

HYDRO NEWS

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MAGAZINE OF ANDRITZ HYDRO



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Units 1 & 2 have started commercial operations in a Turkish hydropower plant *(Page 26)*

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ANDRITZ
Hydro

Latest News

Key Figures 2013

Business development:

Order Intake: 1,865.4 MEUR

Order Backlog Dec. 31: 3,722.4 MEUR

Sales: 1,804.8 MEUR

Employees as of Dec. 31: 7,445

Mali

ANDRITZ HYDRO was awarded a contract from SOGEM for revisions at Manantali hydropower plant, located on the Bafing River, a tributary of the Senegal River in southwestern Mali.



After several minor repairs at existing units over the last years the scope includes the general renovation of unit 3 and a large number of modernization works on the remaining four turbines, generators and governors.

Angola



ANDRITZ HYDRO will supply the electromechanical equipment for the new Laúca hydropower plant in Angola to GAMEK (Gabinete de Aproveitamento do Médio Kwanza), an office of the Angolan Ministry of Energy and Water.

The new hydropower plant on the Kwanza River will comprise two power houses for which ANDRITZ HYDRO will deliver six 340 MW Francis turbines, as well as generators and additional equipment and a 72 MW minimum flow unit adjacent to the dam site.

The project lead is with ANDRITZ HYDRO Ravensburg, Germany. Commissioning is scheduled for 2017.

Austria

ANDRITZ HYDRO has been awarded a contract from VERBUND Hydro Power AG for the rehabilitation of the complete secondary equipment for the hydropower plant Spielfeld in Austria.

The good relationship with the customer and the success of our already delivered automation solutions, have been the reason to choose ANDRITZ HYDRO again.

Pakistan

WAPDA awarded a contract to ANDRITZ HYDRO for the manufacturing and installation of three Pelton turbines and the electromechanical equipment at Golen Gol hydropower plant in northwestern Pakistan.



All works will be done by our ANDRITZ HYDRO teams from Austria, China, Switzerland, Germany and Pakistan. The start of commercial operation is scheduled for 2016.

Hydro News on iPad

Since July 2013 the Hydro News is available for iPads. You have an access to the customer magazine everywhere, offline and online, free of charge to the App-Store.

QR code to download the Hydro News mobile kiosk onto your iPad.





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Dear **business friend**

Even in 2013, ANDRITZ HYDRO remained with a top market position notwithstanding globally declining investments. This is again reflected by positive key figures.

Worldwide project activities regarding electromechanical equipment for hydropower plants were satisfactory in 2013, however were at a comparable level with 2012 and hence consequently below the high level of the years before.

Hydropower represents a stable and reliable factor in the global energy market. The reasons for its success include competitive products as well as the application of the latest technologies. ANDRITZ HYDRO with 7,500 highly qualified and committed employees makes a significant contribution to this.

We were successful in all segments and all regions of the world. 2013 highlights were:

In Europe, a traditionally competitive market, we could win a large number of projects, e.g. San Pedro II in Spain, Upper Kaleköy in Turkey or Komani in Albania. Our mini compact hydro business, too, could further expand its market position with contracts in countries such as Turkey, Switzerland, Italy and Romania.

One of the most exciting markets with enormous future potential is Africa. New projects such as Kpong in Ghana and Djoué in the Republic of Congo, as well as several compact hydropower contracts are the impressive evidence for this. A major project milestone was the successful award for the second unit in Kindaruma, Kenya. The market in the Americas developed very positively, too, for ANDRITZ HYDRO, both as regards new construction and rehabilitation projects. Important contracts in North America are Muskrat Falls, Spray and Lower Notch in Canada. Highlights on

the South American continent are the projects Renance II in Guatemala and Barra Bonita in Brazil.


In the highly competitive Asian hydropower market, the new contracts for the projects Peusangan in Indonesia, Nam Lik in Laos, Sharadarinskaya in Kazakhstan, Dariali in Georgia, Gongri in India and Whakamaru in New Zealand give proof of the advantage of a strong local presence.

