat). And CO_2 can be extracted from the environment and converted into green synthesis gas and downstream products such as e-fuels.

www.ikts.fraunhofer.de/en



Compared to plastics, this "traceless," compostable, organic substitute saves 91% of emissions.

Photo: Traceless

ECO-FRIENDLY PLASTICS SUBSTITUTE

Hamburg-based start-up produces a viable natural alternative to plastic

A young company called Traceless has developed a process that converts plant waste into a sustainable plastic substitute. The granulate produced by the new process can be manufactured using conventional methods to replace plastic or plastic coatings in a variety of products, including food containers, disposable cutlery and clothes hangers. Compared to plastic, the innovative material saves 91 percent of CO_2 emissions and is completely plastic-free, biodegradable and compostable.

The two Traceless founders have successfully completed initial product tests with companies such as clothing retailer C&A and airline Lufthansa. The company is in the process of building an industrial production facility in Hamburg. "Here we want to show that we can actually produce our material on a large scale and competitively," says co-founder and COO Johanna Baare.

www.traceless.eu

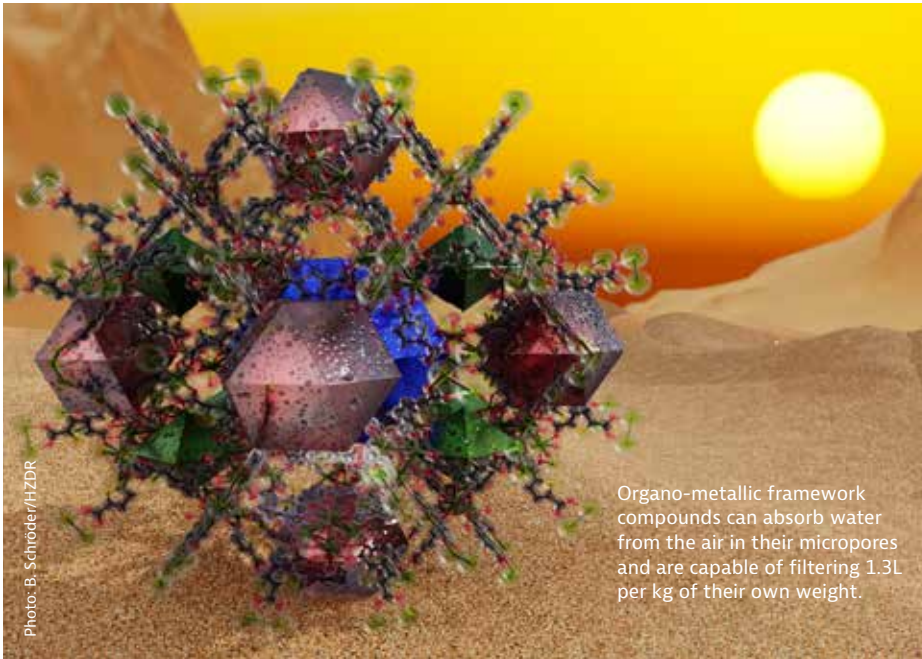


Photo: B. Schröder/HZDR

Organo-metallic framework compounds can absorb water from the air in their micropores and are capable of filtering 1.3L per kg of their own weight.

WATER HARVESTING IN DESERTS

Super sponges from Saxony capture water from the air

A team of researchers from the Helmholtz-Zentrum Dresden-Rossendorf (HZDR) and the Dresden University of Technology in Saxony has developed a groundbreaking method for extracting water from the atmosphere so that inhabitants of arid regions will have a better supply of drinking water in the future. These tiny "super sponges" are made out of metal and organic material and are full of small cavities just like a kitchen sponge. Mass production is still a long way off. The researchers are currently

working on making the super sponges suitable for everyday use. But they are already capable of filtering up to 1.3 liters of water per kilogram of their own weight per day from the air. In the next step, the scientists want to gain a better understanding of the water-binding mechanisms of the super sponges to develop more efficient materials and to increase their suction power.

www.hzdr.de



Photo: N3 Engine Overhaul Services

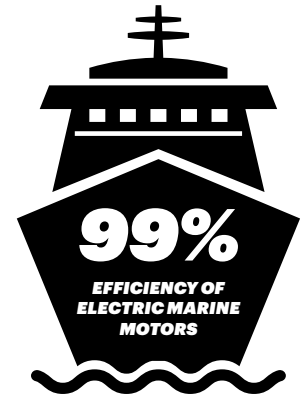
HIGH-TECH AERO HUB

Rolls-Royce-Lufthansa aero overhaul network is growing rapidly

The climbing cost of airline tickets and the specter of climate change have not so far curbed people's desire to travel. In fact, the number of intercontinental flights is steadily increasing. This trend is a boon for N3 Engine Overhaul Services, a joint venture between Lufthansa Technik and Rolls-Royce. Last year the company overhauled and inspected 132

Rolls-Royce engines for more than 50 international airlines. Capacity is set to almost double: Up to 250 engines per year are to be inspected due to increasing demand, and for that reason, N3 is investing around EUR 150 million in expanding its site in Thuringia.

www.n3eos.com



MARITIME TECHNOLOGY 4.0

Next-gen marine propulsion technology helps reduce ship emissions

The long-established company Ramme, based in the eastern regional state of Saxony-Anhalt, has developed electric marine motors with an efficiency of up to 99 percent. Unlike conventional induction motors, the rotors of PM systems are equipped with permanent magnets, making them typically two to four percent more efficient at full load than comparable induction motors. The high efficiency translates into an energy savings potential of more than 20 percent compared to conventional systems.

The Ramme motors help conserve resources and reduce CO₂ emissions in the marine industry. The lower energy costs also improve the return on investment. The technology already has high adoption: Every year 100 ships worldwide, from small ferries to huge cruise liners, are fitted with Ramme motors.

www.ramme.de

SAILING ON A TAILWIND

Start-up creates unique flow measurement technology

Vectoflow, from near Munich, is revolutionizing the world of flow measurement with its unique probes—the first in the world to be produced using a 3D printer. Measuring just 1.2 mm, they are among the world's smallest, most robust and also most accurate.

