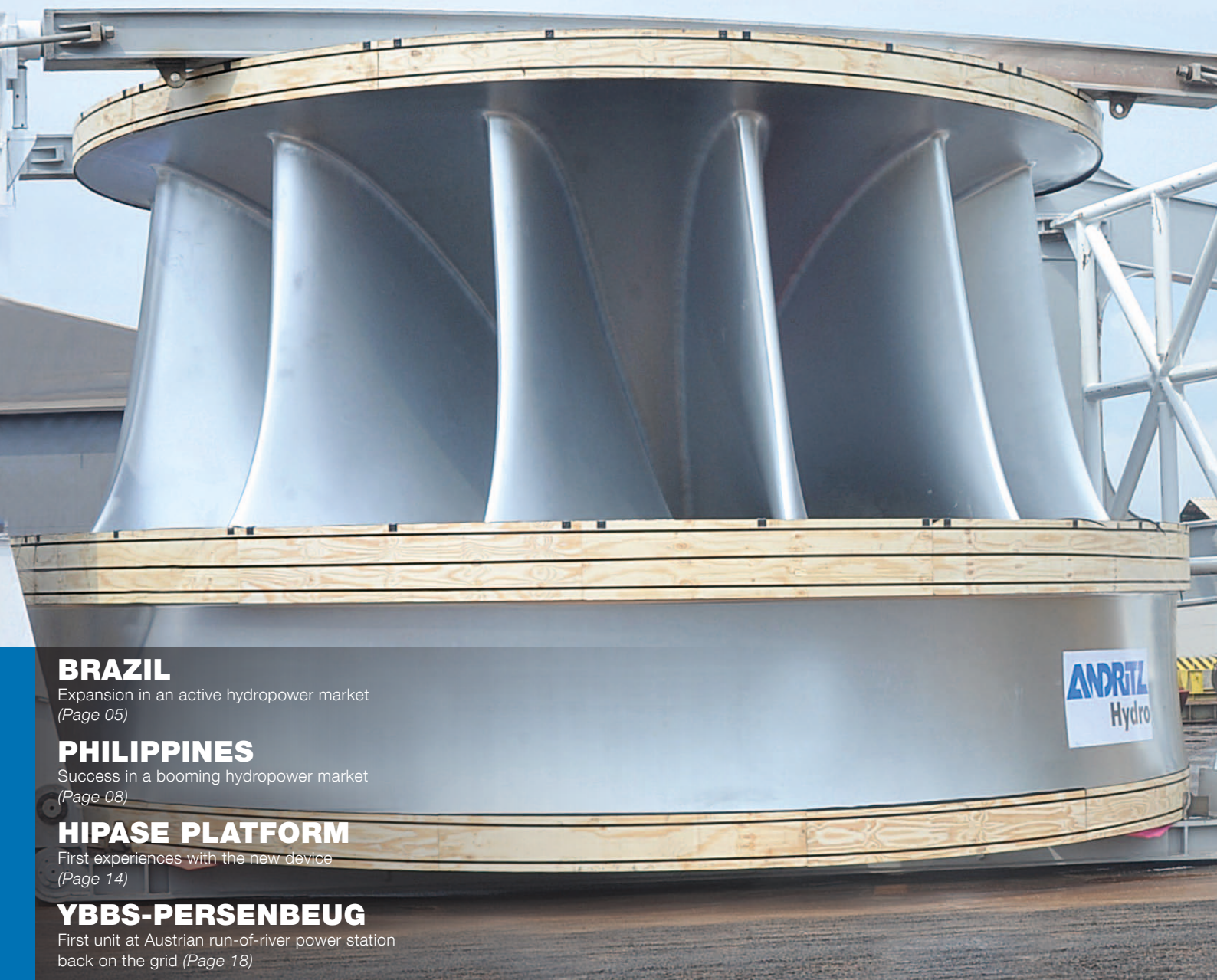


# HYDRO NEWS

No. 28 / 12-2015 • ENGLISH

MAGAZINE OF ANDRITZ HYDRO



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First unit at Austrian run-of-river power station  
back on the grid (Page 18)

# Latest News

## Norway

In accordance with a contract received from Salten Kraftsamband AS, ANDRITZ HYDRO will supply the electro-mechanical equipment for the Norwegian hydropower plants Storavatn (1 x 27 MW and 1 x 8 MW) and Smibelg (1 x 33 MW).

The scope of supply includes three turbines, generators, and auxiliary equipment.



▲ iPad app



▲ Android app

[www.andritz.com/hydronews](http://www.andritz.com/hydronews)

▲ Hydro News online

## India

ANDRITZ HYDRO will refurbish the electro-mechanical equipment of the Stage I power house at hydropower plant Sholayar for Tamil Nadu Generation and Distribution Corporation Ltd. (TANGEDCO).

The scope of supply includes all technical, civil, mechanical and electrical work required for the refurbishing of both units and increasing the installed capacity from 70 MW to 84 MW, resp. by 20%. The stipulated tight time schedule of only 42 months until completion, poses a considerable challenge.

## Turkey

LIMAK Holding Inc. has contracted ANDRITZ HYDRO for the supply and installation of gates and penstocks for HPP Yusufeli, which is currently under construction.

The gates will have a total weight of 2,200 tons, with the total weight of the penstocks amounting to 3,800 tons. Once completed, the hydropower plant will have a total installed capacity of 540 MW.

## China

For the hydropower plant Da A Guo on the HuQu River ANDRITZ HYDRO was awarded a contract by Yajiang JinTong Hydroelectric Development Co Ltd. for the supply, installation, and commissioning of two 130 MW Pelton units.

The first unit will be handed over to the customer for commercial operation in mid-2017.

## Laos

ANDRITZ HYDRO has been contracted by Song Da Corporation to deliver the electro-mechanical equipment for hydropower plant Xekaman Sanxay.

The two 16 MW Bulb turbines are intended to optimize the water flow of the upstream hydropower plant Xekaman 1 and will generate more than 131 GWh of electrical energy a year.

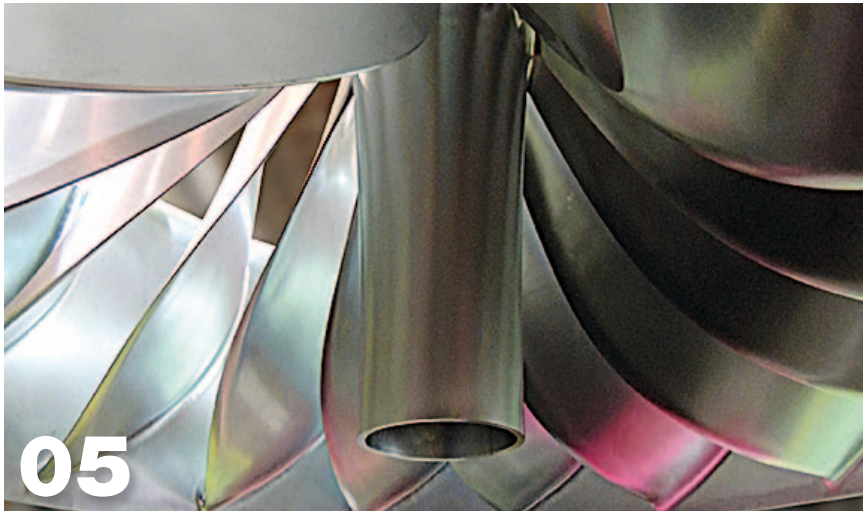
Following projects Xekaman 3 (2007) and Xekaman 1 (2014), HPP Xekaman Sanxay is the third contract that the Song Da Corporation has awarded to ANDRITZ HYDRO.

## Vietnam

ANDRITZ HYDRO received a contract by VNECO Hoi Xuan Investment and Electricity Construction JSC for the supply, installation, and commissioning of the entire electro-mechanical and hydro-mechanical equipment for HPP Hoi Xuan.

The hydropower plant is situated 200 km north of the capital Hanoi. Scheduled for completion in 2017, three units will provide a total installed capacity of 102 MW. This project will also contribute significantly to the further development of the infrastructure and socio-economic conditions in the Thanh Hoa Province and will feed annually 389 GWh of electrical energy into the Vietnamese grid.





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Transportation of Francis runner to Belo Monte hydropower plant, Brazil



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## Dear **business friend**

**A**NDRITZ HYDRO is a leading global supplier of hydro-mechanical and electro-mechanical equipment for hydropower plants. With references covering more than 400 GW of installed turbines ANDRITZ HYDRO and its predecessors have been involved in every third hydropower plant worldwide.

More than 170 years of history and technological development has led to this unique position. Different streams of companies have been put together to form ANDRITZ HYDRO as it exists today.

One line resulted from the evolution of hydro technology in the Alpine region of Europe, where in 2000 VA TECH acquired the hydro business of Sulzer Escher Wyss and merged it with its own hydro business of the MCE Group and the Elin Group to form VA TECH

HYDRO. All were incorporated into ANDRITZ in 2006.

Another line was the European Nordic development, where companies such as Boving, Nohab, KMW and Kvaerner became part of Kvaerner Hydro. Kvaerner Hydro was acquired by General Electric in 1999 and in 2008 ANDRITZ HYDRO acquired certain assets of GE Energy's Hydro business including GE Energy's hydro power technology, engineering and project management resources, research and development capabilities, specialized generator component production facilities in Canada and its majority interest in a Brazilian joint venture with Inepar S.A. Indústria E Construções the Inepar Group.

ANDRITZ has subsequently acquired the remainder of the Brazilian joint

venture. As a result of the 2008 acquisition ANDRITZ HYDRO is the owner of GE Energy's hydro power intellectual property (with the exception of certain motors) and has added to their reference list over 240 GW of GE Energy hydro and Kvaerner installed base. The acquisition also included GE Energy's hydraulic lab in Lachine Canada and related design information. As the owner of the GE Energy's hydro intellectual property, ANDRITZ HYDRO has the full right to exploit this technology subject to certain license agreements in place.

