

The Chemical Industry in Germany

Industry Overview



GERMANY
TRADE & INVEST

Germany – Global Heavyweight for the Chemical Industry

Germany's chemical industry is number one in Europe. The industry employs almost half a million highly trained staff. Businesses and research institutes involved in the sector invest substantially in research and development.

This makes the industry a driving force for innovation. By developing new materials, active pharmaceutical ingredients and high-performance chemicals and plastics, the chemical industry sets the benchmarks for advancing state-of-the-art technologies.

This creates benefits for a number of different fields such as energy efficiency, renewables, energy storage, and mobility. Leading international chemical firms choose to locate in Germany. They are drawn to Germany because of its highly qualified workforce, an excellent research landscape, state-of-the-art logistics, and the presence of world-class infrastructure.

Germany's central geographical location at the heart of Europe provides a further decisive advantage, giving access to a market of more than 500 million customers in the European Union.



■ EU member states

The Industry in Numbers

Decades of Robust Growth

During the period 1960 to 2010, chemical industry revenue in Germany increased from EUR 12 to EUR 171 billion (according to Feri AG and the German Chemical Industry Association – VCI); resulting in an average nominal growth rate of 5.4 percent per year (real growth rate: 3.1 percent per annum). Over the same period, the number of employees decreased from 458,000 to 415,000; increasing productivity sixteen-fold indicated by revenue per employee levels of EUR 412,000 in 2010.

Turnover: European Number 1 and World Number 4

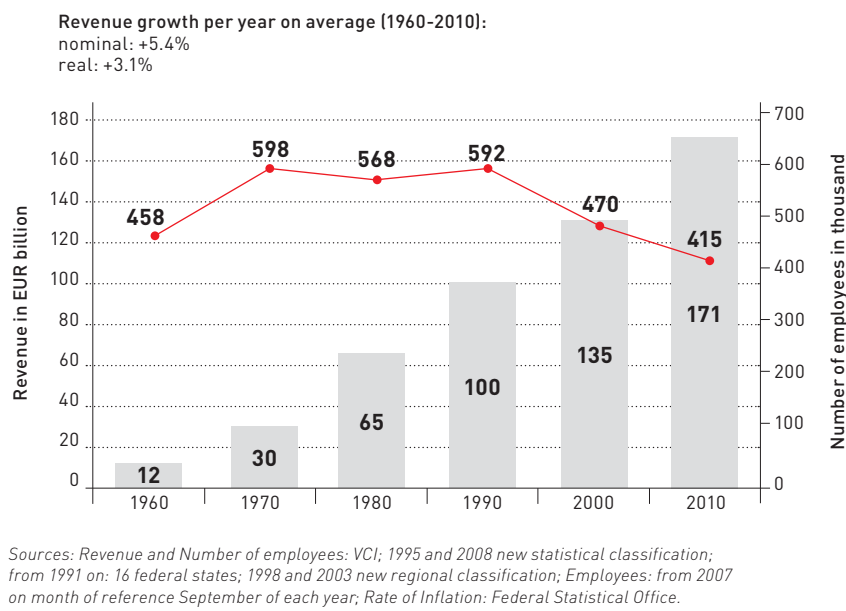
When it comes to chemical production locations, Germany is a global heavyweight, ranking first in Europe. With 2010 turnover of EUR 180 billion (Eurostat), the German chemical industry played a leading role in European performance, generating a quarter of total EU-27 sales of EUR 721 billion.

Germany has occupied the world number four spot in global chemical revenue ranking for a number of years, being passed only by China (EUR 694 billion), the US (EUR 584 billion) and Japan (EUR 214 billion).

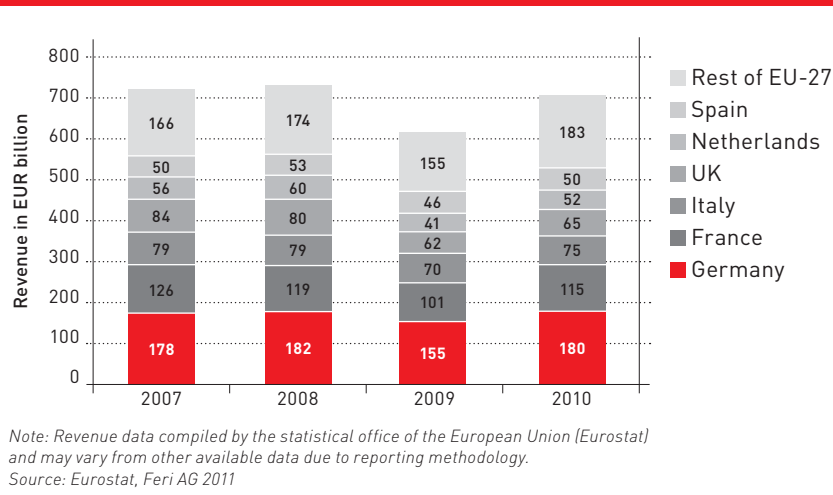
Stable Company Structure

There were nearly 2,000 chemical companies in Germany in 2008, of which more than 90 percent are SME's (less than 500 employees). More than 75 percent of the total chemical revenues were achieved by around 100 companies with revenues of over EUR 250 million each.

German Chemical Industry Revenue and Employee Development



European (EU-27) Chemical Industry Revenue



Major International Players

In the face of numerous global challenges, world-class company performance is imperative. German companies have long been at the forefront in developing innovations and trends and continue to consolidate their global prominence.

In fact, the country's top producers account for no less than six of the top 40 chemical companies, headed up by such illustrious names as BASF, Bayer, Henkel, Evonik, Linde, and Merck.

The German Chemical Industry in Transformation

With around 11 percent of total manufacturing industry turnover, the chemical industry is the third largest industrial sector in Germany after the automotive and mechanical engineering sectors. Previously an industry which was strongly influenced by domestic considerations well into the 1990s, the chemical industry has undergone major structural transformation brought about by constantly changing world market conditions over the past two decades.

