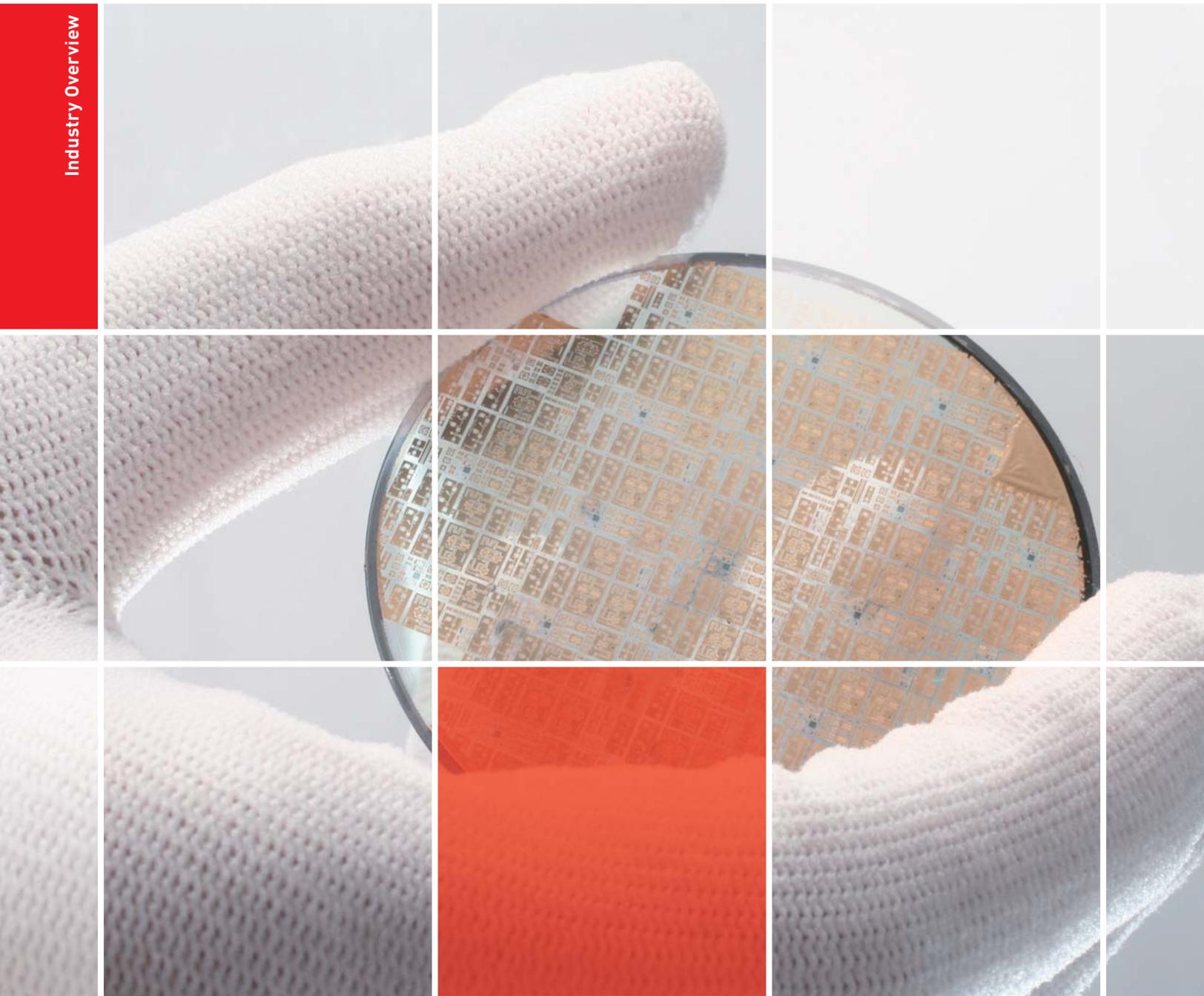


The Electronics and Microtechnology Industry in Germany

Industry Overview



GERMANY
TRADE & INVEST

Germany - Where Expanding Markets and Next Generation Technologies Meet

For 150 years, the German electrical and electronics industry has been a major force in driving technological progress. The first telephone, the first electric engine, and the first programmable computer "Made in Germany" are just a few of its more notable achievements. Never before have international growth, prosperity, employment, and environmental protection depended more on innovations in electronics and microtechnology than today at the start of the 21st century.

Germany plays a major role in this global industry, with German innovations enjoying an unrivaled international reputation. Over half of the products manufactured and services provided by the German electrical and electronics industry are for export.

The future is bright for investments in this sector. Join us and participate in the major growth that lies ahead.



