Construction projects

German Construction Industry International

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BAUEN UND SERVICES

Bundesministerium
für Wirtschaft
und Energie

Sigmar Gabriel,
Federal Minister for Economic Affairs and Energy

Good infrastructure is essential to securing a country's growth and prosperity. The German construction industry addresses this task by implementing numerous projects worldwide. By virtue of its in-depth experience and specialist expertise, it has been a sought-after partner at home and abroad for over 100 years. This is especially true for technically ambitious projects that often – literally – break new ground.

The German government supports the activities of German companies abroad in a variety of ways. In addition to political backing through bilateral discussions and the work of German embassies and chambers of commerce abroad, export credit guarantees and investment guarantees of the German government have for many decades been integral instruments in our foreign trade policy. Companies in the construction industry also benefit from this support in financing and insuring their foreign business operations.

While export credit guarantees (so-called Hermes cover) provide insurance against payment default on economic or political grounds, the investment guarantees of the German government secure the foreign investments of German companies in developing and emerging economies against political risks. Investment guarantees are granted on the basis of the more than 130 bilateral investment protection agreements.

Based on flexible provisions for risk coverage for construction projects, in the past five years alone companies in the construction industry have been granted export credit guarantees in the amount of 600 million euros. We are also seeing increased demand from the construction industry for investment guarantees. In 2012, for example, investments by the industry amounting to some 370 million euros were covered.

Even after authority to transact investment protection agreements passes to the EU Commission under the Lisbon Treaty, the existing agreements will continue to be effective until the EU and the member states have negotiated new contractual arrangements with third countries. The Federal Government will do all it can to ensure that the proven high level of protection continues to be maintained in future.

For our highly export-oriented economy we need open markets and fair regulatory frameworks. The agreement recently adopted at the WTO Ministerial Conference ("Bali Package") has clearly strengthened our approach. The core feature of this package is the agreement on trade facilitation, from which the construction industry will also benefit through the agreed bureaucracy reduction.

We shall persevere along this path in order to create new jobs, secure existing ones and continue in future to constructively support the construction industry in its activities abroad.

Yours sincerely,

Prof. Dr.-Ing. E.h. Thomas Bauer,
President of the German Construction Industry Federation

"German Construction Industries International. Creating foundations for growth."

The world is growing. An increasing number of people above all in our towns and cities require adequate urban infrastructure, well-developed transportation networks and a reliable water and energy supply. Construction builds the foundation on which this growth can take place in a planned, sustainable and resource-friendly way, however varied the needs and requirements on the different continents and in the different regions may be.

With a presence in over 70 countries on all five continents, the German construction industry contributes its know-how – either through direct business or with local subsidiaries and affiliates – to implementing technically ambitious projects in the fields of infrastructure, special foundation work, civil engineering as well as energy and water supply and disposal in industrialised as well as emerging countries. As a result, the German construction industry has earned an excellent international reputation based on engineering prowess, high-quality project management and construction work, and the innovative strength of German construction companies.

This expertise is supplemented by extensive experience of the legal, social and cultural specificities in the respective international markets, gained by virtue of the fact that by definition we – in contrast to the manufacturing sector – perform our production services on-site in the country concerned. Here, experts from Germany work hand-in-hand with regional partners. Like this, the subsidiaries and affiliates of the German construction industry also contribute to maintaining highly qualified jobs on the home market.

Given the tough international competition for attractive large-scale contracts, the German construction industry – in addition to effective political backing for its day-to-day operations – needs to be able to rely on a flexible export credit insurance system that takes account of the nature of international construction operations, in particular with regard to the eligibility of subsidiaries and affiliates for coverage and the inclusion of local costs. We would also like to see greater involvement of German development policy in transport infrastructure and stronger links between development funding and export credit insurance. With a view to the construction markets in the European Union, the German government should urge for transparent award procedures and fair contractual terms for EU-funded construction projects in all member states.

With this backing, the German construction industry will be able to maintain its position in the international construction markets in the future. This new brochure aims to provide you with a general overview of the broad scope of the German construction industry's international operations and the high quality of German civil engineering skills. Please contact us if you would like to know more.

An ever-growing population, an ever-growing demand for living space, commercial properties and other buildings such as cultural and sports facilities: our urban centres, and with them the demands placed on urban life, are growing faster than ever before.

CIVIL ENGINEERING

One of the future tasks for the German construction industry is to support this rapid development with specialised engineering know-how, among other things through involvement in a number of successful projects, including spectacular ones such as the already illustrious Burj Khalifa in Dubai, the Sheikh Zayed Desert Learning Centre in Abu Dhabi, the new Barwa City district in Doha (Qatar) or the hypermodern Stadion Miejski municipal sports stadium in Poland.

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Sheikh Zayed Desert Learning Centre / Al Ain, Abu Dhabi, UAE – see page 11 for more information about this project

Stadion Miejski / Wrocław, Poland

With a capacity of almost 43,000 seats, the municipal stadium (Stadion Miejski) is multifunctional to the core. An utterly compelling design and state-of-the-art technology provide the highest level of comfort and safety. The stadium was one of Poland's four European Football Championship 2012 venues.

By night, a special illumination system creates an intricate play of light and colour on the façade of this modern sports arena. The multifunctional stadium is characterised by the grandstand made of precast concrete units and a filigree steel structure bearing the roof.

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The stadium was built in just one and a half years, after the contract with a Polish consortium was shelved due to substantial delays, ready in time to co-host the 2010 European Championship. The precast concrete units and steel struttings for the roof structure were produced in Germany, transported by rail and erected on-site. An outstanding achievement in terms of organisation, production quality, logistics, engineering and on-time completion.

Burj Khalifa / Dubai, United Arab Emirates

In early 2010, an official ceremony was held in Dubai to mark the inauguration of the world's tallest building: the Burj Khalifa, originally known as Burj Dubai. Standing at 828 metres and more than 160 storeys, the Burj Khalifa is the highest occupied building on earth. Construction work began in 2004, and involved around 13,000 construction workers from 140 different nations. The Burj houses 900 luxury apartments and an Armani Hotel. More than 12,000 people are expected to live and work in the tower on a permanent basis.

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Supporting the world's tallest building is a solid foundation. Within a very short space of time bored reinforced concrete piles 1.5 metres in diameter were driven 45 metres into the ground, meeting the highest demands of precision and quality.

Barwa Commercial Avenue / Doha, Qatar

Located south of the capital, Doha, Barwa Commercial Avenue is an 8-kilometre building complex providing retail, office and living space. Commercial Avenue is situated on the southern perimeter of the city, and offers gross floor space of nearly 900,000 square metres, equivalent to an area of approximately 126 football pitches.

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For this logistically complex project the work of 15,000 people from 50 different nations had to be coordinated. A BIM (Building Information Modelling)-based database was used to monitor construction progress in 20,000 rooms via a tablet PC. Project management relied on continuous performance analysis.

Barwa City / Doha, Qatar

The Barwa City development is a new city district located in the heart of the desert comprising 6,000 apartments for around 25,000 people, including all utility supplies, transport infrastructure and outdoor facilities. The residential units in the 128 apartment buildings have a living area of between 110 and 140 square metres.

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To optimise construction site logistics, a new precast material factory was built directly next to the construction site. Due to the exceptional dimensions of the project, logistics management with 232,000 precast elements as well as quality control of the supplied materials (e.g. 56,000 doors and 48,000 windows) was a particular challenge. During the construction phase as many as 9,000 employees from 33 countries had to be coordinated.

Lakhta Tower / St. Petersburg, Russia

Upon completion, the 460-metre Lakhta Tower will be the tallest building in Europe. It is being built in the Lakhta district in St. Petersburg and is supposed to enrich the historic silhouette of the city. Located directly on the waterfront, the tower is being built on difficult terrain that requires cutting-edge deep foundation works that involve sinking wide-diameter bored piles. The project includes an office centre, as well as a science and educational complex. The centre will also house sports and leisure facilities, a children's technology park and various public facilities including shops, restaurants and cafés, etc. The extremely complex construction calls for in-depth expertise and a high degree of engineering ingenuity on the part of all stakeholders involved.

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The extremely challenging deep foundation works call for in-depth expertise and a high degree of competence in carrying out this kind of work. Specially developed drilling equipment made it possible to sink foundation piles 84 metres deep with the highest possible precision.

Z-Towers project / Riga, Latvia

The earthworks to build the four-storey underground garage level were carried out using the cut-and-cover method. The building site was 92 by 83 metres with a depth of 17 metres below ground level. The hotel and office block was erected on a foundation of bored piles that were anchored into the bedrock. Despite the extremely difficult soil and space conditions, a horizontal drive rate of over 1,000 cubic metres a day was achieved. As part of these works, the overlay of 225 foundation piles, partly beneath the erected ceilings, was demolished.

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Due to the high plasticity and wetness, and consequently low bearing capacity of the soil, as well as the low working height beneath the suspended formwork of the erected ceilings (2.80 metres), specially converted construction machinery was needed to excavate the pit using the cut-and-cover method of construction.

Sheikh Zayed Desert Learning Centre / Al Ain, Abu Dhabi, United Arab Emirates

The Sheikh Zayed Desert Learning Centre is a project dedicated to preserving the environmental and cultural heritage of the Emirates. It is a unique combination of museum, gallery and natural sciences facility that celebrates the natural diversity, habitat and sustainability of the desert through interactive exhibits. As an integral part of the development of the Al Ain Wildlife Park & Resort, the building is the first to be awarded the highest five pearl design rating under the Emirates' sustainable building guidelines, Estidama, and is in the running for LEED Platinum certification. Thus the project will be a promoter for the sustainability standards of future projects.