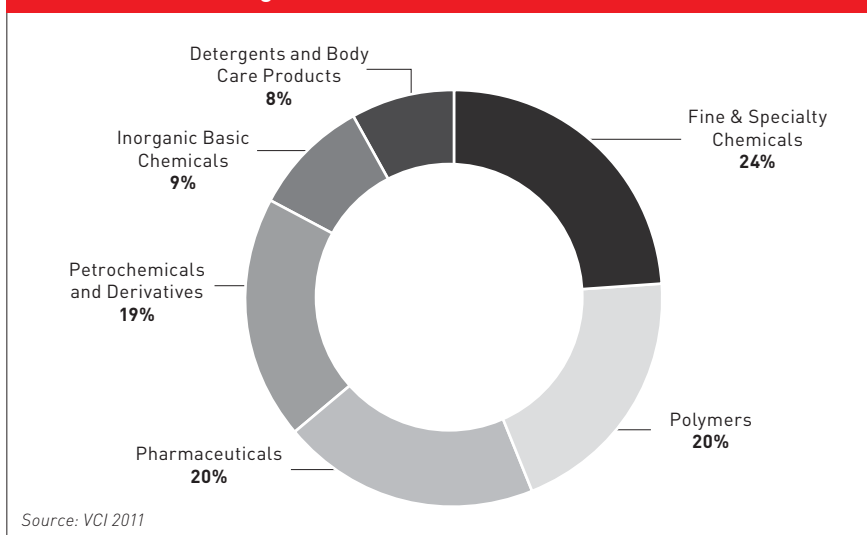
Asia Catching Up

Strong growth in Asia in particular – with a production share of around 50 percent and a strong increase in domestic consumption – has also led to structural changes in the chemical industry in Germany. Impressive is the development experienced by China, a country whose world market share has grown by 16 percentage points in the 10-year period 2000 to 2010 alone.

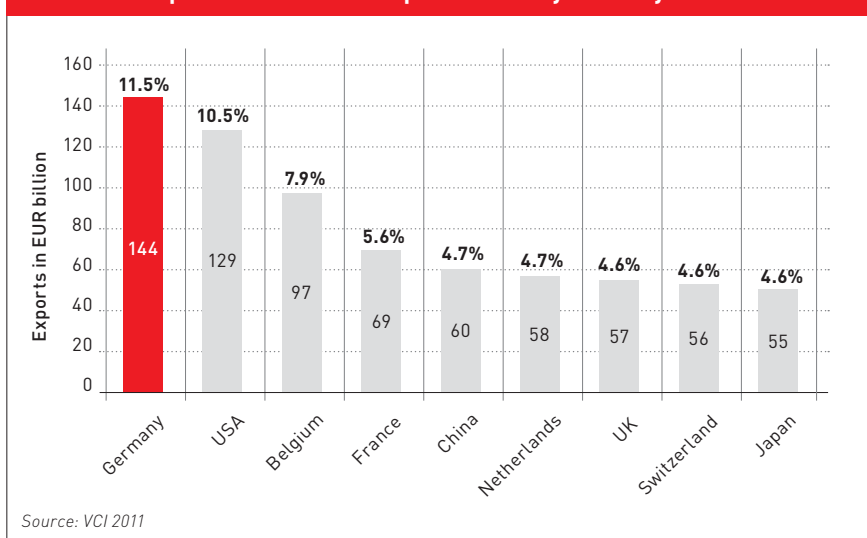
Petrochemistry Goes East

Increasing international competitive pressure has led to the petrochemical moving to the raw materials processing countries; primarily the Middle East, but increasingly also to China. One indicator of this is the expected closure of approximately one quarter of the 42 steam crackers currently located in Europe by 2015. At the same time, the share of fine and specialty chemical production in Germany has increased steadily.

Chemical Market Segmentation as Share of Production Value 2010



Chemical Exports and Global Export Share by Country 2010



Growing Export Markets

The export strength of the German chemical industry nevertheless remained untouched by the changes outlined in the previous sections. In 2010, Germany was the world's largest exporter of chemical products – with market share of 11.5 percent. Of these exports, 62 percent remained within the EU-27 zone, while 12 and 10 percent were exported to Asia and North America (NAFTA) respectively.

Innovative Strength

The defining characteristic of the European chemicals industry is and remains its innovative strength associated with enormous productivity increase potential. Here Germany stands out in particular, both in terms of innovative capacity and practical application in the industry. This is why Germany has retained its world number three spot for global chemical patent registrations with a share of 17 percent, being surpassed only by the US and Japan.

Academic Excellence

University and non-university R&D potential provide the platform for this enormous patent activity. Fifty-eight universities and 24 universities of applied science provide academic training in the chemistry sector. To this come also a number of prestigious non-university R&D institutions who are active in dealing with the challenges posed by future chemical sector issues. These include:

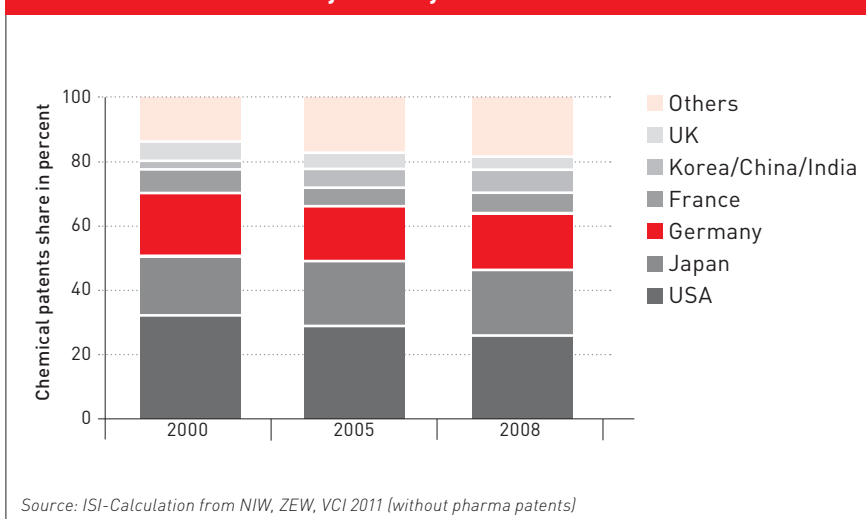
- Max Planck Society: 17 institutes
- Fraunhofer Society: 23 institutes
- Helmholtz Association: 6 institutes
- Leibniz Association: 5 institutes

Intensive exchange between university and non-university research results and private companies ensures a source of new patents and commercial developments.