The Industry in Numbers

Europe's Largest Market

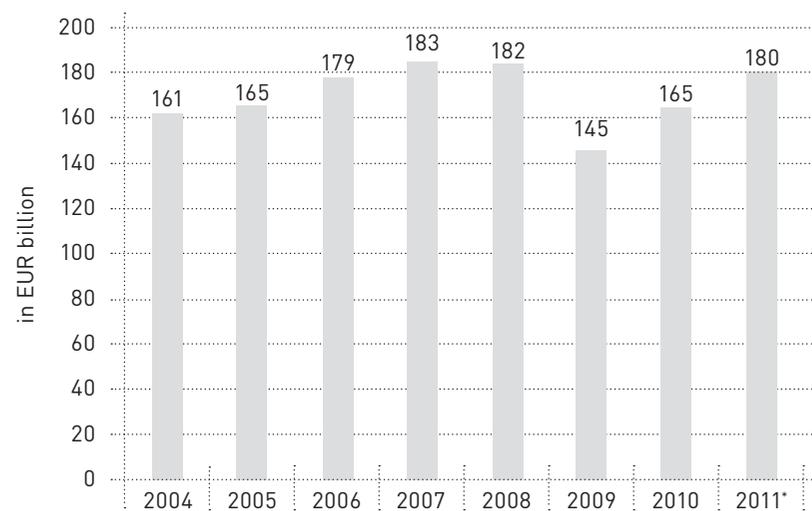
Germany's electronics industry generated a turnover of EUR 165 billion (approximately USD 223 billion) in 2010, of which 85 billion was secured domestically. The industry is expected to grow to EUR 180 billion in 2011, constituting a growth rate of 24 percent (2008-2011). As such, the electronics and microtechnology industry has recovered remarkably from the global slump in 2008-09 and returned to pre-crisis levels within a period of just two years.

In terms of per capita microelectronics consumption, Germany dominates the European market with USD 167 per capita in 2010 and occupies second place internationally (behind Japan and ahead of the USA and China with USD 151 and USD 57 respectively in 2010).

Major Industry Sectors

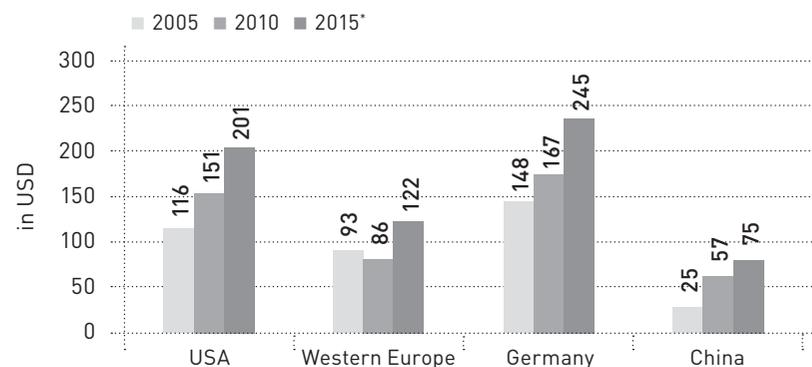
Electronics and microtechnology represents the second largest industry segment in Germany by revenue. The main application segments in Germany are automotive (36.6 percent of all turnover), data processing (28 percent), and industrial electronics (23.4 percent). Compared with other countries, Germany records particularly high percentages in automotive and industrial electronics – thanks in no small part to Germany's strong manufacturing base. Conversely, manufacturing benefits from a strong electronics sector, with electronics being one of the major drivers of innovation in manufacturing.

German Electronics Industry Turnover



Source: ZVEI 2011
*forecast

Per Capita Microelectronics Consumption in Selected Regions



Source: ZVEI 2011
*forecast

Innovative Landscape

Electronics and microtechnology in Germany is exemplified by its innovativeness: EUR 12 billion is invested annually, with more than 40 percent of the products in the electronics and microtechnology sector less than three years old.

Strong Applications Markets

Automotive Electronics

Germany is one of the most important automotive production countries in the world. In 2010, around 5.6 million cars were produced in Germany, with the country hosting the largest concentration of OEM plants in Europe. As well as this, some 6.1 million German-branded cars were produced outside the country.

In order to make this success possible, a number of industry actors have to work together. Most of the innovations currently making themselves felt in the auto industry are strongly connected to the use of electronics, sensorics, and actuator technology. Future prospects for automotive electronics lie in the areas of engine management, safety, infotainment, and telematics. Having experienced overall growth of 150 percent in the period 2000-2010, automotive electronics represents the strongest electronics segment (36.6 percent share) in Germany.

Industrial Electronics

Driven by the rapid growth of sensor technology in the machinery and equipment sector since 2006, industrial electronics represents the third largest application market with 23.4 percent of the German electronic components market. Europe, and particularly Germany, is forecast to further increase share in the industrial electronics world market until 2015. This growth will come at the expense of the USA and Japan. As a result, Germany is and will continue to be one of the leading international producers of industrial electronics and medical devices.