To achieve such precision, the probe is calibrated by being exposed to different flow fields in a wind tunnel. "We measure flows, whether water, air, gas or oil—the main thing is that it moves. During the measurements, we evaluate all possible parameters, i.e., speed, temperature, pressure and flow angle," explains Vectoflow co-founder Katharina Kreitz. Kreitz developed the technology at 27, while finishing her degree in mechanical engineering.

Vectoflow's customers, which include internationally renowned entities such as NASA, Airbus and Tesla, use the measurement data to optimize their products. For example, it makes cars and planes more aerodynamic, thereby saving fuel. Late last year, the company raised EUR 4 million from investors. It will go toward increasing series production.

www.vectoflow.de

55.9%

of new residential buildings in Germany were heated by **electric heat pumps** in 2023.*

26.6%

of new residential buildings in Germany were heated by **district heating** in 2023.*

ANCIENT HEATING CONCEPT

FOR A WARMER FUTURE

The main pool at the Roman Baths of Acquae Sulis in the city of Bath, UK. Naturally heated water at 46 °C gushes up from thermal springs and is piped through the complex.

10.3%

of new residential buildings in Germany were heated by **gas** in 2023.*

Bath's 2,000-year-old Roman baths are a UNESCO World Heritage site. District heating works on a similar principle, where heated water is piped to multiple dwellings.



If Germany is to meet its decarbonization goals, the country is going to have to change the way it heats residential and commercial buildings. So it's looking to expand municipal heating—an idea that goes all the way back to antiquity.

Ancient Romans immersed in hot water and idly exchanging gossip with their peers may not have stopped to consider the intricate system enabling their daily sojourn to the public baths. Like the urbanite of today who hops into the shower without a second thought, hot water was something that simply appeared; the mechanisms underlying it were only interesting when they failed. But for historians of engineering, the baths of ancient Rome are held up in reverence as an early example of district heating. Powered by a wood-burning furnace, a boiler would heat the water before it travelled through pipes to the pools. The fumes produced in the process were cleverly redirected via a structure known as a hypocaust to heat the surrounding air.

Centuries later, modernized but analogous systems are attracting the interest of policymakers in Germany. Against the backdrop of the climate crisis, the transformation of heating systems has generated less public debate than sectors like transport and manufacturing have. But in much of the industrialized world, including in Germany, heating and cooling buildings accounts for more than a quarter

of total energy consumption. And the heating industry is still dominated by fossil fuels, putting efforts to clean it up at the heart of the government's climate policy.

"It's the elephant in the room," says Robert Compton, an energy expert at Germany Trade & Invest, the government's agency for international business promotion. "Heating is the biggest CO₂ problem we face."

THE BOTTOM LINE

Germany is investing heavily to make heating sustainable. With an ambitious plan to roll out district heating systems run on renewables, demand for heat pumps, insulated piping, geothermal energy and waste heat is set to soar.

District heating systems (*Fernwärme* in German) have attracted particular attention because of their three main environmental advantages. By supplying buildings directly through a network of insulated pipes, they remove the need for individual boilers or central heating systems. To date they have tended to be served

by power stations that generate both electricity and heat, a highly efficient process known as cogeneration. Finally, and most importantly, they can be flexibly powered by a combination of renewables such as geothermal, solar and biomass, or by large-scale heat pumps or waste heat sources, for example, by data centers. The main downside at present is that they require a large investment in infrastructure.

A state helping hand

The German government is addressing that challenge with the BEW (*Bundesförderung für effiziente Wärmenetze*) program, which offers financial support for creating new, renewable-powered district heating systems as well decarbonizing existing ones. The intention is to help municipal authorities make their heating sectors climate neutral by 2045 at the latest, a commitment that has been enshrined in German law since January of this year.

This is an ambitious undertaking, especially for smaller municipalities. Fossil fuels still account for over 80 percent of heat consumption in Germany, with natural gas dominating the sector. Some 14 percent of households are currently supplied via district heating networks, with less than a fifth of those powered exclusively by renewables. For companies operating in the sector, the German market therefore presents an abundance of opportunities.

“We expect to see a sharp increase in the portion of homes supplied with district heating from around a quarter to a third,” says Anna Kraus, a project officer for buildings and heat grids at Agora Energiewende, a think tank specializing in Germany’s transition to renewables.

Danish engineering company Danfoss has been developing district heating systems in Germany for several decades. It offers advice on early-phase planning, managing physical infrastructure and using software to monitor the network’s operations. One of the company’s recent projects was in Eurasburg, a municipality with a population of around 4,500 in southern Germany. Tasked with helping authorities to lower their carbon footprint, Danfoss installed a small district heating system serving 80 buildings including the local primary school, town



“We expect to see a sharp increase in the proportion of homes supplied with district heating.”

Anna Kraus, Agora Energiewende

hall and fire station. By eliminating the need for oil boilers, the initiative resulted in a 90 percent reduction in the community’s CO₂ emissions.

The Eurasburg project could provide a blueprint for other small or medium-sized German municipalities now tasked with developing environmentally friendly heating plans for their communities. “We see a big development in Germany, where a lot of these smaller towns will have to decarbonize,” says Jonas Loholm Hamann, head of business development at the company’s district energy division.

Replacing and reconfiguring

As well as installing new heating systems, there are several opportunities to decarbonize existing ones. One way is to alter the heat source, replacing gas with renewables such as

FOUR SUPPLY MARKETS WITH GROWTH POTENTIAL FOR DISTRICT HEATING

GEO THERMAL ENERGY



Geothermal energy comes from deep underground and is generated from the decay of elements over very long periods of time. It currently supplies only 2.5 percent of district heat in Europe. Sometimes referred to as a sleeping giant because of its untapped potential, it is set to play a major role in the future of Germany’s district heating.

HEAT PUMPS



Large heat pumps are extremely efficient at capturing energy from environmental sources such as rivers or the atmosphere. They can also work with geothermal sources or waste heat from data centers or industrial processes, making them a promising option for decarbonizing existing district heating systems.

INSULATED PIPING



The efficiency of district heating systems relies on maintaining the water’s temperature while in transit. High-quality insulated piping is required to ensure that as little heat as possible is lost while the water travels from the heat source to homes and businesses. International providers of insulated piping solutions will find an abundance of market opportunities in Germany.