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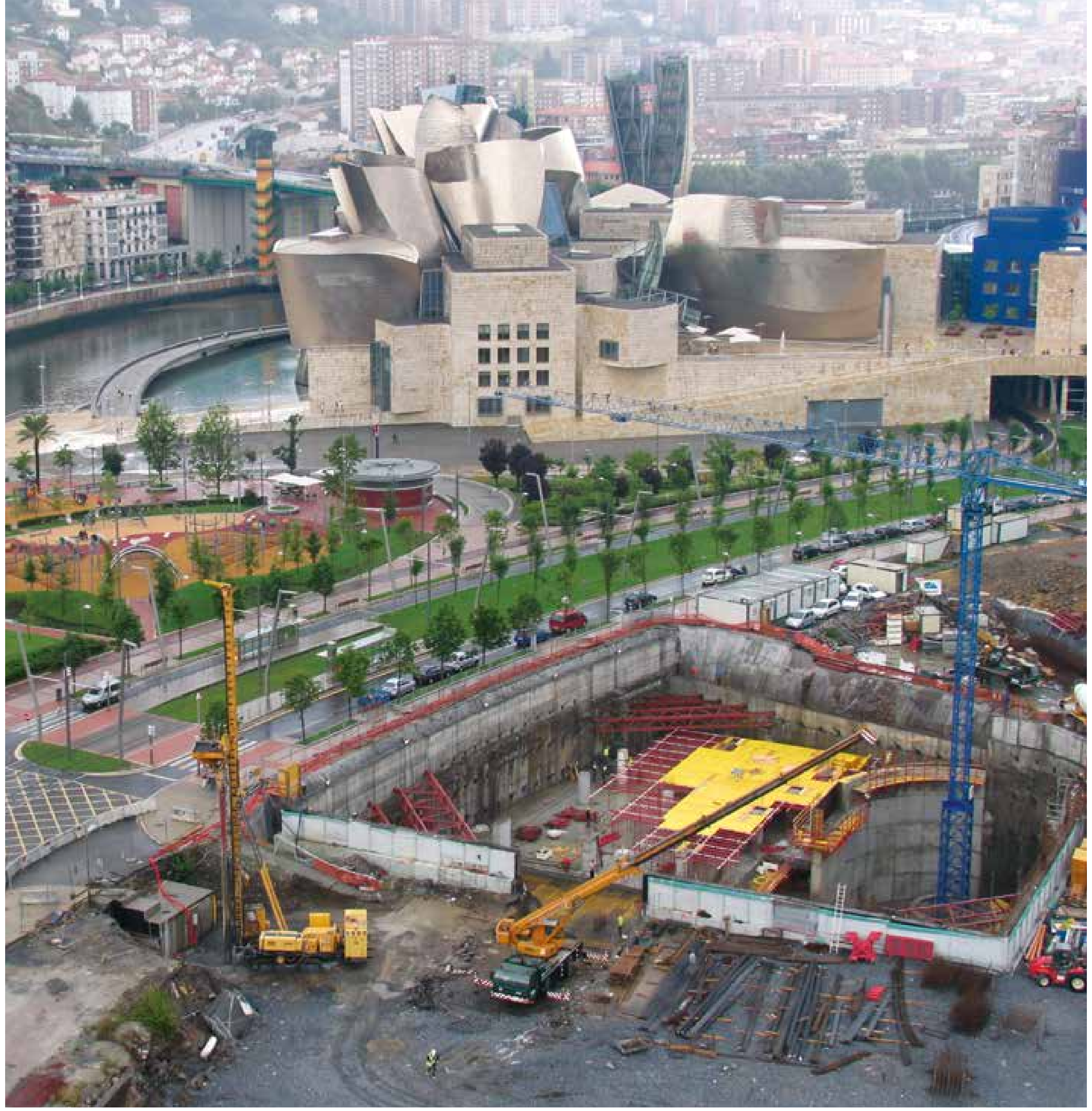
The exhibition building has an area of 12,200 square metres and has been built according to state-of-the-art standards: it features solar panels, energy-efficient glazing and light fixtures. The building is cooled via a concrete core activation system. The wastewater treatment system is designed to significantly reduce drinking water consumption. A systematic pre-cooling air-conditioning system has been installed as part of the project's commitment to energy efficiency.



Campa de los Ingleses / Bilbao, Spain

In the 19th century, the Basque city of Bilbao in the north of Spain was the heart of the mining and steel industry. Coal was intensively mined mainly in the region surrounding the River Nervion. In the 1980s, a process of deindustrialisation began, with the demolition of the former industrial installations and creation of a new urban district for commerce, culture and leisure. This process of urban renewal started with the building of the Palacio Euskalduna Conference Centre and Concert Hall, the Guggenheim Museum and the Library of the University of Deusto, linked by the riverbank esplanade. Together with a new shopping arcade and other urban planning projects, Bilbao's Abandoibarra district thus changed and developed as it moved forward into the 21st century.

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Subsoil improvement measures were carried out for many projects forming part of this urban renewal process. Ultimately an alternative concept (subsoil improvement using gravel columns) delivered a reliable technical solution with optimised costs. This technology met the customer's technical and economic requirements and contributed to answering the environmental problem in an urban area close to the river with an eco-friendly and sustainable solution.

Eurogate green building estate / Vienna, Austria

Eurogate, Europe's largest passive house settlement project featuring around 1,000 housing units with an extremely low heating energy requirement per year, is currently being built near Vienna. The Eurogate plots 4 + 5 project comprises two sites on which 238 housing units and four office blocks are being built.

To reduce expected noise caused by vibrations from an underground metro rail tunnel already in operation, the foundation of the residential building on plot 5 was reinforced with an abutment slab, a sound absorption layer and a mass concrete slab.

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The buildings are being built to passive house standards. It is planned to ventilate the apartments in all buildings through a climate-control and heat-recovery ventilation system in the form of centralised ventilation units. The heating energy requirement is less than 15 kWh/m² per year compared to standard existing residential buildings that need 100–120 kWh/m² per year.

The Internet demonstrates that fast, well-developed routes are the prerequisite for connecting people and possibilities around the globe. The virtual example is just as applicable in the real world.

INFRASTRUCTURE

New roads such as the A2 toll motorway PPP project, giant bridges like the Golden Ears Bridge in Vancouver or the Beijing–Shanghai high-speed rail link: these and many other construction projects contribute to greater mobility, flexibility and quality of life – and reduce the huge backlog demand for infrastructure around the world. The German construction industry operates here as a reliable partner with a broad spectrum of engineering and management skills.

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Cable-stayed bridge over the Waal civil engineering project near Ewijk, the Netherlands – see page 25 for more information about this project

Eleftherios Venizelos International Airport / Athens, Greece

Athens International Airport is an important hub for Southeast Europe and a central transfer point for travellers to Europe from the Middle East. A favourable geographic location, modern infrastructure and good service have made it one of the most popular airports in the region. This is borne out by 16 million passengers and an annual freight traffic volume of 220,000 tonnes, making it one of the region's biggest drivers of economic growth.

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Athens Eleftherios Venizelos International Airport is not only a successful construction project and the world's first BOOT (build-own-operate-transfer) project in the airport sector, but also a good example of a successful public-private partnership. The world's largest privately financed airport project to date was constructed in just 15 months and delivered five months ahead of schedule.

A2 Toll Motorway (PPP) / Konin–Świecko East-West link, Poland

The A2 Toll Motorway is one of the biggest PPP projects in Europe, part of the Berlin–Warsaw–Minsk–Moscow trans-European network and one of Poland's most important traffic arteries. It was constructed in two segments: Konin–Nowy Tomyśl (Segment I: 2001–2004) and Nowy Tomyśl–Świecko (Segment II: 2009–2012). A 27–29-centimetre-thick concrete pavement was laid that features long durability, good grip, no rutting, low noise emissions as well as low maintenance costs.

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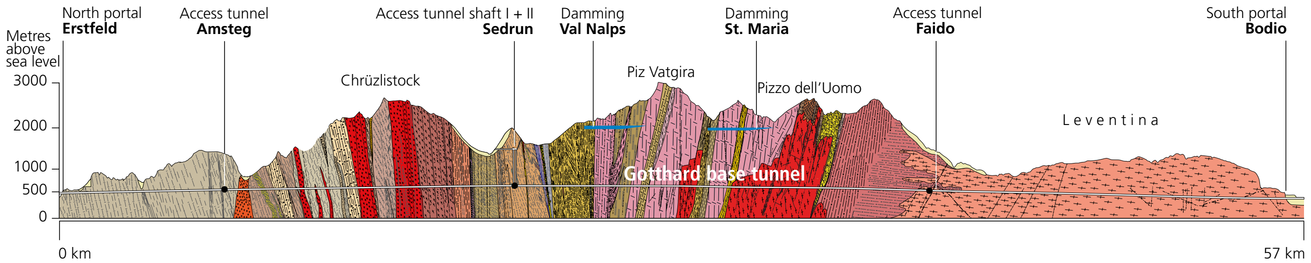
Work within the scope of the PPP included engineering, construction, financing, operation and maintenance of a toll motorway designed for a driving speed of 120 km/h. Operation and maintenance is realised by the "Autostrada Wielkopolska" consortium under a contract awarded for a concession period up to 2037. The project was named "PPP Deal of the Year" by Jane's Transport Finance and "Best Infrastructure Deal in EMEA" by EMEA Finance.