We would be pleased to serve you further with our traditional experience and most modern products, systems and services.

For any additional information please be so kind to get in touch with your usual contacts in ANDRITZ HYDRO.

M. Komböck

H. Heber

W. Semper



# Brazil

## Expansion in an active hydropower market

**B**razil is the second-largest producer of hydroelectric power in the world, with about 60% (Hydropower & Dam World Atlas 2015) of its electric power supply based on hydropower.

The country's biggest hydropower potential lies in the Amazon River basin in the north, while Brazil's population centers and demand for electricity are largely along the southeastern coast. The big challenge is the reliance on mainly one resource for most of the country's electricity generation, combined with the distant and disparate locations of its population centers.

### ANDRITZ HYDRO in Brazil

ANDRITZ HYDRO has been present in Brazil for more than 100 years – the first unit delivered was in São Paulo in 1906. To date ANDRITZ HYDRO has delivered or refurbished about 631 turbine units with a total installed capacity of more than 25,000 MW – some of which still under construction – out of about a 90,000 MW installed total. This record shows the leading role of ANDRITZ HYDRO technology in the Brazilian market – covering the full range of solutions

▼ ANDRITZ HYDRO office in Barueri



▲ IESA plant in Araraquara and runner of HPP Belo Monte during transport

for new hydropower plants, for small hydropower plants, and for modernization projects.

By the beginning of 2015, ANDRITZ HYDRO Brazil increased their already existing majority interest to become 100% owner of ANDRITZ HYDRO Inepar, a joint venture founded in 2008 from the acquisition of the shares of General Electric do Brazil Ltda. with the already consolidated joint venture GE Hydro Inepar do Brazil S.A., now forming ANDRITZ HYDRO S.A.

ANDRITZ HYDRO S.A. will continue manufacturing equipment in the same location, a rented building located inside the IESA plant in Araraquara. A Manufacturing Service Agreement between ANDRITZ HYDRO S.A. and IESA Projetos e Equipamentos S.A. and its new contractual terms, will ensure the use of this facility until the year 2022 and covers the continuity of the provision of services including hydro-

mechanical equipment (i.e. gates, penstocks, stop logs) previously provided exclusively by the Brazilian partner.

ANDRITZ HYDRO S.A. and ANDRITZ HYDRO Brasil Ltda. are both responsible for engineering and manufacturing of equipment for small, medium and large hydropower plants, as well as for the development of automation solutions for both new plants and modernization projects.

In May 2015, ANDRITZ Construções e Montagens Ltda. was founded and is responsible for the fast-growing markets of services, assemblies, and rehabilitation. With headquarters in Santana do Parnaíba, in the state of São Paulo and an administrative office in Barueri, São Paulo, it has also an advanced services office in Araçatuba, São Paulo. This is a strategic location with a significant market concentration since there are 120 hydropower units within a range of 300 km.



▲ Belo Monte spillway at Pimental site

### Belo Monte Complex

The Belo Monte Complex, under construction in Altamira, state of Pará, will be the largest Brazilian hydropower plant and the fourth largest in the world (China: HPP Three Gorges; China: HPP Xiluodu; Brazil-Paraguay: HPP Itaipu). Among many important projects, due to its size, it is the most impressive project in Brazil.

The new hydropower plant will hugely contribute to fulfilling the country's demand for electrical energy, considering the inevitable increase in the estimated consumption for the coming years.

The complex comprises two powerhouses. The major one will be on the

Belo Monte site, consisting of 18 Francis turbines, each with an output of 611 MW and a discharge of 768 m<sup>3</sup>/s. The complementary powerhouse will be built at the Pimental site next to the main dam, consisting of six 38.8 MW Bulb turbines with a net head of 11.4 m and a water discharge of 389 m<sup>3</sup>/s each.

The scope of supply of ANDRITZ HYDRO for the Belo Monte powerhouse includes four generating units with vertical Francis turbines and generators, one blow-down system for this plant, as well as 18 excitation systems. For the Pimental powerhouse ANDRITZ HYDRO will supply the electro-mechanical equipment consisting of six generating units with Bulb turbines and horizontal

generators, electrical power systems, mechanical auxiliaries and automation, protection and control systems equipment, and spillway gates.

The Belo Monte Complex will be the only one built on the Xingu River. The average energy produced will serve 18 million households (60 million people). The whole region will benefit from this project by the injection of resources into education, health, safety, environment, infrastructure, development of agriculture and industry, as well as by attracting new investments. The strip of about 100 km of the Xingu River between the powerhouses guarantees the dam operation with a minimum water flow, which is variable throughout the

▼ Installation of distributor at HPP Pimental



▼ Stator for HPP Belo Monte during manufacturing







▲ Francis runner during manufacturing

year in order to ensure the navigability of the river and to preserve favorable conditions for aquatic life forms.

**World's largest spillway in construction**

The spillway has a total length of 445.5 m, holds 18 radial gates, each 20 m long and 22 m high. The rated flow capacity is 62,000 m<sup>3</sup>/s, which is almost twice the maximum flow recorded in the last 30 years in the Xingu River. The diversion of the river allowed its return to the original course. With the flow controlled by the spillway floodgates and

▼ Kaplan runner installation at HPP Pimental



▲ Transportation of Francis runner

after the beginning of the reservoir flooding, the minimum flow of 700 m<sup>3</sup>/s was registered in the first month, which is above the minimum set by regulators.

The installation of the 18 spillway radial gates was completed within 352 days, observing the strict schedule defined by the customer. This is a record confirming the high standards of ANDRITZ HYDRO.

Paula Colucci  
[paula.colucci@andritz.com](mailto:paula.colucci@andritz.com)

**TECHNICAL DATA**

**Belo Monte:**

Output: 18 x 611 MW / 679 MVA  
 Head: 87 m  
 Speed: 85.7 rpm  
 Runner diameter: 8,270 mm

**Pimental:**

Output: 6 x 38.8 MW / 40.9 MVA  
 Head: 11.4 m  
 Speed: 100 rpm  
 Runner diameter: 6,450 mm



▲ Video



# Philippines

Success in a booming hydropower market

According to International Monetary Fund (IMF), the Philippines will be the most rapidly growing economy in Southeast Asia in 2015 and 2016. Due to this economic growth, which comes along with an increase in population, consumption and energy demand, the Philippines face an enormous challenge regarding electrical energy supply.

The most radical transformation of the Philippine power sector was the restructuring under the auspices of the Electric Power Industry Reform Act (EPIRA) in 2001, which included the breakup of a government monopoly, encouraged the entry of many private players and generated market competition. With the Renewable Energy Act of 2008, a policy was created to define substantive feed-in tariffs (FIT) for hydroelectric power, in order to show the viability of potential projects to developers and investors.

Electricity production in the Philippines is still dominated by thermal resources (natural gas and coal), although hydropower is by far the largest renewable energy source with an actual total share of 20%.

## ANDRITZ HYDRO in the Philippines

In the Philippines ANDRITZ HYDRO has mainly focused on small hydro installations during the last five years. In recent years the following Philippine orders were received:

### Irisan 1

In 2010, ANDRITZ HYDRO received an order from Hedcor Inc., a subsidiary of AboitizPower, to deliver the complete electro-mechanical package, including installation and commissioning, for HPP Irisan 1. The design of the site, especially the buried penstock leading to the pow-



▲ View from outside and inside of HPP Irisan 1

erhouse, took into consideration the needs of local farmers. Since November 2011, the vertical four-jet Pelton turbine has been producing renewable energy.

### Tudaya 1 and 2

As a result of the successful cooperation with Hedcor Inc. at the Irisan 1 project, ANDRITZ HYDRO was assigned to deliver the complete electro-mechanical equipment for HPP Tudaya 1 (one Compact Pelton turbine) and HPP Tudaya 2

(two Compact Francis turbines of different sizes) in 2012. For HPP Tudaya 2 the customer has the intention to develop the powerhouse compound into a visitor center with a focus on schools and universities to show how to develop and operate hydropower plants.

### Sabangan

In May 2013, another contract was signed with Hedcor Inc. The scope of supply consists of two identical, vertical,

▼ Powerhouse of HPP Tudaya 2



▼ Unit hall at HPP Sabangan







▲ Groundbreaking at HPP Manolo Fortich

six-jet 7.4 MW Pelton turbines and a complete water-to-wire package. HPP Sabangan has a 3.2 km waterway system from the intake weir to the powerhouse.

#### Manolo Fortich 1 and 2

ANDRITZ HYDRO continued its success in the Philippines receiving contracts for HPP Manolo Fortich 1 and 2 (see Hydro News 27). Two cascading plants will be built harnessing power from the rivers Amusig, Guihean and Tanaon on the island of Mindanao. The start of the equipment delivery for HPP Manolo Fortich 1 (44.4 MW) is planned for the end of 2016, for HPP Manolo Fortich 2 (26.1 MW) the supply is scheduled for beginning of 2017.

#### Villasiga

In 2011 ANDRITZ HYDRO signed a contract with Sunwest Water and Elec-

tric Co. Inc., part of the Sunwest Group of Companies. The 8 MW Villasiga hydropower project consists of two 3.60 MW and one 800 kW Francis turbines. Despite the site being hit by several natural disasters, ANDRITZ HYDRO is determined to complete the project and to bring the plant online.

#### Catuiran

The contract for the supply of the complete electro-mechanical works for HPP Catuiran was signed with Sta. Clara International Corp., a well-known Philippine business conglomerate, in November 2014. HPP Catuiran is located on the island of Oriental Mindoro and will generate 2 x 4 MW of renewable energy. Start of operation is scheduled 17 months after contract signature in early 2016.

The Philippines have an undeveloped hydropower potential of more than

13,000 MW. ANDRITZ HYDRO is looking forward to being a part of the development of this renewable energy source.