Energy Efficiency

Energy efficiency, CO₂ reduction, and sustainability are high-profile issues in Germany and Europe. Accordingly, a mix of European Union (EU) regulations and guidelines (such as the EuP Directive on the eco-design of energy-using products) and individual member state initiatives (like Germany's EnEV energy-saving regulations) which promote the use of energy-efficient products have been put in place. As a result, a number of sectors are developing innovative solutions which put energy efficiency and sustainability at the heart of their activities (for example, in the lighting sector where 19 percent of all globally produced electricity is used). Of course, this is not just restricted to more efficient lighting, but also includes lamps, ballasts, and intelligent lighting control and management systems. Energy efficiency is a top priority for industry today; not only as a means of protecting the environment, but also as a way of remaining one step ahead of the competition. Cutting-edge technology can result in savings of up to 90 percent in the life cycle costs of individual components

(such as electric motors), and up to 70 percent in ancillary equipment (including pumps, fans, compressed air technology, and cooling systems).

Digital Media

The digitalization of media is gathering momentum in Germany. After the switch to DVB-T in late 2008, the next big step for terrestrial broadcast technology will be the complete digitalization of satellite television by April 30, 2012. Digitalization is a billion euro market in Germany and offers significant growth potential for industry participants along the value chain: from content providers and network operators to flat screen manufacturers. The rise in sales of flat screen televisions in Germany has more than compensated for the decline in tube television sets; resulting in 9.4 million unit sales in 2010 (equivalent to an 8.8 percent increase). New display systems including LCD and LED as well as 3D TV are playing an important role in this market segment. Future technologies such as OLEDs and e-paper are on their way towards commercialization, underlining Germany's traditionally leading R&D role.

Active Night Vision system – Bosch



Investment Markets: Printed Electronics

Rolling out the Applications of the Future

Handheld electronic books, super sharp flat screen TVs, and solar cells that can be printed like paper are just some of the technological innovations currently being developed in Germany.

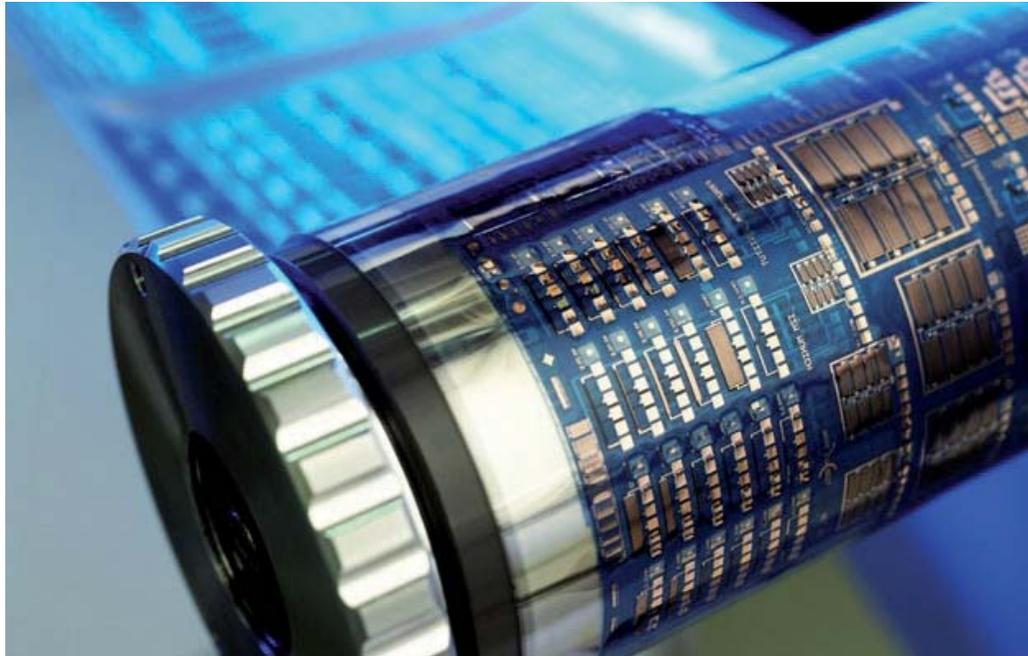
Germany's expertise in electronic device production, printing processes, and chemicals - all essential elements to printed electronics - make it an optimal location for investment in this area. One example: the world's first commercially viable polymer-based displays are now being commercially produced in Germany. This innovative technology allows users to read books or newspapers in convenient handheld electronic format.