The continuous development of our technologies, committed staff and local presence, as well as the contract-compliant handling of our projects to the utmost satisfaction of our clients are ANDRITZ HYDRO's mainstays. Owing to the trust and confidence generously placed in us, we deem ANDRITZ HYDRO ideally prepared for the years to come.

With sincere thanks



M. Komböck



H. Heber



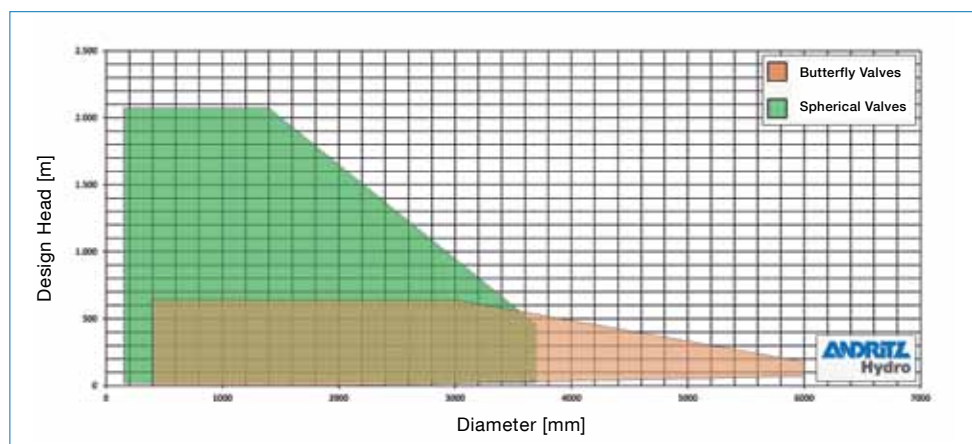
W. Semper

Valves

Lifetime safety and reliability

Valves have withstood the operating conditions within hydropower plants for more than a century and they fulfill various important tasks; from safety elements in powerhouses or penstocks to tight sealing in waterways for maintenance purposes on hydraulic machinery.

In addition to butterfly and spherical valves described herein ANDRITZ HYDRO's product range includes other valve types, like ring gates and cone valves.



▲ Design range of shutoff valves within ANDRITZ HYDRO



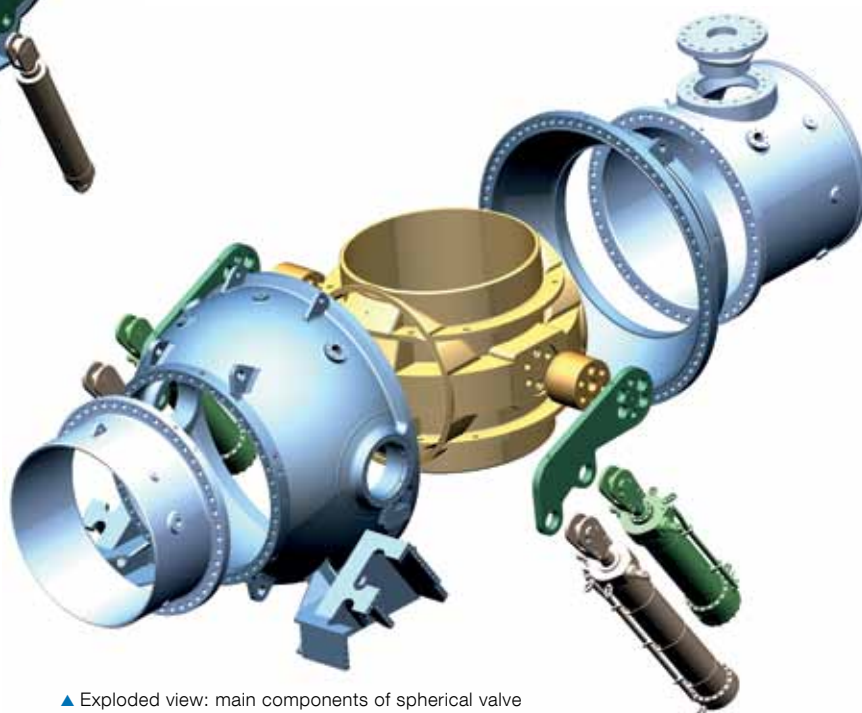
▲ Exploded view: main components of butterfly valve

Spherical valves are mainly used in high head applications, whereas butterfly valves are selected for the low to medium head range. Indicative design limits for each valve type are shown in the diagram above.