Hans Wolfhard

[hans.wolfhard@andritz.com](mailto:hans.wolfhard@andritz.com)

#### TECHNICAL DATA

##### Irisan 1:

Output: 1 x 4.03 MW

Head: 444.5 m

Speed: 1,200 rpm

Runner diameter: 700 mm

##### Tudaya 1:

Output: 6.7 MW

Head: 227.7 m

Speed: 514.3 rpm

Runner diameter: 1,160 mm

##### Tudaya 2:

Output: 1 x 5.15 MW / 1 x 2.55 MW

Head: 82.8 m

Speed: 600 rpm / 900 rpm

Runner diameter: 978 mm / 672 mm

##### Sabangan:

Output: 2 x 7.4 MW

Head: 228.6 m

Speed: 514.3 rpm

Runner diameter: 1,160 mm

##### Manolo Fortich 1:

Output: 2 x 15.87 MW / 2 x 6.69 MW

Head: 516 m / 163 m

Speed: 900 rpm / 720 rpm

Runner diameter: 1,015 mm / 799 mm

##### Manolo Fortich 2:

Output: 4 x 6.54 MW

Head: 160 m

Speed: 720 rpm

Runner diameter: 799 mm

##### Villasiga:

Output: 2 x 3.6 MW / 4.24 MVA and

1 x 800 kW / 1.04 MVA

Voltage: 4.16 KV

Head: 60 m

Speed: 514.3 rpm / 900 rpm

Runner diameter: 1,030 mm / 545 mm

##### Catuiran:

Output: 2 x 4 MW

Head: 61 m

Speed: 450 rpm

Runner diameter: 1,154 mm

▼ Contract signing for the Catuiran hydropower project



# Shongtong Karcham

Electro-mechanical works in one of India's main hydropower regions

In March 2015, ANDRITZ HYDRO received an order from Himachal Pradesh Power Corporation Ltd. (HPPCL) to supply the complete electro-mechanical equipment for the new 450 MW Shongtong Karcham hydropower plant in Himachal Pradesh, India.

Located in the northern part of the country, Himachal Pradesh is one of the most important hydropower regions in India representing about 21 GW or roughly one quarter of India's total hydropower potential. The Shongtong Karcham run-of-river power plant with an underground power house will be located on the river Satluj, upstream of HPP Karcham Wangtoo.

This order is the third large project from HPPCL for ANDRITZ HYDRO. It follows the projects HPP Sawra Kuddu and HPP Kashang, which are currently under execution by ANDRITZ HYDRO India.

For HPP Shongtong Karcham, ANDRITZ HYDRO's scope of supply is design,



▲ Project management with contracts

manufacturing, supply, erection, testing as well as commissioning of three vertical 150 MW Francis turbines and generators including the complete electrical and mechanical balance of plant, generator transformers, 400 kV GIS, XLPE cables, shunt reactors, control, protection and excitation systems as well as coating of underwater parts.

The plant will have a total output of 450 MW and will provide clean and re-

newable energy for approximately 800,000 Indian households.

Shashank Golhani  
shashank.golhani@andritz.com

#### TECHNICAL DATA

Output: 3 x 150 MW
Voltage: 13.8 kV
Head: 126.58 m
Speed: 166.67 rpm
Runner diameter: 3,950 mm

▼ Representatives of HPPCL and ANDRITZ HYDRO during contract signing ceremony







▲ Power house



▲ Units #1 – #4 before rehabilitation

# Temascal I

## Modernization of Francis turbines and generators in Mexico

**In March 2015, ANDRITZ HYDRO received a contract from Comisión Federal de Electricidad (CFE) for the rehabilitation of units #1 – #4 at the Temascal I hydropower plant.**

HPP Temascal I is located on the Tonto River in the state of Oaxaca, Mexico. CFE decided to modernize the turbines and generators, which have been in operation for over 50 years, in order to increase availability, reduce operation and maintenance costs, and to extend the lifespan of this equipment.

HPP Temascal I is the first Mexican project for which CFE has awarded a contract for the modernization of turbines and generators at the same time. The contract comprises design, engineering, disassembly, assembly, logistics, testing on-site, and commissioning. Part of the contract also covers financing of the goods and services supplied, as well as corresponding PAC for each unit after installation at the site.

ANDRITZ HYDRO will deliver new stator windings, new stator laminations, new pole windings, new turbine runners including fixed turbine part modifications, new wicket gates, spiral cases, bottom



▲ Contract signing

rings and repair works for rotor, stator and head cover. All works will be executed by ANDRITZ HYDRO teams from Mexico, Austria, India, and Switzerland.

An upgrade of the nominal capacity of 38.5 MW per unit is not planned, although the generators could be operated without any problems at a maximum capacity of 42 MW. Additionally, the efficiency of the Francis turbines to reduce the specific consumption of water per kWh will be increased, thus enhancing the profitability of the plant.

The major challenges of this project are the execution of the project schedule coordinating design, purchasing, manufacturing of new equipment, repairing of the existing reused components, and synchronizing the fast responses required to solve problems during the in-

stallation phase, as well as delivering the units within a short delivery time.

ANDRITZ HYDRO has a strong presence in Mexico, especially for turbine and automation system modernization projects. With the completion of HPP Temascal I ANDRITZ HYDRO Mexico is expanding its portfolio of services in Latin America. The project shall be executed within 42 months, inauguration is planned for September 2018.

Ander Ibarra  
ander.ibarra@andritz.com

### TECHNICAL DATA

Output: 4 x 38.5 MW
Voltage: 13.8 kV
Head: 50 m
Speed: 180 rpm
Runner diameter: 3,600 mm





# Kargi

Electro-mechanical equipment for a Turkish hydropower plant

▲ View of the site

In March 2015, **ANDRITZ HYDRO** received an order from **Kargi Enerji Üretim ve Ticaret A.S.**, to supply electro-mechanical equipment for the new **Kargi hydropower plant in Turkey**.

Kargi Enerji is a special purpose company of Limak Holding Inc., one of the leading companies in the electricity generation market of Turkey. It has gained an energy portfolio of approximately 2,000 MW of installed capacity and envisages doubling its energy business within the next five years.

The Kargi run-of-river power plant is located about 100 km northwest of the city of Ankara, on the Sakarya River, which is the third longest river in Turkey.

ANDRITZ HYDRO scope of works covers the supply and installation of

two 48 MW Francis turbines, two 55.5 MVA generators, transformers, and switchyard equipment, as well as the related electrical systems. Furthermore, a small 3.7 MW unit shall generate electricity by using the environmental discharge water, which has to be continuously released to the river.

The project is led by ANDRITZ HYDRO Austria. ANDRITZ HYDRO Turkey will contribute the local electrical power systems as well as installation services. The small 3.7 MW unit will be supplied by ANDRITZ HYDRO France. Commissioning of HPP Kargi is scheduled for beginning of 2017.

The units will add further 250 GWh per year of environmental friendly and renewable energy to the Turkish electricity grid.



▲ Contract signing

Gerald Stelzhammer  
gerald.stelzhammer@andritz.com

## TECHNICAL DATA

### Main units:

Output: 2 x 48 MW / 55.5 MVA

Voltage: 11 kV

Head: 78 m

Speed: 250 rpm

Runner diameter: 2,700 mm

### Environmental unit:

Output: 1 x 3.7 MW / 4.3 MVA

Voltage: 11 kV

Head: 78 m

Speed: 750 rpm

Runner diameter: 800 mm

▼ Representatives of Kargi Enerji Üretim ve Ticaret A.S. and ANDRITZ HYDRO during contract signing



▲ Video





# San José

A Pelton project in Bolivia

In February 2015, the EPC contractor POWERCHINA Kunming Engineering Corporation Limited awarded a contract to ANDRITZ HYDRO China for the supply, installation supervision, and commissioning supervision of four Pelton turbines at San José hydroelectric complex in Bolivia.

Owned by Bolivia's state power utility Empresa Nacional de Electricidad (ENDE), the hydroelectric complex is located in the Chapare Province in the center of Bolivia and is part of the expansion plan for the Corani Basin hydroelectric projects. It consists of two powerhouses, San José 1 (two 28 MW Pelton units) and San José 2 (two 35 MW Pelton units). Both run-of-river power plants are designed to use the river basin of the upper Chapare River, Malaga and Santa Isabel rivers as well as the Corani reservoir attached to the existing Santa Isabel hydropower plant.

ANDRITZ HYDRO will supply design, manufacturing, delivery, installation supervision, and commissioning supervision of four Pelton turbines for the HPP San José project. All works will be executed by ANDRITZ HYDRO China in collaboration with ANDRITZ HYDRO Italy.

▼ Meeting between ANDRITZ HYDRO and the customer



▲ Upper Chapare River

The HPPs San José 1 and 2 are expected to provide 754 GWh of electrical energy per year, destined for domestic use.

▼ Contract signing



The project is scheduled to be put into operation by end of 2017.