Gotthard base tunnel / Switzerland

The 57-kilometre Gotthard base tunnel is the heart of the new rail link through the Swiss Alps, built as a double-tube tunnel with a diameter of 13 metres each. With an overburden of up to 2,500 metres, it will be the deepest and longest railway tunnel ever built. The new level-track rail route through the main Alpine ridge with a maximum altitude of just 550 metres above sea level will in future be suitable for long and heavy freight trains. Passenger trains can travel the route with a speed of up to 250 km/h, thus cutting travel time between Zurich and Milan by an hour to 2 hours 40 minutes. Tunnelling works are being carried out simultaneously in five construction stages. In addition to the two portal sections, three other sections are being built via access tunnels. The two tubes are linked every 325 metres by transverse tunnels that can be used as escape routes in emergencies.

Longitudinal geological profile Gotthard base tunnel



Over a length of 57 kilometres many different geological formations had to be cut or bored through.

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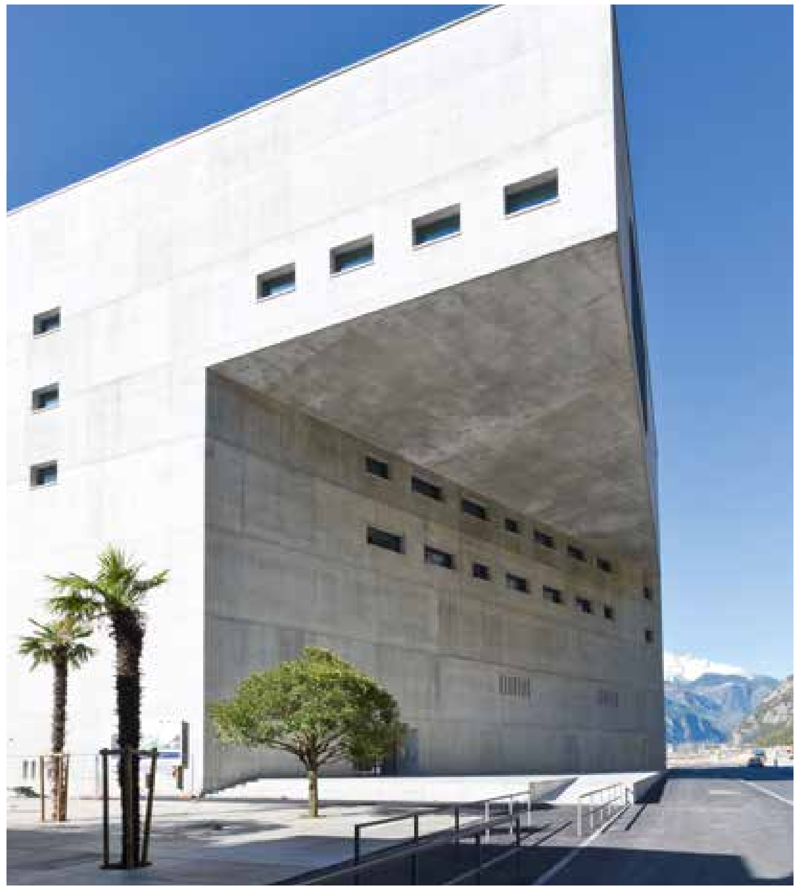
The whole project is characterised by challenging technical design and execution under demanding geological conditions with an overburden of up to 2,500 metres. During the construction phase, excavation machinery used in the mining sector was deployed. To ensure the stability of the tunnel after excavation, special anchors and adjustable steel arches were installed to absorb the high deformations of up to 1 metre. In addition to the two single-track tunnels, a multifunction station for subsequent rail operations was constructed in the Sedrun middle section. During construction, this was used for the complex supply and waste management logistics for the two 800-metre-deep shafts.



Road tunnel / Gdansk, Poland

The Martwa Wisła tunnel is the heart of the direct connection between Gdansk airport and the seaport and is designed to relieve the inner city from the burden of through traffic. The road tunnel is being built on soil with a low bearing capacity with the water table lying just 1 metre below the ground surface. The project involves the participation of a large number of local companies. All engineering works for the approach ramps were completed between June 2012 and July 2013. This project involves Poland's first tunnel boring machine-driven road tunnel.

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The project involved constructing 42,000 cubic metres of Soilcrete® jet-grouted columns, 60,000 square metres of diaphragm walls and 60,000 metres of micropiles, as well as working with high groundwater levels and some challenging ground conditions, which made special demands on the design and execution.

High-speed rail link / Beijing–Shanghai, China

The Chinese Ministry of Railways (MoR) decided in favour of a track system for high-speed rail transport designed, and successfully in operation, in Germany. The pilot line was opened for the start of the Olympic Games in China. Construction on the world's longest high-speed line from Beijing to Shanghai began immediately afterwards. Originally designed for speeds up to 380 km/h, the line went into operation in 2011 following record construction time.

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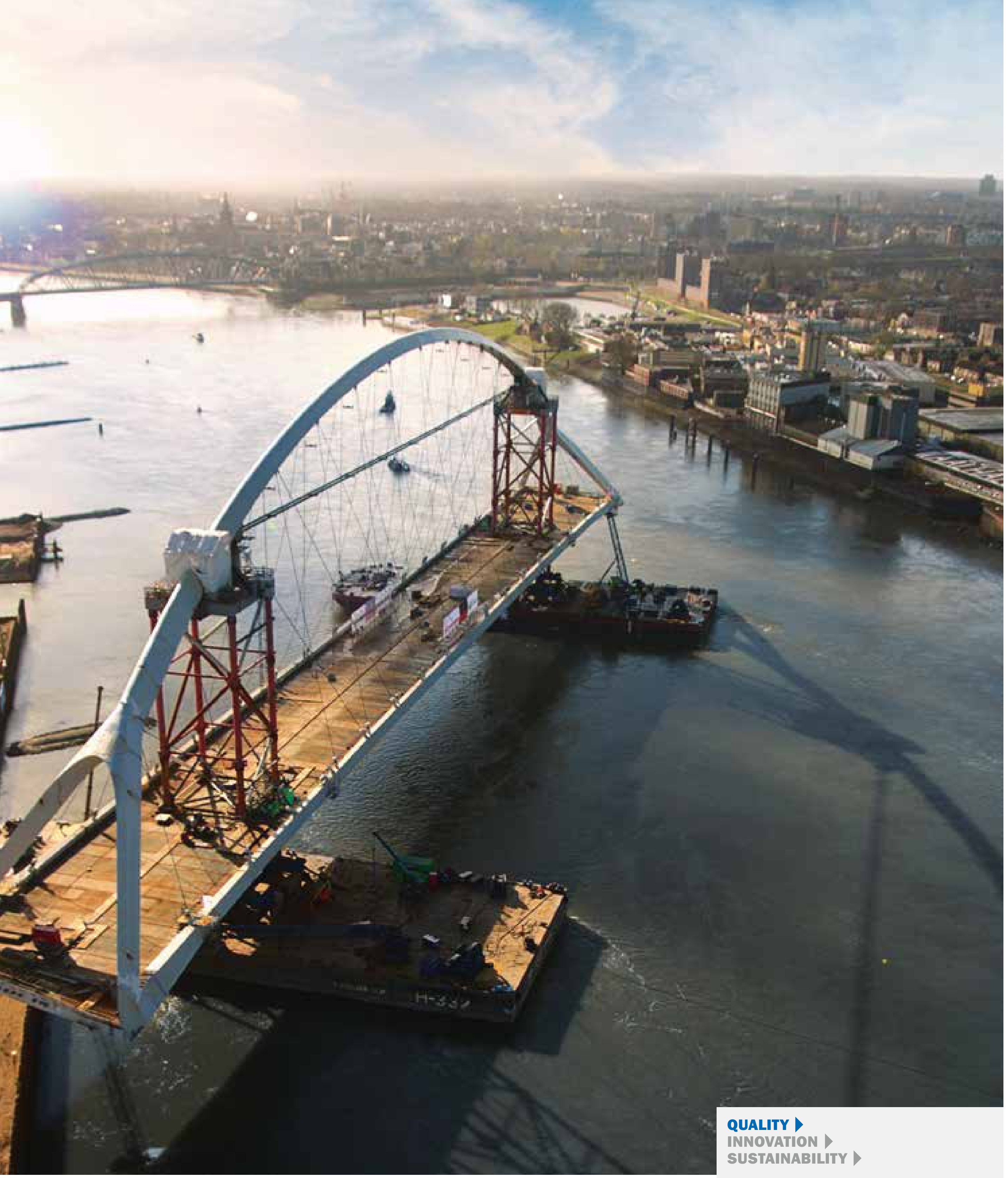
The project involved technology transfer for the system rollout and construction of a 115-kilometre test track to be completed in time for the 2008 Olympic Games. This was followed by the contract for consulting, production monitoring and on-site support for the 1,318-kilometre-long high-speed line between Beijing and Shanghai. As part of the project, over 380,000 track support slabs and 211 high-speed switches had to be produced and laid.