Both valves allow flow in both directions and fit perfectly for the use in the waterways of reversible pump turbines. They can be equipped with service and maintenance seals to allow significant reduction in plant downtime during maintenance.

Design

At the design stage, safety and functionality during operation come first. Analytical verifications are made based on customer requirements, and international standards (e.g. ASME), as well as ANDRITZ HYDRO internal instructions. Modern ANDRITZ HYDRO valves offer numerous innovative technical features, which appeal to customers.



▲ Exploded view: main components of spherical valve

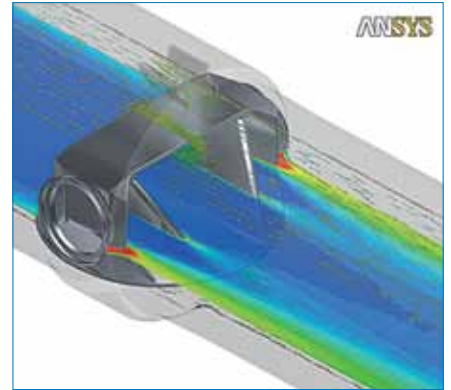
Among other features, ANDRITZ HYDRO now offers an auto-oscillation (self-excited pressure pulsation with increasing amplitudes, which can lead to penstock rupture) detection device. By opening or closing of the maintenance seal the oscillating system is de-tuned and damages due to auto-oscillation can be prevented. This function can either be performed fully automatically or manually after an alarm.

Recently, the design of the butterfly main inlet valve for HPP Cerro del Águila in Peru (DN 3150 mm/PN 36 bar) was completed. In this high pressure application ANDRITZ HYDRO achieved a substantial reduction in the valve head

losses of approximately 15%. This could be managed after several optimization loops by the utilization of CFD (Computational Fluid Dynamics) calculation programs and by taking existing model test results from the standard valve disc geometry as a basis.

Furthermore, this design features leakage monitoring of the maintenance seal, which allows operators to check its tightness before dismantling, thus increasing safety for maintenance staff.

The spherical valve for HPP Teesta Urja in India (DN 1,900 mm/PN 90 bar) is exposed to high concentrations of aggressive sediments in the river water



▲ CFD plot for head loss analysis at lattice type valve disc

and consequently subject to erosion damage. Therefore essential components of the service and maintenance seals were furnished with a tungsten-carbide coating, which ensures a significant extension of the maintenance interval.

Manufacturing, installation and commissioning

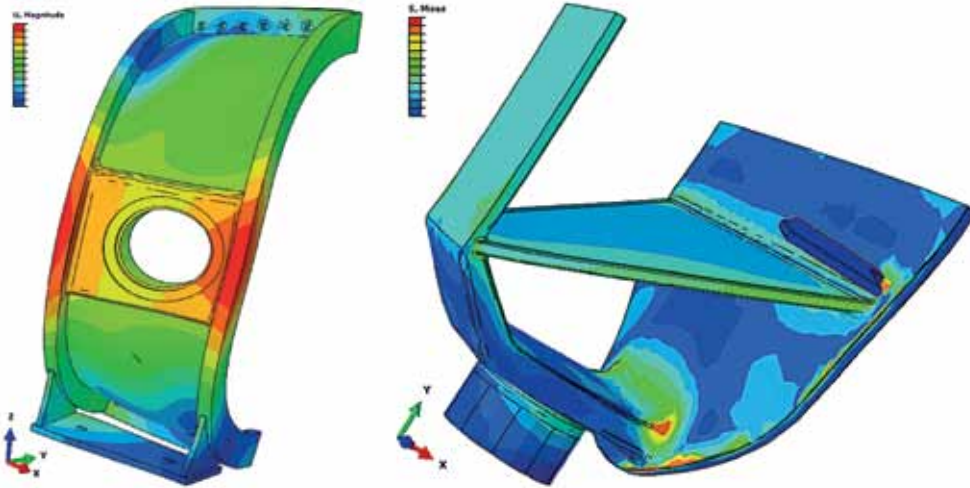
Nominated ANDRITZ HYDRO technical competence centers for spherical and butterfly valves are located in Ravensburg, Germany and Linz, Austria. The strictest requirements are enforced concerning material and fabrication quality as well as machining tolerances during the manufacturing process.