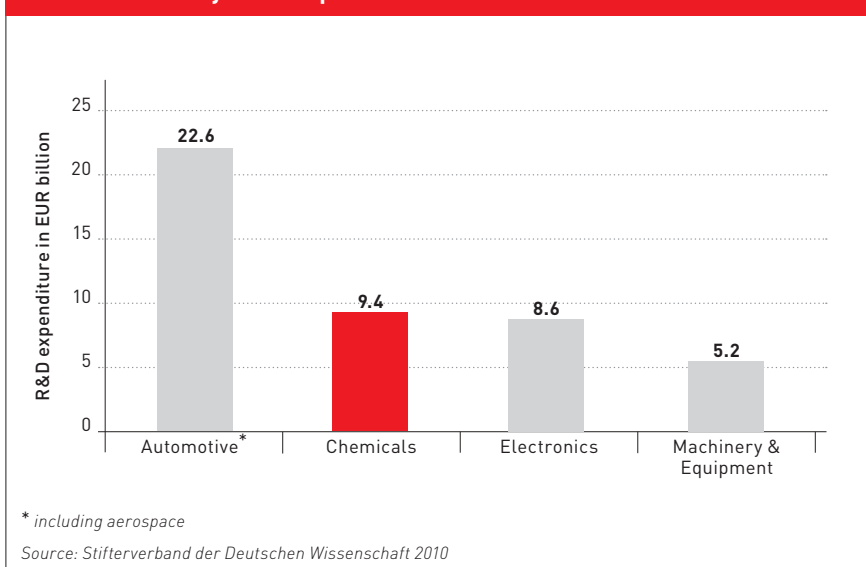
Commercial Innovation

Chemical industry R&D expenditure spent in developing new products is traditionally very high. In 2010, the expenditure in Germany was EUR 9.4 billion (or 5.5 percent of revenue), making the sector the second-strongest R&D industry after the automotive sector. R&D accounts for 19 percent of total industry expenditure, with around one in ten industry workers active in research.

Chemical Patents Share by Country



German Industry R&D Expenditure



High Productivity through Innovation

Germany's chemical companies have reduced their energy needs by 40 percent in just 10 years (period 1996 to 2006). At the same time, turnover for the same period increased by 47 percent, while revenue per employee for the period 1990 to 2010 rose from EUR 177,000 to EUR 412,000.

These productivity increases however, have resulted in growth rates insufficient to maintain employee numbers. As a result, employee numbers in Europe fell from around 1.6 million to just over 1.1 million in the period 1995 to 2010, equivalent to an average annual reduction of 2.1 percent.

Germany - Where Innovation Meets the Market

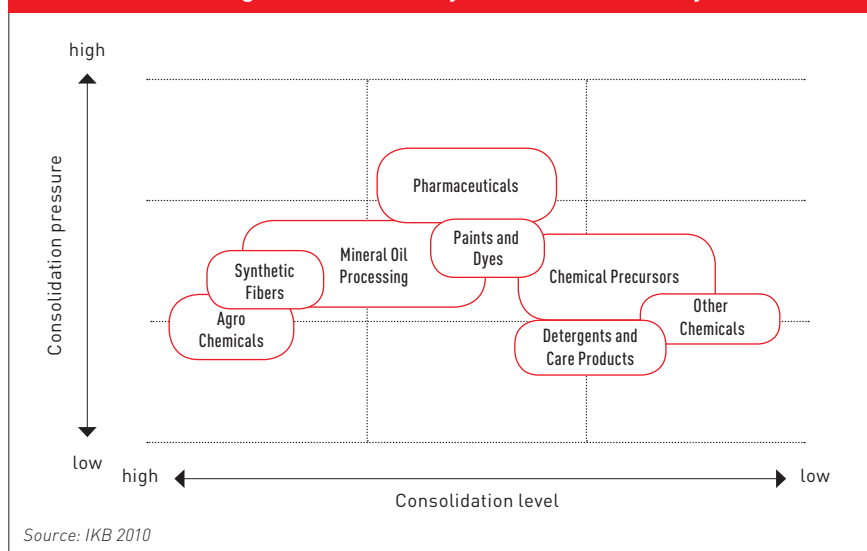
In just the same way that innovative performance through productivity increases has led to a reduction in workforce size, it also serves as a guarantor for the continued existence of a successful and thriving chemical industry in Europe. Germany's chemical industry can continue to place confidence in a reliable and stable business environment. The increased migration of the petrochemical and basic chemical sectors out of Europe in the past decade has led to a fundamental consolidation of the chemical industry.

Companies are increasingly focusing their activities in the high-tech and high-margin specialty and fine chemicals segments. Further changes are expected in the pharmaceuticals sector in the coming years as important "blockbuster" medicine patents expire and foreign generic manufacturers and legislative cost-reduction programs exert pressure. There are three overarching trends which lead to stable growth for the German chemical industry in the future.

Trend 1: From Commodities to Specialties

The development away from mass commodity or bulk chemistry to fine & specialty chemical production can be best observed using a "push-and-pull" model. As a result of high cost pressure, the low-margin equipped mass commodity chemistry is increasingly pushed into the raw materials processing countries (mainly the Middle East).

Concentration Prognosis in Germany's Chemical Industry



Simultaneously, Europe has access to the necessary technologies and know-how required in the constantly growing specialty chemicals market. Europe, with Germany at the forefront, is proving very attractive to the specialty chemical industry.

Trend 2: Formation of Innovation Alliances

A broad consensus that transfer of "knowledge" to "turnover" and the development of research results into marketable products and processes can succeed exists within the European chemical industry. There is also widespread agreement that this can occur in a cross-sectoral context within joint cooperation networks.

Both the business and research sectors are equally committed to the generation of a synergy effect leading to a distribution of risk, reduction of costs, and shorter innovation cycles.

At the same time, cooperation networks of this nature are similarly faced with a number of issues including, for example, questions of handling rights and the joint commercial exploitation of results gathered. Research and development in the chemical industry without the existence of such cooperative alliances seems to be an inconceivable prospect for the future. Above all, the industry will profit from the introduction of innovation alliances in the development of new materials and key technologies for new markets in industries including renewable energies, energy storage, and "new" raw materials.