Organic Photovoltaics

Another form of printed electronics, organic electronics, is playing an important role in the photovoltaics industry. Germany is the world's largest PV market with 45 percent of global installations in 2010. Organic solar cells offer a thinner, more flexible, and potentially cheaper alternative to silicon cells thanks to the fact that these cells can be printed just like paper. Leading industry voices are already claiming that this technology will be used for roof installations by the construction industry in less than a decade.

Organic Light-emitting Diodes (OLEDs)

Another organic electronics application is OLED (organic light-emitting diode) technology. OLED displays are already in use, for example, in MP3 players and certain mobile phones. The technology, which



Reel-to-reel equipment for mass printing of flexible electronics – Fraunhofer IZM

offers a brilliant picture with high contrast, could be integrated into televisions in the coming years as well as finding broader applications in lighting and signage.

Germany – Leading the Way in Printed and Organic Electronics

Germany is a leading location for all areas of the printed electronics industry. Some regions, specifically the Dresden and Heidelberg regions, have distinguished themselves through their expertise in this sector.

The vibrant new printed electronics industry is being created as energetically in Germany as it is elsewhere in the world. Germany is after all the home of printing and the world's leading photovoltaics market. So much so, in fact, that Germany is by far the world's largest user of photovoltaics - having installed as many devices as the rest of the world put together. The printed electronics industry growth is backed by the research work of a significant number of world-

renowned German technical universities, Fraunhofer Institutes, and many other research centers. German industry support - from companies including Robert Bosch and Siemens to BASF, the world's largest chemical company - and access to suppliers and research institutes (e.g., the Fraunhofer Institute for Photonic Microsystems) is helping attract printed electronics leaders to Germany.

In close cooperation with industry, the German government has launched several research programs to support this industry segment. More than EUR 500 million from industry and an additional EUR 100 million in government funding is being invested to push developments in organic photovoltaics, OLEDs, and printed RFID tags in the years ahead.

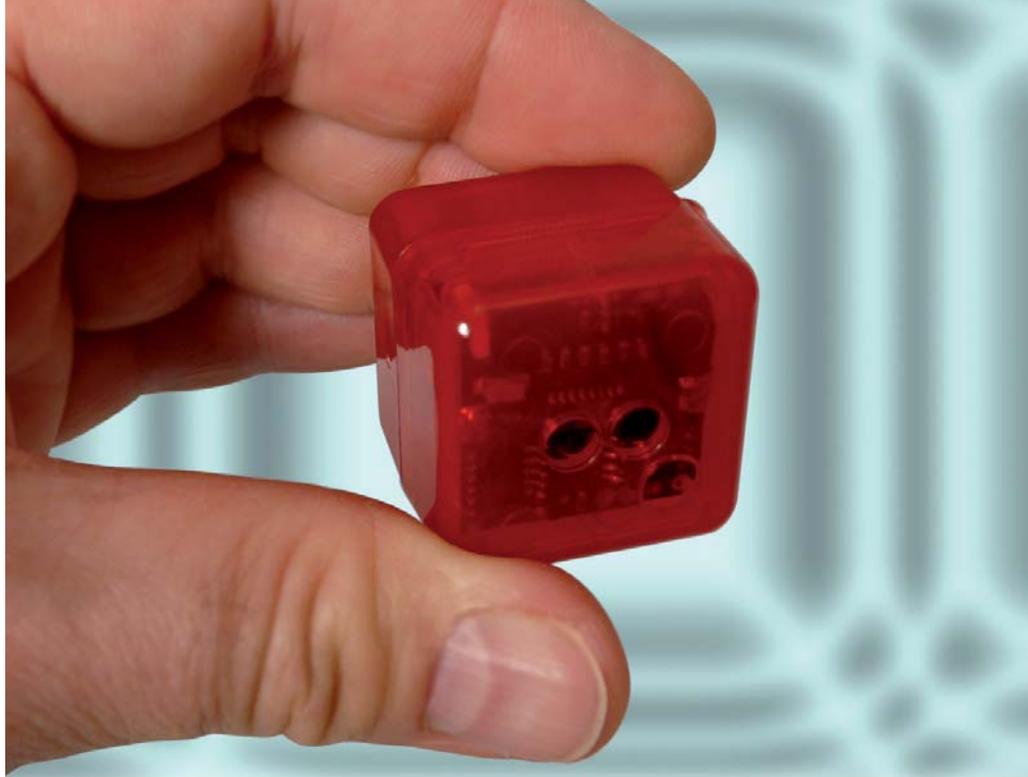
Investment Markets: Microsystems Technology

Emerging Application Industries

Microsystems technology (MST) has become a key area with considerable innovation potential for traditional industrial as well as for emerging technology sectors in Germany. The integration of numerous materials and functions, and the trend towards miniaturization, have been powerful factors in driving the development of new innovation fields within the automotive, chemical, manufacturing, automation, and processing industries and in the field of life sciences. In fact, they have profoundly changed the nature of German industry. Today, a large number of small and medium-sized enterprises have taken up the challenge of developing new products for emerging international markets. These companies can rely on a strong innovation system with close links to education, research and development, and industrial networks.