HEAT STORAGE



Heat storage units in the form of very large, insulated water tanks can be incorporated into district heating systems. The water is heated when more energy is available than the network requires. This could be heat from a solar-thermal plant or excess renewable electricity, which is transformed to heat by electric immersion heaters or heat pumps. The stored heat can then be fed into the network to meet demand as and when needed.

HOW DOES GERMANY'S DISTRICT HEATING LANDSCAPE WORK?

geothermal and solar or installing low-carbon technology like heat pumps. Tailoring systems to the individual needs of buildings is another powerful tool. Well-insulated, modern residential units, for example, do not need to be supplied with the same high temperature water as old, energy-inefficient buildings that are typically gas powered.

In Berlin, municipal authorities recently took over the task of decarbonization after acquiring the city's heating business from Swedish energy provider Vattenfall. The vast infrastructure, comprising a network of some 2,000 kilometers, includes Germany's largest heat storage unit, located on the site of the Reuter West power plant. It can hold up to 56 million liters of water, warmed by surplus renewable energy, mainly from wind and solar plants. The storage unit can be flexibly connected to other sources, allowing it to be fed waste heat from processes such as sewerage treatment. Following a similar principle, in Hamburg, waste heat from a local metal factory is fed into the city's district heating system.

The current boom in artificial intelligence, which requires enormous computing power that generates immense waste heat, could lead to further opportunities. The city of Frankfurt, which is a hub for data centers, is attracting a lot of attention in this regard. "Germany is already one of the most important markets for us, but we also see a big potential in the future," says Loholm Hamann from Danfoss.

A blueprint for district heating

A sixty-year-old model for *Fernwärme* can be found in the northern German town of Flensburg, near the Danish border. Authorities there began installing district heating in the 1960s and have been in expansion mode ever since: today, more than 90 percent of households and businesses get their heat that way. For consumers, connecting to the system is a frictionless process. "They don't have to invest in new heating facilities in order to be carbon neutral," says Peer Holdensen, spokesperson for Flensburg's public utility company. "Instead, they can rely on municipal authorities."

Flensburg's biggest challenge now is to decarbonize. The town has one coal-fired boiler still in operation, as well as two plants that run on natural gas that will be converted to hydrogen. Authorities are planning to build a large

Just over six million households in Germany are currently supplied by district heating, comprising around 14 percent of the national total. There are around 4,000 networks in operation, covering a total distance of well over 30,000 kilometers. The federal government has a target to connect 100,000 buildings to *Fernwärme* networks every year.

The size of individual networks varies greatly, as do the levels of heating that takes place within them. In networks serving newer, well-insulated homes, for example, the water can be heated to lower temperatures than in those supplying older, less energy-efficient buildings.

In dense urban areas like Berlin, Munich and Hamburg, where district heating systems are already well established, the focus is on decarbonization. The German capital boasts western Europe's biggest district heating network, beaten only by Warsaw and Moscow on the entire continent. In smaller municipalities, such as the southern town of Eurasburg in Bavaria, new, smaller-scale networks have been established from scratch, allowing for a quick and effective move away from fossil fuels.

The town of Flensburg near the Danish border is a pioneer in the industry, having built its network in the late sixties. Some 90 percent of households and businesses there are connected to the district heating system. Flensburg's decarbonization plan involves converting existing power plants to hydrogen, harnessing the power of the local fjord and the installation of heat pumps and solar.

heat pump that will draw heat from the water in the Flensburg fjord, alongside solar thermal energy concepts and additional decentralized heat pumps that are also in development. The goal is to make Flensburg's heating system carbon neutral by 2035, ten years ahead of the date mandated by the federal government. The project will require an investment of EUR 400 million, with grants from the BEW forming a cornerstone of the financing model.

Flensburg was an early adopter in an industry that has gained fresh relevance because of the imperative to decarbonize in the face of global warming and the climate crisis. According to Euroheat & Power, an international network promoting sustainable heating, Germany recorded the biggest expansion in district heat distribution networks within Europe in 2022. If all goes to plan, a further 100,000 German homes each year will be connected to district heating systems powered by clean

energy. Achieving this goal will require joined-up thinking and collaboration between many players, from energy providers and software developers to building owners, municipal heating providers, utilities companies, as well as the manufacturers of heat pumps and insulated piping.

"This is very much a complex, multi-player operation," says Compton from Germany Trade & Invest. It may sound like an epic task. But as the saying goes, Rome wasn't built in a day.



Want to benefit from the expansion of district heat distribution networks in Germany?

CONTACT

robert.compton@gtai.de
GTAI expert for energy efficiency

PRESERVING **A PRECIOUS RESOURCE**

The increasing frequency of extreme weather is creating new challenges and at the same time new demands in the water economy in Germany and around the world. The sector is broad and open to new innovations, particularly digital ones.

The issue of water quality was on the agenda at last summer's Olympic Games in Paris. Concerns about the cleanliness of the Seine River disrupted open water competitions, and although the main events did go ahead, some athletes later complained about feeling ill. It was a timely reminder that water management is an international priority in an era of rapid climate change.

One of the companies responsible for carrying out the tests required in Paris was Fluidion, a French firm that's part of innovative alliance called Digital Water City extending across Europe. "In Digital Water City we're working with 23 partners from ten European countries on water management solutions for tomorrow's smart cities," says the Berlin water authority BWB on its website. "Tests are running in the metropolises of Berlin, Paris, Sofia, Copenhagen and Milan. Measures are developed in close conjuncture with local governments, providers, research institutions and innovators in the areas of digitalization and the water economy."

Global warming and extreme weather have increased the need for better water management around the world. The new digitalized sector is still very much in the development stage, opening up new investment opportunities. Fluidion, which specializes in "smart instrumentation," is a great example of a company that could have success in Germa-

ny. "While climate change is concerning, it also clearly opens up business opportunities for international companies—and not only for equipment suppliers," says Julia Braune, Chairwoman/CEO of GTAI. Before joining the German government's international business promotion agency, Braune became a leading authority on water supply issues in Germany and was the managing director of the German Water Partnership from 2017 to 2023. "Digitalization is also finding its way into the water industry. And that means much more than just the installation of radio water meters in households."

Investment boost in Germany

In the face of climate change, public and private water suppliers across the country have been upgrading their plants and equipment to ensure they are fit for the future. Water investments amounted to over EUR 3.5 billion in 2022 according to Germany's Federal Association of the Energy and Water Industries (BDEW)—an increase of 4.5 percent on the previous year.