Ma Yong  
yong.ma@andritz.com

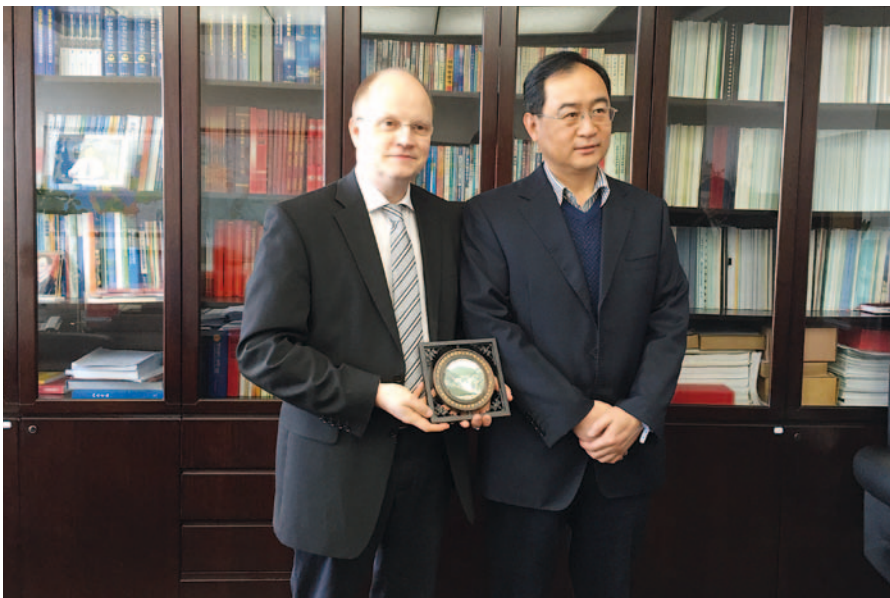
## TECHNICAL DATA

### San Jose 1:

Output: 2 x 28 MW  
Head: 294 m  
Speed: 375 rpm  
Runner diameter: 1,860 mm

### San Jose 2:

Output: 2 x 35 MW  
Head: 294 m  
Speed: 428 rpm  
Runner diameter: 1,740 mm



# HIPASE platform

First experiences with the new device

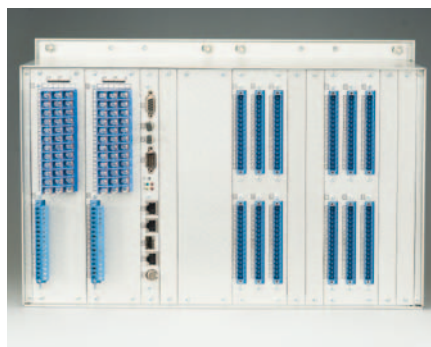
**A**NDRITZ HYDRO automation is the global leader for secondary equipment for hydro-power plants as well as a supplier of excitation, protection, and synchronization systems for thermal power plants. With the development of the new HIPASE platform, ANDRITZ HYDRO automation is actively reacting to a changing market environment for secondary systems (see *Hydro News 24*).

## HIPASE – The new development

The main drivers for the new development are based primarily on new requirements for cyber security, homogeneous interfaces for all subsystems, simple and easy engineering, as well as a common platform for all functions.

Major goals of the development were the conflation of all different disciplines into one common platform, one common engineering workflow, as well as one common workflow for commissioning. HIPASE contains the following features in one unique platform:

▼ HIPASE-T turbine governor



▲ HIPASE device

- HIPASE-P (Electrical protection system)
- HIPASE-E (Excitation system, automatic voltage regulator – AVR)
- HIPASE-S (Synchronizing functionality)
- HIPASE-T (Turbine governing system)

Furthermore, by using one platform for all subsystems the training of engineers will be reduced to a minimum.

## HIPASE – The approach to an unique platform

The HIPASE device consists of a half size 19" housing incorporating up to 32 digital inputs and outputs as well as 12 current and eight voltage transformer inputs. For all applications with extensive signal requirements (e.g. six winding transformer differential protection), a standard 19" full size housing can be used. All HIPASE devices usually contain four boards, individually combined according to the type of application. The processor board is the core component, also supporting different

standard communication interfaces (e.g. IEC 61850 and IEC 60870-5-104). For processing of analogue and digital signals, appropriate analogue and digital interface boards are provided. HIPASE ensures the protection of humans and property as well as data integrity by both hardware and software measurement.

## HIPASE – Security

Due to the complex interconnection of the overall electrical energy generation and distribution infrastructure, cyber security has become increasingly important. This fact becomes clear in the related policies of key power utilities (e.g. the White Paper from Germany's BDEW and the North American NERC CIP Standard).

Comprehensive and consistent security architecture protects the HIPASE device against cyber-attacks – exogenous as well as from the internal network. Core elements of this protection are an internal firewall as well as encrypted data transmission (communication between HIPASE engineering tool and HIPASE devices). Every HIPASE device is equipped with a trusted platform module (TPM) chip, clearly identifying each device and providing unique keys for authentication.

## HIPASE – Engineering and touch panel operation

The HIPASE engineering tool is the perfect tool for easy and efficient engineering of the platform. It is used for all applications, such as excitation, protection, synchronization and turbine governor solutions. It has a future-oriented user





▲ Rosenheim hydropower plant

interface and, in combination with the workflow-oriented menu structure, offers a new quality of user-friendliness.

The HIPASE engineering tool fits perfectly to user requirements and demands. All engineering steps of a project – parameterization, system test, commissioning, system monitoring, and maintenance – are supported by using the tool.

All applications are created with the help of the IEC 61131-3 function block diagram with a full graphic representation. In case of dedicated predefined functionality (e.g. ANSI protection func-

▼ HIPASE presentation for H.E. Alois Stöger (Minister of Transport, Innovation and Technology of Austria)



tions) an engineering wizard will help to select the right functions without the need to create them by oneself.

The fully graphical touch panel allows the online visualization of process signals as well as an indication of internal process data. It is used for the complete operation of the HIPASE device.

#### **HIPASE – pilot projects in operation**

ANDRITZ HYDRO automation has been awarded a lot of projects where HIPASE is used for various functions.

In Austria the first excitation HIPASE-E and protection system HIPASE-P have been installed and commissioned at the Ternberg run-of-river power plant on the Enns River. Two excitation systems have been delivered for two generators with an output of 25 MVA each. The protection system is designed to have complete redundancy with the use of two HIPASE devices for the generator and block protection for each unit.

On the river Inn in Germany HPP Rosenheim and HPP Feldkirch (both equipped with three 35 MW Kaplan units) and HPP Gars, HPP Wasserburg and HPP



▲ HIPASE-P installed at HPP Ternberg

Teufelsbruck (equipped with five 25 MW Kaplan units) will be equipped with HIPASE-E excitation systems. For this project both types of application – excitation for rotating exciter units and static excitation systems – will be applied.

In Canada ANDRITZ HYDRO has received a contract for the delivery of excitation systems for five 18 MW units at HPP Shawinigan on the river Saint-Maurice, the first HIPASE excitation project in Canada. Recently, the first unit was delivered to the customer, after the test runs were successfully finished. Furthermore, ANDRITZ HYDRO has been awarded a contract to supply a





▲ Gars hydropower plant, Germany

HIPASE-P protection system for HPP Nant de Drance. The newly-built pump storage power plant in Switzerland consists of six 174 MVA pump turbines (motor-generators). ANDRITZ HYDRO will equip all six motor-generators, six block transformers, and three station service transformers with HIPASE-P platforms. For all units the protection system will be designed with full redundancy.

**HIPASE – future of automation**

With the new HIPASE platform ANDRITZ HYDRO has developed the basis for future market requirements. Especially with the newest extension for turbine governor applications HIPASE can now be used for all dedicated tasks in hydropower plants. The unique hardware and engineering tool approach for all types of functionalities is the main advantage of the integrated platform. ANDRITZ

HYDRO is looking forward to sharing its long-term experience in the field of secondary equipment with its customers.

Clemens Mann  
[clemens.mann@andritz.com](mailto:clemens.mann@andritz.com)



◀ Video

▼ Dam and reservoir at HPP Nant de Drance, Switzerland





# Dagachhu

Handover and project closing in Bhutan

▲ Inside of the bifurcator

**D**agachhu Hydro Power Corporation (DHPC) and ANDRITZ HYDRO signed a contract for the delivery and installation of hydro-mechanical equipment for the Dagachhu hydropower plant in Bhutan in July 2009. After the project was successfully commissioned and put into operation the last unit was completed and handed over to the customer in March 2015.

The Dagachhu hydropower plant is located in western Bhutan, in the Dagana Province. It is a run-of-river power plant situated in the midst of the southern Himalayas, which poses considerable logistic challenges. HPP Dagachhu consists of an underground power house (cavern), underground waterways of approximately 8 km length and three large desilting chambers, located downstream of the intake construction.

▼ Unit hall



ANDRITZ HYDRO was awarded the contract as part of a consortium. All civil works were carried out by an Indian company. While most of the components of the mechanical equipment were delivered from Europe, major parts like the turbine distributor and the main inlet valves were manufactured by ANDRITZ HYDRO India.

The scope of delivery of ANDRITZ HYDRO included two Pelton turbines, two governors, the bifurcator, penstocks, main inlet valves and cranes, and the complete hydraulic steel structure equipment for the intake and the desilter.

ANDRITZ HYDRO has been present in Bhutan since 1997. After receiving a contract for HPP Basochhu Upper Stage project, an order for HPP Basochhu Lower Stage project followed –

▼ Contract signing



both equipped with two Pelton turbines each. The long-term cooperation between Bhutanese and Austrian government departments was contributory to the receipt of the order for HPP Dagachhu. This contract underlines the good cooperation with DHPC and the important role of ANDRITZ HYDRO in the development of the Bhutanese hydropower market.

Hermann Jaidhauser  
hermann.jaidhauser@andritz.com

#### TECHNICAL DATA

Output: 2 x 63 MW

Head: 282 m

Speed: 272.7 rpm

Runner diameter: 2,450 mm





# Ybbs-Persenbeug

First unit at Austrian run-of-river power station back on the grid

▲ View of the hydropower plant and Persenbeug Castle

**A**fter about two years of project work and six months of downtime due to reconstruction, ANDRITZ HYDRO has completed the refurbishment of the first unit at hydropower plant Ybbs-Persenbeug, the oldest power plant on the Austrian stretch of the Danube River.

VERBUND, Austria's leading electricity company and one of the largest producers of electricity from hydropower in Europe, has pledged 144 Mio. euros towards the refurbishment of the run-of-river power plant as part of "Project Ybbs 2020".