Stadsbrug Nijmegen / Nijmegen, the Netherlands

With completion of the "De Oversteek" bridge in November 2013, the city of Nijmegen has gained a new landmark. A 1,825-metre-long bridge structure over the River Waal, which divides the Dutch Hanseatic city, will significantly reduce city-centre traffic. During the final construction phase, the 285-metre-long and 60-metre-high main span was floated into place at its historically significant location in a technically sophisticated act of precision that generated high media interest and attracted some 10,000 spectators. The tied-arch construction is currently the second-largest vaulted steel bridge in Europe.

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Precision engineered in Germany, the steel segments of the bridge were transported by ship to the pre-assembly site, where the main span, comprising individual components weighing up to 160 tonnes, was pre-assembled in the "dry dock". The bridge, weighing 6,100 tonnes, was then lifted onto two floating pontoons and towed across the river and installed precisely on the concrete piers.

Hong Kong–Zhuhai–Macao bridge / Hong Kong, China

In the 1980s, rapid annual economic growth and increasing cross-border traffic in Hong Kong, Shenzhen and the entire Pearl River Delta prompted an agreement between the Hong Kong government and Shenzhen authorities to improve the regions by opening up new direct road links. In an ongoing project, the world's longest sea-crossing bridge is currently being built that will link Hong Kong with the two Special Administrative Regions Zhuhai and Macau and the Chinese mainland. The entire link will have a total length of almost 50 kilometres. The main part of the bridge is designed as a viaduct. However, so as not to impede international shipping waterways, a combination of four viaducts and an 8-kilometre-long tunnel are being built at strategic points.

On-site presence and experience are a crucial factor for the success of this project.

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The bridge piers rest on bored piles with a diameter of 2.5 metres sunk to depths of up to 100 metres and more. This complex work has to be carried out offshore with the help of drilling equipment as well as auxiliary equipment and material stores mounted on barges. As well as technical excellence, this also requires extensive detailed logistics planning.

Bridges to Prosperity / Kamasiga Kibirira, Rwanda

In July 2012, the first joint project with the non-profit organisation "Bridges to Prosperity" (B2P) was realised in Rwanda. Actively supported by a team of ten employees, a 96-metre-long suspended footbridge spanning the Nyamabare River was built in the Gatsibo region. The new bridge enables the villagers in this remote region in the north of the African state to cross the river safely even during the rainy season, offering them access to commerce, education and medical care without day-long treks.

Ngqura Harbour / Port Elizabeth, South Africa

Two new container berths have been built at the deepwater port of Ngqura near the South African city of Port Elizabeth, making Ngqura the second-largest port in South Africa after Durban. Over 8 million tonnes of building material was extracted from a quarry near the harbour, processed and used to construct the harbour basin, the quay walls and breakwaters. One particular technical challenge was the construction of the harbour basin, which required the dewatering of an area of 300,000 square metres down to 20 metres below sea level.

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Construction of the Ngqura deepwater port provided significant employment and training opportunities within the local communities. Local workers were trained in various construction trades as well as business administration. In pursuing Black Economic Empowerment (BEE) objectives, contracts were awarded to partners, subcontractors and suppliers.

Cable-stayed bridge / Ewijk, the Netherlands

The A50 motorway near Nijmegen has been widened to four lanes in both directions between the Ewijk and Valburg motorway junctions, including construction of a cable-stayed bridge 1,055 metres long, 33 metres wide and with a river span of 270 metres over the River Waal. Two small horizontal pre-stressed hollow box-type girders bear the main load. Between these, pre-stressed prefabricated parts each with two lanes per carriageway run transversely to the bridge direction. On each of the hollow boxes, pylons are installed above the river piers supporting the cable stays that hold the deck in place. In the middle of the river, the bridge is braced with 45 external tendons consisting of 893 strands up to 45 metres long.

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The task of the architects was to mirror the design of the existing steel bridge built in 1973. The architectural design of the new concrete bridge is adapted to the appearance of the existing steel bridge so that the two bridges at first glance form a unified architectural entity. Only a closer second look reveals that the new superstructure is built of concrete and not steel.

Stockholm City Line, Södra railway tunnel / Stockholm, Sweden

The 330-metre-long Södra railway tunnel is part of a 6-kilometre-long new stretch of underground track running below Stockholm's city centre, doubling track capacity from two to four tracks. To protect partially listed and residential buildings, the tracks have been underpinned with special steel core piles and sealed against groundwater infiltration, and old masonry has been permanently stabilised. The construction period up to project completion will take over six years (2009–2016).

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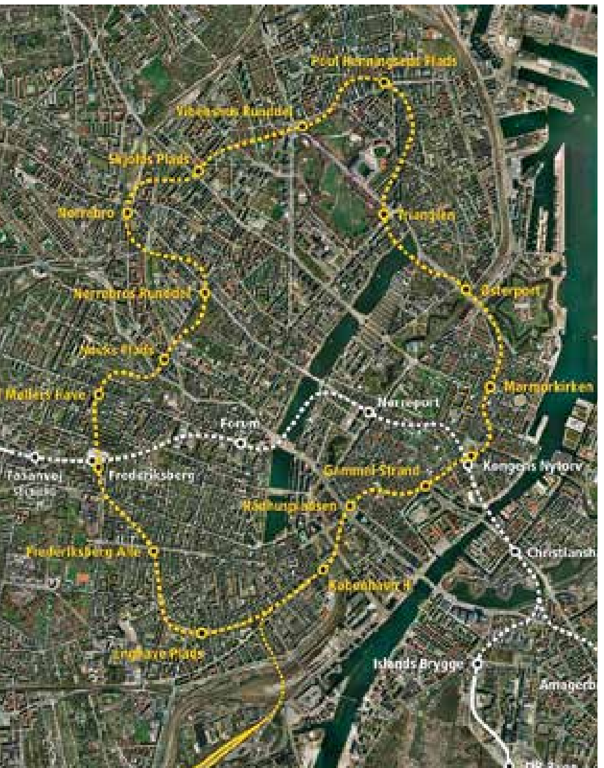
The works were carried out using an innovative construction method largely without interrupting rail services. The foundation of the railway tunnel was anchored into the rock using around 1,100 steel core piles 10–16 metres long with an anchoring depth of up to 12 metres. To ensure the structural integrity of nearby buildings, special small-scale equipment was used to enable work to be carried out effectively in the narrow space beneath the buildings. The works were executed in compliance with strict requirements regarding noise and environmental protection.



Metro Cityringen / Copenhagen, Denmark

For construction of the Metro Circle Line in Copenhagen the internal groundwater level needs to be lowered. In order to protect the historic buildings in Copenhagen's city centre, the previously drained off water has to be reinfiltrated. This involves adhering to groundwater level fluctuation tolerances with centimetre accuracy. Furthermore, the reinfiltrated water must be fit to drink. This is ensured by a unique, complex system of wells, water treatment plants and pipeline systems, controlled by means of PLC systems (programmable logic controllers) and monitored by a SCADA system (Supervisory Control and Data Acquisition).

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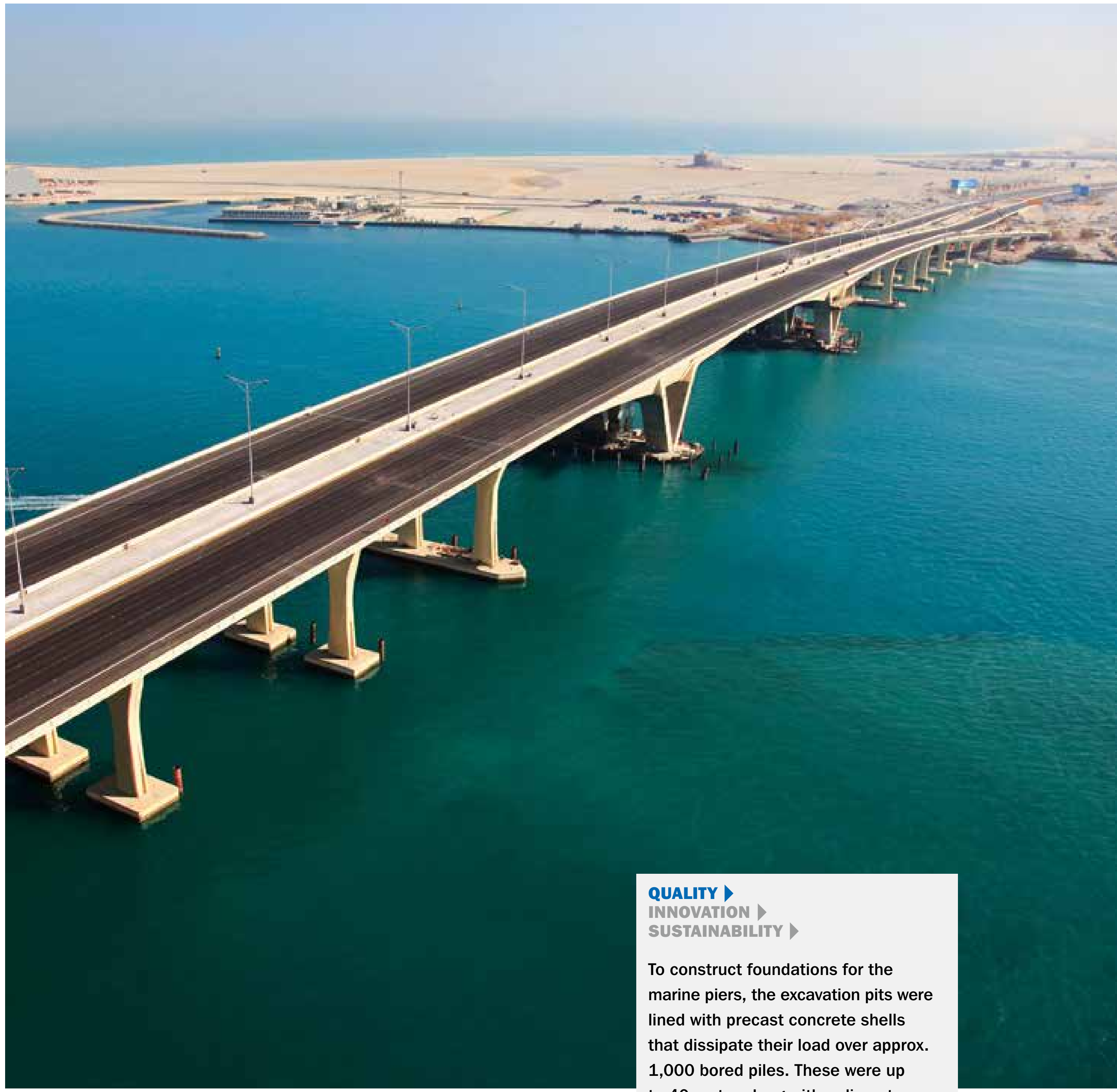
One particular challenge is groundwater management. The many individual works such as pump systems, water treatment plants or pipeline systems need to be coordinated and controlled centrally. For this purpose, state-of-the-art electronically controlled systems are used that are installed and operated by specially trained staff with the necessary expertise.