Around 62 percent of the 2022 investments were spent on installing new pipes and repairing the existing network. New systems for water extraction and treatment are also in demand: German water suppliers invested more than EUR 500 million in this segment in 2022, mainly for the construction of new wells.

Increasingly, water management requires smart digital solutions. "In many areas, digitalization in the water industry is still in its infancy. This opens up great potential for providers of corresponding solutions," says Marc Beckett, scientist at the Fraunhofer Institute for Interfacial Engineering and Biotechnology IGB in Stuttgart. IGB is involved in several research projects on drinking water. Companies like Fuseki based in Essen and Bremen have been developing digital solutions for the water industry for 25 years. With the data and analysis software "hetida 4 water" (h4w), they now have an AI-supported solution, which can support companies in the utilities industry particularly in infrastructure operation, asset management and data analysis. The software can make predictions, identify changes in status at an early stage and report faults.



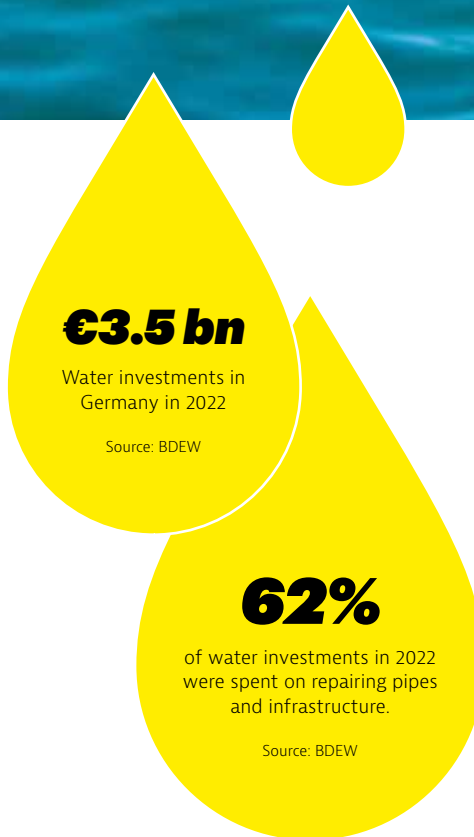
BAVARIAN JEWEL The deep, alpine waters of tourist haven Lake Walchensee in Bavaria, southern Germany, are particularly clear and clean—with visibility up to 40 meters. The water is said to be clean enough to drink from the lake, but with climate change and increasingly extreme weather events, even pristine lakes could be under threat.



Photo: picture alliance/dpa/Frank Hammerschmidt

Manufacturers of sensing technology and companies that can combine hardware, software and AI are now in demand. The start-up Preventio from Frankfurt/Main, for example, merges AI and Big Data to intelligently manage supply networks and detect leaks and anomalies more quickly. Its mission is to make managing complex infrastructure systems as easy as looking at a smartphone. The company, which emerged from a research project at Accadis University of Applied Sciences Bad Homburg, has continuously developed its portfolio of AI-based maintenance solutions and now offers solutions in the areas of leak detection and localization, predictive maintenance and risk assessment.

There are many opportunities in Germany for innovative digital solutions providers both from home and abroad. “Germany has an effi-



cient water industry with a very well developed infrastructure and qualified specialists,” says Fraunhofer researcher Beckett. “This results in a large market that can hardly be served by local providers alone.”

“There are lots of opportunities for international companies, and the size of the market and the country’s excellence in technology, among other things, make it an attractive location for business expansions,” adds Braune. “Germany Trade & Invest can help companies find their place here.”

Do you have an innovative solution that could help Germany manage its water resources?

CONTACT
flerida.regueira@gtai.de
GTAI expert

THE FUTURE OF LOGISTICS

Germany is a major logistics hub for Europe and a leader of innovation in the sector. Now it's steering towards the next generation of autonomous vehicles. Fresh innovations are attracting investment from beyond Germany's borders.

Not long ago, the prospect of driverless trucks motoring down Europe's central highways might have seemed like a futuristic fantasy, and a dangerous one at that. But as the technology has advanced, skepticism and apprehension have given way to a new enthusiasm grounded in reality.

That was evident in the successful demonstration of the SAFE20 project last March, when the German company Dachser showed off its self-driving trucks in its logistics center in Langen, Germany.

The project, which was funded by the German Ministry for Economic Affairs and Climate Action, clearly demonstrated that fully autonomous vehicles could operate in regular service at a minimum speed of 20 km/h in complicated situations with both human-driven vehicles and pedestrians—and it put any lingering doubts to rest. In the confines of the logistics center, the automated vehicles were also capable of maneuvering semi-trailers and interchangeable units.

SAFE20 was supported by the Fraunhofer Institute, whose senior engineer for Material Flow and Logistics, Michael Lücke, says the technology has come of age. "When it comes to self-driving trucks, there's no question that we're technically 99% there," he explains. "Making the vehicles drive—steer, brake, signal on their own—none of that is a problem." Self-driving vehicles are already common in

warehouses and ports. The challenge is to use this machinery in public—in other words, places where there are also unpredictable pedestrians and human drivers. This too, would appear to be only a matter of time. Many regions in Germany are already installing new lanes on stretches of highway to accommodate self-driving trucks. "The infrastructure has

THE BOTTOM LINE

As Europe's biggest logistics hub, Germany is at the center of technological advances in the industry. Self-driving trucks are one of the key innovations that are driving new investment in this future-focused sector.

been developed for some time," says Lücke. "In our experience the problem is the human being, not the autonomous vehicle. Humans tend to be—how should I put it?—imprecise."

Europe's logistics hub

David Chasdi, logistics expert at GTAI, predicts Germany will be at the center of advances in

the sector, thanks to the country's traditional strength in the field.

"Germany is Europe's largest logistics market by far," he points out. "Germany's leading logistics market revenue ranks number one and is almost equal to France and the UK's revenue—Europe's numbers two and three—combined. It generates roughly 20 percent of Europe's total logistics market share." Moreover, as GTAI mobility expert Christoph Mester points out, Germany is already well-prepared for the next stage in logistics infrastructure. "Germany is definitely a pioneer when it comes to nationwide regulation and autonomous driving," he says.