Chemical Industry Trends until 2020

Trend	2010	2015	2020
Raw Materials	Chemicals made out of sugar and starch	Lignocellulose as raw material	Genetically modified plants
Energy	Lithium for batteries	Neodymium for motor magnets	Indium & tellurium for photovoltaic sector
Mobility	Materials with higher energy efficiency levels	New battery technologies	Smart grids

THESE TRENDS WILL LEAD TO INCREASED DEMAND IN:

Cross-Sector Technologies	New Materials
Industrial biotechnology	Lithium
Plant biotechnology	Neodymium, Indium, Tellurium
Energy technologies	Carbon fibers

Trend 3: New Materials and Cross-Sector Technologies

“New” raw materials and energy and mobility: these 21st century megatrends offer enormous opportunities for Europe’s technology-driven chemical industry. Germany in particular will play a leading role in these trends, as one of the major strengths of the German industry is its strong interdisciplinary character. This capability is vital, as cross-sector technologies and the development of new materials are an absolute necessity.

New Materials

New materials will play an increasingly important role in energy and mobility questions. An increase in the share of renewable energy sources in the energy mix requires smart grid concepts and a sophisticated storage strategy.

In the electric sector, “new” elements such as neodymium and molybdenum, for example, are being looked at in terms of their use in motor magnets. Significant commercial activities in the area of lithium-based large batteries for mobile operations already exist in the electrochemical energy storage sector. A subsidiary company of Evonik is producing lithium-based electrodes under the Separion® ceramic high performance separator brand name.

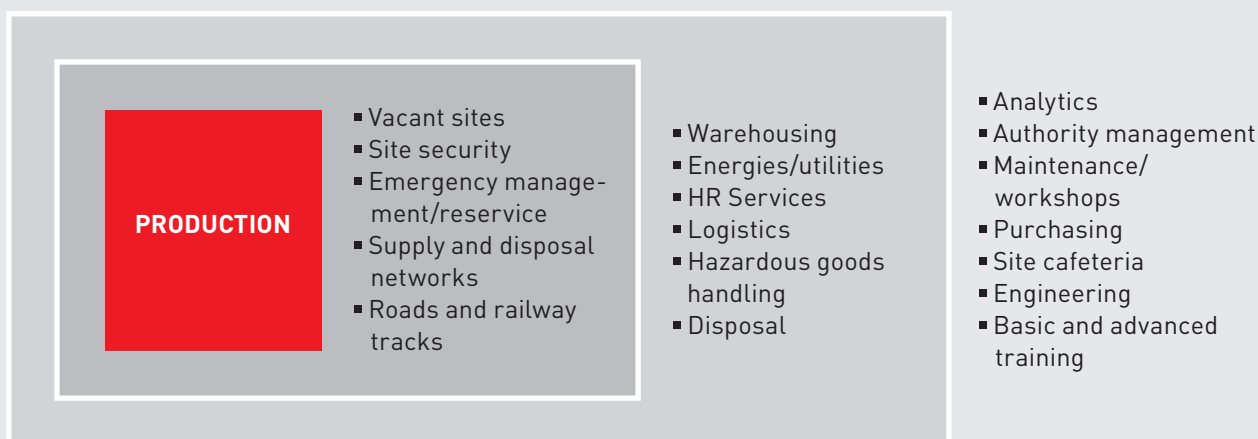
In partnership with Daimler AG, the components will be unified as production ready high-tech battery cells as part of the Li-Tec Battery company. As another example for electrochemical energy storage, Süd-Chemie has announced plans to build a new lithium-iron phosphate battery production site for the new generation of lithium-ion batteries at a cost of EUR 60 million.

Cross Sector Technologies

Peak oil and climate change – these factors, among others, have led the chemistry to make serious efforts to reduce its raw material dependency on oil. Here, the industrial biotechnology sector has, as a classical cross-sector technology, the most promising prospects. In addition to this, the chemical industry – which already utilizes 13 percent of renewable resources – is conducting intensive research to obtain their main chemical building blocks C2 to C4 from outside the petrochemical industry.

BASF, for example, is researching into the production of succinic acid from biomass, Süd-Chemie is working on the realization of “liquid beet” as a new feedstock, and Wacker is active in the yeast-based conversion of biomass feedstocks to ethanol before production of acetic acid via gas-phase oxidation.

Investors choose the services that suit their business model from a site operator service offering.



Source: VCI Fachvereinigung Chemieparcs / Chemiestandorte 2009

Plug & Play Production Concept

Today, the “plug & play” concept is widely understood and appreciated. Sites (e.g. chemical parks) commonly offer a comprehensive range of services which are customized to the needs of prospective foreign or domestic investors. The major benefits to both the site operator or owner and the investor are shared site overheads for increased cost-effectiveness.

Attractive Business Models

All chemical parks offer a wide range of flexible business models which are attractive for potential investors. Subject to their individual requirements, investors can simply buy or lease land from the site owner in order to establish their own production unit. At the other end of the scale, the business model might consist of a site operator investing in and operating new plant for the investor on a custom or toll-manufacturing basis.

In some cases, the contract will specify use of the site services as a prerequisite for the investment; in others, the investor may be allowed to “buy in” services on a competitive basis. Another model makes provision for the site operator to tender for services on a competitive basis from a short list of suppliers on the investor’s behalf.

Chemical Infrastructure

Many chemical parks and sites in Germany are connected to an international pipeline network for raw materials and intermediates, offering almost unlimited possibilities for linked chemical production. Unique value chains are made possible by the wide choice and ready availability of chemicals – with the minimum amount of logistics fuss.

Planning Support

Investors are supported by a number of investment planning and construction services. The most sought-after service is that for obtaining permits. Licensing procedures are completed quickly and efficiently with the competent public authorities assisting in the process from a very early stage.

Utilities

All utilities typically required for the operation of a chemical plant are available to prospective investors, e.g. electrical power (different voltages), steam (different pressure stages), natural gas, industrial gases, water (different qualities), cooling water, compressed air, and nitrogen among other things.

Services

Wastewater treatment, thermal treatment of production residue, emergency services, industrial safety, health and safety and fire protection, environmental services, analysis and testing services, rail dispatching, and product storage all are widely available at large chemical complexes.

► Please also refer to the authorization process section on page 11.

