

# HYDRO POWER

## Business Area Managers:

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**Küblis hydropower station in Switzerland, which was modernized by Andritz VA TECH HYDRO, has an installed power of 45.6 MW and generates approximately 180 GWh of clean electrical energy per year. Increased turbine efficiency and improved mode of operation have resulted in better utilization of available water amounts.**

*(Photo: Penstock bifurcation to individual turbines)*

## Profile

The Hydro Power Business Area of the Andritz Group is a global leading supplier of turnkey electro-mechanical equipment and services for hydropower plants. It offers new hydroelectric power stations, as well as services, rehabilitation, and upgrading of existing plants.

The Business Area also offers the development, design, and manufacture of large-scale pumps for selected applications like water transport, pumps for the primary and secondary loops in nuclear power stations, cooling water pumps for thermal power stations, and centrifugal pumps for the pulp and paper industry.

The Business Area also provides design and manufacturing of air-cooled turbo generators for General Electric (GE), used in GE's gas and steam turbines.

## Market development

In 2006, project activity for hydropower plant equipment was very high. In China and India, the construction of several new hydropower plants has started due to the continued strong increase in electricity demand.

In Europe and North America, due to the ageing installed capacities, investments focused primarily on modernizations and capacity increases. In addition, the demand for pumped storage power stations to secure grid stability in Europe has increased. Besides upgrading projects for existing plants, there was also increased project activity for constructing new small hydropower stations.

Demand for large-scale centrifugal pumps, especially in China, remained very high during the reporting period. With its successful joint venture Andritz-Kenflo, Andritz is the clear market leader for centrifugal pumps for the Chinese pulp and paper industries.

Excluding VA TECH HYDRO, Order Intake of the Business Area would be 111.0 MEUR, significantly up compared to 2005 (71.5 MEUR). In particular, the Pumps Division continued its very successful development in 2006, with the number of stock pumps sold to pulp and paper mills reaching a new record level.

## Acquisition of VA TECH HYDRO

In April 2006, Andritz purchased the hydropower section of VA TECH HYDRO from Siemens Austria. After obtaining the approvals from the relevant anti-trust authorities, the acquisition of VA TECH HYDRO was successfully concluded at the end of May 2006. Andritz VA TECH HYDRO ranks among the world's top three suppliers for hydropower equipment. Integration of the company into the Andritz Group has been started.

## Business development\*)

Sales of the Business Area for 2006 amounted to 467.9 MEUR of which 390.2 MEUR came from first-time consolidated VA TECH HYDRO. Excluding VA TECH HYDRO, Sales of the Business Area would have been 77.7 MEUR, significantly up compared to 2005 (52.7 MEUR). This is mainly due to the continued positive development of Andritz's Pumps business.

EBITA of the Business Area in 2006 was 22.2 MEUR; the profitability (EBITA margin) amounted to 4.7% (2005: 4.9%). Profitability of VA TECH HYDRO developed as planned and amounted to 3.7% in the Second Half of 2006.

Order Intake of the Business Area in 2006 amounted to 585.4 MEUR, of which 474.4 MEUR resulted from the first-time consolidation of VA TECH HYDRO. All Divisions of the Business Area – Large Hydro, Hydro Service, Compact Hydro, Pumps, and Generator Turbo – showed a very solid and satisfactory development.

## Major orders

Verbund-Austrian Hydro Power (AHP) ordered the penstocks and motor generators, including electrical equipment such as excitation systems and frequency converters, for the Limberg II pumped storage power station, Austria. Limberg II is the underground extension of the existing storage power station Kaprun. With two additional pump turbines and motor generator units, this more than doubles the installed capacity.

In August 2006, a contract with civil company Veidekke, Norway for a complete electro-mechanical package for the 84 MW Pelton power plant in Kjosnesfjorden, Norway was signed. Andritz VA TECH HYDRO has been successful in Norway for several years in the modernization of small hydropower. With this contract, it has been able to extend its activities into the Large Hydro segment.

Cleuson-Dixence Construction SA, Switzerland awarded a contract for the rehabilitation of the penstock of the 1,200 MW hydropower plant. VA TECH HYDRO GmbH is the leader in a consortium with MCE Industrietechnik Linz, and is in charge of design and supply of the equipment. The total weight of the new steel lining is 12,600 tons. The design pressure of 200 bars is presently the worldwide highest design pressure for a penstock of a hydropower plant. The award of this contract sets another milestone in the Business Area's history in penstock construction.

VA TECH HYDRO GmbH signed a contract with Nacionalna Električna Kompanija EAD, Bulgaria for the refurbishment of the Dolna Arda hydropower plant cascade. The project involves the renovation of three power plants with a total of 11 units and an output of 270 MW, and the installation of one new unit. A decisive factor for the award was Andritz VA TECH HYDRO's global experience in hydropower plant refurbishments and, in particular, the numerous projects already realized in Bulgaria.

After the Tsankov Kamak hydropower plant, which is currently under construction, Dolna Arda is the second project realized between Austria and Bulgaria based on the stipulations of the Kyoto Protocol. The emission certificates generated will be allotted to Austria's Kyoto targets.

Comisión Federal de Electricidad (CFE), Mexico awarded a contract for the modernization and rehabilitation of the Infiernillo hydropower plant located on the river Balsas in the State of Guerrero, Mexico. The project comprises the modernization of four turbines at Mexico's third largest hydropower station. A CFD study to increase turbine output from 160 to 200 MW will be done in order to optimize the hydraulic profile and behavior of the Francis runners.