The government brought in autonomous driving legislation as early as 2017 and in 2022 amended liability insurance to allow Level 4 autonomous tech on German roads. Level 4 is the second-highest level of automation, which allows the vehicle to drive on its own with the driver present. "That makes Germany the first country globally to have a nationwide regulation for autonomous driving applications up to level four," says Mester.

With a variety of technological institutions working on autonomous mobility, Germany's R&D landscape is second to none. The Fraunhofer Institute, for instance, is developing software that checks and corrects machine learning on the road, as well as interconnected systems that link cars with infrastructure.

**FDI PERSPECTIVE:
IVECO**

With the launch of its semi-automated truck pilot project in southern Germany, the Italian company IVECO has become the latest in a series of logistics companies to take advantage of Germany as an investment location.

The transport vehicle specialist announced the project in July 2024, together with the German artificial intelligence company Plus AI and the German drug store retailer dm, as well as DSV, one of the world's leading transport and logistics providers.

Following initial test runs on the 45-minute drive between dm's distribution center in Waghäusel and the DSV distribution center in Gernsheim, the project will see semi-automated trucks trained by human drivers.

In a statement, Marco Liccardo, chief technology and digital officer of the Iveco Group said the company was "excited to empower fleets and truck drivers with the unprecedented potential of these next-generation vehicles."

The program will gather real-time data on the benefits of automated logistics, which include reduced driver fatigue, improved road safety, and better fuel efficiency.



8
R&D centers operated by IVECO

160
Countries where IVECO provides service points

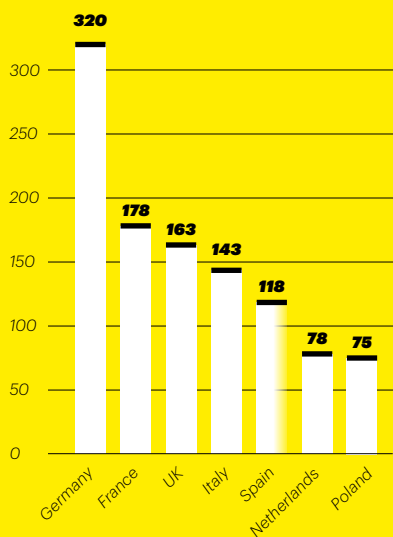
35,000
IVECO employees worldwide

Italian company Iveco Eurocargo showcases its top-of-the-range commercial vehicles including this semi-automated HGV.

Photo: IVECO

**GERMANY IS THE
LARGEST LOGISTICS
MARKET IN EUROPE**

Total turnover in logistics services in European countries (in € bn)



Source: Fraunhofer IIS (2022).

New car technology tends to be introduced first in the premium sector, where Germany has strong brands. The BMW Campus near Munich also has specialists working on autonomous driving software algorithms, and Mercedes was the first car manufacturer in the world to get permission to introduce a "traffic jam pilot" for Level-3 autonomous driving.

Strong R&D is one of the main reasons why there has been a cascade of interest from abroad. "It's impossible to ignore that foreign automobile companies are streaming into Germany and that they want to build factories here," says Lücke.

Government support

Germany's political leaders have long recognized the importance of autonomous logistics. "There's absolutely no question that politicians want to support and subsidize this sector," says Lücke.

The German government has a range of initiatives to support R&D projects, especially for small and mid-sized companies (SMEs). One of these is KMU-innovativ, a program cre-

ated by the German Ministry of Education and Research. The logistics arm of KMU-innovativ funds SMEs that are researching solutions for autonomous networked driving. The aim is to support firms developing product solutions that go beyond the current state of the art and to explore and fully exploit market opportunities.

"For example, a company can say: 'We've got an idea for how to make the steering of autonomous systems easier.' Then KMU-innovativ helps identify a research institute to help them and to get that subsidized," says Lücke. "That of course reduces the risk significantly." "There is a lot happening in Germany," agrees GTAI's Mester. "It's a great investment opportunity for foreign investors that just want to push this."



Want to find out more about strategic investment opportunities?

CONTACT
david.chasdi@gtai.de
GTAI expert for logistics

The German company Reiling offers innovative solutions for recycling outmoded photovoltaic modules in a growing market.



CLOSING THE SOLAR CIRCLE

Germany is setting new records in photovoltaic R&D. But solar-power units don't last forever. So, with the country pushing ahead in its transition to clean energy and a truly circular economy, demand is set to grow incrementally for solutions to recycle obsolete and outmoded PV hardware.

Anyone who has traveled through Germany recently will have noticed a change to its rural and urban landscapes. "If you drive through the country, every 200 meters on average you will see PV instal-

THE BOTTOM LINE

The ongoing expansion of solar power in Germany, combined with the fact that many PV installations will reach the end of their useful lives in the near future, has given birth to a very promising new sector for solar hardware recycling.

lations on roofs, on free spaces," says Markus Krausewitz, site director of ROSI, a French company specializing in the recycling of solar power units, which has recently expanded to Europe's biggest economy. "It's like a tsunami ahead of us."

Germany has long been one of the world's biggest proponents of solar energy technologies, and the country now generates more power from solar modules than any other nation in Europe. "Right now, there are about four million solar power systems installed in Germany, with a total installed capacity of around 80 gigawatts," explains Carsten Körnig, managing director of the German Solar Association.



A SNAPSHOT OF THE SOLAR RECYCLING MARKET

The expansion of solar power in Europe has created new demand. The first major wave of PV installations in Germany began in 2010. Given that most modules function effectively for around 20–30 years, the issue of what to do with obsolete units is becoming increasingly urgent. Photovoltaic panels contain valuable materials like silicon, silver, copper and aluminum, and developing methods to recycle those components is critical to making solar power a circular industry and a truly clean energy source.

“By 2030, between 400,000 and one million metric tons of modules will have to be disposed of and recycled per year in Germany,” says Körnig. “By 2050 it will be 4.3 million tons. The ongoing solar boom will lead to an increased demand for recycling solutions.”

Opportunities for innovators

Germany needs practical recycling solutions and new approaches. One company pushing the boundaries of technology is FLAXRES, a Dresden-based start-up. They have pioneered a system that uses high-intensity light pulses to break modules down to their raw materials, without the need for chemicals. The potential for this technology has been recognized by Korean carmaker Hyundai, which bought an eight percent share in FLAXRES in a multi-million euro deal in early 2024.