In October 2012, ANDRITZ HYDRO was awarded the contract for the revitalization of six vertical Kaplan units. A total of eight maintenance groups were involved in the reconstruction project. As a result, fulfilling the agreed work on schedule posed a huge challenge in terms of time and logistics, but in the end everything was successfully completed as contracted.



▲ Transportation of the line shaft (length: 14.8 m, weight: 95 tons)

The purpose of the refurbishment was to increase the turbines' performance and efficiency and to improve their cavitation behavior. The new Kaplan runner was engineered using the latest flow simulation and optimization software. Based on a series of fully homologous model tests at the hydraulics laboratory, the engineers designed an optimized blade profile that satisfied all requirements.

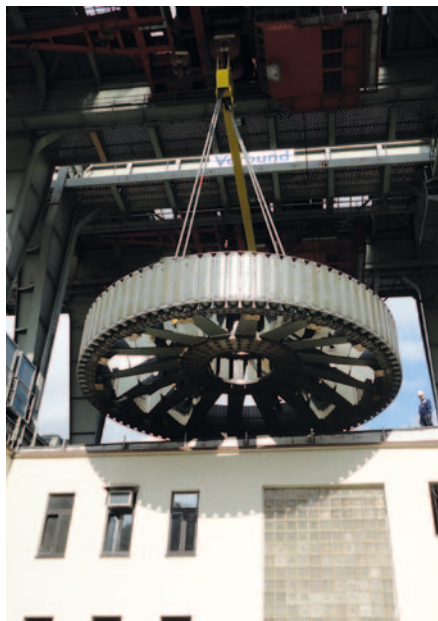
As a result of the refurbishment the nominal output of the plant was raised from 32.2 MW to 35.4 MW. Measuring 7,400 mm in diameter, the new runner was completely assembled and balanced at ANDRITZ HYDRO's facilities in

Graz, Austria. Another component, that was installed as part of the project, was the newly-manufactured self-pumping, self-lubricating guide bearing.

Due to the tight reconstruction schedule, the disassembly, and reassembly of the components was highly challenging – the generator itself consists of more than 250,000 individual parts.

The 45 MVA generator received a new stator, core and winding, rotor poles, a heat exchanger, and a machine fan. In addition, the machine unit was equipped with a carbon dust extractor system. The existing discharge ring was repaired by extensive rust-proof welding





▲ Lifting of the generator rotor



▲ Installation of covers and air shield

and manual polishing covering a total area of 32.8 m<sup>2</sup>. Reusable components were refurbished and tested, with the anti-corrosion coating being replaced as necessary. The existing SICAM automation and control system was adapted, and its control functions and interface to the superior automation and control system were greatly extended. The reconstruction of the first unit allowed an increase of the annual energy production by around 10 GWh, thus ensuring the supply of electrical energy

to more than 2,800 additional households.

The successful commissioning and handover of the first unit marks the achievement of another important milestone of the revitalization project “Ybbs 2020”. Once the project is complete, additional 77 GWh of electrical energy will be generated from renewable hydropower, which constitutes a significant contribution to sustainable, CO<sub>2</sub>-free energy production.

Franz Grundner  
franz.grundner@andritz.com

Gerhard Hofstätter  
gerhard.hofstaetter@andritz.com

Michael Hager  
michael.hager@andritz.com

**TECHNICAL DATA**

Output: 35,4 MW / 45 MVA

Head: 10.6 m

Speed: 68.2 rpm

Runner diameter: 7,400 mm

▼ Kaplan runner in the ANDRITZ HYDRO manufacturing workshop



▲ Video







# Lalashan

Two Francis units start commercial operation in China

▲ Hydropower plant and Bachu River

**A**NDRITZ HYDRO China received a contract from Huaneng Hydropower Company for the supply of electro-mechanical equipment for the Lalashan hydropower plant in September 2010. Huaneng Hydropower Company is one of the largest hydropower companies in China and has already cooperated successfully with ANDRITZ HYDRO on projects like HPP Yinping, HPP Lengzhuguan and HPP Xiaotiandu.

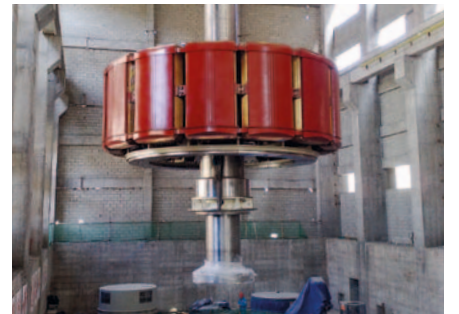
Lalashan run-of-river power plant is located in Batang County, in Garzê within the Tibetan Autonomous Prefecture situated in the western Sichuan Province, in China. It is the third cascade hydropower plant on the Bachu River.

The scope of supply for ANDRITZ HYDRO comprises design, manufacturing, transportation, erection supervision, and commissioning of two vertical 48 MW

Francis turbines, two spherical inlet valves and two generators.

Transportation of the equipment was a big challenge due to the remote location and high altitude of HPP Lalashan. However, the equipment delivery on time fit well into the construction progress of the site. After the successful finishing of a 72-hour test run in December 2014, during which the hydropower plant reached all technical performance and guarantees required by the contract, the commissioning could be executed. In October 2015, the project was closed, the Preliminary Acceptance Certificate (PAC) signed, and the plant was handed over to the customer for commercial operation.

This order and the successful start of the commercial operation is an important milestone in the continuation of the medium-high head Francis unit business in China. The project was deliv-



▲ Rotor lifting

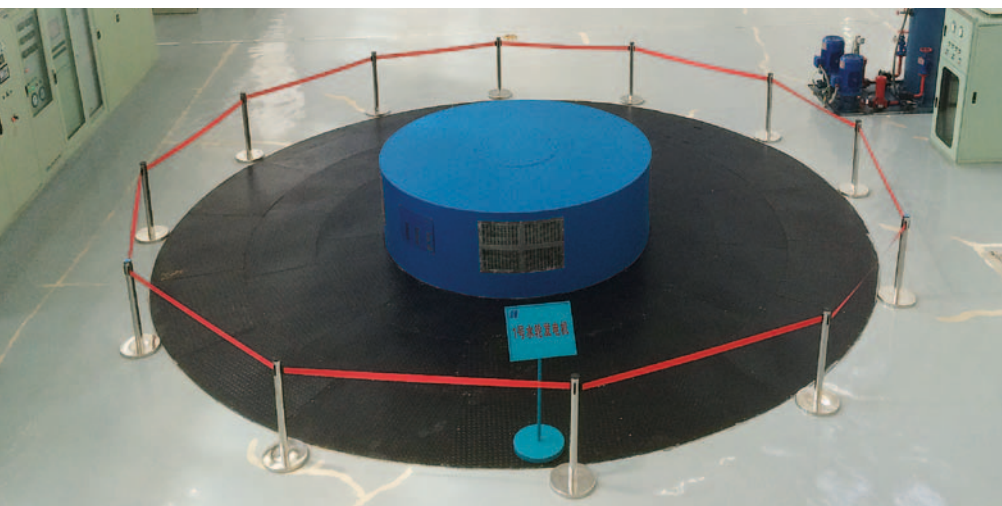
ered to the complete satisfaction of the customer and demonstrates ANDRITZ HYDRO's leading technology in the Chinese hydropower market.

Zhefei Zhou  
zhefei.zhou@andritz.com

## TECHNICAL DATA

Output: 96 MW
Head: 212 m
Speed: 428.6 rpm
Runner diameter: 1,640 mm

▼ Unit #1







▲ Hydropower plant on the Rhine River

# Schaffhausen

Swift emergency repair in Switzerland

**B**eginning of 2015, unit #2 at Schaffhausen hydropower plant resumed commercial operations after a successful 14-day trial run.

Situated on the river Rhine in northern Switzerland, HPP Schaffhausen was commissioned in 1963. After maintenance work on unit #2 by the customer in July 2014 start-up, synchronization, and putting the unit under load were on schedule and went ahead without any problems. Unfortunately sudden onset of noise and heavy vibrations required an immediate shut-down of the unit. ANDRITZ HYDRO was contracted by Kraftwerk Schaffhausen AG to perform the necessary emergency repairs. Work on the unit began without delay.

First the oil supply head was dismantled. Lifting the head revealed the full extent of the damage: the upper bearing point of the inner oil supply duct had seized and blocked the duct, causing it to rupture. The damage to the duct, which runs from the top to the bottom of the unit, was massive. All rotating parts had to be removed to allow the runner to be transported to ANDRITZ HYDRO Germany in Ravensburg for disassembly and repair. Working together with all available plant employees, work was begun within a few days,



▲ Preparations for reassembly

starting with the draining and dismantling of the unit. In September 2014, after only 23 days of work, the runner was restored to the point where it could be removed.

By the end of October 2014, the repaired runner had been delivered and reinstalled. In the meantime, the turbine governor was also refurbished to make optimum use of the downtime.

As planned, the turbine and regulating gear were up and running again beginning of 2015. After its successful trial run, the unit was handed over to the customer to be put back into commercial operation.

Dominik Widmann  
dominik.widmann@andritz.com



▲ Retraction of the runner

Walter Scherer  
walter.scherer@andritz.com

## TECHNICAL DATA

Output: 14.4 MW  
Voltage: 10.4 kV  
Head: 5 m – 8 m  
Speed: 71.42 rpm  
Runner diameter: 5,900 mm



## Ecuador Sigchos

**In April 2015, ANDRITZ HYDRO Spain received a contract from Hidrosigchos C.A. for the supply of three horizontal 6 MW Pelton turbines to be installed in the Sigchos hydropower plant in Ecuador.**

HPP Sigchos is located in the province of Cotopaxi, Cantón Sigchos. The reservoir is situated on the Toachi River, in the sector named Antimpe, whereas the hydropower plant is located on the left margin of the river, directly upstream from the confluence with the Pugsiloma Creek.