Infrastructure

The country's chemical production environment benefits from best-in-class logistics infrastructure. The major chemical carbon source, crude oil, is distributed by an advanced net of pipelines. Thirteen refineries (with a total capacity of 115 million tons per year – equivalent to three percent of global capacity) and eight steam crackers supply Germany's chemical industry with all of the necessary building blocks.

Pipelines

Of the 145 million tons of chemicals transported annually in Germany, 36 percent are transported by pipeline. Major chemical sites are interconnected through pipelines that transport raw materials such as ethylene within the country and via Belgium and the Netherlands to neighboring chemical production centers and Europe's northwestern seaports. There are also hydrogen, carbon monoxide and oxygen pipelines between chemical parks with a specialized production focus.

Road and Rail

In road haulage, new highway (*Autobahn*) building is scheduled across northern Germany. The country's interurban *Autobahn* network has a length of more than 231,000 km. Federal trunk roads account for around 53,400 km of this network and highways make up around 40,700 km. New *Autobahn* investment is scheduled, particularly in northern Germany. Projects connecting the cities of Magdeburg and Schwerin (A14), Lüneburg and Wolfsburg (A39), as well as projects around Hamburg (A20 and A22) are all currently underway.



Energy Security

Security of energy supply is a crucial factor in the energy-intensive chemical industry; especially when choosing an investment location and determining the market prospects of any planned facility.

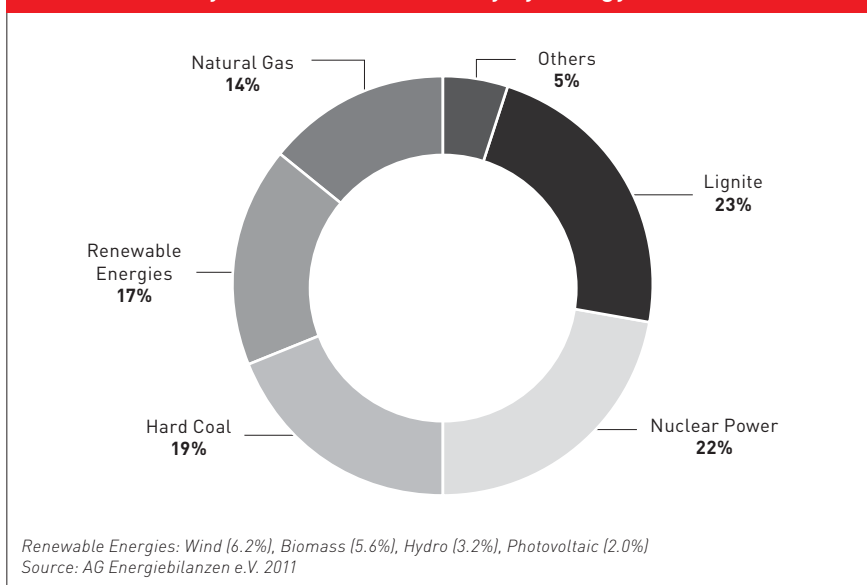
Germany: Lowest Power Outages in the World

The security of Germany's electricity supply is very high by international standards. Unlike the US and some other countries in Europe where major blackouts are recurrent, power outages are definitely the exception in Germany. The average amount of time lost to blackouts in the US is nearly four hours per year and in Spain two hours per year. Italy and the UK suffer from outages of around 80 minutes per year. These all exceed the German average of just 40 minutes per year.

Diversity of Supply

Germany has to rely on imports for around two-thirds of its energy supply. The picture is similar in many industrial countries. However, in marked contrast to its counterparts, Germany's energy mix is very broadly diversified. Lignite and hard coal account for around 42 percent of energy, followed by nuclear power (22 percent), and natural gas (14 percent). Renewable energies already account for 17 percent of Germany's energy mix, making it the third most important energy source. This share has been more than quadrupled in the period 1990 to 2010.

Gross Electricity Generation in Germany by Energy Carrier 2010



Renewable Resources Secure Future Energy Supply

Germany's ambitious energy supply goals (including 30 percent and 50 percent power consumption from renewable sources by 2020 and 2030 respectively) will contribute to energy security in the future. Germany counts among the world's most innovative countries in terms of developing and commercializing energy storage technologies. A number of demonstration and pilot facilities are already testing a diverse range of mechanical, electrical, chemical, and electro-chemical energy storage technology solutions.

Nord Stream Pipeline: Natural Gas Direct from Russia

In the winters of 2007 and 2008 it became apparent that the uncertainty of natural gas delivery from Russia using traditional supply channels brought significant risks for countries in central and Eastern Europe. The Baltic pipeline (length 1,224 km) will turn Germany into the international hub for Russian gas in Europe for a minimum of 50 years.

Moreover, Germany will become Europe's preeminent trading market for natural gas with an additional capacity of 55 billion m³ per year.

Chemical Parks Benefit from Secure Power Supply

A secure power supply is a pivotal factor for profitable operation of industrial plants. To guard against disruption in power supply, or even of a voltage dip from a single supply source, chemical parks are made secure through the provision of a number of redundant supply lines.

Most chemical parks have gone one step further in their efforts to secure power supplies by constructing and operating their own on-site power plants. In addition to electricity, an undisrupted supply of steam and the overall energy cost are also key success factors.

Authorization & REACH

The time taken to gain approvals for chemical plant construction significantly impacts on the time required to implement an investment; this in turn has a marked effect on the profitability of the project. Both the complexity and scope of the permit, as well as the efficiency of the organizations involved in granting approvals, differ widely in the global competitive arena.

Chemical Business Regulations in Europe

Environmental laws in Germany have mostly resulted from the implementation of European Union legislation. More specifically, the German Federal Emission Control Act (12. BImSchV - Störfallverordnung) was formulated to implement the European IPPC, the British COMAH (Control of Major Accident Hazards) program and the Seveso II directives (see website links inside the back cover). All environmental issues are implemented in the German chemical parks (as well as handling of authority procedures), resulting in a genuine "plug & play" situation for chemical producers.

Swift Construction-Planning Procedure

At present, around 60,000 industrial plant facilities in Germany have received formal authorization in accordance with both European and German law. The authorization process in Germany has been radically streamlined and simplified for investors in recent years. Today, all facility-related approvals and permits (covering industrial safety, construction, emission control, fire protection, and occupational health and safety) are covered by a single application submitted to one authority.