The state utility CADAFE, Venezuela signed a contract for the modernization of the Pena Larga hydropower station. Besides the installation of two new 20 MW Francis turbine runners, the complete automation system, the turbine governors, the electrical excitation, and protection system will be replaced by state-of-the-art technology and a modern online monitoring and diagnostic system.

The state-owned enterprise EDELCA, Venezuela signed a contract with the Consortium EUROBRAS for the supply of five large Francis turbines. The consortium is led by VA TECH ESCHER WYSS Ravensburg, a company of Andritz VA TECH HYDRO. The turbines will be installed at the second powerhouse of the Simon Bolivar power plant in Guri on the Caroni River, which is the biggest tributary in the Orinoco river basin. With a maximum output of 770 MW per unit, the turbines of Guri 2 belong to the most powerful in the world. Each single Francis runner will have a finished weight of almost 200 tons.

Karnataka Power Corporation Ltd., India awarded the contract for Stage II of the Varahi underground power plant, comprising the installation of 2 x 115 MW Pelton turbines, generators, automation system, and the complete balance of the plant. This order confirms the strong market position of Andritz VA TECH HYDRO in India.

PNG Power Limited ordered the upgrade and rehabilitation of the Rouna 2 hydropower station in Papua New Guinea. Rouna 2, located 40 kilometers northeast of Papua New Guinea's capital Port Moresby, is the uppermost of four power stations of the Rouna hydro scheme, all using the waters of the Laloki River to supply Port Moresby with electricity. PNG Power Limited decided to rehabilitate the station to guarantee reliable operation, to achieve modern working safety standards, and to extend its operational life by another 20 to 30 years. Additionally, the unit power will be increased by more than 30%. →

## Key figures Hydro Power

MEUR	2006 <sup>*)</sup>	2005	2004	2003	2002	2001
Sales	467.9	52.7	43.8	32.0	29.3	26.0
Order Intake	585.4	71.5	58.7	37.3	28.3	28.6
Order Backlog as of 31.12.	1,659.5	60.5	40.7	27.2	21.5	22.6
EBITDA	33.3	4.8	5.5	3.2	7.4	2.3
EBITDA margin	7.1%	9.1%	12.6%	10.0%	25.3%	8.9%
EBITA	22.2	2.6	3.8	3.3	5.8	-0.1
EBITA margin	4.7%	4.9%	8.7%	10.3%	19.8%	n.sp.
Capital investments	13.5	3.4	2.4	1.7	2.6	0.9
Employees as of 31.12.	3,678	474	365	302	277	246

<sup>\*)</sup> VA TECH HYDRO was consolidated into the financial accounts of the Andritz Group for the first time in Q3 2006. For the reference periods of last year, no pro-forma figures are available.

## Research and Development

Ethiopian state utility Ethiopian Electric Power Corporation (EEPCO) – through its turnkey contractor Salini Costruttori s.p.a. – placed an order to supply four 115 MW Francis turbines. The hydropower plant at the Beles River will be the largest hydropower station in Ethiopia. This order, once again, confirms the successful partnership between EEPCO and Andritz VA TECH HYDRO, which has lasted for more than 40 years.

Vattenfall Europe Generation, Germany's largest hydro-power utility, ordered an automation system (NEPTUN), including a digital protection system for the modernization of its Markersbach pumped storage station. After completion of this upgrade, it will be possible to operate Markersbach by remote control from the area control center of Goldisthal. This is another important success in the cooperation with Vattenfall Europe Generation.

The Business Area was awarded a large number of orders for centrifugal pumps in China, thus further strengthening Andritz's market leadership in this region.

In the Sudan, a large order for spare parts for irrigation pumping stations came into force.

An order for eight large pumps for the "South Water to North China" large-scale project was received. In addition, two major orders for the supply of core components for water power stations in China were put into force.

A wide variety of very advanced hydraulic designs has been developed in connection with recent contracts. In the field of Francis turbines, the new generation of runner designs was the key to successful upgrade projects ranging from high head runners in Norway to large 770 MW runners in Venezuela.

In the field of low head units, new axial runners for existing units with special casing designs have been developed. The optimization of runner casing interaction has also been the key success factor in the upgrading of Pelton units.

Continuous research in numerical design has also enabled further progress in the field of single-stage and multi-stage pump-turbines.

Very attractive synergy potentials have been identified and already exploited between the hydraulic designs of large tailor-made pumps for water transport and the designs for pump-turbines and pumps for storage power plants.

A further interactive R&D initiative has been launched with respect to the field assessment of existing hydro plants, both from the mechanical and the electrical point of view.

New developments for high-voltage insulation and a cost-effective design were successfully introduced for hydro generators, as well as for turbo generators. Further research activities on large rotating electrical machines with high-rated voltage were focused on the optimization of the stator end winding design regarding corona phenomena.

For the cooling of high-performance (maximum-capacity) bulb-type generators, an innovative ventilation system was developed, which provides several advantages for the mechanical and electrical design. The ventilation design is based upon numerical fluid dynamics (CFD) and measurements.

Detailed CFD simulations were carried out in order to investigate the oil flow and mixing behavior in the cavities between adjacent thrust bearing pads.

Another focus of R&D was placed on technologies in the field of automation. The new SAT 250 product line represents a state-of-the-art system for control centers and operator stations. For excitation and protection systems, the development of new platforms has been launched. The application of the very successful technology for governors and plant controls has been extended to all kinds of turbine types and sizes.

The large pumps program was extended by Francis pumps. The development program further includes extensions for and improvement of semi-axial and axial pumps, the latter as bulb pumps. Other main points in the development program include materials and coating for components sensitive to wear, shaft bearing assembly, and rotor dynamics for main coolant pumps. ■



Andritz dewatering pump for Sudan after shop assembly.