ANDRITZ HYDRO

From water to wire

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ANDRITZ HYDRO is a global supplier of electromechanical systems and services ('From water to wire') for hydropower plants. The company is a leader in the world market for hydraulic power generation.

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We promote hydropower as the most economic form of renewable energy. In close cooperation with our customers, we elaborate long-lived, environmentally friendly concepts.

We maintain nature, mankind, and technology in perfect harmony, as part of our own corporate culture.

Therefore, sustainability and conservative use of resources are given top priority.

What we represent:

- Over 170 years of experience in turbine design
- More than 30,000 turbines installed, totaling approx. 400,000 MW output
- Over 120 years of experience in electrical equipment for power stations
- Complete supply range up to 800 MW
- 3,500 delivered generators, totaling 185,000 MVA output
- Leading in service and rehabilitation for upgrades
- World market leader for COMPACT HYDRO

Hydropower: sustainable, renewable,environmentally friendly

We are strongly committed to the sustained protection of the environment, in parallel with economic growth and social progress. The tenet is meeting the needs of the present generation, without compromising the ability of future generations to meet their needs.

Future development of worldwide power generation

Hydropower currently meets about 20% of the world's electricity needs. Most medium-term scenarios predict that power needs will be primarily met through a combination of various new, renewable, and fossil fuel resources. According to current forecasts, awareness of global warming (due to CO_2 emissions from fossil fuel plants and other sources) will lead to a significant political pressure in the next decade. As a result, the demand for hydropower – the best-proven and most developed form of renewable energy – will grow.

Our customers also attach great importance to sustainability. Their sustainability strategies are based on installation of modern, environmentally friendly technologies and processes, and social responsibility. Therefore, these companies invest in infrastructure, healthcare and education at the locations and communities at which they operate. Additionally, new jobs for the local population, subsuppliers, and other industries are created, improving the standard of living of thousands of people.

The hydropower advantages

Up to now, only about 30% of global hydropower resources have been developed. Compared with other energy sources, hydropower offers some important advantages:

- Hydropower is a well-proven form of power generation.
- Water is a renewable source of energy.
- Hydropower contributes significantly to the reduction of greenhouse gas emissions.
- Hydropower is a clean form of energy and leaves no environmentally harmful residues.
- Hydroelectric power generation is cost efficient and not sensitive to fuel price increases.
- In many regions of the world, hydropower reservoirs are also vitally important for water supply, irrigation and flood protection.
- Civil works construction of hydropower plants creates local jobs and supports the regional economies.
- Hydropower conserves fossil fuel resources.

Approaching the future – based on experience

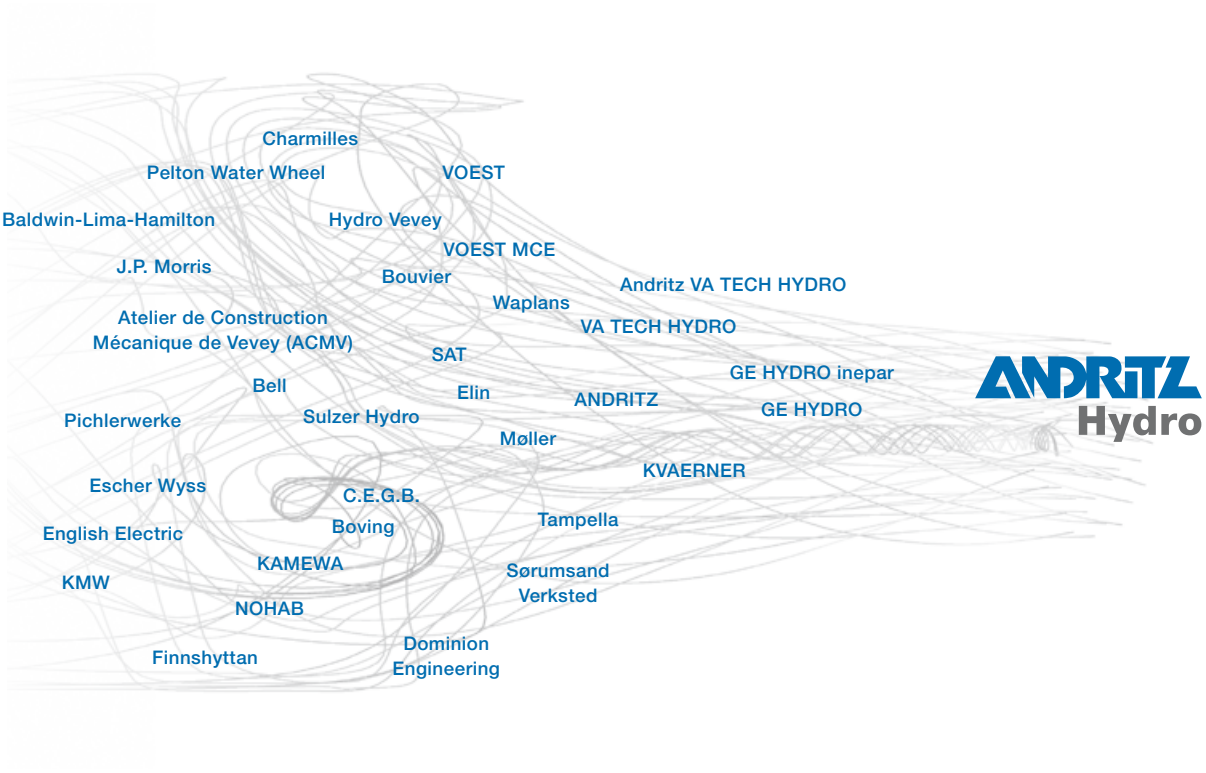
Over 170 years of experience in hydraulic energy supply business and intensive research and development work form the solid basis of our capabilities. This experience is valuable, and we pass it on to our customers, day-to-day, just as the results of our research and development efforts.

