HYDRONEWS

No. 20 / 10-2011 • ENGLISH

MAGAZINE OF ANDRITZ HYDRO

www.andritz.com

ANDRITZ Hydro

Latest News

Belo Monte, Brazil

ANDRITZ HYDRO as a partner of the consortium together with Alstom (leader), France and Voith from Germany, will supply mechanical and electrical equipment for the Pimental hydropower plant, which is part of the Belo Monte project. The contract will come into force in the third quarter of 2011.

Sihwa, Korea

On 29 August 2011, the opening ceremony of the world's largest Tidal power plant in Sihwa, Korea was celebrated in the presence of the president of Korea (see article on pages 20-21).

Acquisition of Hemi Controls, Canada

ANDRITZ HYDRO expands its automation services by acquisition of Canadian company Hemi Controls, located in Chambly. Hemi Controls is a well established leader in design and implementation of control, automation and protection systems for hydroelectric power stations. This acquisition is part of the ANDRITZ HYDRO strategy to increase its automation and control business globally and strengthening especially the Canadian market position for full automation, protection and control technology and water-to-wire project execution capabilities. The proven ANDRITZ HYDRO governor and excitation products will add into the Hemi Controls product portfolio.

Danube cascade, Austria

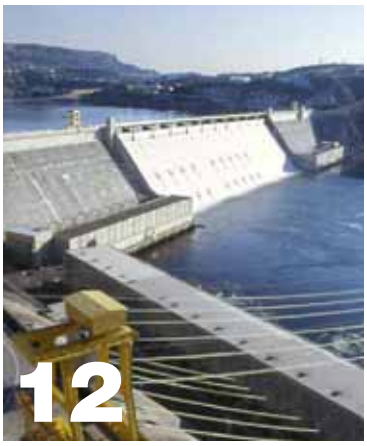
After eight years of project duration, the modernization of the control systems for all power plants located on the Austrian section of the Danube river was completed successfully. The large project included the modernization of the control system of 43 turbines, the renovation of the congestion level control and the flow control for the entire Danube river. Another important objective of the project was a central control system for all 68 machines, transformers, gates and outdoor switchyards of this cascade via the central control station Freudenau. By the use of NEPTUN solution the control system and the data transfer has been standardised for all units to ensure a consistent operation.

First large Russian contract Iovskaya

On 26 July 2011, ANDRITZ HYDRO signed the refurbishment contract for hydropower plant Iovskaya with the Russian power utility TGC 1 in Murmansk, Russia. This contract is the first large order in Russia for ANDRITZ HYDRO LLC, founded only one year ago, and will be entirely executed by them. JSC Territorial Generating Company No.1 (TGC 1) is the leading producer of electricity and heat energy in the North-West region of Russia and the third biggest territorial generating company in the country. This complex rehabilitation project was won against well established and strong local competitors. The rehabilitation works contains the replacement of two Kaplan runners (48 MW each), new generator stator windings, replacement of the automation, protection, excitation and governor systems including dismantling and installation works. Completion of works is scheduled for November 2014.

Augst-Wyhlen / Laufenburg, Germany / Switzerland

In summer 2011, ANDRITZ HYDRO Automation celebrated the success ful completion of this ambitious project. The objective of the project was the renovation of the control systems for 23 Straflo and seven Francis turbines. For each of these units start-up and shut-down sequences, mechanical and generator protection, turbine control and SCADA systems were renewed. A special highlight of the project was the partial renovation of the excitation systems by using the existing thyristor bridges.



CONTENTS

Cover Smart grids:
Artist impression of future energy supply in the year 2050

Imprint

Publisher: ANDRITZ HYDRO GmbH, A-1141 Vienna, Penzinger Strasse 76, Austria, Phone: +43 (1) 89100
Responsible for the contents: Alexander Schwab **Editorial team:** Christian Dubois, Clemens Mann, Jens Päutz, Edwin Walch, Kurt Wolfartsberger

Graphic design: Layout / production: A3 Werbeservice
Circulation: 21,400 • Printed in German, English, French, Spanish, Portugiese and Russian language

Dear **business friends**

The increasingly international trend towards hydropower continues. All hydropower segments show a steadily growing market environment throughout the year 2011. As a reliable and renewable energy with a high yield factor and a solid economic basis, it keeps a main part of the future energy mix.

Various successfully implemented projects worldwide underscore this development as well as the trust of our customers in ANDRITZ HYDRO. The vast experience, high quality standards and leading technologies are essential elements of these successes. Orders for the equipment of the large hydropower plant Belo Monte in Brazil, for the pumped storage plant Nant de Drance in Switzerland or the modernization of turbine generator units at Grand Coulee Dam in the USA as well as many other projects confirm this. For ANDRITZ HYDRO, a growing market environment means the obligation to maintain and continually improve the high technical standard.

This challenge affects all business areas – from research and development to manufacturing and realization of a project. Additionally, there will be new demands for the hydropower sector in the future. New layout criteria for turbines and generators due to changes in performances, new types of hydropower plants, and a fundamental change in the structure of future energy supply are the driving forces.

ANDRITZ HYDRO is optimally prepared for the new technologies. The largest tidal power plant worldwide – Sihwa in Korea – is currently going into service, the HYDROMATRIX® plant Ashta in Albania is in its implementation phase as scheduled, and the development of the world's first 1 MW tidal current turbine is nearing completion.

ANDRITZ HYDRO met the challenges of the smart grid to the components of hydropower plants with parameter adjustments for the electrical system, control technology, generators and turbines. At the same time, new projects are being developed. The possibility of equipment modifications as well as the use of new products will play increasingly important parts in future "smart-ready" modernizing projects. With these products and solutions ANDRITZ HYDRO is well prepared, for future demands.

With sincerest thanks for your confidence

M. Komböck

W. Semper

H. Heber

Smart grids

ANDRITZ HYDRO in the context of future intelligent grids

▲ Future hydro applications enabling the functionalities of the smart grid

Increasing capacity of renewable energy sources, a higher electricity demand and the unbundling of the electricity economy are leading towards new challenges for secure and stable grid operations. For example by 2050, Germany intends to cover 80 % of the electricity demand by renewable energy sources and most of today's conventional base load power plants will have been switched off such as nuclear and coal-fired plants.

Hence, the adjustment of mainly volatile renewable electricity to the demand through energy storage systems will be one of the most important issues to maintain a stable, convenient and affordable energy supply. Pumped storage powerplants (PSPPs) and innovative hydropower generation options are dedicated to enable these developments.

The grid as the application area

The energy networks of today are based on the requirements and design of the early 20th century. In these days, the main goal of the electricity grid was to transmit energy from central production sites to concentrated industry sites and urban areas. For nearly 100 years, the requirements have not changed until the unbundling of the electricity market. The separation and liberalization of generation, transmission and distribution led to the first change in grid operations. Actually, the high voltage transmission grids have been subject to higher stress and dynamically changing conditions since then. Approximately in the same time range, the first decentralized renewable energy generation systems like photo voltaic (PV) or wind power hit the market on a broad basis. With the wide spread acceptance of these, the low and medium voltage distribution grids also became strained additionally.

The next step will be the integration of a huge amount of renewable energy sources to backup or even substitute conventional base load generation systems like coal-fired or nuclear power plants. In combination with a centralized control of low-level consum-

er behaviour, this will be referred to the "smart grid." Due to the fact that renewable energies are very volatile and intermittent, their energy production cannot be managed. In order to enable the renewable energies, reserve power for short and midterm but also large energy storage systems for seasonal applications are needed. This complementary energy can be most efficiently and economically provided by hydropower plants. Furthermore, hydropower plant provide a powerful option to allow effective grid congestion management.

Hydro and the intelligent grid of the future

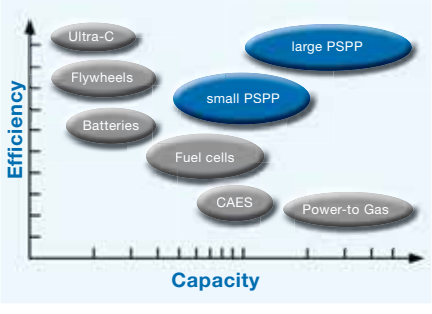
The smart grid is one idea to coordinate the available energy and the current demand. One single control entity incorporating smart meters, individual home renewable energies (e.g. solar on the roof), storage options and improved weather forecasting enables dynamic energy pricing and thus managing of the energy demand. Having a host of controlled and volatile renewable energies feeding energy into the grid means energy storage will be done on all voltage levels in the grid. This ranges from large pumped storage power plants to mini and micro storage close to the consumers. The US Department of Energy defined the benefits of the smart grid in its "Modern grid Initiative" report:

1. Be able to heal itself
2. Motivate consumers to actively participate in operations of the grid
3. Resist attack
4. Provide higher quality power that will save money wasted from outages
5. Accommodate all generation and storage options
6. Run more efficiently
7. Enable higher penetration of intermittent power generation sources

For hydropower plants, there are many applications in a smart grid. Large pumped storage power plants are the only technology known today to store huge amounts of energy with reasonable efficiency for arbitrary time.

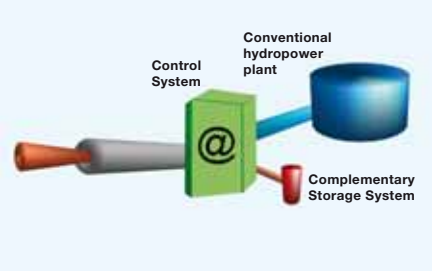
▲ Aerial view of pumped storage power plant Goldisthal in Germany

Furthermore, hydropower plants deliver valuable services supporting proper and secure grid operation and stability. Compared to other large scale storage technologies like Power-to-Gas (P2G), production of synthetic methane through electrolysis and methanation from CO_2 and storing of the methane in existing gas pipelines) or compressed air energy storage (CAES), hydropower plants have a considerably high cycle efficiency of 80 to 90% based on proven technology. On the other hand, they are usually located remote from consumers in alpine regions and need a certain time to start or change the operating mode. But from today's point of view this might be mostly too slow to react to smart grid inherent storage requirements. It is ANDRITZ HYDRO's commitment to develop our technology to easily cope with the requirements of increasing dynamic behaviour of our hydropower equipment.



▲ Efficiency over capacity for different storage technologies

The large amount of volatile renewable energy in a smart grid can't be controlled in any instance. If the wind is not blowing or the sun not shining, there wont be any energy generation from those sources. According to a German study, almost each year there are several periods of more than 10 days where less than 10 % of the wind generation capacity are active continuously. It is clear that with large scale pumped storage power plants alone, this energy demand cannot be covered completely. But along with other options like decentralized compact pumped storage power plants, higher energy efficiency and a few centralized large scale peak hydropower plants, these no wind periods can be overcome without notice. So there will be several markets for different storage options, from decentralized small scale systems that are charged and discharged several times a day to large scale storage for emergency operation, peak covering and long term storage. Of course, pumped storage power plants are not the only hydro option to be applied to a future intelligent grid. Run-of-river power plants as well are a proven and adequate method of generating power close to the consumer. Representing strong interconnection points of the grid, they enable other energy technologies to participate in the market. From today's point of view it is easily imaginable to connect a Power-to-Gas system or an alternative storage system directly to a run-of-river power plant and thereby enhance the performance of both, resulting in perfect synergy.