Strong Industry Growth

The German MST market is estimated at around EUR 82 billion. Microsystems technology is playing an increasingly important role in growth and employment. Approximately 766,000 jobs in Germany are directly linked to MST - with the trend set to continue. Accordingly, MST developments have to be rapidly translated into commercial products and marketed. The leveraging effect of MST applications - estimated at 25 times the investment volume - is even more important. Germany has long been the technology leader for integrated systems solutions and continues to hold an outstanding position in the field of MST as the European home of microelectronics and microtechnology.



Red Cube - Meilhaus Electronic

Longstanding Research Tradition

Industry can rely on a long-established MST research infrastructure in Germany. Germany is able to call upon a long and strong research tradition in physics, materials and electronics which has led to the creation of a broad applied-research resource of Max Planck Institutes and universities. The University of Freiburg holds the largest MST faculty in Germany with specific focus on design and microfluidics. Other technical universities with broad microsystems competences include those in Berlin, Hamburg and Munich. The Karlsruhe Research Centre of the Helmholtz Gemeinschaft represents the largest facility for both basic research and application-oriented developments (with particular capabilities in LIGA technology and non-silicon materials). Several Fraunhofer institutes are also involved in researching silicon and polymer microelectronics and MST and their applications, covering the whole spectrum of materials and technologies. These core competences are bundled together in the Fraunhofer Microelectronics Alliance. A number of independent and commercial research institutes are also active in this area. In total, more than 50 universities and technical colleges are carrying out research and teaching in this key technology area.

Supporting MST Innovation

In 2010, the German government made R&D funding to the tune of EUR 80 million available for microsystems as a part of its ICT 2020 framework program. Four specific fields of innovation are being funded: human beings, environment, mobility, and industry. These fields are profiting increasingly from microsystems technology, as is best exemplified by the latter field of industry: dynamic 3D visualization provides new perspectives in the field of automation and robotics while new processes of production and integration have changed the way mechanical and plant engineering is being conducted. Mounting and connecting techniques, micro-nano integration, measuring and testing techniques, and technical cognition are the key technologies. In addition to this funding initiative, microtech firms are also being given the opportunity to use so-called "application centers" in order to turn promising ideas into products. Staff and equipment at these centers are financed from the public purse.