Our pioneering companies – some are listed below – paved the ground. Our current research and development work concerns all products, but especially turbines, generators, automation, and pumps.

Hydraulic development of turbines and pumps concentrates on efficiency increase, smooth running and stable operation over long life cycles – big challenges considering the existing high technical level, which are readily accepted by our well trained and highly motivated research teams. Development takes place in state-of-the-art hydraulic test rigs, whose operation is based on the standards of the International Electrotechnical Commission, IEC, as well as virtually. Computer Aided Engineering (CAE) has a leading role in our work: before manufacturing a machine or even before taking a machine to the test rig, it must have been simulated in all details. This computer-based flow simulation (CFD) optimizes the flow components and simulates strength and lifetime properties of the machine components.

Generator development centers around efficiency increase by optimized cooling, design innovations, and further development of the insulation material.

Focus in automation technology is on protection, excitation and the enhancement of human-machine interfaces as well as on ensuring seamless automation and communication structure in hydropower plants.



Our special pride

Optimum implementation of every single customer contract – regardless of the size of the project. Some highlights that we are particularly proud of are also recognized world records.

Cleuson Dixence, Switzerland
The three vertical-shaft, five-jet Pelton turbines in Cleuson Dixence (see insert photo) are operated under the most extreme conditions. The head – 1,869 m – as well as the machine output – 423 MW – represent two world records.

Goldisthal, Germany
The two asynchronous, variable-speed motor generators in Goldisthal are the only ones of their kind installed outside Japan. They are a real milestone in the pumped storage technology in Europe.

Three Gorges, China
The Three Gorges Project (three gorges dam) is the largest hydropower plant of the world (26 x 700 MW = 18,200 MW). GE Hydro (today ANDRITZ HYDRO) delivered seven turbines and six generators.

Sihwa, South Korea
The tidal power station on Sihwa Lake in South Korea (see photo below) opens a new chapter in the development of renewable energy production. The ten machines have an overall output of 260 MW and when completed, will form the world's largest tidal power station. (picture below)

Tarbela Dam, Pakistan
The bifurcation at Tarbela Dam (see large photo on the right) is unique. This pipe has an inner diameter of 13.2 m and a height of over 16 m in the centre – the same as a four-storey building. This pipe has even made it to the Guinness Book of Records. (picture page 9)

Large new installations

The market for large new plants is increasingly attaching importance to suppliers overall competence. In addition to the technical requirements, customers tend to opt for financial prowess and social responsibility.

Our ‘Large Hydro’ division offers the whole range of electromechanical equipment for large new installations. This core competence – the ability to provide the whole portfolio of products and services from a single source – is based on cutting-edge proprietary technology developed in our hydraulic laboratories, as well as on the fact that we manufacture the core components in our own workshops.