Main components can be made either from castings, forged or welded structures based on size and pressure rating criteria.

Modern narrow gap welding techniques (e.g. submerged arc or electron beam) are applied on thick walled items to ensure competitive manufacturing costs. These reduce the required quantity of filler material and, incidentally, minimize welding distortions too.

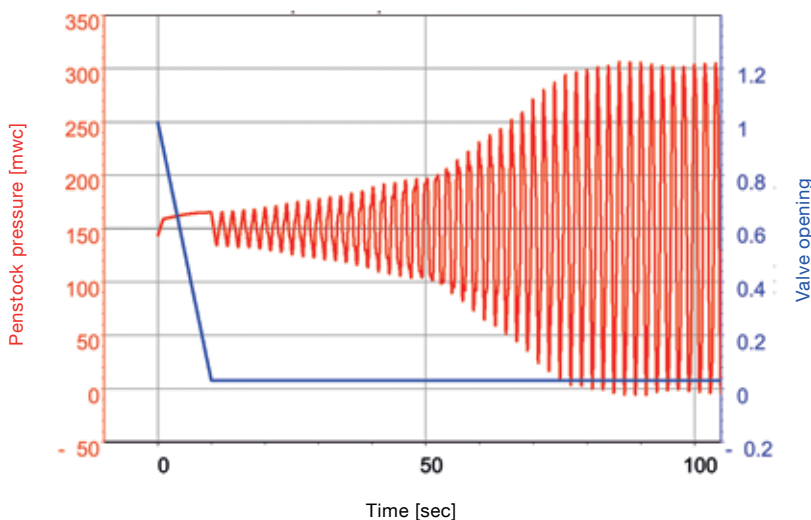
Functionality of single components as well as the overall system are checked during workshop assembly (including pressure and tightness tests) to ensure smooth installation of the valves at site.

Commissioning ensures the correct set-up and optimization of operational parameters, for example tuning of the valve closing times to prevent unacceptable penstock water hammer.



▲ Finite element analysis plot for stress and deformation verification

▼ Simulation of pressure pulsation due to auto-oscillation



Time [sec]



▲ Spherical valve for HPP Herdecke during assembly in the workshop

Service

Valves are exposed to high loads during operation but the years of operation are less critical than the effective number of load changes. Nowadays hydraulic machinery and their valves are subject to an increased number of start/stop cycles due to changes in the grid demands, however their layout and design was calculated for far fewer cycles. Therefore valve maintenance and rehabilitation are becoming even more essential to guarantee both the operational safety and the availability of the entire hydropower plant.

Condition assessments of important components and design improvements can be made in cooperation with customers in a pre-service phase to optimize the rehabilitation and its duration. For example, at the total overhaul of the spherical valves at HPP Herdecke in Germany (DN 3,300 mm/PN 28 bar/170 tons), where all components had to undergo non-destructive testing and documentation. Wear and defective areas were assessed referring to functional safety and rectification measures,

which were discussed and defined with the customer. Following the completion of the overhaul and the valve re-assembly, final tightness and functional tests were immediately performed in the workshop, whereupon a “drop-tight” rating could be reached.

With this valve service our customer can rely on safe and undisturbed operation in the upcoming years.

The global ANDRITZ HYDRO valve fleet covers more than 3,500 installed units. Due to one century of valve experience in combination with constant research and development efforts, every size, pressure rating and technical challenge can be managed individually, be it for new applications or service tasks.