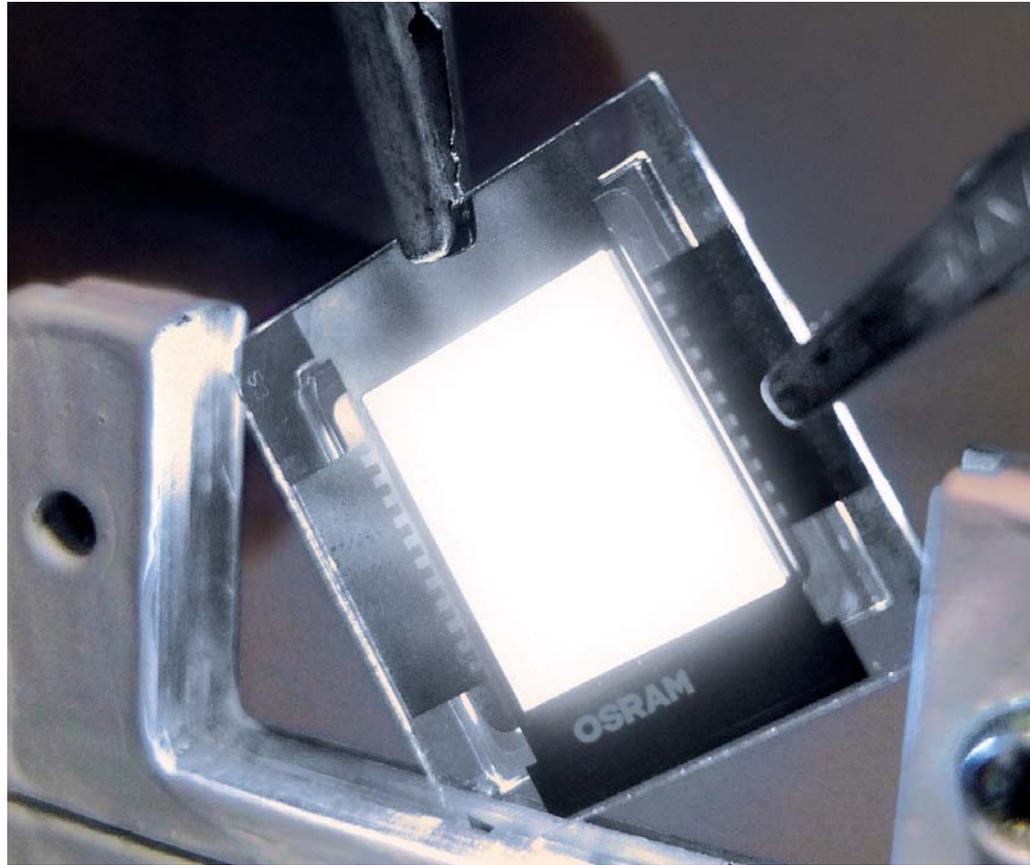
Investment Markets: Lighting

Market Perspective

Germany enjoys a leading position in the global lighting market. German lighting industry sales currently amount to EUR 3.5 billion and the global market share level is at 12 percent. Germany's export rate is the highest of the three leading international lighting markets. The German market is also being driven by high energy-efficiency consumer awareness levels and a highly innovative environment, which is resulting in a high adoption rate of new technologies. Germany's high ranking is important in terms of the challenges that lie ahead - as dealing with the disadvantageous effects of lighting has truly become a global problem. Lighting consumes around 19 percent of the electricity generated worldwide. The European Commission has formulated an energy policy to increase requirements for energy efficiency (office and street lighting, incandescent lamps and other sources of lighting in private households). This legislation implies that there is likely to be an increased demand for compact fluorescent lamps (CFL) in the short to medium term. The concerted focus on energy efficiency will spell good news in the long term for the LED-based market.

Europe's Strongest LED Market

The semiconductor-based LED light forms an extremely large segment in the lighting market: LED light output is doubling almost every two years. Companies such as OSRAM continue to break LED brightness records, and are making good progress in the race to establish a viable alternative to incandescent lamps and fluorescent tubes. In 2010, the European market grew by 43.2 percent. Current forecasts predict



Organic phosphorescent area light – OSRAM

that every third light source will be an LED by 2025. According to industry experts, the greatest growth potential exists in the auto industry, lighting, electric equipment, and more particularly, in signage and displays.

However, LED is already in active competition with organic LED (OLED), which is being promoted through the government's OLED Initiative 2015. The advantages of semiconductor light make it predestined for universal use. Although small, robust, and inexpensive to produce, it provides a great deal of light, a large reflection angle, is flexible, and can be produced in large numbers. The future prospects of this segment lie in the acceptance of using efficient light which will help reduce CO₂ emis-

sions in Germany by approximately 13 million tons. Intelligent light also provides more security, comfort, and efficiency. New applications are possible with the use of synergies with solar energy.

Large German companies play an active role in this market segment. As the largest lighting market in Europe, Germany has always been a testing ground for new technology. Investment opportunities can be found along the value chain for material and equipment providers, packaging providers, chip makers, and even more vertically integrated players.

Financing & Incentives

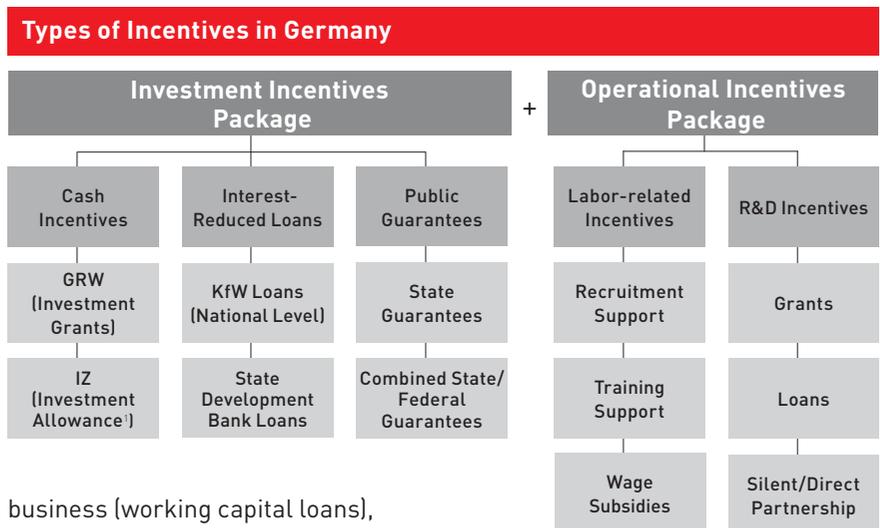
In Germany, investment projects can receive financial assistance through a number of different instruments. These instruments may come from private sources or consist of public incentives programs available to all companies – regardless of country of provenance. They fit the needs of diverse economic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

Early Stage Investment Project Financing

Technologically innovative start-ups in particular have to rely solely on financing through equity such as venture capital (VC). In Germany, appropriate VC partners can be found through the *Bundesverband Deutscher Kapitalbeteiligungsgesellschaften e.V.* (BVK – “German Private Equity and Venture Capital Association”). Special conferences and events like the *Deutsches Eigenkapitalforum* (“German Equity Forum”) provide another opportunity for young enterprises to come into direct contact with potential VC partners. Public institutions such as development banks (publicly owned and organized banks which exist at the national and state level) and public VC companies may also offer partnership programs at this development stage.