In detail, we supply the entire mechanical and electrical equipment – from project design, engineering, model testing, purchasing, manufacturing, and installation to project management for:

- Penstocks, gates and hydraulic steel structures
- Turbines and digital speed governors
- Shut-off valves
- Generators
- Control and automation
- Protection, excitation and synchronization
- Monitoring and diagnosis systems
- Site management
- Testing and commissioning, training

Small hydropower

State governments are increasingly promoting small hydropower stations, both where the construction of new stations and the modernization of existing ones is concerned, because small hydropower is an essential contribution to sustainable and renewable energy generation with low environmental impact.

In a constantly growing market of small hydropower plants we are a leading global supplier.

Our achievements with emphasis on complete solutions ('From water to wire') for electromechanical equipment contain the entire production line and service spectrum for small and medium hydroelectric power plants with unit output up to 30 MW.

This range is covered by the 'COMPACT HYDRO' program. Special concepts have been developed, resulting in maximum efficiency, shorter installation periods, shorter delivery times, and and optimized compact power house dimensions.

Our solutions make therefore hydroelectric power plants up to 30 MW particulary economical for our customers.

Turbine types in the 'COMPACT HYDRO' program:

Axial Turbines

- Head up to 30 m, output up to 10 MW
- Runners with three up to six blades
- With double or single governor
- Horizontal, inclined, or vertical shaft line

Francis Turbines

- Head up to 300 m, output up to 30 MW
- Spiral turbines, horizontal or vertical shaft arrangements

Pelton Turbines

- Head up to 1,000 m, output up to 30 MW
- Horizontal shaft design with 1 up to 3-jets or
- Vertical shaft design with 2 up to 6-jets

Modernization and renewal

About 50% of the primary and secondary technology installed in hydropower plants all over the world are older than 30 years. Therefore, the market is being increasingly driven by modernization and upgrade of existing hydropower plants.

Our ‘Hydro Service’ division is specialized in focusing on optimization of existing operations and maintenance of hydropower equipment. We assist our customers in reaching their goals – maximization of the energy production yield, increase of competitiveness, and generation of sustainable value.

Individual customer requirements are complied with individual solutions meeting the technical, economical, and legal requirements. Our services range includes components and spare parts supply, complete automation packages, installation services, short-term repairs and modifications, inspections and overhauls, residual life analysis, risk assessment, feasibility studies, training, rehabilitation, modernization, and upgrade.

This means for our customers:

- Increased plant availability, reliability, and safety
- Boosted power generation through optimal utilization of available water resources
- Increasing revenues from peak power generation and grid regulation
- Reduced service and maintenance costs
- Reduced risk of standstills and unplanned maintenance
- Optimized plant value and maximum operating life

Automation

The same as for primary technology, increase of output and decrease of costs are goals of power station automation. The requirements for new plants differ from those in modernization projects.

'Hydro Automation' offers modern automation solutions from an extensive portfolio:

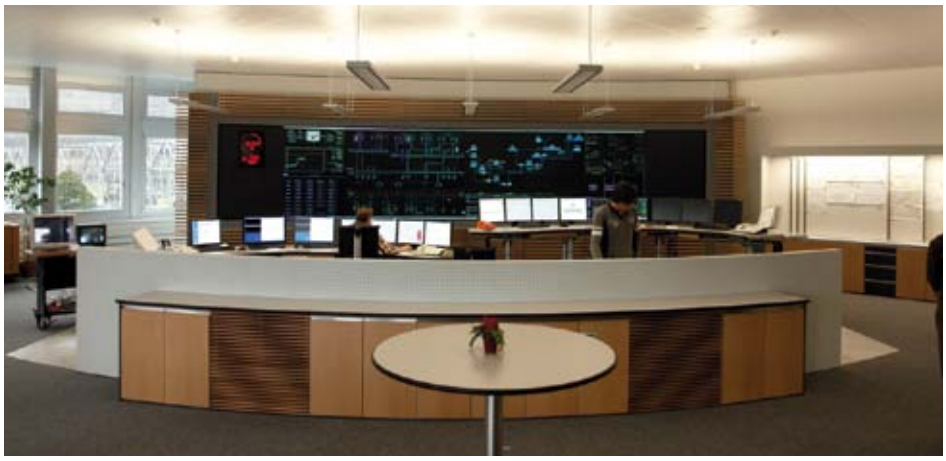
- Automation & Control
- Excitation
- Power Plant Management
- Monitoring & Diagnosis
- Protection
- Synchronization
- Turbine governors

The advantages that our customers gain from our integrated automation concepts are lower investment costs, simplification of start-up, and short standstill times during system replacement.