Sheikh Khalifa Bridge / Abu Dhabi, United Arab Emirates

Completed in October 2009, a ten-lane expressway and the new 1.5-kilometre-long Sheikh Khalifa Bridge links the "culture island" of Saadiyat, a premier destination offering recreational activities, a residential complex, a business and a cultural centre, with Abu Dhabi harbour. Apart from ten traffic lanes the 60-metre-wide, technically sophisticated bridge also has capacity for two railway tracks, making it one of the largest infrastructure developments in Abu Dhabi and one of the widest in the world.

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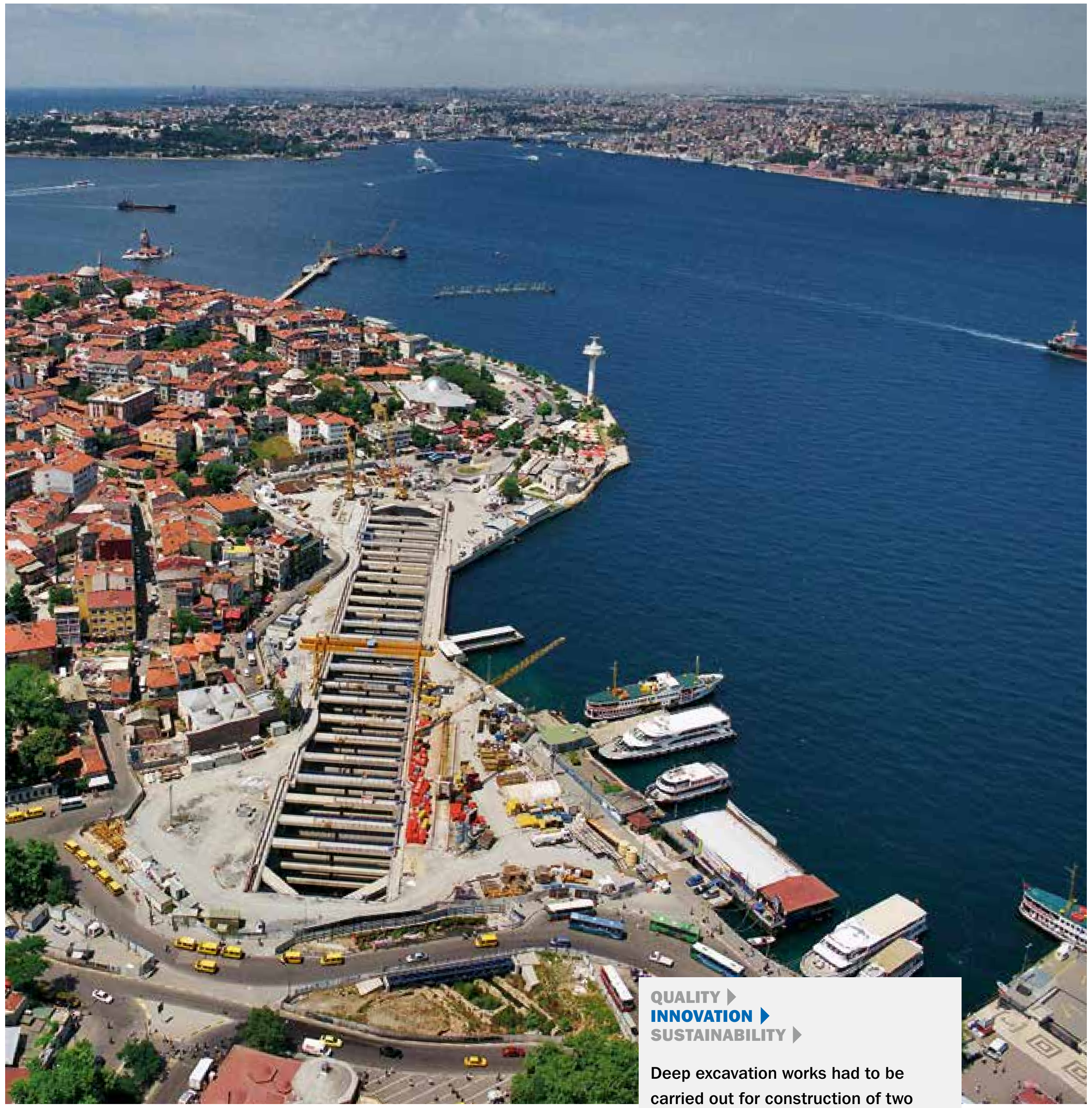
To construct foundations for the marine piers, the excavation pits were lined with precast concrete shells that dissipate their load over approx. 1,000 bored piles. These were up to 40 metres long with a diameter of 150 centimetres. Because of the special requirements, three different construction methods were used: the cantilevering construction method in the offshore area, the incremental launching method from Abu Dhabi main island and falsework on Saadiyat Island. The bridge has central spans of 110 metres, 200 metres and 135 metres across shipping lanes. The carriageway is 23.20 metres wide on each side with a central clearance of 11 metres for a railway line.



Marmaray project / Istanbul, Turkey

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Deep excavation works had to be carried out for construction of two stations. In Üsküdar, the 30-metre-deep watertight construction pit was located directly on the Bosporus. A diaphragm wall 1.5 metres thick and 55 metres deep was reinforced below the foundation level with a water-cement mix injected at high pressure.

Marmaray is an ambitious rail transport project that links Europe and Asia via an underwater rail tunnel. New underground metro stations were constructed in Yenikapı and Sirkeci on the European side and in Üsküdar on the Asian side.

Golden Ears Bridge / Vancouver, Canada

The Golden Ears Bridge project consists of a six-lane road bridge across the Fraser River and the corresponding access roads to connect the bridge with the existing transport infrastructure. The project connects the cities of Langley and Maple Ridge in the Greater Vancouver area. The core of the project is the 976-metre-long bridge. It consists of three main segments with a length of 244 metres each and two end spans, each 122 metres long. The bridge is 40 metres high. One distinguishing feature is the considerably shorter pylons compared to a conventional cable-stayed bridge with a height of approx. 90 metres and the low height of the bridge girders that characterise the overall architectural appearance.

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To optimise the total costs the client chose an innovative award procedure in which financing, design, construction and maintenance were to be provided by a single service provider for a period of 32 years. The technical challenge consisted in constructing the four main river pier foundations in the Fraser River using large bored piles up to 90 metres long. The supporting structure was designed to be earthquake-proof with expansion joints featuring "fuse-box" seismic protection to allow for cost-effective repairs in the aftermath of an earthquake.

Protecting natural resources, generating and distributing eco-friendly energy – while at the same time meeting an enormous energy demand: this is an integrated task that demands accountability and a high level of competence.

ENERGY

In both areas, the German construction industry has an internationally proven track record. Consequently, it plays a key role in the generation of climate-friendly energy. For example in the realisation of the world's biggest wind farm – or construction of a pioneering tidal power plant off the north coast of Scotland.