▲ The vision of integrating an alternative small scale storage system with high dynamics into a conventional hydropower plant

▲ ECOBulb™ unit ready for operation

▲ Artist impression of a subsea array of Hammerfest Strom tidal current generators

TECHNICAL DATA ECOBulb™ systems
Output: 500-5,000 kW
Head: 2-15 m
Flow: 15-100 m³/s

With the development of the HYDROMATRIX® systems, ANDRITZ HYDRO has the opportunity to fill the gap between large run-of-river plants and small dams not intentionally built for power generation. Easily integrated in navigation and irrigation dams, unused ship locks and even intake towers, these matrix turbines can deliver a constant amount of otherwise lost electric energy to the grid.

▲ HYDROMATRIX® turbine generator units prior to installation at Ashta, Albania

TECHNICAL DATA Ashta I & II
Output: 24.03 MW / 45.1 MW
Head: 5 / 7.5 m
Speed: 300 / 375 rpm
Number of units: 90

TECHNICAL DATA HS1000
Rated power: 1,000 kW
Speed: 1,000 rpm
Rotor diameter: 24 m
Rated water flow velocity: 2.5 m/s
Water flow range: 2-5 m/s

Another ANDRITZ HYDRO innovative technology is the product ECOBulb™. Incurring low civil cost and the absolute minimum of electric equipment to assure reliable operation, the ECOBulb™ is the most economical product for generating electricity from low discharges and small heads without impairing the environment. Furthermore, ANDRITZ HYDRO's portfolio of seaborne tidal current generators is a positive way to use the highly stable and predictable sea currents evoked from lunar gravity. In contrast to wind power, sustained no-flow situations will not occur with tidal currents.

With many spots around the world having a tidal current potential of more than 1 GW, the ANDRITZ HYDRO/Hammerfest Strøm HS1000 tidal power generator is an unobtrusive but very efficient way to harvest the vast energy of the steady tidal currents.

Moritz Pichler
Phone: +43 (1) 89100 3677
moritz.pichler@andritz.com

Conclusion and Outlook

The future will apply many changes to the power systems known today. With the integration of an extremely large capacity of renewable energy sources in the upcoming decades, the main issue will be to enable the volatile and intermittent energy sources to serve as base load supply. To achieve this, modern hydropower equipment with improved flexibility and functionality will be the answer. Especially speed variable hydropower plants as proven technology will play a major role. In addition, decentralized small pumped hydro systems will support the development in that respect. Both hydro technologies will break into the market, each having their own characteristics and benefits. From a today's point of view it is clear that modern hydropower plants are indispensable for the upcoming revolution in the grid. ANDRITZ HYDRO's products are still unsurpassed regarding life time, efficiency and capacity. With pumped storage power plants, run-of-river-plants, matrix turbines and tidal power plants, ANDRITZ HYDRO is able to supply a broad portfolio of modern hydro systems for a green and sustainable electric energy environment of the future.

Nant de **Drance**

In January 2011, ANDRITZ HYDRO received a contract from Nant de Drance SA to execute the steel construction lot for the pumped storage power plant in Switzerland

▲ Installation of the trash rack in the lower inlet and outlet structures

The contract includes design, supply, installation and commissioning of the complete equipment of both water ways.

The pumped storage power plant Nant de Drance is located between the two existing reservoirs Vieux Emosson and Emosson in the west of the Canton Valais on the way from Martigny to Chamonix. The reservoir Emosson is the main reservoir of existing power plants and is used as lower reservoir for the future pumped storage power plant.

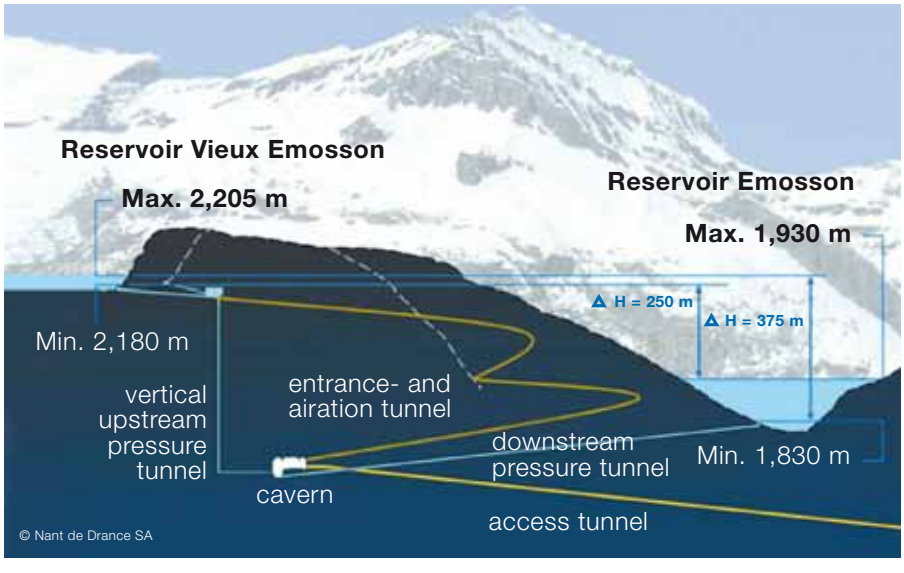
The reservoir of Vieux Emosson is situated approximately 300 m above and is used at the moment only as additional seasonal reservoir. For the expansion of the pumped storage power plant Nant de Drance the dam shall be increased by a maximum of 20 m. Water tunnels and machine cavern are located inside the mountain and are accessible by a tunnel with a length of 5 km. The Owner Nant de Drance SA is organized as partnership with investments of the Alpiq AG, the Swiss Federal Railways (SBB) and the Valais company FMV.

The construction and concession permits for the pumped storage power plant Nant de Drance with an installed capacity of 600 MW were granted in August 2008. The construction works of the access tunnel have been started in autumn 2008. Due to the increasing demand for electrical power at peak times as well as to cover severe

© Nant de Drance SA

▲ Lac d'Emosson with a view to the Mont Blanc massif

▼ Longitudinal profile of pressure tunnel



© Nant de Drance SA

3D view of upstream and downstream pressure tunnel linings ▶

TECHNICAL DATA
Steel lining for upstream pressure tunnel
Internal pressure: max. 614.5 m
Diameter: 7 / 5.5 / 4.7 / 3.2 m
Material: S690QL1
Wall thickness: 29 - 90 mm
Steel lining for downstream pressure tunnel
Internal pressure: max. 346.4 m
Diameter: 3.7 / 4.7 / 5.5 m
Material: S690QL1
Wall thickness: 26 - 55 mm
Butterfly valve
Diameter: 6,000 mm
Dynamic pressure: 10 bar
Roller gate
Width: 4,250 mm
Height: 6,500 mm
Stat. pressure: approx. 154 m

© Nant de Drance SA

consumption peaks from the SBB railway system, the possibility for increasing the output of the pumped storage power plant from 600 to 900 MW was examined in 2010 and approved by the Board in early 2011. The four originally planned pump turbines will be supplemented by two additional 150 MW units. For each water way the scope of supply for ANDRITZ HYDRO includes the steel lining for the upstream and downstream pressure tunnels, the butterfly valve in the upper valve chamber, the roller gate in the lower gate chamber, the trash racks in the upper and lower inlet / outlet structures as well as auxiliary equipment. All components must meet the highest standards with regard to quality and reliability.

Because of the dimensions and loads, the equipment is located in the "high-end" sector of hydraulic steel structures.

© Nant de Drance SA

▲ Reservoirs Vieux Emosson and Emosson

Logistics and work on site will be a great challenge. The entire water way is divided into six installation areas.

Due to their dimensions the components have to be prefabricated mostly at site in confined spaces in underground caverns. The entire contract period will last six years. The main works on site are planned from 2014 to 2016.

This order marks a milestone in the ANDRITZ HYDRO development of high quality hydro-mechanical components. It once again confirms the excellent and long standing cooperation between customers and colleagues in Switzerland and Linz.

Dieter Sitz
Phone: +43 (732) 6986 75553
dieter.sitz@andritz.com

Hagneck

ANDRITZ HYDRO received an order of the Lake Biel Power Generation Ltd. (BIK) for the supply of turbines and generators in July 2011

The contract includes the supply, installation and commissioning of two directly driven Bulb turbines including governors and auxiliaries, as well as two directly coupled Bulb turbine generators including excitation and cooling systems.

On 20 January 2010, the Council of Berne has awarded the contract for the renovation of the power plant Hagneck to the Bielersee Kraftwerke AG.

In future, the new power plant Hagneck will make better use of the energy potential of the Aare river close to Hagneck. The water power plant is adapted to today's requirements regarding security and the capacity of flood discharge.

▲ Model of the new hydropower plant Hagneck

▲ Existing power plant Hagneck with weir bridge

Therefore, the existing power plant is expanded and the weir will be replaced by a new construction. The capacity is increased to 280 m^3/s without changing the gross head.

ANDRITZ HYDRO was awarded the contract by a public tendering procedure in accordance with GATT/WTO, in spite of well-known international competitors due to the highest rating in the award criteria technical solutions, evaluated prices, time schedule, evaluation of suppliers and key persons. The order is realized in close cooperation between ANDRITZ HYDRO companies in Germany, Austria and Switzerland.

Construction works of the new weir power plant start in 2011.

The two machines are scheduled for commercial operation in autumn 2014.

Jürg Emler
Phone: +41 (44) 278 2312
juerg.emler@andritz.com

TECHNICAL DATA
Output: 2 x 10.8 MW / 13.75 MVA
Voltage: 6.3 kV
Head: 8.4 m
Speed: 107.14 rpm
Runner diameter: 4,400 mm
Stator diameter: 5,000 mm

Hissmofors

ANDRITZ HYDRO Sweden wins important turbine and generator order

▲ Photo of the old power plant, the new station will be placed on the right bank

In February 2010, ANDRITZ HYDRO Sweden signed the contract from JÄMTKRAFT AB for the delivery of two turbines and two generators for Hissmofors. This order is an important milestone for the generator business in Sweden and Scandinavia.

The Hissmofors hydropower plant is a very old power station. Until April 2011, it was equipped with seven units. Then, the four oldest units were taken out of operation. The first unit was installed 1896. In 2009, JÄMTKRAFT AB decided to build a new power plant. Hissmofors is located only 15 km from the ANDRITZ HYDRO Sweden workshop.

JÄMTKRAFT AB is a municipality owned power company and has 15 power stations in the region Jämtland in middle of Sweden and a long good relationship with ANDRITZ HYDRO.

The new units will increase the power output from the power station with 30% and will secure the power distribution for JÄMTKRAFT AB. The construction and manufacturing of the generator parts is a cooperation with Weiz and Vienna and the installation will be done by ANDRITZ HYDRO Sweden. The turbine design and manufacturing will be done in the ANDRITZ HYDRO Sweden workshop.

▲ The civil contractor makes a new downstream channel

The scope includes the complete design, supply, installation and commissioning. The connection to the grid is scheduled for autumn 2013.