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▲ Spherical valve for HPP Herdecke: completion of tightness testing after service

TECHNICAL DATA

Projects currently under execution:

Cerro del Águila:

3 butterfly valves
Nominal diameter: 3,150 mm
Design pressure: 36 bar

Nant de Drance:

2 butterfly valves
Nominal diameter: 6,000 mm
Design pressure: 10 bar

Upper Tamakoshi:

1 spherical valve
Nominal diameter: 2,500 mm
Design pressure: 90 bar

Teesta Urja:

6 spherical valves
Nominal diameter: 1,900 mm
Design pressure: 89.3 bar



▲ Xekaman 3 hydropower plant

Vietnam

The rising country in Southeast Asia

Located between India and China, Vietnam is a booming country in the exposed area of Indochina.

Vietnam has a fast growing population of about 90 million people who live mainly along the 3,400 km long coast line. In the mountainous area, towards the borders with Laos and China, we find ethnic minorities. The country has a history of more than 2,100 years, but in the 19th century Vietnam was integrated into French Indochina and so had its first contact with Europe.

Starting from scratch in the early 1970s the economy of the country is now taking off at enormous speed. In 1975 only 10% of the population had access to

▼ Ha Long bay in northern Vietnam



electricity. Nowadays Vietnam has an electrification rate of 97%. The country is focusing on renewable energy, mainly hydropower, which contributes 45% of the total electricity production. The electricity masterplan intends to deliver more than 20,000 MW in Vietnam and in the border area of Laos in the upcoming years. Besides electricity several other exporting industries, like pepper (world no. 1), coffee (world no. 2), and seafood as well as high-tech products, are gaining international importance.

ANDRITZ HYDRO representative office

For more than 15 years ANDRITZ HYDRO has run a representative office in the Vietnamese capital of Hanoi. The office sells equipment for new hydropower plants, manages project execution and gives support to clients for spare parts and services.

Customer Day

Due to the request for stable electricity supply and integration into an Indochina grid, Vietnam is developing the construction of pump storage power plants. Dedicated to these activities, ANDRITZ HYDRO organized a Customer Day in

October 2013. About 60 participants from the Ministry of Industry and Trade, engineering companies, private customers and financial institutions, like the World Bank and the ADB, attended this successful event.

Current projects

ANDRITZ HYDRO Vietnam is currently executing the following projects: HPP Chi Khe (2 x 20.5 MW, bulb), HPP Hang Dong A (2 x 8 MW, Pelton), HPP Nam Can 2 (2 x 10 MW, Pelton), HPP Nam Chim 1A (2 x 5 MW, Francis), HPP Nam He (2 x 8 MW, Francis), HPP Ngoi Phat (3 x 24 MW, Francis), HPP Tra Xom (2 x 10 MW, Pelton), HPP Thuong Kon Tum (2 x 110 MW, Pelton) and HPP Xekaman 1 (2 x 142 MW, Francis). Meanwhile, the projects HPP Suoi Lum (2 x 10 MW, Pelton) and HPP Xekaman 3 (2 x 125 MW) successfully started operations in 2013.

HPP Chi Khe

At the end of 2013 ANDRITZ HYDRO received an order from AGRIMECO for the supply, supervision and the commissioning of electromechanical equipment for the Vietnamese Chi Khe hydropower plant. Equipped with two bulb



▲ Contract signing of HPP Xekaman 1

turbine units HPP Chi Khe will have an installed capacity of 41 MW.

The hydropower plant is located on the Ca River, approximately 150 km south of Hanoi. The project is being developed by Agrita-Nghe Tinh Power JSC (consisting of AGRIMECO and Tan Tao Group). ANDRITZ HYDRO will supply electromechanical equipment, including two bulb turbines, horizontal generators, mechanical auxiliaries, electric power systems and automation. The energy generated by HPP Chi Khe will be supplied to the national grid via a new transmission line. The project is scheduled to begin commercial operation in December 2015.