Whether it is newly constructed or modernized, each hydropower station requires specially adapted architecture meeting its specific requirements. Modernization and replacement projects must take the history of the station into account, which is reflected in different products, functions, cables, and sensors used over the different time periods. These projects typically require a step-by-step approach.

Modernizations as well as new construction of large systems are characterized by a high extent of complex hardware architecture, differing communication systems, and integration of the latest technologies. In small hydropower stations, cost optimized hardware architectures with functional integration are the typical features.

Each operational and maintenance concept takes a number of modern technologies and products into account. The global use of mobile telephones, internet, and GPS are state-of-the-art. Any modern automation concept can utilize these technologies for optimization and simplification of maintenance.

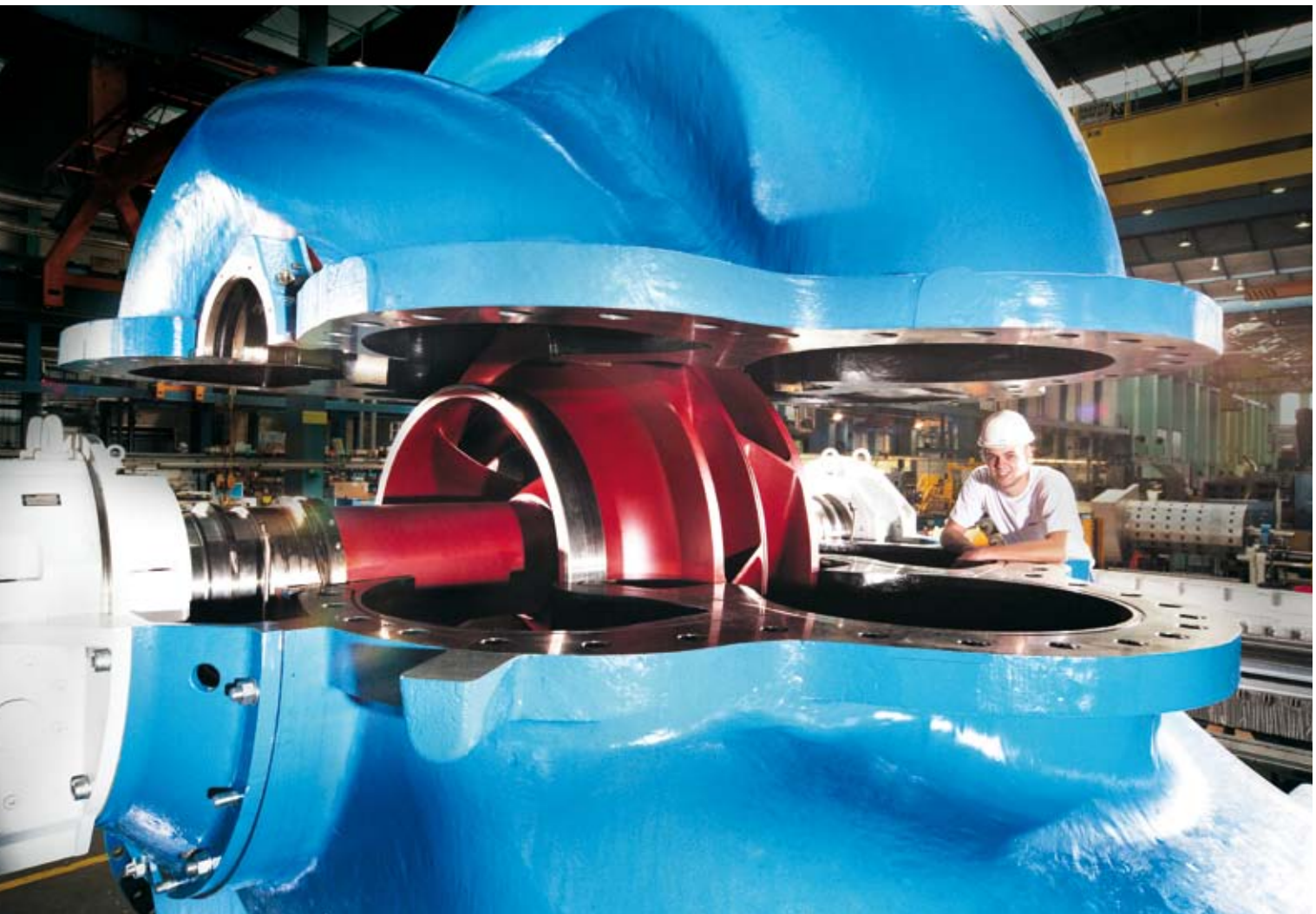


Pumps

The world market has a growing demand for larger and more efficient pumps that are especially tailored to individual requirements. Here, too, experience and future-oriented research and development work counts.