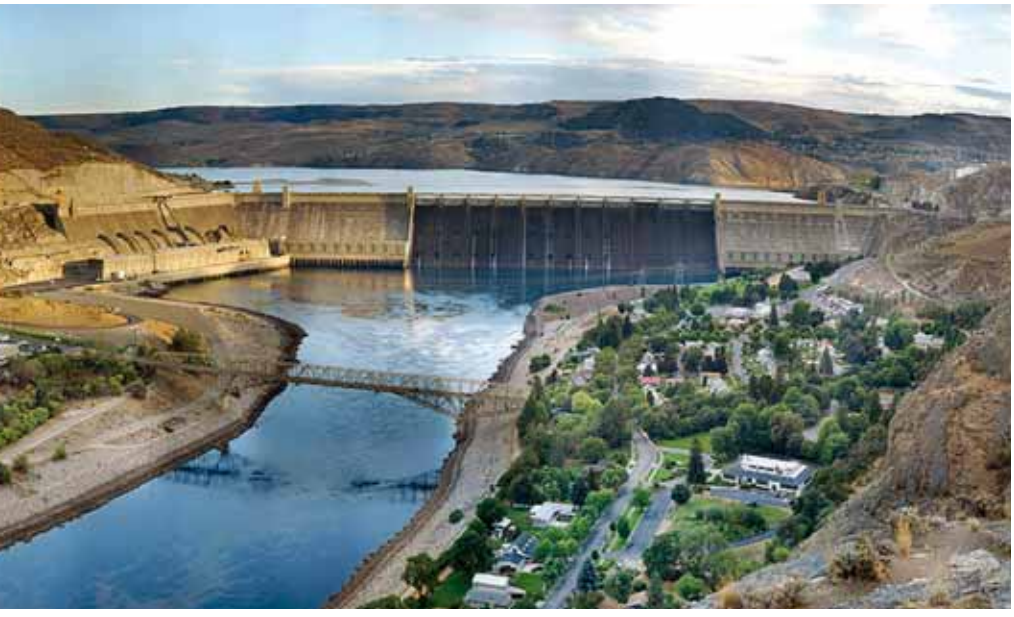
Stefan Olsson
Phone: +46 (640) 177 26
stefan.olsson@andritz.com

▲ Demolition of the old powerhouse and dam

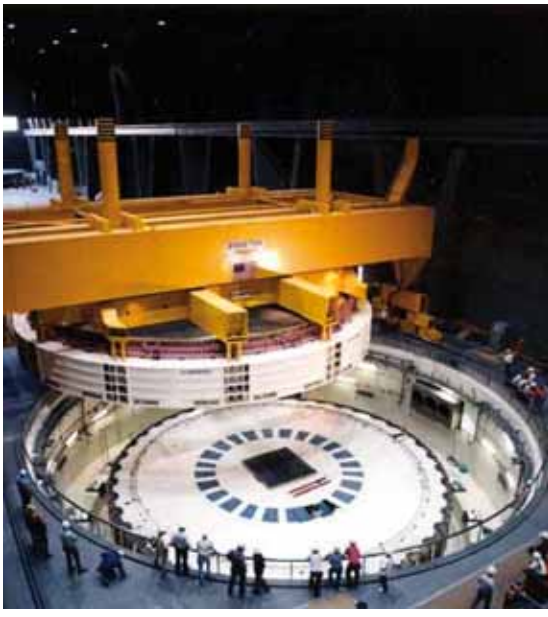
TECHNICAL DATA
Output: 2 x 33.2 MW / 38 MVA
Voltage: 10.5 kW
Head: 18.5 m
Speed: 125 rpm
Runner diameter: 5,100 mm
Stator diameter: 9,000 mm

Grand Coulee Dam

ANDRITZ HYDRO US secures largest rehab order to date



▲ Grand Coulee dam panorama



▲ Grand Coulee rotor installation

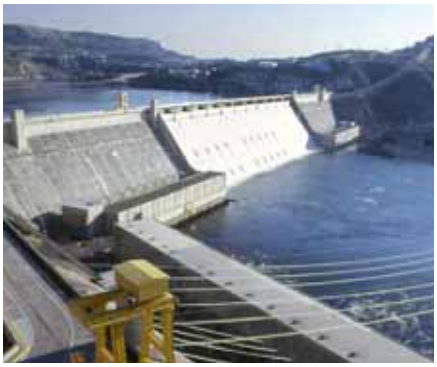
In early May 2011, the US Bureau of Reclamation awarded a construction contract for the overhaul of three units (G-22, G-23 and G-24) at the Grand Coulee third power plant to ANDRITZ HYDRO Corp. This contract represents a significant award for ANDRITZ HYDRO in the US market and is the culmination of a great deal of work and cooperation between many areas within the company.

Grand Coulee dam supports four different powerhouses containing 33 hydro electric generating units. The original left and right powerhouses contain 18 units and the left has an additional three service generators; all together have a total installed output of 2,280 MW. The first generator was commissioned in 1941 and all 18 were operating since 1950. The third power plant contains a total of six main units with a 4,215 MW installed output. Generator units G-19, G-20 and G-21 in the third power plant have a 600 MW installed output each, but can operate at a maximum output of 690 MW. The contract with ANDRITZ HYDRO involves units G-22, G-23, and G-24 which have each an 805 MW installed output. Each turbine is supplied with water by an individual penstock and the largest of these are 12 m in diameter and can supply up to 990 m^3/s (35,000 cfs). Additionally, there are six pumping units. The dam's power facilities originally had an installed output of 1,974 MW, but expansions and

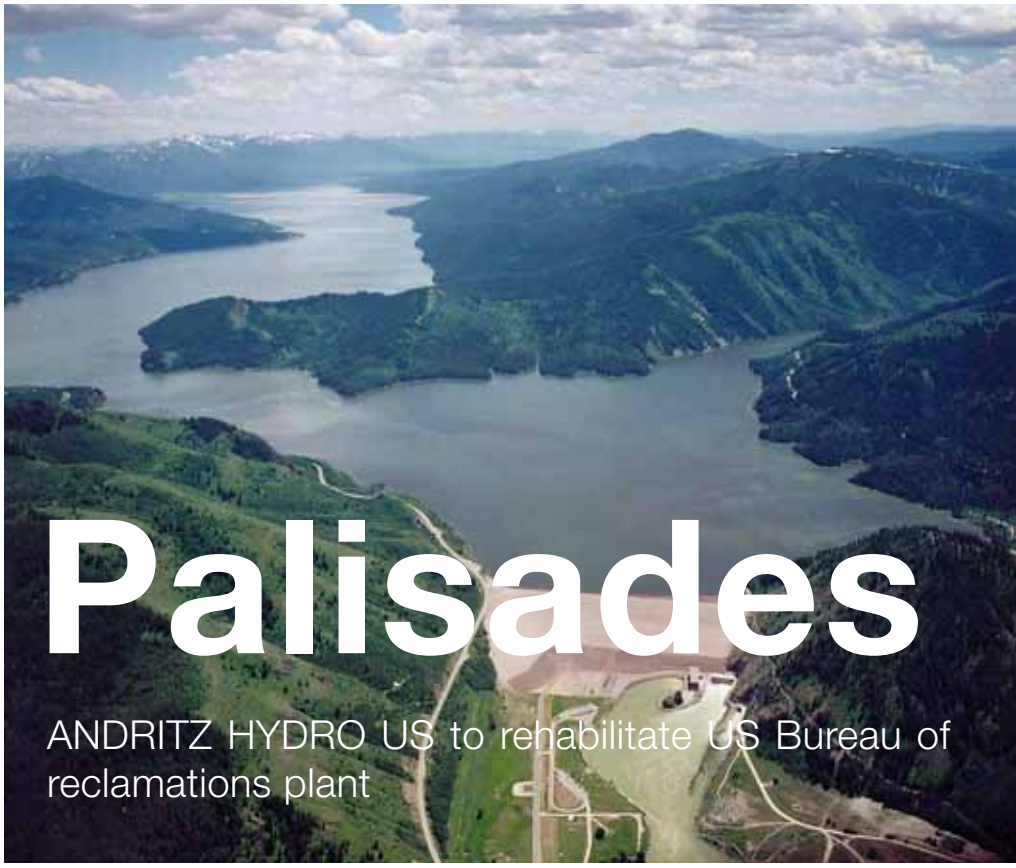
Grand Coulee Dam is the largest hydropower plant in the United States. Located on the Columbia River about 90 miles west of Spokane, Washington, the Grand Coulee Dam provides about one-quarter of the total generation of hydroelectric power for the Columbia River System.

upgrades have increased generation to 6,809 MW installed, 7,079 MW maximum. Each unit is expected to take 17 months to complete with only one unit being worked on at a time. In March 2013, work will start to facilitate the construction of two buildings to perform onsite machining and refurbishment of components. It is expected to be completed at the end of the year 2017. The contract work consists of the complete dismantling of the turbine and generator units, inspection of all components and refurbishment as well as the replacement and reassembly of the units. A significant portion of this work will be performed directly at site due to the extreme size of most of these components (i.e. runner weight 430 tons) making transportation to a rehabilitation facility nearly impossible. In fact, during the original construction of these units the runners were fabricated at site simply due to their massive size.

ANDRITZ HYDRO Corp. looks forward to the challenge of such an involved project and continuing the successful relationship with the Bureau as well as the personnel at the Grand Coulee site.



TECHNICAL DATA Grand Coulee Dam
Output: 805 MW
Head: 100 m
Speed: 87.7 rpm
Runner diameter: 9,800 mm



Palisades

ANDRITZ HYDRO US to rehabilitate US Bureau of reclamations plant

▲ Palisades Dam

In middle of April 2011, the US Bureau of Reclamation awarded a contract to ANDRITZ HYDRO US for the rehabilitation of four Francis runners, including model test and refurbishment of various turbine components, at the Palisades hydroelectric plant, located southeast of the Idaho Falls, Idaho along the Snake river.

The Palisades power plant is another in a series of successes that ANDRITZ HYDRO US has had with the Bureau of Reclamation. Grand Coulee, Hoover, Spring Creek and Folsom are all recently awarded rehabilitation projects to ANDRITZ HYDRO. The power plant was constructed between 1951 and 1957, and was utilized primarily for irrigation and flood control during its early years. The existing Francis units produce an output of 31.6 MW each which will be uprated with the new equipment. Unit outage will begin in September 2012. Completion is planned for May 2016. Along with new runners (23 tons each), ANDRITZ HYDRO will also supply new wicket gates, new discharge rings and all field works including on-site machining. ANDRITZ HYDRO Corp. looks forward to continuing the successful relationship with the Bureau with the Palisades project.

Vanessa Ames
Phone: +1 (704) 943 4343
vanessa.ames@andritz.com

▲ Palisades Generating units

TECHNICAL DATA Palisades
Output: 32.5 MW
Head: 57 m
Speed: 163.3 rpm
Runner diameter: 3,277 mm

Tatar & Pembelik

Two new contracts for ANDRITZ HYDRO in Turkey

▲ Tatar spillway structure under construction

In February 2011, Darenhes Elektrik Üretimi A.Ş. has signed two contracts with ANDRITZ HYDRO for the supply of electromechanical "water-to-wire" packages for two new hydropower plants in Turkey. These contracts underline ANDRITZ HYDRO's leading position in the booming Turkish hydropower market.

Both, Tatar and Pembelik hydropower plants are located on the Peri river on the border of the provinces Elazığ and Tunceli in East Anatolia. Pembelik is located upstream and Tatar downstream of the existing Seyrantepe hydropower plant, which is also owned and operated by Darenhes. The owners of Darenhes are BilginEnerji and Limak Yatırım, two private Turkish investment companies.

▲ After contract signature

▲ Pembelik construction activities at diversion tunnel entrance

Tatar hydropower plant features a clay filled dam with a height of 74 m from the river bed, while Pembelik has an 81 m rockfill dam. The intakes for both plants are followed by a short penstock leading to the powerhouse. The scope of ANDRITZ HYDRO in each powerhouse includes two vertical Francis turbines, generators, transformers as well as the complete electrical equipment including automation. Furthermore, the 154 kV switchyards to connect the power stations to the grid will be supplied.

The project will be executed by ANDRITZ HYDRO Austria together with its subsidiary location in Ankara, which provides competence for the electrical power systems as well as all installation activities on site. The civil construction activities for both projects are ongoing since 2010, thus requiring extremely short delivery periods for the electromechanical equipment. In addition to fulfill Darenhes' tight time schedule, ANDRITZ HYDRO's capability to supply high quality equipment from European manufacturing sources with superior performance parameters enabled it to win these projects against fierce international competition.