The scope of supply includes design and delivery of three Pelton turbines

with three jets per unit, synchronous generators, main inlet valves, hydraulic



power units, digital turbine governors, and the cooling water system.

Furthermore, ANDRITZ HYDRO will deliver EPS, automation, and the travelling

crane, as well as transport, installation, commissioning, and all performance tests. The handing over of the unit to the customer for commercial operation is scheduled for December 2016.

Aurelio Mayo  
aurelio.mayo@andritz.com

### TECHNICAL DATA

Output: 3 x 6 MW
Voltage: 13.8 kV
Head: 299.4 m
Speed: 600 rpm
Runner diameter: 1,165 mm

## Canada New Post Creek

**Ontario Power Generation and Taykwa Tagamou Nation, on whose traditional territory the project is located, have begun construction of the New Post Creek hydropower plant, a 27 MW greenfield development. They have awarded an EPC contract to Kiewit/Aecon New Post, a partnership who will be ANDRITZ HYDRO's customer.**

The New Post Creek run-of-river power plant is located in the northeastern part of the Canadian Province of Ontario. The plant must operate from a rated discharge of 49 m<sup>3</sup>/s down to 10 m<sup>3</sup>/s without excessive vibration or rough operation. In dry periods there may be several starts and stops per day.

ANDRITZ HYDRO has delivered many turbines and generators to Ontario Power Generation Inc. and has also worked with Kiewit on several EPC contracts in both eastern and western Canada over the last few years. This contract continues a long relationship between ANDRITZ HYDRO and both



customers. A Limited Notice to Proceed with engineering of HPP New Post Creek was signed in December 2014. The Notice to Proceed with the contract followed in March 2015. ANDRITZ HYDRO Canada will design, supply, install, and commission the water-to-wire equipment package featuring two 13.5 MW horizontal Compact Francis turbines and two synchronous generators. These will be the first Compact Francis turbines ever delivered to eastern Canada by ANDRITZ HYDRO.

First embedded parts are due to be delivered in November 2015. The main

equipment is scheduled for delivery in June 2016. Commissioning is scheduled for January 2017.

Thomas Taylor  
thomas.taylor@andritz.com

### TECHNICAL DATA

Output: 27 MW
Voltage: 6.9 kV
Head: 63 m
Speed: 360 rpm
Runner diameter: 1,758 mm



## Chile Embalse Ancoa

**In April 2015, ANDRITZ HYDRO signed a contract with Hidroeléctrica Embalse Ancoa S.p.A. for the supply of electro-mechanical equipment for the new Embalse Ancoa hydropower plant in Chile.**

Located 200 km south of Santiago de Chile, in the region of Maule, in Linares province, the hydropower plant will use the waters of the Ancoa reservoir through a 130 meter-long penstock. The maximum flow of 26 m<sup>3</sup>/s was calculated by a mathematical model taking into account the yearly demand from an irrigation channel, which is fed by the units and, if required, by two relief valves. A 66 kV line with a length of 30 km will connect the power plant substation to the national grid.

The planned project will comprise a greenfield power house, for which ANDRITZ HYDRO will deliver two horizontal 13.75 MW Francis turbines, generators, mechanical auxiliaries, electrical power systems (EPS), automation as well as a tele control center. Commissioning is scheduled for January 2017.

HPP Embalse Ancoa will provide about 86 GWh per year of clean energy to the Chilean Central Interconnected System (SIC).

Paolo Crestani  
paolo.crestani@andritz.com

### TECHNICAL DATA

Output: 27.5 MW / 32 MVA

Voltage: 13.8 kV

Head: 35 m – 120 m

Speed: 428 rpm

Runner diameter: 1,287 mm

## Austria Grünsee and Greith

**In early March 2015, the 811 kW turbine at Grünsee hydropower plant was officially commissioned and started commercial operation.**

Less than a year earlier, in July 2014, ANDRITZ HYDRO received a contract from KW Grünsee GmbH to supply a vertical, six-nozzle Pelton unit for HPP Grünsee in the province of Styria.

In August 2014, ANDRITZ HYDRO received an order from Greither Wasserkraft GmbH for the delivery and installation of a horizontal, three-nozzle Pelton turbine at HPP Greith located in the neighbor valley of HPP Grünsee. The equipment was put into operation at the end of August 2015.

Both schemes are run-of-river power plants with intakes equipped with Coanda screens and penstocks made of GRP-pipe. The Pelton turbines are equipped with butterfly inlet valves and are connected to 400 V generators.

Edwin Walch  
edwin.walch@andritz.com

### TECHNICAL DATA

#### Grünsee:

Output: 811 kW

Head: 80.1 m

Speed: 500 rpm

Runner diameter: 705 mm

#### Greith:

Output: 353 kW

Head: 150.9 m

Speed: 1,000 rpm

Runner diameter: 500 mm



## Norway Hakavik

**Statkraft awarded a contract to ANDRITZ HYDRO for the supply of electro-mechanical equipment for the Hakavik railroad hydropower plant in Norway in May 2015.**



HPP Hakavik is located at the Eikeren Lake in Buskerud County and was originally commissioned in 1922. The hydropower plant contains four 2.3 MW Pelton units.

ANDRITZ HYDRO will replace one of the existing units with a new Pelton unit with a higher output of 5.5 MW including supply of the associated generator, automation, control and EPS equipment, an inlet valve, and a new inlet penstock with 100 m length. The project is a collaboration between ANDRITZ HYDRO teams from Norway and Switzerland.

Completion of the project is scheduled for 2018. The Hakavik hydropower plant will provide an average annual production of about 26 GWh of electrical energy to the Norwegian railroad.

Kristian Glemmestad  
kristian.glemmestad@andritz.com

### TECHNICAL DATA

Output: 5.50 MW

Head: 380 m

Speed: 500 rpm

Runner diameter: 1,540 mm

## Nepal Puwa Khola 1 and Upper Mailung A

**ANDRITZ HYDRO's Mini Compact Hydro business made its first breakthrough in the Francis and Pelton turbine business in Nepal by signing two contracts.**



ANDRITZ HYDRO has signed a first contract with M/s Puwa Khola One Hydro Power Pvt Ltd. for the supply and supervision of installation and commissioning of two horizontal 2 MW Francis turbines for the Puwa Khola 1 hydropower plant in Nepal. HPP Puwa Khola 1 is located near the towns of Shanti Danda and Barbote in the Eastern Development Region. The project is scheduled to be put into commercial operation in 2016.

The second Nepalese contract was awarded to ANDRITZ HYDRO by M/s

Energy Engineering Pvt Ltd. for the supply and supervision of installation, and commissioning of two horizontal, two-jet Pelton turbines at Upper Mailung A hydropower plant. HPP Upper Mailung A is located on the river Mailung about 180 km from Kathmandu. It will have a total installed capacity of 6.42 MW.

Both projects are an important success for ANDRITZ HYDRO in this region, strengthening its globally leading position in the range of electro-mechanical equipment for mini-scale hydropower plants and will pave the way to the Nepalese hydropower market.

Sanjay Panchal  
sanjay.panchal@andritz.com

### TECHNICAL DATA

#### Puwa Khola:

Output: 2 x 2 MW  
Head: 108.09 m  
Speed: 1,000 rpm

#### Upper Mailung:

Output: 2 x 3.21 MW  
Head: 439 m  
Speed: 1,000 rpm

## Vietnam Chau Thang

**In February 2015, ANDRITZ HYDRO's Compact Hydro business division made a breakthrough in Vietnam with low head turbines.**

ANDRITZ HYDRO India signed a contract with Prime Que Phong JSC for the supply, supervision of installation, and commissioning of two vertical Kaplan units for the Chau Thang hydropower plant in Vietnam. The total installed capacity will be 14 MW.

HPP Chau Thang is located on the Quang River in the communes of Chau Thang and Que Son, some 330 km north of the capital Hanoi. The project

is scheduled to be put into commercial operation in 2016.

This is the first low head Kaplan turbine supplied out of India and an important success for ANDRITZ HYDRO in this region, as the range of required turbine types in Vietnam is now completely covered.

Sanjay Panchal  
sanjay.panchal@andritz.com

### TECHNICAL DATA

Output: 2 x 7 MW / 8.75 MVA  
Voltage: 11 kV  
Head: 21 m  
Speed: 272.7 rpm  
Runner diameter: 2,350 mm

## Kenya Lower Nyamindi and South Mara

**After the successful assignment of the order for the North Mathioya hydropower plant in 2014, the general EPC contractor JIANGXI Water and Hydropower Construction Kenya Ltd. awarded ANDRITZ HYDRO with another two contracts to supply the complete electro-mechanical equipment, including two 930 kW Compact Francis turbines for HPP Lower Nyamindi and one 2.2 MW six-jet vertical Compact Pelton turbine for HPP South Mara.**

The two hydropower plants were developed as pilot projects for the construction of small hydropower plants to generate power for the Kenya Tea Development Agency (KTDA).

Both hydropower projects will further secure independent electrical energy supply for two more local tea factories. The groundbreaking ceremony at Lower Nyamindi Hydro Power project under the management of KTDA Power Company, took place in August 2015.

Delivery of ANDRITZ HYDRO's scope of supply to Kenya is planned for the beginning of 2016, the completion of the project is scheduled for mid-2016.

Hans Wolfhard  
hans.wolfhard@andritz.com

### TECHNICAL DATA

#### Lower Nyamindi:

Output: 2 x 0.93 MW  
Head: 44 m  
Speed: 750 rpm  
Runner diameter: 647 mm

#### South Mara:

Output: 2.2 MW  
Head: 180 m  
Speed: 750 rpm  
Runner diameter: 720 mm



## Montenegro Bistrica

**In May 2015, ANDRITZ HYDRO received a contract from SISTEM-MNE D.O.O. for the delivery of two small power generating units for the Bistrica hydropower plant in Montenegro.**

ANDRITZ HYDRO will supply two 1.8 MW Francis turbines and synchronous generators together with all necessary equipment, including automation, protection, auxiliary supply

system, and medium voltage system. During the contract evaluations ANDRITZ HYDRO offered the most economical solution while ensuring a maximum level of security, taking into account specific conditions. The penstock is quite long, thus significant water hammer can occur during transients, which can create serious damage. ANDRITZ HYDRO's hydraulic department conducted extensive transient calculations and could accurately determine the necessary safety equipment, which was decisive in winning the contract.