A permitting authority is bound by law to grant approval within a maximum period of seven months after the completed documents have been submitted.

REACH

REACH is the Regulation on Registration, Evaluation, Authorisation and Restriction of Chemicals. The regulation centralizes and simplifies chemicals legislation throughout Europe. The stated objective is to improve the level of knowledge about the potential dangers and risks posed by chemicals. Companies are expected to assume even more responsibility for the safe use of their products. Federal authorities offer a wide range of REACH-related information allowing small and medium-sized companies in particular to become quickly familiar with the provisions.

REACH-CLP

The EU Regulation on Classification, Labeling and Packaging (CLP) of Substances and Mixtures more commonly known as the "CLP Regulation" introduces the globally harmonized system (GHS) of the United Nations for the classification and labeling of chemicals into the EU and is in effect in all EU member states. The objective of the CLP is to guarantee a high level of protection of human health and the environment as well as the free movement of substances, mixtures and certain specific articles within the EU. This means the global harmonization of regulations for classification and labeling of substances and mixtures (UN-GHS) for marketing use.

► Please refer to Germany Trade & Invest's website for further links and contact information:
www.gtai.com/chemicals

Cost Effectiveness

Stable Labor Costs

Within the last decade, the labor cost gap between Germany and its eastern European neighbors has been significantly reduced. Since 2001, wages have risen in most European countries (EU-27). While some countries – particularly those in eastern Europe – experienced an increase of more than seven percent, Germany recorded the lowest wage rise within the EU at just 1.6 percent on yearly average.

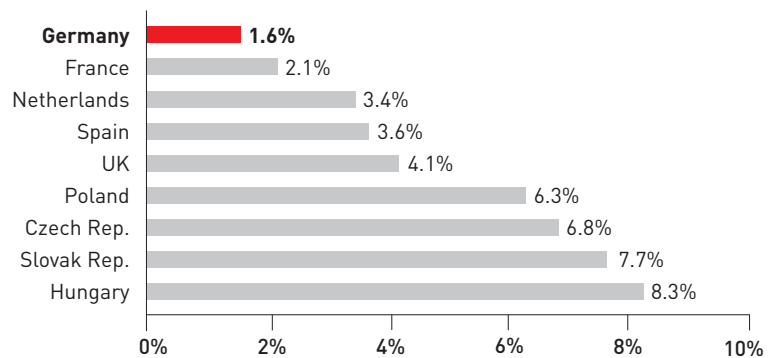
Competitive Tax Conditions

Germany offers a competitive tax system providing attractive tax rates for companies. In recent years, the German government has implemented root and branch reforms of the tax system to make the country a more attractive business location. The German tax system allows for differing tax rates in German municipalities. On average, corporate companies face an overall tax burden of less than 30 percent. Significantly lower tax rates are available in certain German municipalities – up to eight percentage points less. This makes Germany's corporate tax system one of the most competitive tax systems among the major industrialized countries.

Highly Skilled Workforce

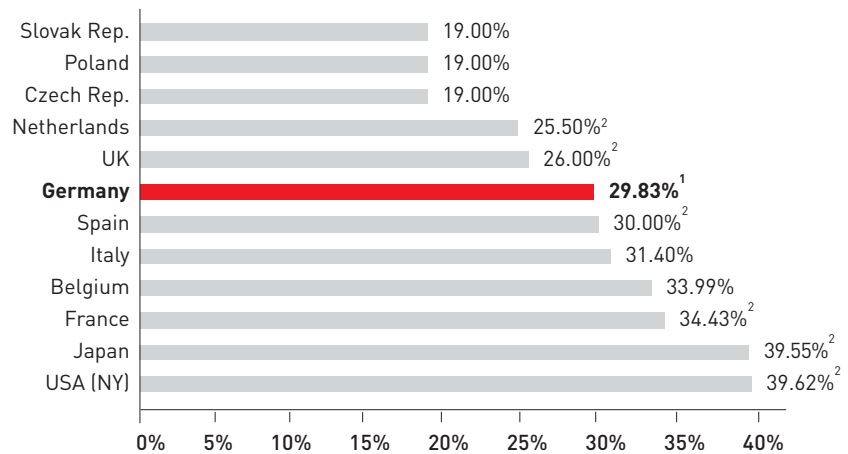
Germany's excellent workforce is decisive to the country's high productivity rates. It comprises over 40 million people – making it the largest pool of ready labor in the EU. Germany's world-class education system ensures that the highest standards are always met. More than 80 percent of the German workforce has received formal vocational training or is in possession of an academic degree.

European Labor Cost Growth 2001-2010



Annual average growth expressed as percentage of industry, construction and services.
Source: Eurostat 2011

Average Corporate Tax Burden of Selected Countries 2010



Note: ¹ National German average; lower overall tax rates in certain areas are possible, e.g. 22.83% in certain municipalities.

² Top corporate income taxation rate; lower starting rates or other special tax rates available. Example USA: progressive rate from 15% to 35%.

Source: German Federal Ministry of Finance 2010

Engineering Excellence

In 2010, some 443,000 students – at more than 400 universities – embarked on a course of academic study. According to the OECD, Germany has an excellent standard of higher education. Technical fields of study experienced an undergraduate enrollment level increase of more than eight percent.

Germany's share of university students in the sciences, mathematics, computer sciences, and engineering is the second highest in the EU, with 31 percent of all students. In addition, the country can be proud of one of the highest rates of graduates with a doctoral degree. With 312 PhD graduates per million inhabitants, it ranks second in a comparison of OECD countries.