Michael Haslinger
Phone: +43 (732) 6986 2722
michael.haslinger@andritz.com

TECHNICAL DATA Tatar
Output: 2 x 66.6 MW / 2 x 76.15 MVA
Voltage: 13.8 kV
Head: 64.5 m
Speed: 166.7 rpm
Runner diameter: 3,620 mm
Stator diameter: 8,300 mm

TECHNICAL DATA Pembelik
Output: 2 x 65.8 MW / 2 x 74.2 MVA
Voltage: 13.8 kV
Head: 69.4 m
Speed: 166.7 rpm
Runner diameter: 3,620 mm
Stator diameter: 8,300 mm

Ulu Jelai

New contract secured in Malaysia

▲ Kuala Lumpur, capital town of Malaysia, nightview

ANDRITZ HYDRO has secured an order for the turnkey delivery of the complete electrical and mechanical works for the 382 MW Ulu Jelai, hydropower plant. In July 2011, the award was placed by Salini Malaysia SDN BHD, a subsidiary of Salini Costruttori Italy, who is undertaking the execution of the entire EPC contract together with Tindakan Mewah SDN BHD.

The power plant is located in the state of Pahang, in the district of the Cameron Highlands about 140 km north of Kuala Lumpur and 80 km to the west coast of mainland Malaysia. The main features of the project comprise the Susu Dam, an 88 m high RCC dam on Bertam river, two diversion weirs on Lemoi and Telom river for the diversion of flows from adjacent catchments via 7.5 km and 8,5 km long transfer tunnels into Bertam river, an underground power station and the required associated water conveyance and access road system. ANDRITZ HYDRO will deliver and install two Francis units including synchronous generators, the hydro mechanical equipment, all the mechanical auxiliaries and the electrical power systems.

Tenaga Nasional Berhad (TNB), Malaysia's largest power utility, will own and operate the plant. With the purpose of meeting peaking energy demand requirements, the Ulu Jelai power plant's capability to provide fast start-up and spinning reserve, will also provide critical reliability and safety to the national grid. In addition to the security and economic benefits, the implementation of hydroelectric power generation is in line with TNB's fuel balance policy and Malaysia's commitment in carbon emission reduction.

The contribution to carbon reduction of the Ulu Jelai plant can be translated to an equivalent of approximately 250,000 tons per year.

Andre Schopper
Phone: +43 (1) 89100 3948
andre.schopper@andritz.com

TECHNICAL DATA
Output: 2 x 191 MW / 219 MVA
Voltage: 15 kV
Head: 321 m
Speed: 333.3 rpm
Runner diameter: 2,400 mm
Stator diameter: 7,600 mm

Coca Codo Sinclair

Major project can solve Ecuador's energy crisis

The power plant Coca Codo Sinclair is located at the Coca river source in the province Napo, about 150 km east of the capital Quito.

Since 1992, the construction plans of the power plant Coca Codo Sinclair exist. With 1,500 MW it will cover 35 percent of Ecuador's electricity demand. Currently, the country has an installed power plant output of 4,230 MW. 48 percent are generated by hydropower, 40 percent by thermal power plants and 12 percent are imported. This means an increase of renewable hydropower to 70 percent.

The power plant will be equipped with eight 6-nozzle vertical Pelton turbines, a runner with 22 buckets with a width of 835 mm. Mid of 2015, due to the commissioning of the hydropower plant, Ecuador will achieve autonomy in power supply for the first time. The project is financed from the Chinese „Eximbank". The total cost of the project amounts to USD 1.98 billion. Ecuador provides almost USD 300 millions. The Chinese company Sino Hydro acts as EPC contractor.

▼ Welding of buckets to the runnerdisk

▲ Workshop production equipment on right river bank

Together with the Chinese company Harbin, ANDRITZ HYDRO was awarded the contract for the supply of the electromechanical equipment. ANDRITZ HYDRO delivers nine SUPERHIWELD™ Pelton runners (one spare runner is included) and 48 nozzles. Furthermore, ANDRITZ HYDRO is responsible for the hydraulic concept and the model test. The delivery of the first runner will be effected in August 2013.

▲ Peltonnozzle with deflector

Josef Grininger
Phone: +43 (732) 6986 4843
josef.grininger@andritz.com

TECHNICAL DATA
Output: 8 x 188.3 MW
Head: 604 m
Speed: 300 rpm
Runner diameter: 3,349 mm

Brazil

Commissioning of two plants and one new contract in 2011

▲ View of Mascarenhas hydropower plant

▲ Aerial view of Rondon II hydropower plant

Rondon II

The Rondon II hydropower plant, owned by Eletrogóes, has started its commercial operation at the end of the first half of 2011. Located in Pimenta Bueno, state of Rondônia, it has an installed output of 75 MW, with three vertical shaft Francis turbines.

▲ Installation of generator rotor in Rondon II

Mascarenhas

In the first half of 2011, the Mascarenhas hydropower plant, located in Baixo Guandu, Espírito Santo State, went into operation again after refurbishment. ANDRITZ HYDRO Brazil has been refurbishing and modernizing this plant since 2008. The first of the three units came into operation in March 2011. The remaining two units are just now undergoing testing and installation.

TECHNICAL DATA Mascarenhas
Output: 4 x 49.5 MW / 55 MVA
Voltage: 13.8 kV
Head: 17.6 m
Speed: 105.8 rpm
Runner diameter: 5,861 mm
Stator diameter: 8,300 mm

When modernizations are complete, the financial gain is estimated to be around 6 to 7%. This plant went into operation in 1974 with three vertical shaft Kaplan turbines and was undergoing its first modernization in 2000, having its initial power increased from 123 MW to 198 MW. In 2006, a fourth generating unit came into operation. The unit was manufactured by GE Hydro Inc., currently ANDRITZ HYDRO Inepar do Brazil. In 2007, a new contract with ANDRITZ HYDRO Brazil was signed for the second modernization process.

Garibaldi

ANDRITZ HYDRO Inepar signed a contract to supply equipment for the Garibaldi hydroelectric power plant, located on the Canoas river, in the municipalities of Cerro Negro and Abdon Batista, Santa Catarina state, in the southern region of Brazil. Garibaldi's installed output is enough to meet the demands of a city of approximately one million inhabitants. The scope of supply includes engineering, manufacturing of three vertical shaft Francis turbines, three synchronous generators, three speed governors, three voltage regulators, installation supervision and commissioning. The three units are scheduled to go into commercial operation in the second half of 2013.

Joel Almeida
Phone: +55 (11) 4133 0008
joel.almeida@andritz.com

TECHNICAL DATA Garibaldi
Output: 3 x 59.6 MW / 74 MVA
Voltage: 13.8 kV
Head: 40.3 m
Speed: 138.46 rpm
Runner diameter: 4,170 mm
Stator diameter: 8,680 mm

▼ Installation of turbine runner in Mascarenhas

Hacininoglu

First plant of Kandil cascade in Turkey in operation

▲ Inauguration ceremony

▲ Power plant machine hall

ANDRITZ HYDRO has commissioned the first of the three plants of the Kandil cascade and put it into operation in the first quarter of 2011. The successful completion of the project was enabled by the competent cooperation between the ANDRITZ HYDRO Teams from Linz, Vienna, Weiz as well as in Ankara.

▲ Powerhouse

▲ The power plant from downstream with Ceyhan river

The Contract was signed with Enerjisa, a 50 / 50 partnership between Verbund of Austria and Turkish industrial giant Sabanci Holding in April 2008.

The inauguration ceremony was held at the Hacininoglu power plant site on 27 March 2011 with the participation of a great number of important persons from both countries: the Turkish Prime Minister, Mr. Recep Tayyip Erdoğan and Minister of Energy Mr. Taner Yıldız, Minister of Environment Mr. Veysel Eroglu, Minister of Education Mrs. Nimet Cubukcu and Minister of Industry Mr. Nihat Ergun, President of EMRA Mr. Hasan Köktaş as well as Sabancı Holding CEO Mrs. Güler Sabancı and Verbund Boardmember Mrs. Ulrike Baumgartner-Gabitzer. The plant with two Francis turbine generator units is located on the Ceyhan river in the Kahramanmaras province, Göksun town near Ilıca village.The two other plants in the same cascade - Sarıgüzel as well as Kandil - will also be supplied with ANDRITZ HYDRO equipment and are scheduled to be commissioned in 2012. This adds up to a combined installed capacity of 445 MW with an estimated average annual energy of close to 1,500 GWh. Hacininoglu is the first large hydropower plant commissioned in this area and will supply approximately 40% of the energy demand of the region.

ANDRITZ HYDRO supplied the turbines, generators, excitation, protection and control, automation and visualization system including AC- / DC-distributions and emergency Diesel system. The system with the ANDRITZ HYDRO electronic turbine governor will also be one of the major contributions to the Turkish grid stability.

Johann Lehner
Phone: +43 (732) 6986 3468
johann.lehner@andritz.com

TECHNICAL DATA
Output: 2 x 71.10 MW / 75.5 MVA
Voltage: 10.5 kV
Head: 131 m
Speed: 300 rpm
Runner diameter: 2,375 mm
Stator diameter: 6,400 mm

Alkumru

Turkish president joins inauguration ceremony

▲ Dam and powerplant at Alkumru

On May 19 2011, the inauguration ceremony of Alkumru was held at the job site with the participation of the President of Turkey Mr. Abdullah Gül, Prime Minister Mr. R. Tayyip Erdoğan, Minister of Energy Mr. Taner Yıldız and Minister of Environment Mr. Veysel Eroglu. The welcome speech was given by Mr. Nihat Özdemir, Director of Limak Holding followed by Mr. Sezai Bacaksız Co-Director.

ANDRITZ HYDRO has successfully finalized the installation and commissioning of the project Alkumru in Turkey with the taking over certificate of unit 3. All three units were handed over prior to the contractual dates. The contract with Limak Hydroelectric Power Plant Investment Inc. was signed in December 2008. The power plant is equipped with three Francis turbine generator units and is located on the Botan river in the province of Siirt; lateron the Botan river disembogues into the Tigris river. Limak Hydro Electric Power Plant Investment Inc. is a company of the Limak Holding and is operating hydropower plants with a total capacity of 427 MW (including Alkumru). Furthermore and including ongoing projects and licenses owned by Limak the company plans to reach an installed capacity of 1,500 MW by 2015.

The order execution was driven by a short implementation period and short periods of unit commissioning of one month between the units. All that challenges have been solved by excellent cooperation of the involved ANDRITZ HYDRO locations, Vienna, Linz, Weiz and Ankara. An additional highlight was the first complete installation performed by ANDRITZ HYDRO's own installation team. ANDRITZ HYDRO has supplied turbines, generators, excitation system, protection system as well as the entire electrical equipment covering the 154 kV switchyard including extension of two substations, transformers, busducts, AC / DC station service, emergency Diesel system and the control system for the complete plant.

The unit control system including turbine governor is designed for the UCTE grid code - the units are able to operate in synchronous condenser mode, in order to supply reactive power to the grid in low water periods.