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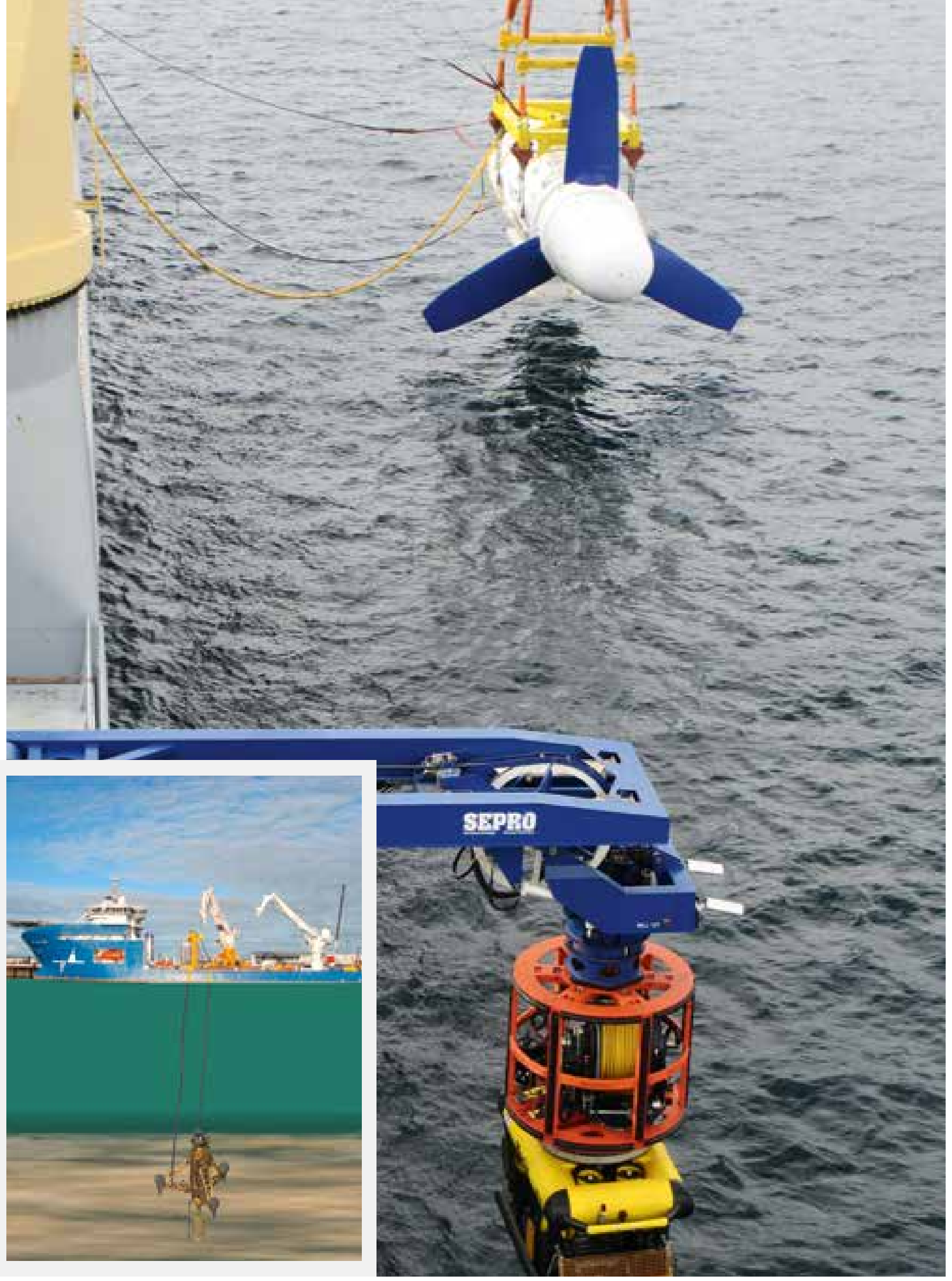
London Array offshore wind farm – Thames Estuary / London, United Kingdom – see page 32 for more information about this project



European Marine Energy Centre / Orkney, United Kingdom

Generating energy from tidal currents is one of the most promising and sustainable technologies of the future. The waters around the United Kingdom harbour the greatest potential worldwide for harnessing tidal energy from the seas. However, this technology is also suitable for application in some regions of Canada, South Korea, Australia, Patagonia, Alaska and New Zealand.

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Due to the adverse conditions, installing foundations for such turbines on the seabed is extremely difficult. Therefore an innovative underwater drilling method for digging monopile foundations under challenging environmental conditions was developed. This technology was successfully applied for the first time in July 2011 for the foundation of the Voith Hydro Ocean Current Technologies' tidal energy turbines at the EMEC tidal test site off the Scottish coast.

London Array offshore wind farm – Thames Estuary / London, United Kingdom

The world's largest offshore wind farm, London Array, consists of 175 wind turbines and two transformer stations with a total electrical output of 630 MW. It generates enough energy to power nearly 500,000 households from renewable energy sources and reduce harmful CO_2 emissions by over 900,000 tonnes a year. The technical basis of the project is the design, production, transport and installation of 177 offshore foundations in water up to 25 metres deep off the UK coast. Drawing on many years of experience installing 550 offshore foundations in the Baltic and the North Sea, it was possible to hand over the foundations turnkey and on schedule in just under 16 months. Logistics services for turbine assembly were also provided.

QUALITY
INNOVATION
SUSTAINABILITY

In order to bring down operating costs, an innovative concrete working platform was used in the development, design and production of the offshore foundations. This is less susceptible to corrosion than comparable steel constructions. Implementing a complex logistics management system for production, transport and installation ensured cost-effective project execution. Thanks to excellent health and safety precautions the whole project was realised without any major accidents.

Heavy-lift jack-up vessel INNOVATION

The high-performance heavy-lift jack-up vessel INNOVATION enables safe loading, transport and installation of offshore wind energy plants.

The fully automatic rack and pinion jacking system with 96 elevating units jacks the vessel up out of the water on four supports, thus providing a stable platform. This makes the INNOVATION absolutely self-sufficient and offshore installations safer, more efficient and more cost-effective.

QUALITY
INNOVATION
SUSTAINABILITY

The INNOVATION is a powerful heavy-lift jack-up vessel that successfully meets the high demands on challenging offshore wind energy projects. The all-in-one solution – loading, transport, installation – makes the INNOVATION absolutely self-sufficient. The concept and design of this special vessel are based on the engineering expertise of German construction specialists.

Cheves Hydropower Project / Lima, Peru

The Cheves Hydropower Project is a run-of-river power plant located about 130 kilometres north of the Peruvian capital, Lima. The project utilises the hydrological resources of the Huaura and Checras rivers to generate up to 837 gigawatt hours of zero emissions energy per year for the national Peruvian electricity grid. At 2,000 metres above sea level, 19.5 kilometres of tunnels, two river inflow weirs with desanding plants and a 50,000-cubic-metre underground powerhouse were built during execution of the 168-megawatt project. Over a period of 34 months, a total of 500,000 cubic metres of rock was excavated.

QUALITY
INNOVATION
SUSTAINABILITY

The Cheves hydropower plant has been recognised by the United Nations as a so-called CDM plant. The energy generated replaces conventional power plants in Peru and will lead to a 394,000-tonne reduction in CO_2 emissions.

Natural draught cooling tower / Dahej, India

The DGEN power plant, comprising three turnkey power plant units, is being built in the town of Dahej on the south-west coast of the Indian state of Gujarat. On completion, the plant will have an electrical output of 1,200 megawatts (MW). When problems arose during building of the associated natural draught cooling towers, German expertise was in demand. A highly specialised team of 50 arrived from Herne initially to supervise the construction work and ultimately to assume responsibility for building the last cooling tower using their own equipment and personnel. The hydroelectric cooling tower formwork developed in-house was shipped to Mumbai specifically for this purpose and installed on-site.

QUALITY
INNOVATION
SUSTAINABILITY

The system used is ideally suited for construction of hyperbolic cooling tower formwork. It can be adapted to the formwork geometry to be realised, works with manually operable wooden formwork elements with a horizontal polygonal length of only 50 centimetres and like this guarantees minimal manufacturing tolerances to the target geometry.

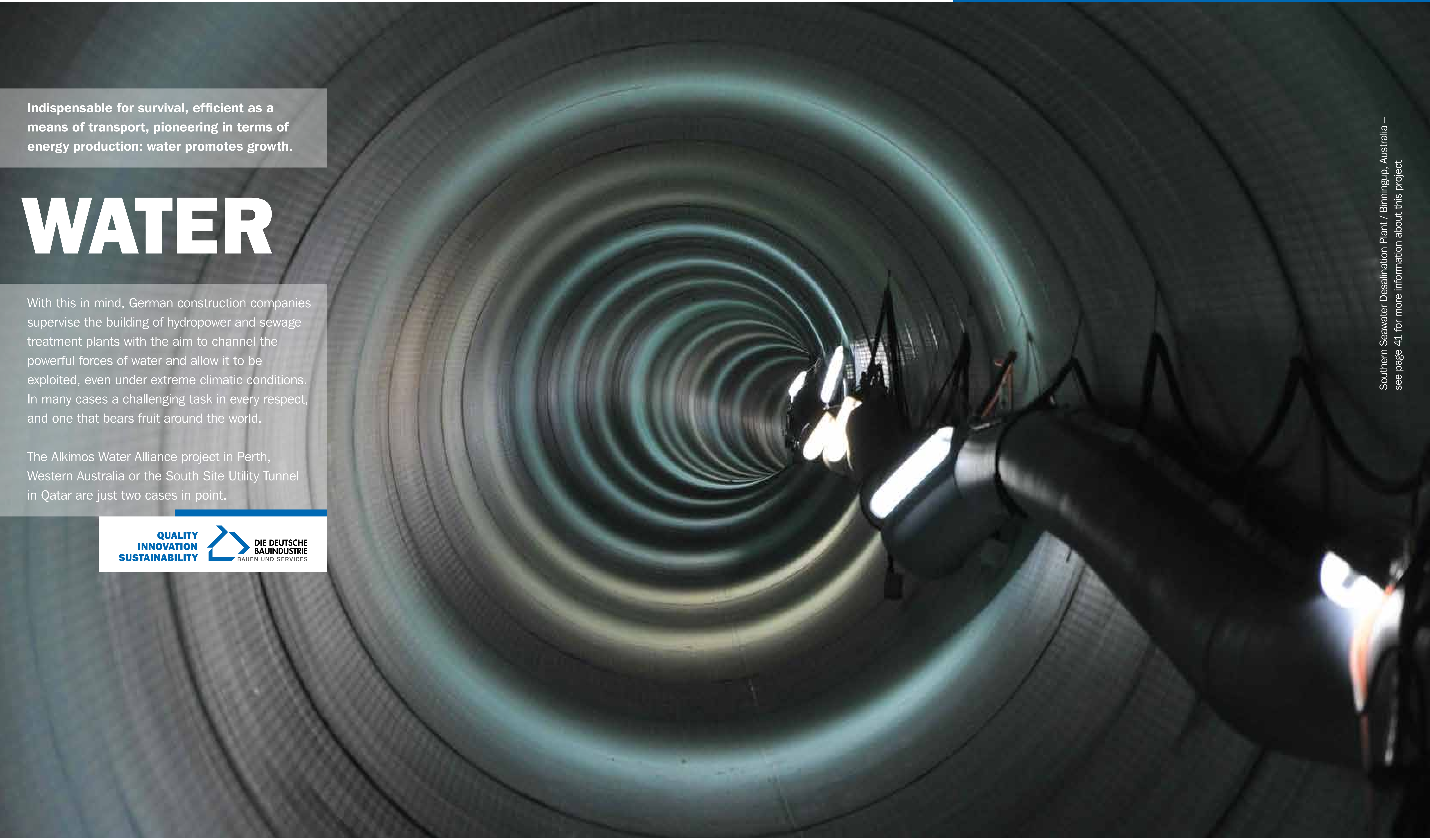
Indispensable for survival, efficient as a means of transport, pioneering in terms of energy production: water promotes growth.