Local authorities are also doing their bit to encourage outside investment. Earlier this year, ROSI—whose company name is an acronym for Return of Silicon—announced plans to set up a new facility in the town of Elsnig, in the eastern German regional state of Saxony. The firm has developed processes that use thermal and soft chemistry to recover valuable components from solar modules.

“ROSI’s focus is on silicon,” says Krausewitz, “for which we have almost no natural resources in Europe at the moment.” In 2023, China was responsible for more than two-thirds of global silicon production. Its output was 60 times higher than that of the top EU producer,

Flérica Regeuira-Cortizo is a senior manager in Energy, Building and Environmental Technologies at Germany Trade & Invest (GTAI).

Why are photovoltaic recycling technologies important for Germany?

Germany has taken a pioneering role in the transition to clean energy. With a growing number of solar modules reaching the end of their lifespan, it now faces the challenge of recycling these modules. Progress in these technologies could help us regain valuable materials and support the circular economy.

What can Germany offer companies looking to expand in this sector?

Germany has a number of funding programs that support innovations in this field. The government and regional agencies offer comprehensive support in site selection, funding applications and integration into local networks. GTAI experts support international companies at every stage, from planning through to locating in Germany.

What other factors make Germany an attractive location?

Germany offers an ideal environment for photovoltaic recycling companies, thanks to its stable economy, developed infrastructure and commitment to renewable energy. Companies can profit from a well-educated workforce, a strong industrial base and a first-rate research environment, all of which facilitate the development of new technologies. Last, but not least, Germany remains an open-minded country and economy.

France. “We would like to step into a bright, green future, but without silicon, without silver, without all the high-value materials, it is not possible,” Krausewitz adds. “So the idea was to use the existing material and bring the materials in a very pure form back to the circle again.”

Germany’s early adoption of solar power makes it an obvious place for companies like ROSI to expand from. Put simply, they are going where the business takes them. “If you have a look at Europe, in the year 2035, 50 percent of modules that will need to be recycled are

located in Germany,” Krausewitz explains. “We need to minimize logistics. So Germany is a natural choice.”

A bright future

ROSI’s strategy makes even more economic sense considering the expansion of solar power in Germany since the initial burst of installations. In 2012, Germany’s installed solar capacity was just over 34 gigawatts (GW). By 2023 that had more than doubled to over 81 GW.

And that growth is only going to accelerate. The German national government has set a goal of tripling the current rate of new PV installations by 2026. It wants to see the country generating 215 GW of solar electricity before the end of the decade.

Relocating to a new country is always a major undertaking. But help is at hand for companies who want to follow in ROSI’s footsteps and set up shop in Germany. Germany Trade & Invest advised the company on its expansion and made sure it was hooked up with the partners it needed on the ground.

“In Saxony, from the very beginning, we enjoyed great support from the region’s economic development agency, the district administrator, and also the authorities,” says Krausewitz. “With all the support, the infrastructure, and also the motivated people we got in touch with, Germany is a really good place to be.”

That winning combination means the sun will shine in Germany on companies investing in photovoltaic recycling technologies. Krausewitz is encouraging more firms to “make hay,” as the saying goes. “I recommend every company to look at the mid- and long-term opportunities in Germany,” he advises.

Want to find out more about investing in solar recycling?

CONTACT

Flérica.Regueira@gtai.de
GTAI recycling expert



NORTH, SOUTH, EAST AND WEST

Germany borders more countries than any other EU member. That's an economic strength that can offer special advantages to international companies wanting to work with Germany's nearest trading partners.

When employees of the financial services provider ODDO BHF travel by train from company headquarters in Paris to Saarbrücken in southwest Germany, it takes them just under two hours. The journey from the German financial capital Frankfurt to Saarbrücken isn't much longer. That's one of the reasons why in 2021, the financial group opened a new service center in Saarbrücken near the Franco-German border.

3,767 kilometers is the length of the border between Germany and its nine neighboring countries: Denmark to the north, Poland and the Czech Republic to the east, Austria and

Switzerland to the south, France, Luxembourg, Belgium and the Netherlands to the west. Germany has more direct neighbors than any other country in Europe. The borderland regions (*Grenzregionen*) are attractive locations for foreign companies for three good reasons.

The first is that international companies setting up a location in the *Grenzregionen* will find it convenient to offer their products and services in the markets of those neighboring countries as well as in Germany. Conversely, they can source preliminary products in the adjoining countries and in Germany. Proximity to no less than nine neighboring economies, with excellent logistics routes on all sides, simplifies expansion from Germany into the rest of Europe.

"This is highly attractive for companies in many sectors," said Tobias Chilla, professor of geography at the Friedrich-Alexander-University Erlangen-Nuremberg. "For some industries, customers on the other side of the border are the decisive argument, for others it is the favorable purchase conditions of pri-

mary products." Many companies expanding across borders opt for locations—for example, Polish companies setting up in eastern Germany—close to their home base. In day-to-day business, such proximity is a great advantage

THE BOTTOM LINE

Germany's borderland regions on all sides offer obvious locational advantages for its closest trading partners: greater convenience, shorter supply chains and a diverse pool of multilingual talent to draw on.

and reduces risk, enabling efficient logistics between the locations. In some cases, companies even share resources such as machines or vehicles. The short commute between the company's headquarters and the subsidiary



A VILLAGE OF TWO COUNTRIES The villages of Suderwick in Germany and Dinxperlo in Achterhoek, the Netherlands, are seamlessly joined to form the unique cross-cultural community of 'Dinxperwick'. The national border runs directly along this street: on one side the houses are Dutch, on the other, German.

Photo: picture alliance/ANP/Vincent Jammik

also saves employees travel time, costs and stress. Language can also be a deciding factor for companies from the German-speaking countries of Austria and Switzerland. Austrian and Swiss companies wanting to tap into the Polish market can benefit from having a location in the German-Polish border region where German is a *lingua franca*.

“A company headquarters in Germany simplifies communication with local authorities and service providers for companies from German-speaking countries,” says Fabian Möpert, senior manager of EU/EFTA at Germany Trade & Invest and an expert on foreign market information for Poland, Hungary, the Czech Republic and Slovakia. “Translations of contracts and other documents are not necessary, which saves time and resources.”