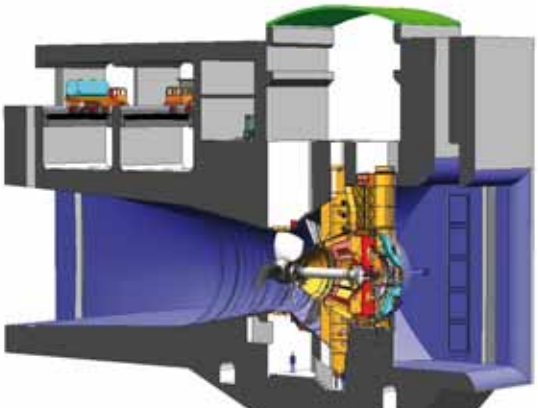
Roman Mynarik
Phone: +43 (1) 89100 3445
roman.mynarik@andritz.com

▲ View of generator main floor

TECHNICAL DATA
Output: 3 x 88.6 MW / 97 MVA
Voltage: 13.8 kV
Head: 101.5 m
Speed: 250 rpm
Runner diameter: 3,080 mm
Stator diameter: 7,500 mm
Transformer voltage and output:
13.8 / 154 kV, 97 MVA, YNd11
Switchyard: 154 kV, 31.5 kA,
seven feeders + two extensions

Sihwa

Since the beginning of July 2011 seven units are operating in the world's largest tidal power plant in Korea



▲ CAD-section through a machine

▲ The Bulb casings are embedded in concrete

In 2005, ANDRITZ HYDRO was awarded by the Daewoo Engineering & Construction Co., Ltd. to carry out the engineering for the electromechanical equipment of the Korean Sihwa Tidal power plant, except its weir. Furthermore, the core components for the turbines (runner, wicket gates, bearings) and generators (poles, windings, laminated stator core, bearings) as well as governors, protection, excitation and powerhouse automation systems are supplied by ANDRITZ HYDRO. Additionally, ANDRITZ HYDRO supervised the manufacturing of most machine components, the site installation and executed the commissioning.

The procurement of the machine components on the basis of the technical documentation of ANDRITZ HYDRO as well as the assembly on site were part of the scope of supply of Daewoo.

The power plant is equipped with ten Bulb turbine generator units with a unit capacity of 26 MW. Therefore, Sihwa with a maximum total output of 260 MW, became the largest tidal power plant in the world. Until then, the hydropower plant of La Rance in France held this record. The basic concept of the Bulb turbines and generators was taken over from the hydropower plant Freudenau in Austria. The powerhouse was installed in an existing dam with 13 km of length. The basin, which is separated by the dam, has an area of 56 km².

Usually, tidal power plants generate energy in both directions – from sea to lake and from lake to sea. In this specific case, energy is generated only at high tide (from sea to lake). Since the construction of the dam, the building up near the lake has been allowed. Therefore, as a consequence, the lake may only reach a maximum level of - 1.0 meter. Thus, a power generation from lake to sea is not economical anymore, because the turbines cannot be optimized for one direction of flow.

At low tide the lake is emptied through the open gates and the free-running turbines in sluicing mode. This means that for this specific operating case the direction of rotation is reversed.

▲ Aerial view of the power plant and weir

▲ Installation of shaft

▲ Runner and distributor

▲ After flooding the coffer dam is removed

Compared with conventional hydro power plants, a particular challenge lies in the corrosion protection of salt water impinged parts. It has been placed special emphasis on material selection and corrosion protection. For the protection of parts covered with sea water a cathodic protection system has been installed.

Furthermore, it had to be taken into account that contrary to turbines in run-of-river plants or in storage power plants a permanent regulation must be carried out because of the constantly changing of heads.

▲ Last works at the artifical island

▲ Installation of generator rotor

Contrary to run-of-river plants this tidal power plant is started twice a day and runs in sluicing mode. Due to the tidal range, which is not regularly of the same height (depending on moon, sun, seasons etc.) and considering the volume of the lake, a sophisticated programming of the power plant control is necessary to obtain an efficient utilization of the available energy.

In July 2011, seven units are put into operation and released for energy production. The completion is scheduled for October 2011.

Leopold Losbichler
Phone: +43 (732) 6986 3465
leopold.losbichler@andritz.com

TECHNICAL DATA

Output: 10 x 26 MW / 26.76 MVA
Voltage: 10.2 kV
Head: 5.82 m
Speed: 64.29 rpm
Runner diameter: 7,500 mm
Stator diameter: 8,200 mm

world record

Kárahnjúkar

A large project successfully implemented in Iceland

In October 2003 Iceland's national power company Landsvirkjun awarded to ANDRITZ HYDRO a contract for turbine model test, design, engineering, manufacturing, supply, installation and commissioning for the electromechanical equipment of the Kárahnjúkar hydropower plant project. Within the ANDRITZ HYDRO group, the locations Ravensburg, Weiz, Vienna and Linz were involved.

The Kárahnjúkar hydropower plant is located in eastern Iceland on two glacial rivers, the Jökulsá á Dal and Jökulsá í Fljótsdal, originating at the north-eastern region of Europe's largest glacier, Vatnajökull. The six turbine generator units are fed by an annual storage reservoir. The energy production is transmitted to an aluminium smelter located at Reydarfjördur on the east coast of Iceland which was built by the US-based company Alcoa. The lot awarded to ANDRITZ HYDRO was known as "KAR 30" and comprised a near complete electromechanical package for six turbine generator units, high head Francis turbines with draft tube gates, governors, main inlet valves and generators with excitation systems.

This was delivered together with all the mechanical and electrical auxiliaries like cooling water systems, drainage and dewatering systems, oil handling system, overhead cranes, fire fighting equipment, station transformers, 400 V distribution, MCC's, 110 VDC system, cabling and earthing, automation, protection and the 11 kV switch gear. The electromechanical equipment is installed in different places the powerhouse, the control building and various chambers along the main waterway system. After contract award in 2003, the following year was dominated by the basic and detailed design, and the model test conducted in the laboratory of ANDRITZ HYDRO Linz, Austria. The plant layout, the engineering and design of all the components were coordinated closely and intensively with

▼ Lowering of a spiral caseing for installation and embedding into concreate

▲ Generator rotor to be installed into stator

▲ Mr. Arni Benediktsson, Landsvirkjun togehter with the ANDRITZ HYDRO project team after final acceptance

the consulting engineers as well as with the client's experts. In early February 2005, the first draft tube arrived at site, marking a milestone for the initial mobilization of the ANDRITZ HYDRO site team. Later, during the main installation phase, the number of site staff was increased considerably and the site management together with the expatriate supervisors from Germany, Austria and Eastern Europe were supported extensively by the mechanics and electricians of ANDRITZ HYDRO Indonesia as well as the workers from the Icelandic subcontractor Stalsmidjan. The work force on site reached its peak in mid 2006, when more than 70 people were working for ANDRITZ HYDRO.

At the beginning of August 2007, water started to accumulate in the lower half of the headrace tunnel for the first time, which allowed ANDRITZ HYDRO's commissioning engineers to test the turbines in the powerhouse. At this time, the generator unit 1 already had been in use for four months, disconnected from the turbine, in synchronous condenser mode. By the end of August 2007, unit No. 2 was hooked up to the power grid for the first time, having successfully passed the initial tests. In November 2007, the final tests could be started whereby the commissioning team successfully put into operation all the four remaining turbine generator units within a month's time. After installation of the last unit, the commissioning activities could be finalized in early March 2008, when the power station came into full commercial operation. Alcoa, operating the aluminium smelter at Reydarfjördur, continuously raised their power demand in parallel to the commissioning of the turbine generator units and finally were able to even increase their capacity by about 10%. At the end of the two year's warranty period our customer Landsvirkjun formally issued the Certificate of Final Acceptance for all the units.

▼ Machine hall floor after commissioning

During a technical seminar on 17 September 2007, Páll Magnússon, chairman of the board of directors of Landsvirkjun, reported on the "Importance of the Kárahnjúkar Project" for the national economy, the regional development, the green energy production, the technical and scientific society and last but not least for Landvirkjun as a company. Landsvirkjun's installed power increased by about 50% up to 1,900 MW. Hydropower plants have a long lifetime and will yield a reasonably long term profit, he said.

In May 2011, Landsvirkun's project manager and the ANDRITZ HYDRO project team met for a final close down meeting. On this occasion, the Landsvirkjun's representative once again expressed his full satisfaction with the performance of the entire ANDRITZ HYDRO team.

▲ Birds eye view of Alcoa Aluminium smelter at Reydarfjördur, East Coast of Iceland

A great success story for Landsvirkjun as well as ANDRITZ HYDRO came to an end with the signing of a final statement to close the contract "KAR 30".

Josef Moosmann
Phone: +49 (751) 29511 437
josef.moosmann@andritz.com

TECHNICAL DATA
Output: 6 x 116 MW / 130 MVA
Voltage: 11 kV
Head: 530 m
Speed: 600 rpm
Runner diameter: 1,400 mm
Stator diameter: 4,450 mm

Kongsvinger

Expansion of a power plant in Norway

▲ Kongsvinger power plant after the expansion, from tailwater side (the expansion at the left end of the power house)

On 9 June 2011, the official opening of the new unit No. 2 in the Kongsvinger power plant was celebrated by performing a remote start of the new unit from the system control center, located 150 km away.

The Kongsvinger power plant is situated in the Glomma river system, approximately 7 km downstream from the city of Kongsvinger. In December 1975, the existing power plant was put into operation with one horizontal Bulb turbine. One of the large electric power production companies in Norway, Eidsiva Vannkraft, produces 7 TWh renewable energy in 44 hydropower plants each year. They aim to increase the production of renewable energy by improving the utilization of existing power plants. With the expansion of Kongsvinger, Eidsiva Vannkraft is increasing the yearly production in this power plant from 130 to 200 GWh. ANDRITZ HYDRO delivered the electromechanical equipment for the new unit. The scope of work was shared between the three ANDRITZ HYDRO locations Ravensburg, Weiz and Jevnaker. ANDRITZ HYDRO in Ravensburg designed, manufactured and delivered the Bulb turbine and the hydraulic governor, ANDRITZ HYDRO in Weiz designed, manufactured and delivered the Bulb generator and ANDRITZ HYDRO Norway delivered the electronic governor and the auxiliary systems such as cooling water, drainage and dewatering and was responsible for project management, training, installation and commissioning with the assistance from Ravensburg and Weiz on technical support and installation supervisors. The contract with ANDRITZ HYDRO was signed in June 2008.

▼ Turbine runner installation (site manager Sven-Åke Persson to the left)

The new unit was taken over by the customer on the contract date 15 April 2011, Originally, the plan was to deliver the stator in two parts due to transport limitations in Norway. But a transport survey carried out after the contract was signed, showed that by transporting through Sweden, it was possible to transport the complete stator to site. This had several advantages such as smaller Bulb diameter, higher generator efficiency, complete test of the generator in the workshop and simpler installation procedures on site. Even with this improvement, the site installation was a challenge due to the very confined space for the new unit, many complicated and heavy lifts and installation personnel who had to work on top of each other. However, the installation was successfully completed in time for the start of commissioning.

The already existing unit from 1975 is now in need of a proper rehabilitation and one of the reasons for expanding with a new unit was to avoid loosing the power generation through the winter period when the existing unit is being refurbished. ANDRITZ HYDRO Norway has been awarded the rehabilitation contract. Kongsvinger reaffirms once more the global leadership of ANDRITZ HYDRO in Bulb turbines and the trust of our customers in our expertise.