The start of commercial operation of HPP Bistrica is scheduled for March 2016. With this contract ANDRITZ HYDRO is further developing its Mini Compact Hydro solutions in southern Europe.

Rudy Yvrard  
rudy.yvrard@andritz.com

### TECHNICAL DATA

Output: 2 x 1.8 MW  
Head: 95.5 m  
Speed: 1,000 rpm  
Runner diameter: 572 mm

## Malaysia Kampar

**ANDRITZ HYDRO signed a new contract in Malaysia.**

The order was signed between M/s Panzana Enterprise Sdn Bhd. (PESB) and ANDRITZ HYDRO and comprises electro-mechanical works for the Kampar hydropower plant (2 x 2.5 MW). PESB is a rapidly growing company

and is emerging as one of the leading Malaysian hydropower developers in the field of infrastructure and construction.

The Kampar hydropower plant is located in Sungkai Kampar, in the state of Perak Darul Ridzuan. It is a run-of-river project with a surface power house.

ANDRITZ HYDRO will supply a water-to-wire package and technical services including installation and commission-

ing of the supplied equipment. The project is scheduled to be completed at the beginning of 2016.

Sanjay Panchal  
sanjay.panchal@andritz.com

### TECHNICAL DATA

Output: 2 x 2.5 MW  
Head: 283.5 m  
Speed: 750 rpm  
Runner diameter: 890 mm

## Norway Eidsfoss and Vrangfoss

**On behalf of Norsjøkraft AS, Statkraft Energi AS awarded a contract to ANDRITZ HYDRO for rehabilitation of the control system at the Eidsfoss and Vrangfoss run-of-river power plants in March 2015. The hydropower plants are owned by Norsjøkraft AS and operated by Statkraft Energi AS.**



Both hydropower plants are located in southeastern Norway in Telemark County and are using the waters from the Skien water system. Built in the early 1960s, they still operate with the first relay-based control system.

The scope of ANDRITZ HYDRO's supply comprises the replacement of the local control system, modifications of the turbine and generator systems, and installation of the cable connections. In addition, new measurement transformers, surge arrester and disconnector switches at medium and high voltage level are part of the delivery.

To keep the water level stable in all operation conditions, a level controller with additional emergency functionality has to be implemented in the control system. Furthermore, the intake gate will be equipped with new servomotors.

The commissioning of HPP Eidsfoss is scheduled for the end of 2015 and the works at Vrangfoss hydropower plant are scheduled for the end of 2016.

Uwe Krawinkel  
uwe.krawinkel@andritz.com

### TECHNICAL DATA

#### Eidsfoss:

Output: 1 x 15 MW  
Voltage: 7.5 kV  
Head: 10 m  
Speed: 100 rpm

#### Vrangfoss:

Output: 2 x 17.5 MW  
Voltage: 10 kV  
Head: 23 m  
Speed: 200 rpm

## Canada Ear Falls Generating Station

**In May 2015, ANDRITZ HYDRO received a contract from GDB Constructeurs for the modernization of Ear Falls Generating Station in Canada.**

The Ear Falls Generating Station is located on the English River at the outlet of Lac Seul Dam, about 215 km northeast of Kenora, Ontario.

The Hydro-Electric Power Commission of Ontario constructed the Lac Seul Dam in 1929 and included 20 sluiceway openings. It was initially constructed to regulate the waters of the English and Winnipeg rivers. Starting in 1930 and finishing in 1948, sluiceways 13–20 were converted to generator intakes. The run-of-river power plant was built to provide power for the local mining industry. Each unit consists of two intake gates – units #1 and #2 are identical as are units #3 and #4. The turbines have an output of 5.59 MW and the generators are rated for 6 MVA.

The scope of supply for ANDRITZ HYDRO includes design, supply, installation, and commissioning of eight intake gates, embedded parts and hoists.

The project is scheduled for four consecutive years. Final commissioning is due to take place in September 2018.

Bryon Demeester  
bryon.demeester@andritz.com

### TECHNICAL DATA

Gate weight: 9.1 tons  
Sill to deck evaluation: 11.6 m  
Hoist capacity: 18.2 tons

## Pakistan Tarbela Power Station



**ANDRITZ HYDRO won a contract from Pakistan's Water and Power Development Authority (WAPDA) for the supply of static excitation systems for six units at the Tarbela Power Station.**

HPP Tarbela Power Station, located on the Indus River about 50 km northwest of the capital Islamabad, was first finalized in 1976. Its dam is one of the largest earth-filled dams in the world and also second largest by structural volume, creating an impressive reservoir with a surface area of approximately 250 km<sup>2</sup>. The total installed capacity of HPP Tarbela Power Station is 3,478 MW.

Currently, the secondary equipment is subject to an entire refurbishment including modernization of the excitation systems, slip ring assembly, and auxiliary systems. In 2014, ANDRITZ HYDRO refurbished the static excitation systems of the units #5 and #6.

Now the existing rotating exciter units #1–#4 will be replaced by static excitation systems. At units #7 and #8 the existing static excitation systems will be replaced by new ones.

Both orders for units #1–#4 as well as for units #7 and #8 confirm the excellent reputation of ANDRITZ HYDRO within the Pakistani hydropower market. All six units will be commissioned sequentially, starting in 2016.

Ferdinand Schedl  
ferdinand.schedl@andritz.com

### TECHNICAL DATA

Output: (Unit #1 – #4) 4 x 206 MVA /  
(Unit #7 – #8) 2 x 184 MVA  
Voltage: 13.8 kV  
Head: 127 m  
Speed: 136.4 rpm

## Spain Castrelo

**In February 2015, ANDRITZ HYDRO was awarded a contract from FerroAtlántica S.A. for the replacement of the spiral casing of all three units and the rehabilitation of turbine, generator, and auxiliary equipment at Castrelo hydropower plant in Spain.**

HPP Castrelo is located at the Ezaro River. It was originally put into operation in the 1950s and has a total output of 40 MW.

The rehabilitation project will be executed by a team from ANDRITZ HYDRO Spain. The scope of supply includes the generator rehabilitation, rotor and stator cleaning, as well as the corrosion protection for the new



spiral cases. It further comprises the rehabilitation of the turbine, the generator and the auxiliary equipment.

Shop work for the first unit began in April 2015 and is due to be completed within nine months.

Alan Bakry  
alan.bakry@andritz.com

### TECHNICAL DATA

Output: 1 x 10 MW / 2 x 15 MW  
Head: 229 m  
Speed: 750 rpm



## Thailand Nam Pung

In March 2014, Electricity Generating Authority of Thailand (EGAT) awarded a contract to ANDRITZ HYDRO China for two units at the Nam Pung hydropower plant in Thailand.

Located on the Nam Pung River, in southern Thailand, HPP Nam Pung is one of five small hydropower rehabilitation projects on this river.

The hydropower plant consists of one powerhouse with two 3.15 MW Francis units, which have been operating since 1965. Both units will now be modernized to improve the efficiency of the turbines.



ANDRITZ HYDRO will provide design, manufacturing, delivery, installation supervision, and commissioning of the runner, governor, mechanical auxiliaries, generator, excitation, control, protection, and EPS for unit #2 and governor, automation, EPS and other auxiliary equipment for unit #1. The manufacturing of the runner was completed by beginning of September 2015. The project will be executed by ANDRITZ HYDRO China in collaboration with ANDRITZ HYDRO Austria.

This is the first hydropower project for ANDRITZ HYDRO China in Thailand.

Commissioning of unit #1 is scheduled for May 2016, unit #2 is due to be put into operation in April 2017. The electricity generated is destined for domestic use.

Shan Qi  
shan.qi@andritz.com

### TECHNICAL DATA

Output: 2 x 3.15 MW
Voltage: 3.3 kV
Head: 85 m
Speed: 750 rpm
Runner diameter: 820 mm

## Turkey Beyhan-1

The Beyhan-1 Dam and hydropower plant (3 x 186 MW and 1 x 25 MW) was successfully handed over to the customer Kalehan Beyhan Enerji Üretim A.S.

By mid-April 2015, the last of the three 186 MW main units could be handed

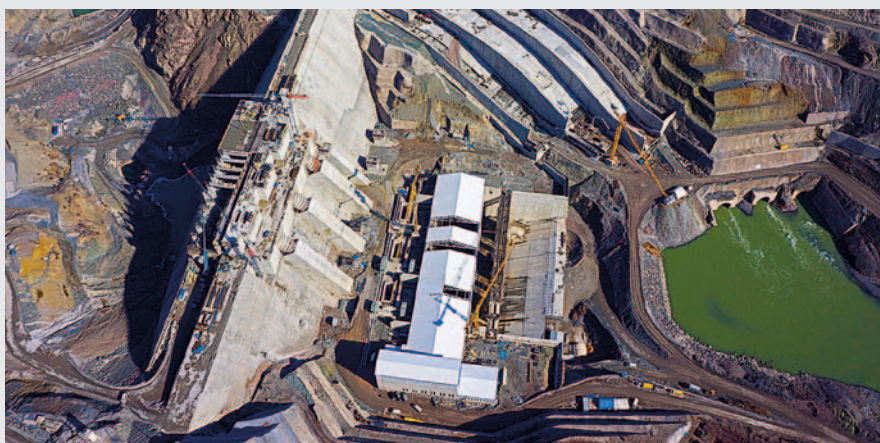
over, almost two months before the contractual agreed date, so the customer was able to operate all main units already during the wet season (January to May).