Financing & Incentives

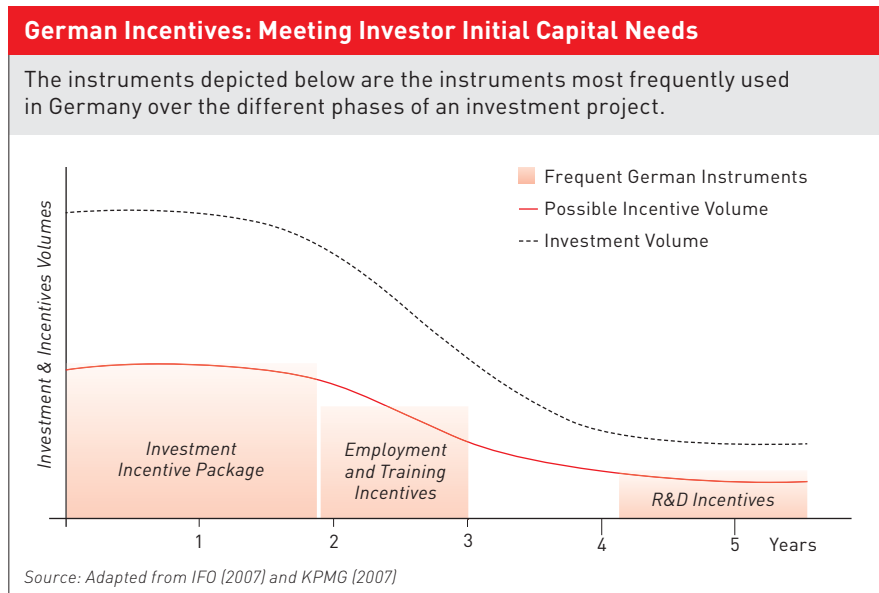
In Germany, investment projects can receive financial assistance through a number of different instruments. These instruments may come from private sources or consist of public incentives programs available to all companies – regardless of country of provenance. They fit the needs of diverse economic activities at different stages of the investment process.

Early Stage Investment Project Financing

Technologically innovative start-ups in particular usually rely solely on financing through equity such as venture capital (VC). Germany offers several public-private-partnership programs to support companies in the start-up phase. One example is the *High-Tech Gründerfonds* (“High-Tech Start-up Funds”) program: a partnership between government, the KfW development bank and industry (industry partners include BASF, Deutsche Telekom, Siemens, Daimler, Carl-Zeiss and Robert Bosch) which provides a total of EUR 272 million in venture capital funding to start-ups. The individual federal states also have specific funds directed to support innovative start-ups obtaining equity capital as well as funds supporting specific R&D programs in the form of grants and loans. R&D grants are also available at the federal level as well as through programs of the EU.

Later Stage Investment Project Financing

Debt financing is a central financing resource and the classic supplement to equity financing in Germany. It is available to established companies with a continuous cash flow. Loans can be borrowed for day-to-day business (working capital loans), can help bridge temporary financial gaps (bridge loans) or finance long-



term investments (investment loans). Besides offers from commercial banks, investors can access publicly subsidized loan programs in Germany. These programs usually offer loans at attractive interest rates in combination with repayment-free start-up years, in particular for small and medium-sized companies. These loans are provided by the state-owned KfW development bank and also by regional development banks.

Cash Incentives for Investment Projects

When it comes to setting up production or service facilities, investors can count on a number of different public funding programs. These programs complement the financing of an investment project. Most important are cash incentives provided in the form of non-repayable grants applicable to co-finance investment-related expenditures such as new buildings, equipment or machinery. In Eastern Germany, investment grants are complemented by an investment allowance, which is usually allotted in the form of a tax credit but which can also be provided in the form of a tax-free cash payment.

Labor-related Incentives and R&D Project Grants

After the location-based investment has been initiated, companies can receive further subsidies for building up a workforce or the implementation of R&D projects. Labor-related incentives play a significant role in reducing the operational costs incurred by new businesses. The range of programs offered can be classified into three main groups: programs focusing on recruitment support, training support, and wage subsidies respectively. R&D project funding is made available through a number of different incentives programs targeted at reducing the operating costs of R&D projects. Programs operate at the regional, national, and European level and are wholly independent from investment incentives. At the national level, all R&D project funding has been concentrated in the so-called High-Tech Strategy to push the development of cutting-edge technologies. Substantial annual funding budgets are available for diverse R&D projects.

Our Investment Project Consultancy Services

Germany Trade & Invest Helps You

Germany Trade & Invest's teams of industry experts will assist you in setting up your operations in Germany. We support your project management activities from the earliest stages of your expansion strategy.

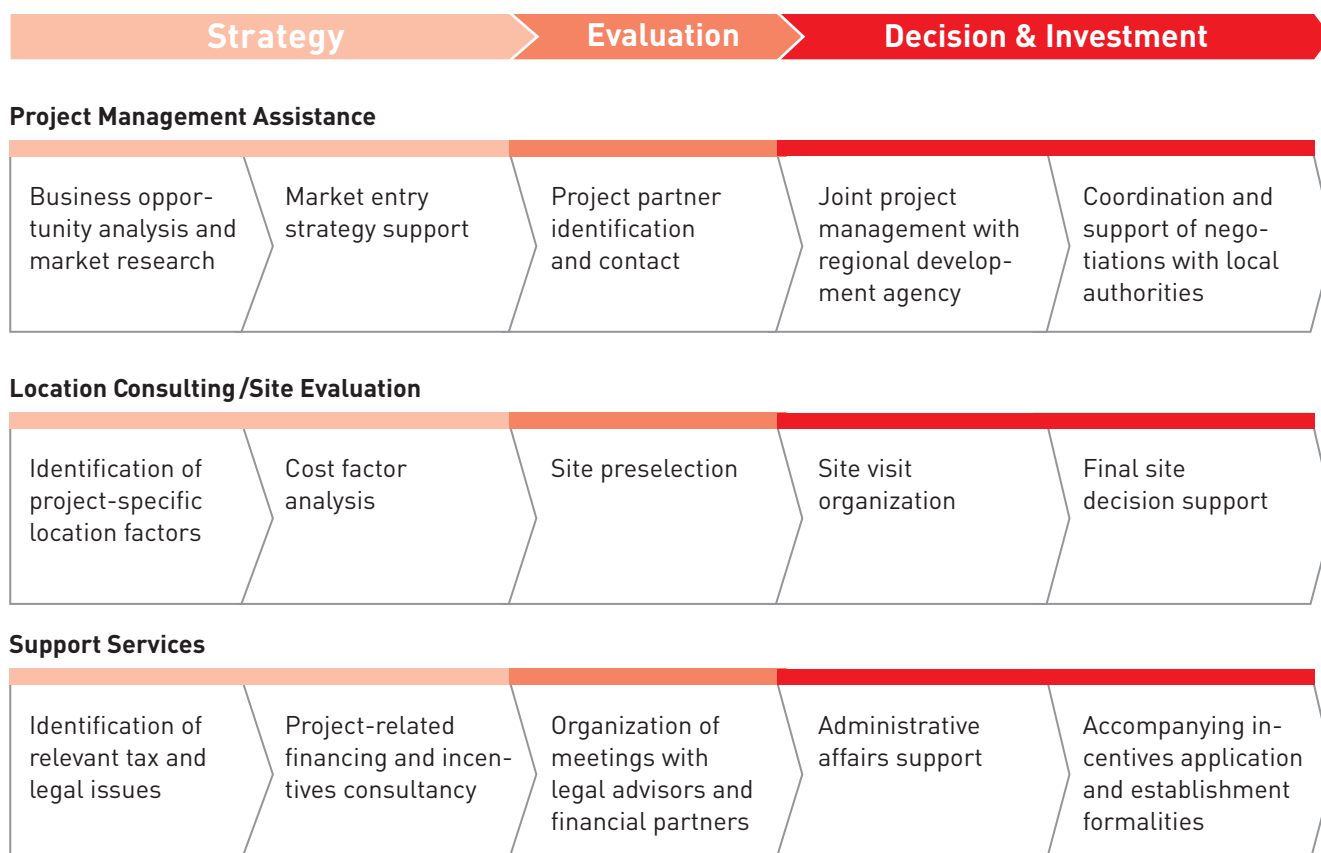
We provide you with all of the industry information you need – covering everything from key markets and related supply and application sectors to the R&D landscape. Foreign companies profit from our rich ex-