Jona Tande
Phone: +47 (91) 31 56 22
jona.tande@andritz.com

TECHNICAL DATA
Output: 22.74 MW / 25.8 MVA
Voltage: 6.0 kV
Head: 9.8 m
Speed: 93.75 rpm
Runner diameter: 5,500 mm
Stator diameter: 5,900 mm

Santo Antonio

Powerhouse control system in Brazil

▲ Santo Antonio spillway

Santo Antonio is a 3,150.4 MW power plant on Madeira river, in the north of Brazil with a total of 44 Bulb turbines with generators distributed in three powerhouses. Eight units are situated at right bank's powerhouse, 24 units at the left margin and twelve units in the riverbed's powerhouse. A fifteen gates main spillway, complemented with a secondary one with three gates, can handle flows over 45,000 m³/s during the rainy season. All those installations are distributed along the dam.

ANDRITZ HYDRO Brazil was awarded by Siemens Brasil, who is responsible for the entire power plant protection and control system supply, to deliver basic and detailed design and engineering services to the control system for 44 units, 6 auxiliary services, two spillways and implementation of joint control functionality.

The basic topology of the automation units for the powerhouses consists of a redundant SICAM AK 1703 ACP platform. A total of 52 touch panels with 250 SCALA licenses allow local control at the front door of the cubicles. A third party supervisory system integrates the entire power plant at six local control rooms and one big central control room.

ANDRITZ HYDRO Brazil has successfully concluded the factory acceptance tests of sixteen units, two spillways and two auxiliary services, according to the time schedule, helping Siemens Brasil to accomplish with the outstanding task of delivering the complete control system of the power plant.

In order to conclude the proper integration of all suppliers in the power plant (meters, governors, excitation and instrumentation) the strategy was to integrate device by device in dedicated time slots, with the presence of the end customer. All the functionalities were tested (redundancy, database, commands, etc). The time during the factory acceptance tests was reduced and has given the control team the confidence that the unique interface with the different suppliers is granted. The joint control functionality was implemented in the AK1703 ACP platform. The tests were held with Siemens Brasil and the end customer. The provided controls are voltage and active power set points, distributed among the 44 units. The success of the joint control and other functionalities like black start sequences in the power plant, reinforced the confidence of the end customer and Siemens in the ANDRITZ HYDRO Brazil expertise of control engineering in power plants and scalable solutions. There are still 28 units to test in factory, and the end of the project is still far away. But using the scalable concept of the 1703 ACP products and the know-how acquired during the sixteen first units, the tasks will represent no problem for the control team. The commissioning activities of the first eight units are scheduled to start in September 2011. ANDRITZ HYDRO Brazil is proud to be part and an active partner in one of the biggest control projects in Brazil at the present time.

Tiago Ferreira
Phone: +55 (11) 4133 1221
tiago.ferreira@andritz.com

▲ Electrical panels and cubicles

▼ Construction site of power plant

E.ON
Central control station

E.ON realized one of the world's largest central control station with 250 SCALA from ANDRITZ HYDRO Automation

E.ON Wasserkraft GmbH (EWK) operates more than 100 hydropower plants and numerous pumping stations and weirs. On the basins of the rivers Danube, Edersee, Isar, Lech and Main the storage, pumped storage and run-of-river power plants will be remotely monitored and controlled by regional control stations.

▲ Overall design of the central control station

As part of the E.ON central control station (CCS) project at Landshut, the decentralized control station staff will be entrusted by the regional control stations with the task of controlling all hydropower plants of E.ON from a central location. This requirement means a major challenge for the planners and operators of the CCS project. Although there are such a large number and variety of plants with different operating modes a secure and centralized operation has to be ensured. Under any circumstances, it is inadmissible that in stressful situations the operator has to pick out at first the relevant data from a flood of information and has to consider which power plant must be operated in which section of the river.

The solution can only be achieved by a consistent and clear display of the plants by the greatest possible compression and reduction of the process information as well as by a similar operation of all units. The foundation stone of the project was laid with the standardization of the display of elements (machine, weir, flow). In the presentation all symbols and used colours have always the same meaning, the same appearance and the same position. Due to the clear position on the display there is no need to waste space for textual descriptions. Furthermore, all measurement values were standardized. For example, all upper water levels are shown generally as a relative value in centimetres corresponding to the storage level. A large screen projection wall which consists of 12 (6 x 2) modules, each with a resolution of 1,920 x 1,200 pixels serves as an overview. Due to the large screen with a total resolution of 9,600 x 2,400 pixels and to the standardized and compressed display of the elements it is possible to show all power plants of all river basins orographically exact (i.e. simulation of flow conditions). This means that a pixel on the large screen projection corresponds exactly to 100 m course of a river.

In addition, the individual power plants are placed as compressed displays on the large screen projection according to their position in the river basin. This display makes it possible that on the one hand the control station staff gets an overview of all rivers. On the other hand, also detailed statements about specific power plants are possible. In the control station six workstations are available for the operation of the plants, each with three screens. Here too, the standardized display is used for the display of the power plants in the river basin and for the detailed images of the power plants. In addition to the standardization of the display also the data model and the data transmission have to be standardized. At the moment, the currently existing control system of the power

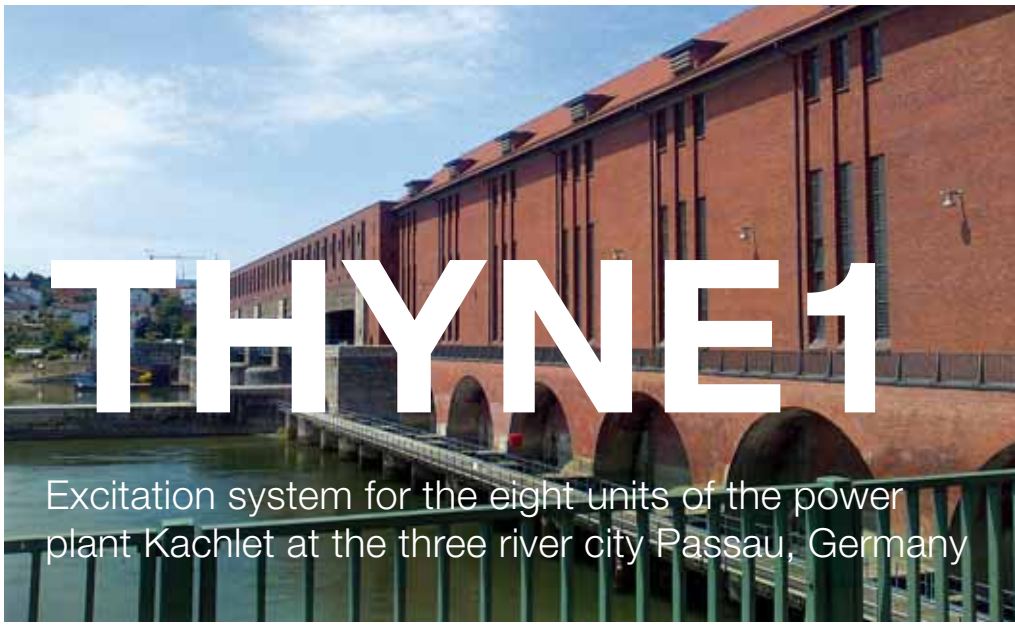
plants does not correspond to this standardization. Up to the complete replacement of the control systems of the power plants an implementation of data model OLD to data model NEW has to be executed in a gateway.

The aim of this gateway is to build summary information or new combined signals from the individual signals of the power plant as well as to convert measured values and to transfer the data and commands received from the CCS to the correct actuators. As transmission protocol to the CCS the standardized protocols IEC 60870-5-101 and 104 are used. During the first expansion phase, the entire CCS will be realized and the first two river basins of the Isar and the Danube rivers will be connected to CCS. For the central control station, the proven control system 250 SCALA is used. It is characterized not only by the comprehensive SCADA functionality but also by an extremely high performance (data model with up to 300,000 process variables, messages load of > 3,000 phone/sec). In the central control stations also control systems of 250 SCALA are in use, which also takeover the function of the gateways by using a specially developed software. Using a simple parameterization of individual data point parameters, individual standards and conversions are defined.

▲ Design of the central control station

When the expansion of the CCS is completed, all power plants will be equipped with a new control system, which is connected directly to the CCS due to the standardized data model and the standardized transmission.

Clemens Mann
Phone: +43 (1) 81195 6884
clemens.mann@andritz.com



THYNE1

Excitation system for the eight units of the power plant Kachlet at the three river city Passau, Germany

In July 2011, ANDRITZ HYDRO Automation supplied the new compact excitation system THYNE1 for the modernization of the voltage regulator of all eight units of the power plant Kachlet which is owned by E.ON Energie AG.

In 1921, a short piece of the Danube river should be made navigable, because outside the town of Passau the navigation was affected. In this rocky section with steep gradients, it was cheaper to dam the Danube river and to construct sluices instead of reshaping the river bed. At that time eight machines with a total capacity of 42 MW were planned to finance the project.

The profit was used completely for the repayment of the construction costs. In 2011, due to further renovations the voltage regulators were replaced by the compact excitation THYNE1 to regulate the reactive power of each unit more precisely and to use the units in the best way.

Each unit consists of a synchronous generator with a DC exciter. Its field is fed by a THYNE1. This supply concept for the excitation equipment offers a simple, reliable power supply, independently of influences of the grid. For the start, an additional supply from the power station battery is available. Due to the large time constants in the exciter circuits of the units at each THYNE1 the option for an extended field demagnetization was used to improve the dynamic behavior.

Each of the eight THYNE1 has an integrated touch panel which displays the operating values continuously. The communication with the control system takes place via a bus interface according is realized with IEC 61870-5-104. Due to the simple and intuitive operation of the THYNE1 the voltage regulators were put in operation from employees of a partner company independently.

Wolfgang Spanny
Phone: +43 (1) 81195 6919
wolfgang.spanny@andritz.com

▼ View into the machine hall of the power plant Kachlet

Switzerland
Bitsch

Order for two new Pelton runners. After intensive negotiations and a sales winning strategy the customer Electra Massa (Operator HYDRO Exploitation) has placed an order for two new Pelton runners for the Bitsch hydropower plant in early 2011.

One runner will be manufactured according to the MicroGuss™ technology and the other will be fabricated according to HIWELD™ process.

Both are going to be manufactured in Kriens and coated with the specific coating SXH™7X. The two runners will be delivered within 14 months.

Alexandre Fournier
Phone: +41 (41) 329 53 45
alexandre.fournier@andritz.com

TECHNICAL DATA

Output: 2 x 146 MW
Head: 733 m
Speed: 375 rpm
Runner diameter: 2,820 mm

New Carledonia
La Néaoua

At the end of 2010, ANDRITZ HYDRO received an order from Enercal, New Caledonia, for the revision of the two Pelton units including spherical valves and generators. Some pieces of the injectors (nozzles, needles, sockets, etc.) were also replaced. Within the same project, Enercal issued an additional purchase order for the replacement of two electronic governing systems and voltage regulators including installation and commissioning.

La Néaoua hydropower plant was built in the late 1980's. The original supplier was the "Ateliers de Constructions Mécaniques de Vevey". The plant is located about 250 km of Nouméa, capital city of the country. The machines have never been refurbished since they were first put into service. The contract came into force in early January 2011, starting date of studies and manufacturing. The disassembling work will begin end of August 2011, taking advantage of the painting and sandblasting of the penstock. The commissioning will be held during November 2011. The voltage regulators and speed governors will be installed in place of the old panels. The Mipreg 600c will replace the old ACMV speed governor type 200. Additionally, the customer has placed orders for coupling bolts and nuts.

Serge Ferraresi
Phone: +41 (21) 925 7776
serge.ferraresi@andritz.com

TECHNICAL DATA

Output: 3.6 MW
Head: 421.3 m
Speed: 750 rpm

Guinea
Grandes Chutes

ANDRITZ HYDRO will supply one new Francis runner and coupling bolts for Grandes Chutes, owned by Electricité de Guinée (EDG).