HPP Beyhan-1 is the first of four planned hydropower plants on the river Murat in eastern Turkey. With an installed capacity of 600 MW, HPP Beyhan-1 is a cornerstone of the energy supply in this important Turkish region.

In 2012, ANDRITZ HYDRO, as leader of a consortium, received from Kalehan Enerji Üretim A.S. the contract for delivery and installation of the electro-mechanical equipment (see Hydro News 22). The three 186 MW Francis turbines, produced and supplied from ANDRITZ HYDRO, are among the largest of their kind ever installed in Turkey.

From mid-2015 a further 1,250 GWh per year of renewable energy will be supplied to the Turkish grid.

Werner Lindenthaler  
werner.lindenthaler@andritz.com



### TECHNICAL DATA

Output: 3 x 186 MW / 1 x 25 MW
Head: 73 m
Speed: 115.4 rpm
Runner diameter: 5,650 mm

# New test bench

## ANDRITZ HYDRO India completes first vertical generator test set-up

**A**NDRITZ HYDRO India has successfully completed its first vertical generator running test at its new shop test bench.

In mid-2014 ANDRITZ HYDRO India started expanding its vertical test bench with the aim of fulfilling all testing requirements within the committed delivery time. The test bench was designed by ANDRITZ HYDRO engineers and established on time to meet the first generator testing schedule.

One of the key features of the new test bench was the possibility to perform over-speed tests up to 1,400 rpm. ANDRITZ HYDRO India is now fully equipped to perform running tests up to 35 MVA for generators with both horizontal or vertical shaft orientations.

The first vertical generator order for ANDRITZ HYDRO India was for the Kal hydropower plant, owned by TPSC (India) Private Limited. The contract comprised the supply of one synchro-

nous generator unit to the Indian market. The generator is designed with all necessary instrumentation including a brushless excitation system and an automatic voltage regulator (THYNE™ 1) to meet the customer specification and IEEE standards.

The testing of the generator for HPP Kal included heat run tests at rated speed, a sudden three-phase short circuit test and an applied voltage test with the rotor locked in direct and quadrature axis. This generator was also specially tested for damper measurement due to its hybrid pole construction.

ANDRITZ HYDRO India has proven its competence by testing this first vertical generator with all stringent requirements as per standards and is looking forward to new challenges to prove its new shop test bench.

A J Nakhate  
aj.nakhate@andritz.com

### TECHNICAL DATA

Output: 16.67 kVA
Voltage: 11 V
Frequency: 50 Hz
Speed: 375 rpm

▼ Generator of HPP Kal during testing





# Hemicycle Controls Inc.

The automation specialist in Canada



▲ Hemicycle team in Chambly

**H**emicycle Controls Inc., based in Chambly, Canada, is a supplier of hydro automation systems and expert in controls, protection, SCADA systems, generator excitation, and turbine speed governors. Hemicycle also integrates medium voltage switchgear and station services equipment as part of its supplies.

In tune with a growing demand and an evolving market, Hemicycle was acquired by ANDRITZ HYDRO in 2011 as part of a strategic focus on expanding automation products and services capability in the North American market. With beginning of 2016 Hemicycle Controls Inc. will be fully integrated into ANDRITZ HYDRO Canada Inc.

## Product range

The offered services for above mentioned products range from complete detailed design with documentation and

software development to manufacturing, testing, site installation, commissioning and training. The synergy created through this integration with the added value of ANDRITZ HYDRO state-of-the-art technology products is proving successful for the customers.

## Current projects in Canada

For the new 209 MW Muskrat Falls hydropower plant Hemicycle's scope of delivery includes controls, protection, SCADA, governors, exciters and EPS equipment for four units and gates (see Hydro News 23).

While new North American hydropower developments are constrained in the current economic climate and by low energy prices, there is a potent market for rehabilitation. This is an opportunity where Hemicycle together with the entire ANDRITZ HYDRO portfolio of product and services comes into play to serve the client's needs, either on specific

component demands or on a wide project scope.

Furthermore, in the Canadian rehabilitation market, Hemicycle is working on a variety of projects including also static exciters and speed governors for clients such as Ontario Power Generation and Hydro Quebec.

For the Canadian small hydro market Hemicycle is supplying electrical equipment for hydropower plants like Upper Lillooet, Boulder Creek, New Post Creek and Chaudière Falls.

The projects gained and results achieved so far are attributable to the worldwide commitment of technologically-minded ANDRITZ HYDRO teams. With the additional capacity of Hemicycle and a potent market, ANDRITZ HYDRO is looking forward to future projects.

Christian Roy  
christian.roy@andritz.com

Control and protection panels designed and  
▼ manufactured in Chambly





# Brazilian events in 2015

In 2015 ANDRITZ HYDRO was successfully present at numerous exhibitions and trade fairs in Brazil, of which two were major events.

In August 2015, ANDRITZ HYDRO attended the XI SIMPASE forum in the city of Campinas, São Paulo, with a booth and presented a paper about cyber security in automation and control networks. The forum provides an excellent place for the exchange of experience of automation systems.

During the XXIII SNPTEE in October 2015, in Foz do Iguaçu, Paraná, ANDRITZ HYDRO presented its products and solutions portfolio for new hydropower plants and modernization projects. ANDRITZ HYDRO participated also with a booth and took part in the seminar with five technical papers, considering the interaction between production and transmission of electricity.

Paula Colucci  
[paula.colucci@andritz.com](mailto:paula.colucci@andritz.com)

## EVENTS

**Asia 2016**  
 Booth 062  
 01 – 03 March 2016  
 Vientiane, Lao PDR  
[www.hydropower-dams.com](http://www.hydropower-dams.com)

**Energy Efficiency Africa 2016**  
 Booth Austria  
 15 – 16 March 2016  
 Johannesburg, South Africa

# HydroVision 2015

Portland, USA

**HydroVision 2015, the international hydropower conference and exhibition, took place in Portland, Oregon, from July 14–16, 2015.**

Once again ANDRITZ HYDRO served as Gold Sponsor for the conference allowing its brand to be front and center in multiple places throughout the conference facility, including the registration desk, the conference delegate bags,

the opening reception and the golf tournament and, of course, with its impressive booth display.

On July 15, 2015 ANDRITZ HYDRO hosted many customers, consultants and friends at ANDRITZ HYDRO NIGHT, held at the beautiful Ponzi vineyard. The guests enjoyed majestic views, including a beautiful sunset, while enjoying a wonderful selection of food and great musical entertainment. The customer appreciation

event has become a much anticipated highlight for customers and colleagues.

All-in-all HydroVision 2015 proved once again to be a valuable resource for strengthening ANDRITZ HYDRO's brand in the hydropower market in the United States and highlighting its ever-increasing range of services.

Vanessa Ames  
[vanessa.ames@andritz.com](mailto:vanessa.ames@andritz.com)



# Supplier and Service Provider of the year

ANDRITZ HYDRO wins Indonesian award

**D**uring the annual supplier gathering of PT. Pembangkitan Jawa-Bali (PJB) in May 2015, ANDRITZ HYDRO Indonesia was awarded first place in the category “Supplier and Service Provider” for the year 2014.

PJB is a subsidiary of PT. PLN (Persero), the state-owned electricity utility of Indonesia, operating plants such as HPP Cirata (1,008 MW), HPP Tulungagung (36 MW) and HPP Sengguruh (32 MW). The annual gathering aims to strengthen the relationship between PJB and its suppliers.

ANDRITZ HYDRO Indonesia has always been among the top 10 suppliers and

service providers. This time the excellent performance and compliant handling of the contracts, as well as dedicated work of the project team during 2014, convinced PJB to award ANDRITZ HYDRO first place out of a field of more than 80 suppliers and service providers assessed for the prize.

This award is an outstanding achievement and ANDRITZ HYDRO Indonesia will strive to continue providing excellent services to all of its customers for the benefit of the people of Indonesia.

Thomas Locher  
thomas.locher@andritz.com



# Customer Day

Tbilisi, Georgia

**A**NDRITZ HYDRO has been highly successful in the Georgian market, winning several projects in recent years. To further strengthen its role as a leading system provider for electro-mechanical hydropower equipment in Georgia, a “Customer Day Georgia” was held for the third time in Georgia’s capital Tbilisi in June 2015.

Georgia currently produces 75% of its electrical energy (2,700 MW) from hydropower, with plans to raise this share to a full 100% in the future. In view of these medium- and long-term goals, and inspired by the excellent experience and feedback from the previous two Customer Days, the third edition of the “Customer Day Georgia” once again was a great success.

It was attended by 150 participants representing all ANDRITZ HYDRO partners

in the Georgian hydropower market, including local customers, officials from the energy ministry, project developers, planners, and experts from engineering offices and financial institutions. Deputy Minister of Energy, Ilia Eloshvili, opened the Customer Day with a keynote speech.

The central part of the event was dedicated to customers reporting on their current project experience with ANDRITZ HYDRO in Georgia. Specialist lectures on the topics of new facilities, small hydropower, automation, and financing underscored the wide range of ANDRITZ HYDRO’s product and service portfolio and emphasized its role as a leading system provider for electro-mechanical hydropower equipment in Georgia.

Jens Päutz  
jens.paetz@andritz.com



# HIPASE

The new product platform for excitation, protection, turbine governor and synchronization



**ANDRITZ HYDRO is a globally leading supplier of electro-mechanical equipment and services for hydropower plants.** HIPASE is the first common platform which covers excitation, protection, turbine governor, and synchronization for hydropower plants. The newly developed platform HIPASE addresses the latest

technological possibilities and unifies for the first time in one product the different device characteristics of electrical protection, voltage control, turbine governor, and synchronization worldwide.

**We focus on the best solution – “from water-to-wire”.**