Our Pump department derives its huge know-how from the long experience – over 170 years – in hydraulic machine and pump construction, and also from ongoing research and development work in the company's research centre – work that never stops. It is this innovative activity that places us as a world recognized specialist for pumps.

Our scope of supply includes: development, model tests, design engineering, manufacturing, project management, logistics, installation, service, spare parts and training of engineered large pumps. The world market has a growing demand for larger and more efficient pumps that are especially tailored to individual requirements. Here, too, experience and future-oriented research and development work counts. Standard centrifugal pumps, reactor pumps as well as complete pumping stations. ANDRITZ pumps are used for the most different applications, whether for safe drinking water supply for megacities like Hong Kong and Beijing or as the entire range of process pumps required for pulp and paper mills. Customers all over the world have confidence in us and rely on our long-term experience in all areas of the value added chain.



Turbo generators

Gas and combined cycle power stations cover an essential part of the demand of the fast growing energy market. A core of these power stations is formed by modern, high-performance turbo generators.

Over 120 years of experience in generator construction, highest quality, innovation, keeping to delivery dates, and customer orientation make our 'Generator Turbo' division one of the leading suppliers of air-cooled turbo generators in the world. Customers are attracted by our standardized solutions with short delivery times that enable rapid pay-offs of power station investments.

Our turbo generator range extends from 10 up to 350 MVA. We offer customers development and design, manufacturing, site installation, and aftersales services.

Over 650 turbo generators are in operation all over the world, reaching a total capacity of 65,000 MVA. One of them is the generator in the world's largest bio fuel power station in Alholma (Finland).

Since the beginning of the 1990´s, we have cooperated successfully with a leading supplier of steam and gas power stations. This cooperation comprises supplies and joint developments for air-cooled turbo generators.

Our competences

Our motto ‘From water to wire’ also signifies that we provide the necessary competences over the entire product portfolio and the full lifetime cycle of hydropower stations with manufacturing of all core components.

From water to wire
Integrated solutions, with complete electro-mechanical equipment, including design, engineering, manufacturing, delivery, site installation, and commissioning.

Life cycle
Analyzing the systems over the entire lifecycle with tailormade services and solutions for the use of potential output-increase and modernization. A well developed services network guarantees rapid, competent, and on-the-spot response to our customers needs.

Own expertise
Permanent enhancement of expertise in engineering and manufacturing – to maintain leadership in the future. This quality is ensured at all sites. We have the competence to design and build all major core components of hydropower plants in our own workshops.