The two units of the Grandes Chutes hydro power plant were built in 1955 by ANDRITZ HYDRO. The only major change brought since they were built was the modernization of the governing system also carried out by ANDRITZ HYDRO. The new runner will be delivered in a very short period of time in order to urgently replace the existing damaged Francis runner in operation. This replacement will maximize the operating time and assure the best possible operational quality. Considering the time schedule, the new runner was manufactured using a milling technology from one forged component similar to the Pelton runners with so called "Fully Forged" technology; the hydraulic shape used is an already proven hydraulic profile. The runner is designed and supplied without the lower moveable labyrinth as ANDRITZ HYDRO will adapt the runner to the client's assets with modern manufacturing methods.

Carlos Contreras
Phone: +41 (21) 925 7721
carlos.contreras@andritz.com

TECHNICAL DATA

Output: 2 x 5 MW
Head: 118.5 m
Speed: 750 rpm
Runner diameter: 880 mm

France
Auzat / Soulcem

EDF has awarded ANDRITZ HYDRO an order for the refurbishment of three excitation systems at Auzat and Soulcem hydropower plants in the French Pyrénées.
Following the technically complex project of La Coche in 2009, static excitation with back-to-back systems, EDF has now selected ANDRITZ HYDRO for the renewal of conventional installation with medium excitation current. ANDRITZ HYDRO will realize in 2011-2012 the complete rehabilitation of the excitation systems for Auzat and Soulcem hydropower plants located in the south of France. The scope of works includes engineering, manufacturing, delivery and commissioning of the three excitation systems, based on THYNE4 technology, for three Francis units. It is an important milestone/reference for ANDRITZ HYDRO as this project is included in the "pilot" phase of the upcoming "RenouvEau" great rehabilition program from EDF - 540 units to be renovated within the next 10 years.

Quentin Seringe
Phone: +41 (21) 925 7723
quentin.seringe@andritz.com

TECHNICAL DATA

Output: 3 x 26 MW
Voltage: 5.65 kV
Speed: 1,000 rpm

France
Bois de Cure

ANDRITZ HYDRO received the order from Electricité de France (EDF) for the supply of three new Francis runners. The aim of the replacement is to improve the efficiency and the cavitation behavior through a modern hydraulic profile.
The Bois de Cure power plant was built in the early 1930's and is located in the Yonne region (Bourgogne) in France. The replacement of all the runners in operation needed to be done not only to increase the efficiency, but also to improve their behavior in regards to cavitation due to very severe hydraulic conditions. As these units are being used as a base generation, only one runner per year, during the scheduled turbines revision and maintenance period, can be installed. Therefore the first runner will be put in place in 2013 and the last one in 2015. All the runners to be supplied will be manufactured from a forged disk and machined to the final hydraulic shape. Further to the runners, will be supplied stationary labyrinth rings and the coupling bolts.

Carlos Contreras
Phone: +41 (21) 925 7721
carlos.contreras@andritz.com

Switzerland
Giswil / Unteraa

ANDRITZ HYDRO Automation received an order from the power plant Obwalden for the renovation of the control system of unit 3 including the outdoor facilities of the power plant Unteraa in April 2011.
The new unit (turbine and generator) will be installed by ANDRITZ HYDRO as a supplement to the three existing power plants. As part of the tendering process ANDRITZ HYDRO awarded the order for the renovation of unit 3 as well as for the replacing of the existing control system with the modern 250 SCALA central control system. The power plant will be controlled and monitored from afar via remote maintenance. The outdoor facilities (reservoir of the Kleine and Grosse Melchaa, the new water reservoir Marchgraben, butterfly valves and gates of the Lungerersee) can be integrated with fibre optic cables in the new power plant. The start-up and shut-down sequence control system as well as the turbine control devices are implemented in the TM1703 ACP automation units. For generator and transformer protection the electrical protection systems DRS Compact were used. The scope of supply of ANDRITZ HYDRO includes engineering, cabinet construction, commissioning, installation and wiring.

Urs Küng
Phone: +41 (41) 329 5613
urs.kueng@andritz.com

TECHNICAL DATA

Output: 12 MW / 16 MVA
Speed: 500 rpm
Runner diameter: 1,198 mm

Turkey
Kirik Dag

ANDRITZ HYDRO received an order from Özenir Elektrik for design, manufacturing, testing, supply, transportation, installation and commissioning of the electromechanical equipment for the hydropower plant Kirik Dag, consisting of two vertical axis 5-jet Pelton turbines, two spherical valves, two synchronous generators and the complete electrical balance of plant equipment.

The consortium under the lead of ANDRITZ HYDRO in France won the contract against fierce international competition. The contract was signed in April 2011. Kirik Dag hydropower plant will be located near the city of Hakkari in the southeastern part of Turkey. Turbines and related equipment will be supplied by ANDRITZ HYDRO France, generators by Indar Spain and the electrical balance of plant equipment as well as site installation services by ANDRITZ HYDRO Ltd. Şti. in Turkey. Kirik Dag will be the first hydropower project of Özenir Elektrik and will be the basis for a long term cooperation with ANDRITZ HYDRO. The commissioning is foreseen in summer 2012.

Alp Töreli
Phone: +90 (312) 4088020
alp.toereli@andritz.com

TECHNICAL DATA

Output: 2 x 8,979 kW
Head: 245 m
Speed: 500 rpm
Runner diameter: 1,180 mm

USA
Lake Livingston

On 28 April 2011, East Texas Electric Cooperative (ETEC) awarded a contract to ANDRITZ HYDRO to deliver the turbine generator equipment for the hydropower station of the existing Lake Livingston Dam on the Trinity river in the state of Texas.

ETEC is designing the powerhouse to contain three vertical shaft Kaplan turbine generator units. It is expected these units will produce approximately 132.1 GWh annually and will utilize water releases into the Trinity River up to a peak capacity of approximately 172.4 m^3/s (4,500 cfs). The scope of supply of ANDRITZ HYDRO comprises three vertical Kaplanturbines, Indar will supply three synchronous generators of 9.85 MVA / 13.8 kV and TEWAC, a consortium partner will supply three hydraulic oil units for turbines and generators. The turbines will be provided with concrete semi spirals instead of full steel spiral case liners (for economical reasons). The hydraulic shape will be designed by ANDRITZ HYDRO, civil construction is not included. Also ANDRITZ HYDRO and Indar supervise the installation and commissioning of the supplies. The start-up is scheduled for the beginning of 2014.

Louis G. Morin
Phone: +1 (514) 214 7541
louis.morin@andritz.com

TECHNICAL DATA

Output: 3 x 8,400 kW
Head: 21.37 m
Speed: 240 rpm
Runner diameter: 2,600 mm

Canada
Long Lake

In June 2011, ANDRITZ HYDRO was awarded a contract by Long Lake Hydro Inc. for the supply of "water to wire" equipment for the hydropower plant Long Lake.

The Long Lake hydropower plant is located on the river Cascade near the border of British Columbia and Alaska. The project will be able to benefit from considerable storage and will supply an excess of 130 GWh per year to BC Hydro. The Long Lake reservoir will be redeveloped and feed into a 7.2 km long penstock conveying the flow to the Pelton units. It is expected that the construction of the Long Lake hydropower plant will improve the water quality of the Cascade and Salmon rivers by providing more flow during the critical winter months to dilute effluents from the past mining operations in the area providing a win-win-solution for the community and all partners in the project. The scope of supply of ANDRITZ HYDRO comprises two horizontal Pelton turbines with two nozzles, penstock connection, spherical valves, by-pass system, generators, auxiliaries, automation and control systems including installation and commissioning. The start-up is scheduled for November 2012.

Michele Stocco
Phone: +1 (514) 428 6854
michele.stocco@andritz.com

TECHNICAL DATA

Output: 2 x 17,700 kW / 19,300 kVA
Head: 726 m
Speed: 720 rpm
Runner diameter: 1,500 mm

Germany
Gars

The hydropower plant Gars on the Inn river was constructed in the years 1935 to1938 for the utilization of hydropower generation as well as to avoid degradation of the river bed.

Five vertical Kaplan units are operating with a total flow of 420 m³/s. To increase the annual energy, the Verbund Innkraftwerke Ldt. will build an extension power plant. The energy from additional 100 m³/s will result in an increase of the annual energy production of 13.7 GWh which corresponds in a supply of green energy to 3,400 households and stands for a saving of 11.000 tons of CO_2 emissions. ANDRITZ HYDRO was awarded a contract to supply one Compact Bulb turbine including the direct coupled generator (6.3 kV) as well as the entire control system and all electrical equipment. The cut of the first sod for the new power plant was done on 25 May 2011. The commissioning is scheduled for the end of the year 2012. The hydropower plant Gars is the third upgrading of a power plant on the river Inn after Jettenbach and Wasserburg. Both were constructed in the years 2004 and 2009 and are equipped with units of ANDRITZ HYDRO too.

Martin Reisser
Phone: +49 (751) 29511 489
martin.reisser@andritz.com

TECHNICAL DATA

Output: 5,640 kW
Head: 5.86 m
Speed: 136.4 rpm
Runner diameter: 3,650 mm

Czech Republic
Budejovice

The hydropower plant Ceské Budejovice on the Vltava river is located in the centre of Budejovice city in the region of South Bohemia.

After 80 years of operation, the old units have reached their lifetime and will be substituted by three vertical Kaplan turbines of the Compact Hydro range of ANDRITZ HYDRO with a rated flow of 10 m³/s each. End of 2010, Aqua Energie s.r.o awarded to ANDRITZ HYDRO Ravensburg three double regulated vertical Kaplan turbines including oil supply units, supervision of installation, commissioning and training. The direct connected low voltage generators (400 V), the entire automation and remaining electrical equipment of the power station are ordered by the customer separately. The new turbines will be placed in the existing semi spiral casing in such a way to minimize the required jet grouting and concrete works. The draft tubes have to be modified due to the lowering of the tailwater. The reason for these modifications is the revitalization of the Vltava river to enable the navigation by excursion boats. These circumstances results in a higher net head with an improved output in future. The supply ex works is scheduled for the end of 2011.

Martin Reisser
Phone: +49 (751) 29511 489
martin.reisser@andritz.com

TECHNICAL DATA

Output: 3 x 440 kW
Head: 5 m
Speed: 230.7 rpm
Runner diameter: 1,450 mm

Panama
El Alto

The El Alto hydropower plant is located in the west of Chiriquí province, near Costa Rica border.

The project consists of a reservoir with gravity dam (RCC), a tunnel of 3.4 km length and 5.5 m diameter, a penstock and the powerhouse on the left bank of the Chiriquí Viejo river, approximately 3.5 km downstream of the diversion dam and 2.5 km far from Plaza de Caisán village. ANDRITZ HYDRO (Spain) is responsible for the engineering, procurement, manufacturing, installation and commissioning of three units of vertical Francis turbines, generators and butterfly valves. The contract was awarded in February 2011. Commercial operation is scheduled in November 2012.