Diverse labor pool

Companies based in borderland regions have a diverse pool of employees to draw from. “Those looking for employees in several countries sometimes have a greater choice,” says

Möpert. Furthermore, companies that use the labor markets of next-door countries can react more quickly to short-term bottlenecks in the domestic skilled labor market.

The willingness to work across borders has increased in recent years. With the exception of 2020, the number of people commuting to work in Germany from neighboring countries on a daily basis has risen continuously since 2010. According to the Federal Employment Agency, around 240,000 cross-border commuters were employed in Germany in June 2023. Most of them come from Poland, followed by France and the Czech Republic.

This creates multinational teams that are characterized by cultural diversity. People from neighboring countries are often brought up to be multilingual—expertise invaluable to companies with international expansion ambitions. “Those who communicate with customers and business partners in their native language and are familiar with the cultural circumstances minimize misunderstandings and quickly build trust,” explains Chilla.

The German regional state of Saarland, where Saarbrücken is located, is a pioneer when it comes to multilingualism. From the first year of school, children there are presently taught French as well as their native language. The education program and campaign is part of the state’s so-called “France strategy.” Its aim is to make multilingualism the norm in large parts of the population by 2043. The strategy covers all areas of daily life—from school, university and working life to medical infrastructure and cross-border mobility. Companies like ODDO BHF are positioned to benefit directly from this campaign.







Want to find out more about Germany's borderland?

CONTACT

invest@gtai.de



STRONG SECTORS IN WESTERN GERMANY

-  Mechanical engineering
-  Plastics and chemicals
-  Metal and steel
-  Financials

The Ludwigskirche in the city of Saarbrücken on the French border. This gem of Baroque architecture was completed in 1775.

→ THE IDEAL CENTER: ODDO BHF

The Franco-German financial services group ODDO BHF opened its new service center in Saarbrücken in south-west Germany in 2021. “The location underlines our strategy as a Franco-German group,” explains Michael Cattarius, managing director of ODDO BHF Solutions. The city is centrally located between the two headquarters in Paris and Frankfurt. “The border location facilitates cross-border meetings and thus promotes cohesion within the group,” says Cattarius.

Cattarius also emphasizes linguistic diversity: “The potential for multilingual employees is much greater than at other locations. This allows us to create real added value in intercultural and linguistic terms.”

In total, the company employs around 3,000 people who manage client assets totaling more than EUR 140 billion worldwide across the main business areas of private wealth management, asset management, investment banking and corporate and international banking. The service center in Saarbrücken currently supports the group’s back office and IT units, but ODDO BHF has plans to expand its scope.



STRONG SECTORS IN NORTHERN GERMANY

-  Renewable energies
-  Maritime economy
-  Digital economy
-  Life sciences

→ **HANDY FOR SCANDIS: CONSID**

The Swedish IT service provider Consid opened a German office in Hamburg at the beginning of 2023. The company develops digital transformation solutions and digital business models for German clients including Norddeutsche Landesbank in Hanover and the online retailer Otto. The proximity of the northern German city to the Scandinavian countries was a decisive factor in the choice of location.

“The business culture in Hamburg is comparable to that in northern Europe due to its proximity to Scandinavia,” says Lars Napret, regional manager for northern Germany. “A similar understanding of values facilitates business cooperation.” Consid is one of a cohort of Swedish companies coming to Hamburg. “More and more Swedish companies are using the city as a starting point to enter the German market,” Napret enthuses. “Some even describe Hamburg as the southernmost Scandinavian city.”

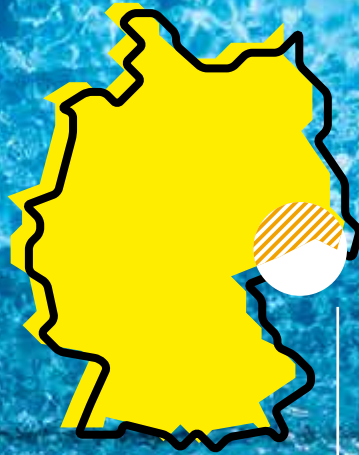
Due to its borderland location, the travel time between Hamburg and Consid’s company locations in Denmark and southern Sweden is short. “The employees in Copenhagen and Karlskrona in Sweden are helping us to set up the company,” says Napret. “That’s why short distances were important to us.” The Fehmarnbelt tunnel between Germany and Denmark will provide an even faster transport connection from 2029.

Proximity to Scandinavia is one of the many advantages of Hamburg as a location. The city is home to many international companies including Consid, the Swedish IT service provider, which opened an office there in early 2023 to offer digital solutions for German clients.

→ CLOSER TO CUSTOMERS: BELIMO

Belimo Automation Deutschland, a subsidiary of the Swiss Belimo Holding, opened a new site in Großröhrsdorf near Dresden in eastern Germany in 2019. “The new location enables shorter transport routes and therefore faster delivery times for our customers in Germany and northern and eastern Europe,” explains managing director Volker Benath. The company is the global market leader in the development, production and sales of field devices for the energy-efficient control of heating, ventilation and air-conditioning systems. In addition to service and logistics, the 55,000-square-meter site in Großröhrsdorf also houses workshop and assembly areas.

Benath sees another advantage of the location close to the border: “The new site simplifies customs clearance from Germany immensely.” Before setting up the site in the eastern German border region, the company supplied European customers directly from Switzerland and therefore from outside the European Union.



STRONG SECTORS IN EAST GERMANY

-  Automotive industry
-  Microelectronics
-  Information technology
-  Renewable energies

The Masseneibad in Großröhrsdorf, near Dresden, has great leisure facilities including this 2,400 m² outdoor pool.

Looking out over the city of Basel from a viewpoint in Grenzach-Wyhlen to the Roche towers—a symbol of the region’s strong pharmaceutical connection and its proximity to Switzerland.







→ **R&D EDGE: ROCHE**

The Swiss pharmaceutical company Roche has four German sites, and it’s no accident that two of them are in border regions. The group’s biotechnology center in Penzberg, Bavaria, for example, is not far from Austria. Although the proximity to the border did not play a major role when the foundation stone was laid in 1972, Annett Fischer, head of Sites Network Communications Germany at Roche, finds major advantages today. “We maintain good contacts with universities in Innsbruck in Austria,” she says. “And we also receive job applications from Austria.” Over the past five years, the Group has invested around EUR 1.3 billion in expanding the site.