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



¹⁾ only in Eastern Germany

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 (*Investitionszulage IZ*), 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.

Germany's Operational Incentives Package

High Productivity

Measured in unit labor costs, Germany experienced a major increase in productivity the past decade. In marked contrast to other European countries which have experienced an overall increase in unit labor costs, Germany's unit labor costs decreased by a yearly average of 0.3 percent for the period 2005 to 2010. This made the economy more competitive – particularly manufacturing.

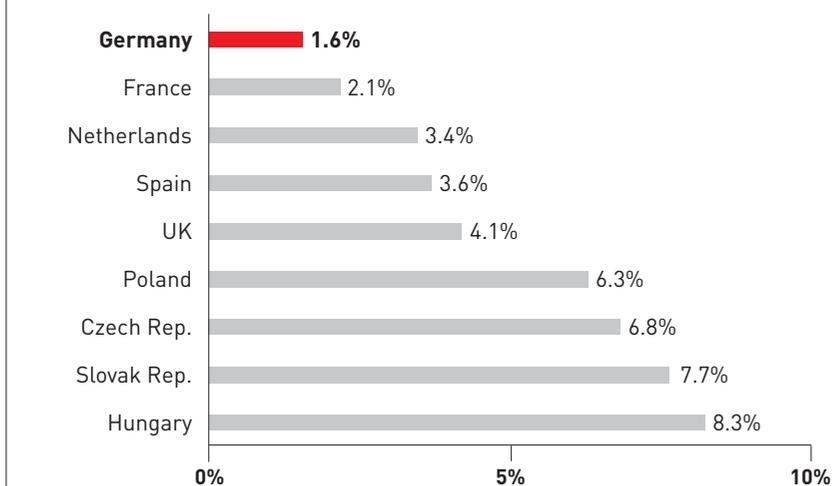
Competitive Labor Costs

At the same time, the labor cost gap between Germany and its eastern European neighbors has been significantly reduced. In fact, Germany has gained the labor-cost edge in recent years. Since 2000, wages have risen in most European countries (EU-27), with the growth rate averaging 3.7 percent. While some countries – particularly those in eastern Europe – experienced a rise of more than seven percent, Germany recorded the lowest labor cost growth within the EU at just 1.6 percent. This has been another decisive argument in favor of Germany as a premium business location.

Excellent Production Standards

Germany's high productivity is also closely linked to its excellent production process standards. This has been confirmed by a study of international executives conducted by the World Economic Forum. According to the study findings, Germany is seen as a country where the best and most efficient process technology is applied.

European Labor Cost Growth 2001-2010



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

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.

Dual Education System

Germany provides direct access to a highly qualified and flexible labor pool. For vocational training the country developed the dual education system – unique in combining the benefits of classroom-based and on-the-job training over a period of two to three years – which is specifically geared to meet industry needs. There are currently around 350 occupations recognized by the system. The German Chambers of Industry and Commerce (IHKs) ensure that exacting standards are rigidly adhered to, guaranteeing the quality of training provided across Germany.

Engineering Excellence

According to the OECD, Germany has an excellent standard in higher education. In 2010, some 443,000 students – at more than 400 universities – embarked on a course of academic study. 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. German universities have introduced masters and bachelor degrees for improved international acceptance and comparison. 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.

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.

Strategy

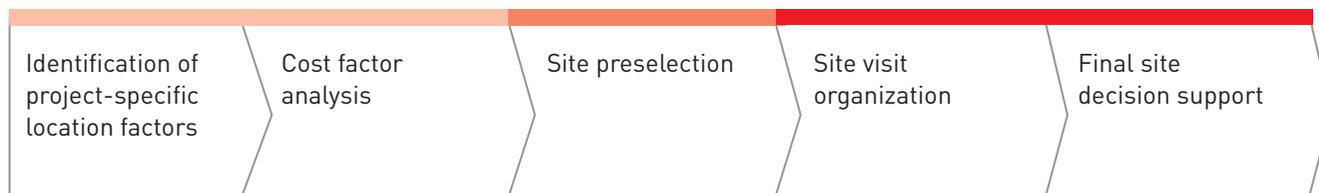
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Decision & Investment

Project Management Assistance



Location Consulting /Site Evaluation



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Gesellschaft für Außenwirtschaft
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Friedrichstraße 60