perience in identifying the business locations which best meet their specific investment criteria. We help turn your requirements into concrete investment site proposals; providing consulting services to ensure you make the right location decision. We coordinate site visits, meetings with potential partners, universities, and other institutes active in the industry.

Our team of consultants is at hand to provide you with the relevant background information on Germany's tax and legal system, industry regulations, and the domestic labor market. *Germany Trade & Invest's*

experts help you create the appropriate financial package for your investment and put you in contact with suitable financial partners. Incentives specialists provide you with detailed information about available incentives, support you with the application process, and arrange contacts with local economic development corporations.

All of our investor-related services are treated with the utmost confidentiality and provided free of charge.



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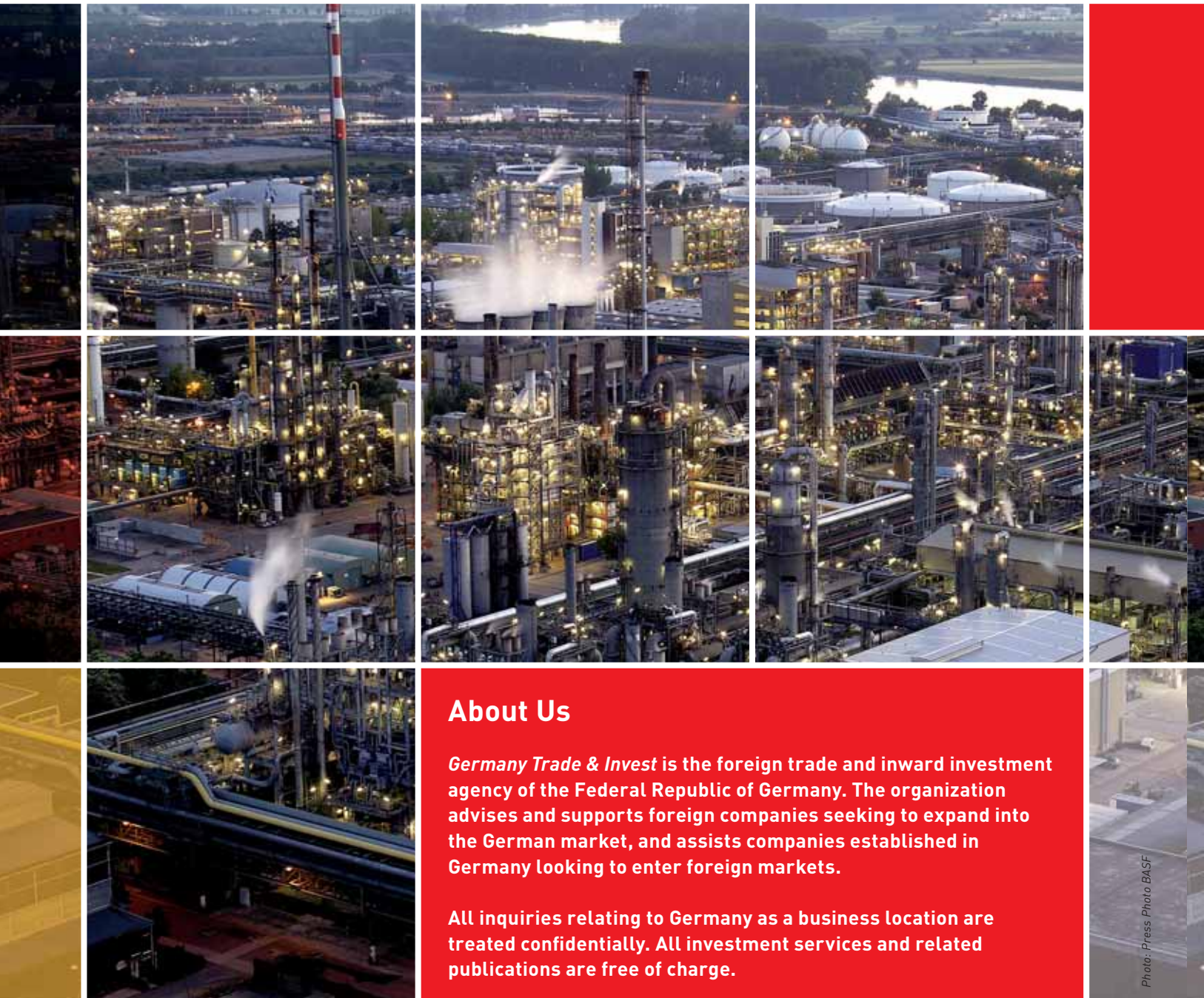
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About Us

Germany Trade & Invest is the foreign trade and inward investment agency of the Federal Republic of Germany. The organization advises and supports foreign companies seeking to expand into the German market, and assists companies established in Germany looking to enter foreign markets.

All inquiries relating to Germany as a business location are treated confidentially. All investment services and related publications are free of charge.

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