Main participants:
Owner: Hydro Caisán, S. A.
Client: Hidraúlica del Alto, S.A. / UTE Plaza Caisán
Tunnel: SELI
Penstocks: IIA-Honduras
Dam and power house: Cobra Infraestructuras Hidráulicas
BoP and switchyard: Cobra Instalaciones y Servicios
Transmission lines: Codepa
Turbines, generators and butterfly valves: ANDRITZ HYDRO

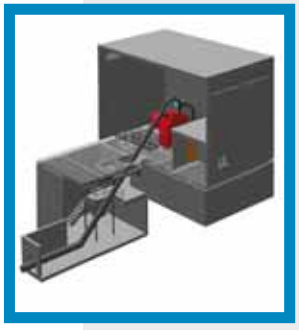
Aurelio Mayo
Phone: +34 (914) 251042
aurelio.mayo@andritz.com

TECHNICAL DATA

Output: 3 x 22.4 MW
Head: 121.8 m
Speed: 514 rpm
Runner diameter: 1,450 mm

Switzerland
Hofen

"Improving the water quality of Steinach river" is the motto of a large project. Due to this, ANDRITZ HYDRO received the order to realize a sub-project for the supply and commissioning of a horizontal Pelton turbine by the city of St. Gallen in the beginning of 2011.
Since 1918, the sewage treatment plant "STP" Hofen releases the purified waste water into the river Steinach, which finally flows into the Lake Constance. The defined aim of the new concept developed by the city of St. Gallen is to improve the water quality of the river to use the water potential of the waste water to generate hydropower. Therefore, a turbine will be installed at the end of a new water pipe in the community of Steinach at the Lake Constance. The scope of supply includes a horizontal 3-jet sewage water Pelton turbine with bypass, generator, auxiliary equipment and electronic turbine governor SICAM TM1703 ACP. Since, in the future, the turbine will work with untreated waste water, the main components will be manufactured from duplex material. A special designed shaft seal between the generator shaft and the turbine housing prevents penetration of harmful vapours from the tailrace into the machine room. The commissioning of the new plant will take place in spring 2013.



Marco Baumann
Phone: +41 (71) 929 3645
marco.baumann@andritz.com

TECHNICAL DATA

Output: 1,246 kW
Head: 167 m
Speed: 600 rpm
Runner diameter: 860 mm

Azerbaijan
Shamkirchay

After Vayxir project, a small hydropower plant located in Nahcivan, awarded to ANDRITZ HYDRO in 2005, CENGIZ Inşaat Sanayi ve Ticaret A. Ş., a Turkish company based in Istanbul, is confirming confidence to ANDRITZ HYDRO by awarding a contract for the Shamkirchay, located in Azerbaijan.
Shamkirchay is situated on one of the tributaries of the Kura river in the north-western part of the Republic of Azerbaijan. The project includes a 885 m long water distribution tunnel, a reservoir, irrigation canals and a power plant with 34 MW installed output. The construction of the water distribution tunnel is completed. The contract inlcudes six identical horizontal Francis turbines, synchronous generators and associated equipment, suitable for large head variations. The commissioning of the Shamkirchay power plant is foreseen to take place in August or September 2012. Thanks to our partners, Indar Electric from Spain for the synchronous generators and ANDRITZ HYDRO Ltd, Şti Turkey for the local manufacturing, this project became a first success in Azerbaijan.

Dominique Leleux
Phone: +33 (475) 230508
dominique.leleux@andritz.com

TECHNICAL DATA

Output: 6 x 5,755 kW
Head: 119.5 m
Speed: 600 rpm
Runner diameter: 925 mm

Albania
Ternoves

The Ternoves hydropower plant is located near the village of Bulqizë, approx. 70 km northeast of the capital Tirana and it uses the existing works and dams from the lakes Zi and Sopove. The natural drainage area of the lake Zi is to be increased by additional channels and tunnels to catch the run-off of the adjacent watersheds and lead them back to the Zi lake.
With their storage capacity, the lakes Zi and Sopove are used to manage the incoming run-offs and to maximize the energy production. From the intake structure at lake Zi, the new 5.1 km long penstock (DN 700 mm) reaches the powerhouse located at the foot of the mountain having a gross head of 999.6 m and a design flow of 1 m³/s. In May 2011, Teodori 2003 sh.p.k. awarded a contract to the consortium consisting of ANDRITZ HYDRO and Indar Electric to deliver a 2-jet horizontal Pelton turbine, water cooled generator, spherical valve (DN 400 / PN 120) with moveable sealing seats, hydraulic oil pressure unit, cooling system, spare parts including installation and commissioning. The trial operation is scheduled for the end of 2012.

Edwin Walch
Phone: +43 (732) 6986 3473
edwin.walch@andritz.com

TECHNICAL DATA

Output: 8,580 kW / 10,000 kVA
Voltage: 6.3 kV
Head: 964.6 m
Speed: 1,000 rpm
Runner diameter: 1,260 mm

Austria
Niklasdorf

The Niklasdorf Energie und Liegenschaftsverwaltung Ltd. (NEL) runs an old power plant equipped with one ANDRITZ axial turbine made in 1991 and three 100 years old Francis turbines which were reaching the end of their life time and will be out of operation soon. A 550 m long channel with a rated discharge of 30 m³/s conveys to the turbines. The Niklasdorf hydropower plant is located on the river Mur in the federal state of Styria and downstream of the hydropower plant Leoben. Last year NEL decided to improve the economic and ecology by constructing a new run-of-river hydropower plant with a rated flow of 70 m³/s and a new weir structure downstream of the existing timber frame rock filled type weir. The new turbines on the weir and the existing bevel gear Bulb turbine located in the channel power house with a flow of 15 m³/s will increase the annual energy production from approx. 10 to 20 GWh. In May 2011, NEL placed the order to ANDRITZ HYDRO for the supply of two Compact Bulb turbines including generators (6,3 kV), digital turbine governors, oil supply units and sump pump equipment as well as installation and commissioning. The start up is scheduled for January 2013.

Edwin Walch
Phone: +43 (732) 6986 3473
edwin.walch@andritz.com

TECHNICAL DATA

Output: 2 x 1,430 kW
Head: 4.46 m
Speed: 176.5 rpm
Runner diameter: 2,600 mm

Events in **Brazil**

In 2011, ANDRITZ HYDRO Brazil and ANDRITZ HYDRO Inepar Brazil participated in important events and conferences in the hydropower field in Brazil. Once again as sponsors, to promote their products, services and technologies through public exhibitions and booths in the exhibition areas.

The Hydro Power Summit Latin America was held in May at the Hotel Intercontinental in São Paulo and presented topics of great relevance to the Latin American markets.

In August, the SIMPASE IX Symposium on Automation of Electric Systems, took place in Curitiba, Paraná. The symposium holds 18 years of tradition in the area and promotes the exchange of information and experience between industry experts. The event is sponsored by Cigré-Brazil, and it is organized and executed by Copel.

In September 2011, the Hydrovision, one of the greatest international events in the field of hydropower, took place in Rio de Janeiro. The event is designed for people from the private sector to present new techniques for manufacturing equipment and consulting areas. It is also featured relevant content for the day-to-day hydropower industry, focusing on solutions and practical approaches to specific issues and challenges.

To complete the events series of 2011, the 21st SNPTEE (National Seminar on Production and Transmission of Electricity) was held under the coordination of Eletrosul. SNPTEE had its first edition in 1971. Today it is recognized as the biggest national seminar in the area. In October, the event, which is held twice a year, had its year's edition in the city of Florianópolis, Santa Catarina state. In addition to the technical exhibition, it promoted the exchange of information, experiences and news in the energy sector.

This has proven to be an excellent marketing strategy, through which ANDRITZ HYDRO companies could show the public more of their technology, which is present in huge projects in Brazil such as Santo Antonio (3,450 MW), Jirau (3,750 MW) and Belo Monte (11,230 MW).

Paula Colucci
Phone: +55 (11) 4133 1260
paula.colucci@andritz.com

Russia Power

One more important step into the Russian hydropower market

ANDRITZ HYDRO attended the annual Russia Power – a leading energy fair in Russia – for a second time. Due to an increase in Russia's interest in water power the number of exhibitors and therefore also the exhibition area doubled compared to last year.

The interested audience used this opportunity to find out more about ANDRITZ HYDRO's delivery spectrum, capability and competence.

Special presentations concerning modernization and rehabilitation, large Kaplan runners, generators, pump storage technologies as well as solutions for small-scale hydro formed the basis for a lively exchange at the booth. The fair team consisting of local and international staff of ANDRITZ HYDRO as well as the new fair concept ensured a successful presence.

Jens Päutz
Phone: +43 (1) 89100 2675
jens.paeutz@andritz.com

Hydro Automation Day

High-tech in elegant architecture

The HYDRO Automation Day has been an integral part of calendars of ANDRITZ HYDRO's automation clients for years. Traditionally, Palais Ferstel in Vienna offered an elegant setting for the day's event. The very modern equipment, the new presentation concept, as well as the room concept already implemented last year formed the basis of an open and communicative atmosphere.

The great interest in this event showed in the increased attendance as well as in the always increasing internationalization. More than 300 attendees from over 20 countries took this opportunity to inform themselves through presentations and personal discussions of the current automation topics.

Special highlight this year was the live-presentation of a 3D fluid dynamic simulation. Following the day event, the Interspot Filmstudio in Vienna provided the optimal evening location. A saxophone greeted guests at the reception.

The studio had been transformed into a theatre setting for a gala evening where international artists impressed with outstanding performances – magic crystal balls, floating aerial acrobats and whirling rings.

Jens Päutz
Phone: +43 (1) 89100 2675
jens.paeutz@andritz.com

HydroVision 2011

Sacramento, California, USA

The HydroVision 2011 exhibition took place in Sacramento in California from 19 – 22 July. Once again, ANDRITZ HYDRO served as GoldSponsor for the conference. That allowed our brand to be front and center in multiple places throughout the conference facility, including the registration desk, the conference delegate bags, the opening reception, the golf tournament and of course our impressive booth display.

The ANDRITZ HYDRO booth was always well frequented, often following technical presentations by one of our competent colleagues. We hosted our first technical seminar concentrating on pumped storage technology which was well attended. On Wednesday, 20 July, ANDRITZ HYDRO hosted many customers, consultants and friends at the ANDRITZ HYDRO NIGHT, held at the beautiful Tsakopoulos Library Galleria. This customer appreciation event has become an anticipated event for our customers and colleagues.

All in all, HydroVision 2011 proved once again to be a valuable resource for strengthening our brand in the hydro market in the United States and highlighting our ever-increasing range of services.

Vanessa Ames
Phone: +1 (704) 943 4343
vanessa.ames@andritz.com

ICOLD 2011

Fair presence at the International Committee on Large Dams

ANDRITZ HYDRO has been active on the ICOLD (International Committee on Large Dams) for many years. This year's meeting took place in Luzern, Switzerland. In the immediate vicinity of Luzern lies Kriens, at the same time one of ANDRITZ HYDRO's four locations in Switzerland.

ANDRITZ HYDRO successfully attended the fair with an own booth. The Swiss clients and international participants used this opportunity for direct discussions and exchange of experience.

Jens Päutz
Phone: +43 (1) 89100 2675
jens.paeutz@andritz.com

EVENTS:

HYDRO 2011
17 – 19 October 2011
Prague, Czech Republic

HydroVision Russia and **Russia Power 2012**
5 – 7 March 2012
Moscow, Russia

ASIA 2012
26 – 27 March 2012
Chiang Mai, Thailand

NEPTUN

is more than a solution of Hydro Automation

NEPTUN, one of the first integrated solutions for Hydro Automation, makes more of your hydro asset. The main highlights are the increase of the annual energy generation, the reduction of capital and operation expenditures, the integration of new IT-services and the simplification of your total automation system. Depending on your requirements it is possible to integrate different combinations or all of the subsystems.

We focus on the best solution – from water to wire.

HP.HN20.7,600.en.10.11

ANDRITZ HYDRO GmbH
Penzinger Strasse 76, 1141 Vienna, Austria
Phone: +43 (1) 89100, Fax: +43 (1) 8946046

contact-hydro@andritz.com
www.andritz.com