10117 Berlin

Germany

T. +49 (0)30 200 099-555

F. +49 (0)30 200 099-999

invest@gtai.com

www.gtai.com

Chief Executives

Dr. Jürgen Friedrich, Michael Pfeiffer

Authors

Max Milbredt, Manager, Electronics & Microtechnology,
Germany Trade & Invest, max.milbredt@gtai.com

Jonathan Schoo, Manager, Electronics & Microtechnology,
Germany Trade & Invest, jonathan.schoo@gtai.com

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William MacDougall, *Germany Trade & Invest*

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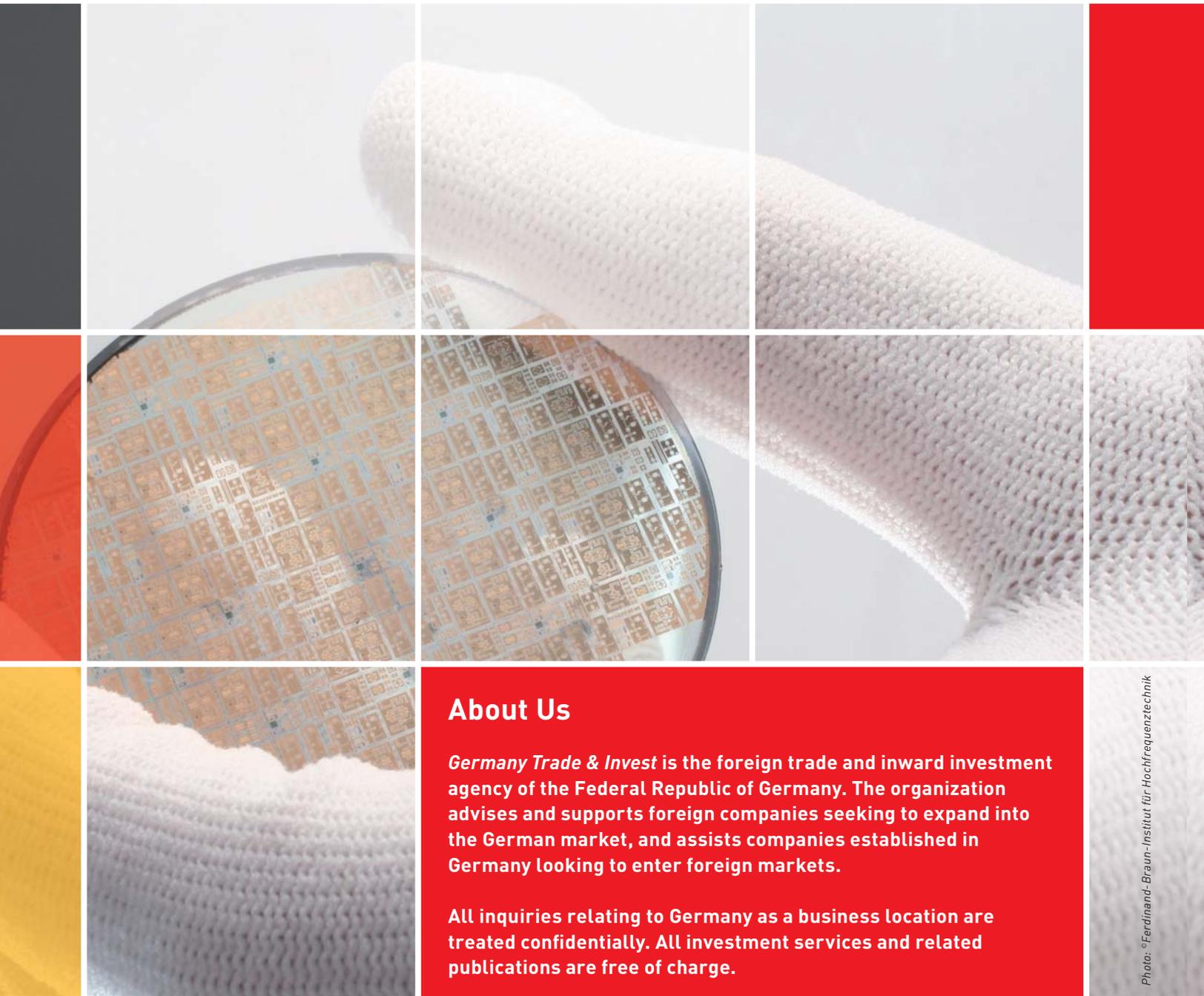
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All market data provided is based on the most current market information available at the time of publication. *Germany Trade & Invest* accepts no liability for the actuality, accuracy, or completeness of the information provided.

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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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Germany Trade & Invest
Friedrichstraße 60
10117 Berlin
Germany

T. +49 (0)30 200 099-555
F. +49 (0)30 200 099-999
invest@gtai.com

www.gtai.com