Only a few kilometers separate the group’s headquarters in Basel and its southern German site in Grenzach-Wyhlen, Baden-Württemberg. Since Roche specializes in research, production and patient care, this proximity increases efficiency and time-to-market across the Group. “The rapid exchange between the sites enables us to incorporate experience from Germany into our global strategies at an early stage,” says Fischer. After all, Germany has a key role to play, as Fischer points out. “A market launch in Germany is the gateway to the markets in the 27 EU member states.”

STRONG SECTORS
IN SOUTHERN GERMANY

-  Mechanical engineering
-  Automotive industry
-  Electrical engineering
-  Chemicals and pharmaceuticals

“NO OTHER COUNTRY INVESTS AS MUCH IN GERMANY.”

Germany and the Netherlands are more than just neighbors: they share a long trading history. But do Dutch companies still see Germany favorably? Günter Gülker, managing director, German–Dutch Chamber of Commerce shares his views.

Germany and the Netherlands are direct neighbors in Europe, and the economies of both countries are closely intertwined. How has this special economic relationship developed in recent years?

GÜNTER GÜLKER: It is no secret that Germany is the Netherlands’ undisputed most important trading partner. What the public is often not aware of is that the Netherlands, with a recent trade volume of EUR 220 billion, is also Germany’s third most important trading partner worldwide—after the US and China. And what many people may not be aware of is that the Netherlands is the largest investor in Germany. It has seeded EUR 183 billion in Germany, more than any other country, according to the latest figures from the Deutsche Bundesbank. It’s a positive trend that is continuing. Incidentally, there are currently 2835 subsidiaries of Dutch companies in Germany.

Why does Germany remain an attractive location for Dutch companies?

GG: In the B2C sector, market size and purchasing power are decisive factors, with entrepreneurs not only seeing the potential of the German sales market, but also the entire DACH region as a market with more than 100 million consumers. In the B2B sector, it’s cooperation with other firms that mobilizes Dutch companies. For them, Germany is the country of market leaders and hidden champions. It’s

therefore a popular partner, especially in the technology sector. In 2021, the German–Dutch Innovation and Technology Pact was signed for this purpose. It further intensifies bilateral cooperation and accelerates the development of technical solutions. Within this framework, there are many future-oriented collaborations in areas such as smart mobility, cyber security, life sciences and the circular economy.

What are the advantages of Germany as a business location for international investors compared to other European economies?

GG: Dutch companies value the German Mittelstand—Germany’s strength in medium-sized enterprises. They appreciate the technological excellence. And above all there’s trust. In Germany, a word is a bond. That creates the basis for long-term successful cooperation.

Which sectors are particularly interested in locating in Germany?

GG: The renewable energy sector and the hydrogen network are important. Cooperation in bilateral real laboratories is also particularly interesting. These “field labs”—as they are called in the Netherlands—exist in many different areas, for example in robotics, photonics and IT. For many Dutch companies, Germany is the key market: it’s strong on sustainability and offers a range of opportunities.

Interested in expanding to Germany or doing more business with the Netherlands?

CONTACT

g.guelker@dnhk.org
Günter Gülker, managing director,
German–Dutch Chamber of Commerce

Günter Gülker, managing director, German–Dutch Chamber of Commerce (AHK Niederlande) in Den Haag

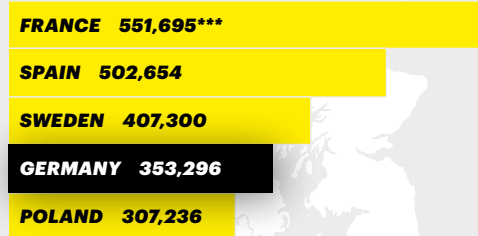
How Germany Works

THE METRICS OF SUCCESS

Germany prides itself on being the heart of the European Union. But how does it stack up against other countries in the bloc? Germany is nowhere near the biggest country in terms of area, but it's easily the EU's largest market. That's due to its relatively dense population as well as other factors. The following figures illustrate Germany's unique place in the EU.

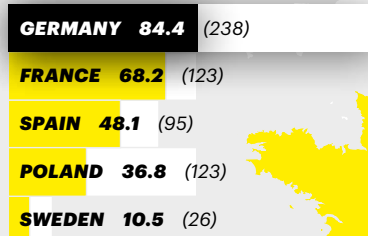
AREA

Area of the five largest EU countries (in square kilometers)*



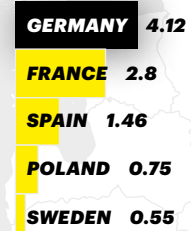
POPULATION (AND DENSITY)

Million inhabitants, 2023** (and inhabitants per square kilometer, 2021)**



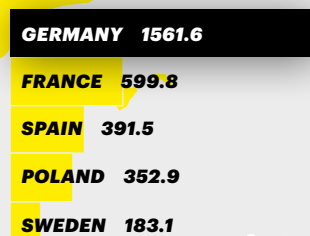
GROSS DOMESTIC PRODUCT

GDP in trillions of euro (2023)*



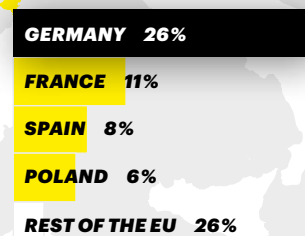
EXPORT

Total export in billions of euro (2023)*



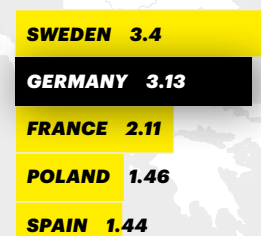
INDUSTRIAL PRODUCTION

Countries' share of the EU's total sold industrial production (2022)*



R&D EXPENDITURE

Gross domestic expenditure on research and development in % of GDP (2022)*



*Source: Eurostat

**Source: Statistisches Bundesamt

***excluding overseas territories

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Alexander Walter
alexander.walter@gtai.de

Germany Trade & Invest

Friedrichstraße 60, 10117 Berlin
T. +49 30 200 099-0
info@gtai.de