WATER

With this in mind, German construction companies supervise the building of hydropower and sewage treatment plants with the aim to channel the powerful forces of water and allow it to be exploited, even under extreme climatic conditions. In many cases a challenging task in every respect, and one that bears fruit around the world.

The Alkimos Water Alliance project in Perth, Western Australia or the South Site Utility Tunnel in Qatar are just two cases in point.

QUALITY INNOVATION SUSTAINABILITY
DIE DEUTSCHE BAUINDUSTRIE BAUEN UND SERVICES



Southern Seawater Desalination Plant / Binningup, Australia – see page 41 for more information about this project

South Site Utility Tunnel, Education City / Doha, Qatar

QUALITY
INNOVATION
SUSTAINABILITY

Since completion in 2012, the project delivers a complete solution for the water supply of a new city district. The tunnel, 10 metres below ground and 9 kilometres long, was built using the cut-and-cover construction method. For the project, 85,000 cubic metres of concrete and 14,000 tonnes of reinforcement steel, along with 100,000 metres of power and fibreglass cables, were installed.

The contract covered design and construction of the South Site Utility Tunnel and associated facilities such as drinking water, firefighting, irrigation and cold water pipes over a distance of 9 kilometres and a depth of 10 metres. The Education City in Qatar with a Qatari university and American, French and English partner universities is aiming to achieve centre of excellence status. The Education City Campus will also accommodate 12 stadiums for the 2022 Football World Cup.

Alkimos Wastewater Treatment Scheme / Perth, Australia

The Water Corporation of Western Australia commissioned construction of a 6.3-kilometre-long wastewater tunnel connecting the existing main sewer line with the new Alkimos wastewater system in the northern suburbs of Perth. The tunnel was built using the pipe jacking method, which reduces the impact on the environment and the area surrounding the construction site.

QUALITY
INNOVATION
SUSTAINABILITY

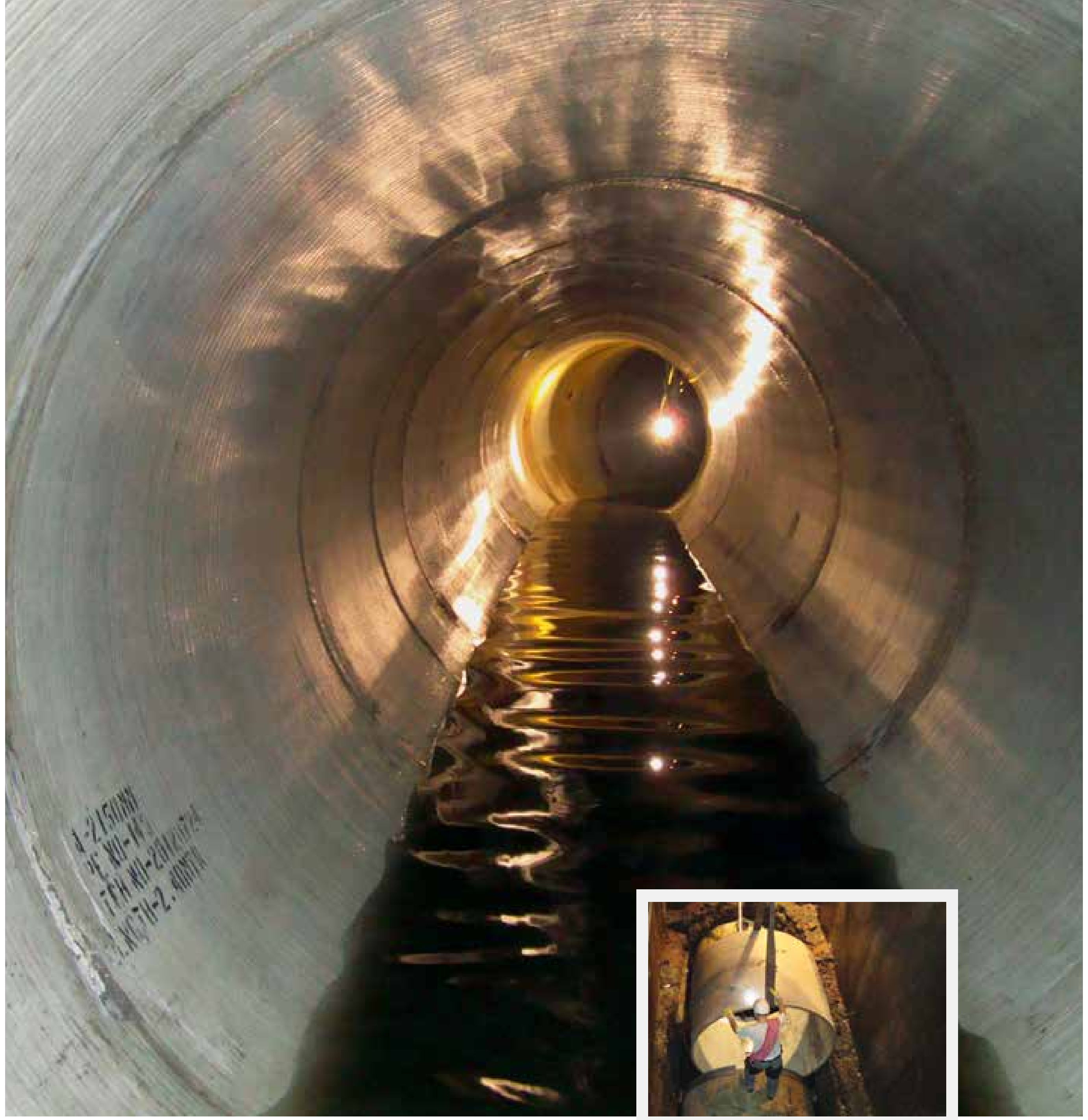
The main sewer line was constructed employing pipe jacking technology in a complex and highly variable geology with both sand and hard rock. This involved drilling 13 jacking and receiving shafts with a maximum depth of 20 metres. The 15-metre-long tunnel boring machine reached a maximum torque of 800 kNm. Utilisation of state-of-the-art technology resulted in maximum deviations from the target point of +/– 20 millimetres. The maximum driving rate was 84 metres in 24 hours.

Center Hill Dam rehabilitation / Tennessee, USA

In 2007, the US Army Corps of Engineers classified Center Hill Dam as high risk due to cavity formation and seepage through the dam foundations caused by karst development over the years. A complex technical rehabilitation project was prepared that got underway in 2012.

QUALITY
INNOVATION
SUSTAINABILITY

The primary feature of work is the installation of 30,000 square metres of concrete seepage barrier in the existing dam extending to depths upwards of 90 metres. The project is subject to strict constraints regarding dam safety and environmental protection.



Sewer rehabilitation / Kolkata, India

The Hazra Road project is part of a three-phase rehabilitation and refurbishment project in Kolkata. Kolkata, formerly known as Calcutta, was the capital of the British Indian Empire until 1911. The central sewer system was built during British colonial rule, making it the third oldest in the world. The combined sewer up for refurbishment was built by the British at the end of the 19th century and has not been properly inspected, cleaned or maintained since then. Congested roads, a minimum amount of space, resolute traffic restrictions and a highly sensitive client and local residents make the general conditions in what is one of the most densely populated urban areas in the world both extremely interesting and challenging. The annual monsoon necessitates much more precise construction site planning than is generally the case, not only due to widely varying discharge amounts. The sewer to be refurbished has a total length of 4,044 metres and is built of brick circular profiles from DN 1640 to DN 2265. Due to inadequate maintenance of the sewer in recent decades, up to 80 percent of its cross section is now covered with silt. Given the necessary discharge capacity, the rehabilitation measures had to ensure that vastly different amounts of flow between 100 l/s and 1,700 l/s during the course of the day can be pumped along the renewal section. The rehabilitation was carried out with GRP liners using trenchless technology.