ANDRITZ HYDRO
an ANDRITZ GROUP business area

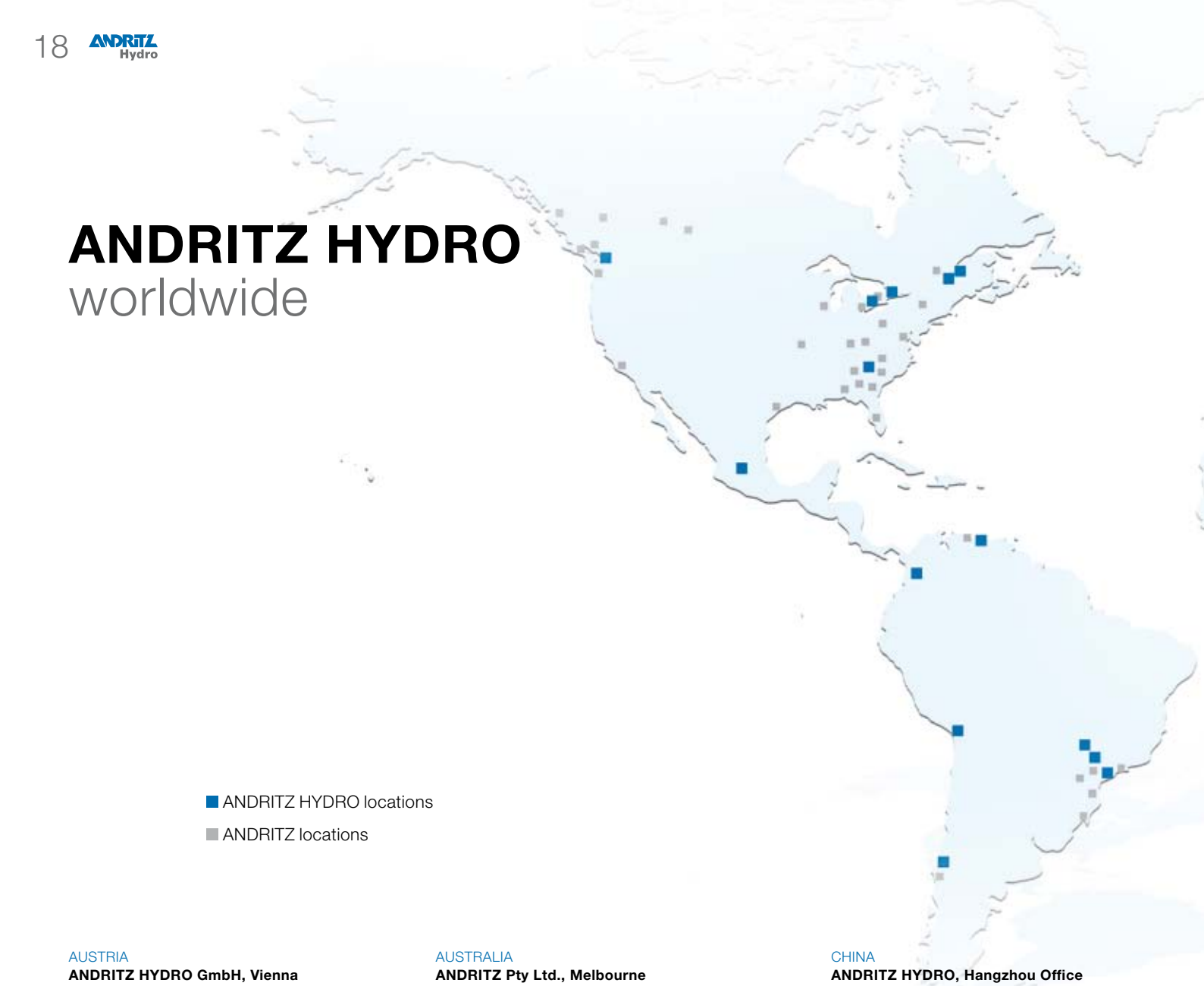
Listed technology Group ANDRITZ is a global market leader for customized plants, process technologies, and services for the hydropower, pulp and paper, metals, and other specialized industries as solid/liquid separation, feed and biofuel.

The ANDRITZ GROUP, headquartered in Graz, Austria, has around 13,000 employees and over 150 production sites, service and sales companies throughout the world.

In the past decade, ANDRITZ GROUP sales have increased annually by more than 21%. This growth is based predominantly on strong organic expansion by means of market growth and product innovation, as well as on successful acquisition of companies with complementary products, technologies, and services.

Established in 1852, ANDRITZ has a long tradition in manufacturing machinery and industrial plant. In the hydropower sector, the Group can draw on almost 170 years of experience.

ANDRITZ HYDRO
worldwide



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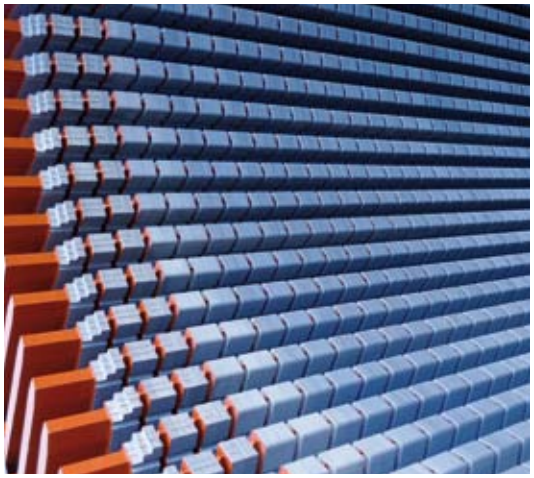



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