QUALITY
INNOVATION
SUSTAINABILITY

By consulting closely with the client it was possible to successfully complete the work ahead of schedule with minimal impact on public life and without exacerbating the already difficult traffic situation. In excess of 1,500 pipes were supplied just in time and immediately installed. At the same time, more than 6,000 cubic metres of sand deposits were cleared out of the sewer and disposed of.

Construction of a sewage treatment plant / Rousse, Bulgaria

Next to Sofia, Varna, Burgas and Plovdiv, Rousse is one of the largest cities in Bulgaria and a major industrial centre in the north-west of the country. In 2005, a financing agreement was signed between the European Commission and the Bulgarian government within the scope of the ISPA programme to improve the water and wastewater infrastructure in the Rousse conurbation area. The agreement among other things covers the new build of the Rousse municipal sewage treatment plant on the banks of the Danube. The project includes planning (design, approval planning, construction planning), construction and commissioning of the sewage treatment plant with a population equivalent of 240,000.

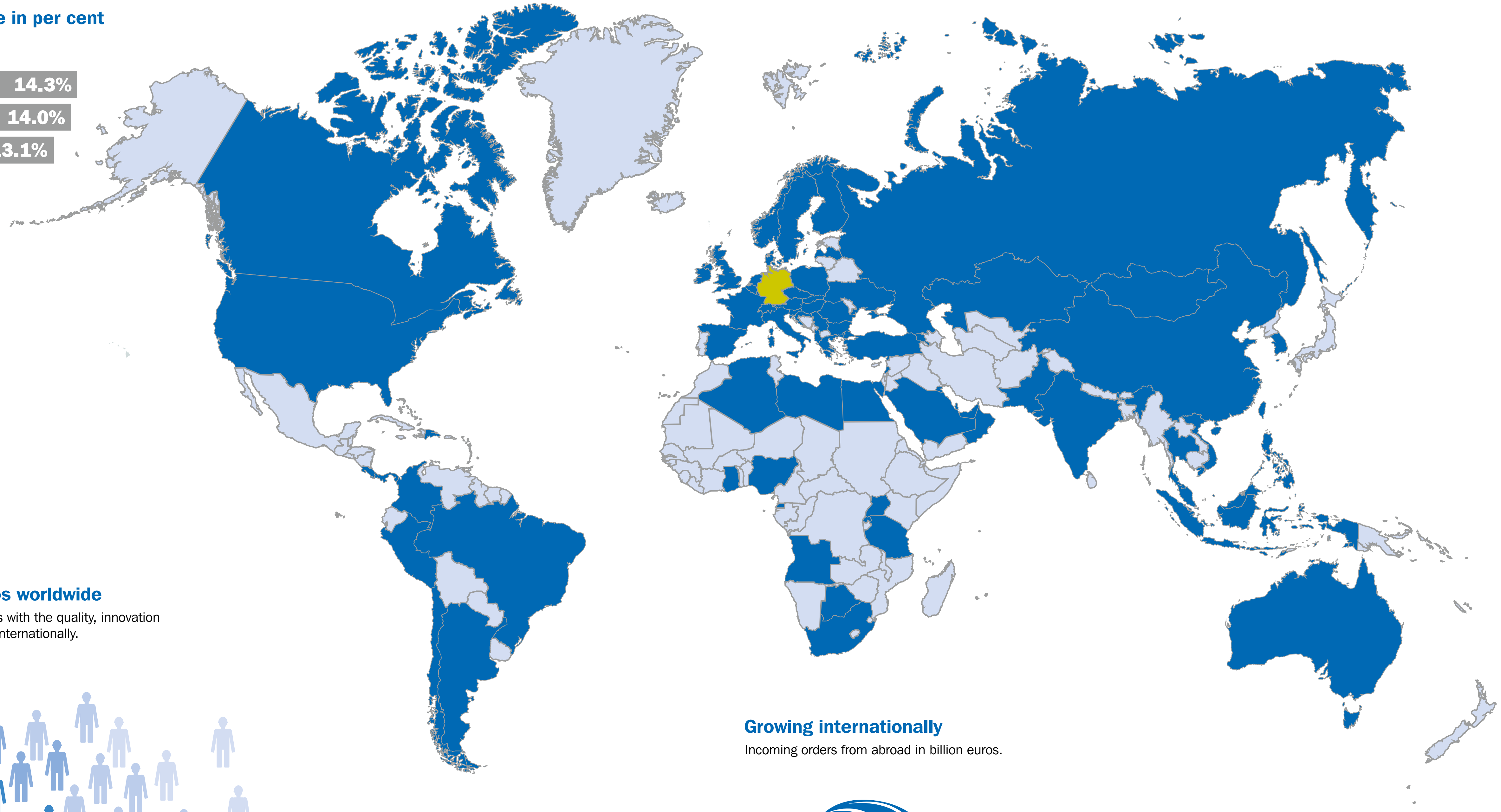
Southern Seawater Desalination Plant / Binningup, Australia

Commissioned at the end of 2011, the Southern Seawater Desalination Plant in Western Australia is located around 150 kilometres south of Perth. With a capacity of 100 gigalitres per year, the plant is one of Western Australia's biggest potable water suppliers. One particular challenge was the construction of three separate tunnels extending 550 metres out to sea. The average daily driving rate in sand and limestone was 20 metres.

QUALITY
INNOVATION
SUSTAINABILITY

The project involved construction of three intake and outfall tunnels for seawater with horizontal and vertical double curves using pipe jacking technology. Pipe jacking was executed by two dual mode boring machines which started from a central launching pit later converted into a pumping station, and were recovered in offshore reception pits 550 metres from the shore, where the tunnel boring machines were once again salvaged.

German Construction Industry International – present in over 70 countries on five continents.



Share of international construction revenue in per cent

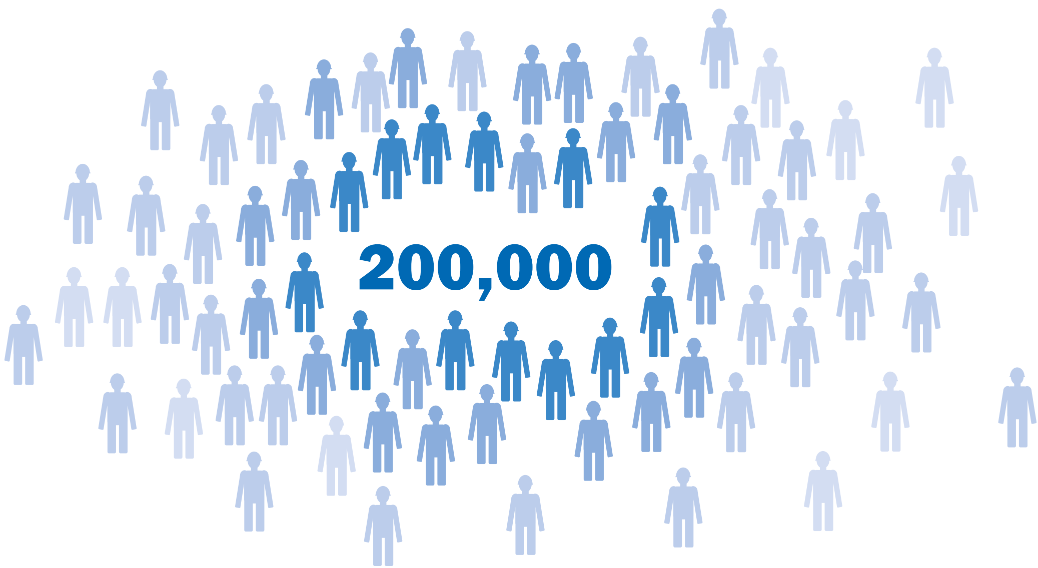
Excellent competitiveness on the world market.

Spain	14.3%
USA	14.0%
China	13.1%
Germany	8.5%
France	8.5%
South Korea	8.1%
Italy	6.1%
Japan	4.1%
Other	23.3%

Source: Engineering News-Record, values 2012

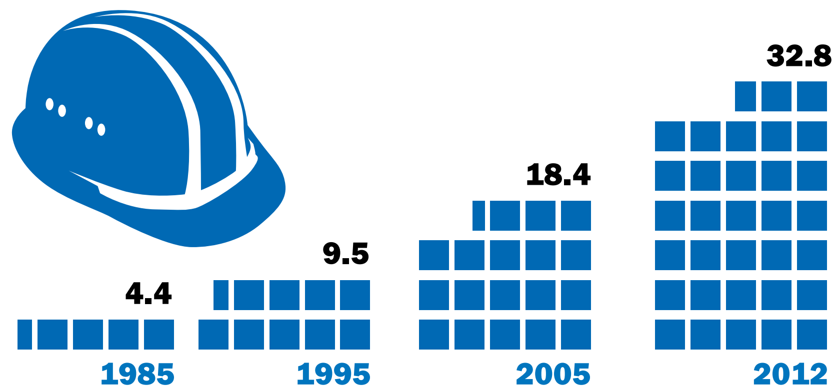
German construction companies create jobs worldwide

Some 200,000 employees at home and abroad are synonymous with the quality, innovation and sustainability of German construction companies operating internationally.



Growing internationally

Incoming orders from abroad in billion euros.



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