HPP Xekaman 1

In December 2013 ANDRITZ HYDRO signed a contract for the delivery of the complete electromechanical equipment for the Xekaman 1 hydropower plant (Laos PDR). Following on from the finalization of the Xekaman 3 project, this was the second order for ANDRITZ HYDRO from Song Da Construction Corp of Vietnam and Viet-Lao Power Investment and Development Joint Stock Company within a year. HPP Xekaman 1 is the second hydropower project in Laos PDR backed by the Viet-Lao Power Investment and Development Joint Stock Company.



▲ Contract signing of Chi Khe project

The scope of supply includes two Francis turbine generator sets, the governing system, automation and protection system and auxiliary systems as well as the complete switchyard. Song Da Construction Corp of Vietnam, the main shareholder of Viet-Lao Power Investment and Development Joint Stock Company and EPC contractor, will take care of local transport and erection under the supervision of ANDRITZ HYDRO.

The majority of the generated electricity will be exported to Vietnam, though a small proportion will be supplied for domestic consumption in the vicinity of the project site. The finalization of the HPP Xekaman 1 project is planned for 2016.

ANDRITZ HYDRO Vietnam holds the technical competence for tailor-made solutions to serve its clients in this challenging market by supplying electro-

mechanical equipment for hydropower plants in all sizes, from 1 MW to 1,000 MW. We consider Vietnam to be one of the most vital and prospective hydropower markets today.

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TECHNICAL DATA

Chi Khe:

Output: 2 x 20.5 MW
Head (max.): 11.28 m
Speed: 100 rpm
Runner diameter: 5,500 mm

Xekaman 1:

Output: 2 x 145 MW
Head (max.): 105.4 m
Speed: 187.5 rpm
Runner diameter: 4,128 mm



A country with great potential for hydropower modernization

▲ ANDRITZ HYDRO Inepar office in Araçatuba

Brazil holds an enormous potential for hydroelectric power generation and thus presents many infrastructure challenges for the coming years.

At present, a large number of Brazilian hydropower plants have been operating for more than 40 years. Many of them demand upgrades, offering opportunities for modernization and rehabilitation of equipment.

ANDRITZ HYDRO branch offices

Currently, ANDRITZ HYDRO runs three branch offices in Brazil, of which the latest one has recently been inaugurated. The new branch office is located in Araçatuba, in the northwest of São Paulo state.

It focuses on the execution of Service and Rehab works, covering tasks like

the refurbishment and reparation of turbines, generators and hydromechanical equipment, as well as electrical and mechanical auxiliary services. The projects cover a wide field of maintenance activities, from small interventions up to the exchange of some components or even the complete substitution of the equipment. The services aim for an increase in productivity and improved cost-benefit ratios, reliability and/or output capacity, therefore improving the return on the invested capital.

The new facility is located in a strategic region. Within a radius of approximately 300 km from Araçatuba you can find more than 100 large turbine-generator units, offering significant potential. Some of the most important hydropower plants in the region are HPP Ilha Solteira, HPP Três Irmãos, HPP Jupuí, HPP Porto Primavera, HPP

Nova Avanhandava, HPP Água Vermelha, HPP Promissão, HPP Ibitinga, HPP Bariri, HPP Barra Bonita, HPP Rosana, HPP Taquaruçu, HPP Capivara, HPP Chavantes, HPP Estreito and HPP Marimbondo.

The branch office is staffed with skilled and experienced experts from companies which used to provide the same scope of service. Due to the high number of hydropower plants, the region also offers a workforce with plenty of relevant skills.

The new ANDRITZ HYDRO branch office will enable better integration of field services into the company structure in areas such as engineering, project management, procurement, quality control and others. This integration will ensure even minor field maintenance jobs maintain quality and will also boost the execution of large rehabilitation and modernization projects with a 100% ANDRITZ HYDRO team, consequently enabling the desired quality, agility and speed in rehabilitation projects.

Current projects

In the past few years ANDRITZ HYDRO has received many modernization contracts in Brazil. Some of these Service and Rehab projects involving field service activities with expected execution in 2014 are as follows:

ANDRITZ HYDRO was awarded a contract for the rehabilitation of the generator and 39 MW Kaplan turbine at Barra Bonita 1 hydropower station within 10 months (Hydro News 24).

In mid-2013 Vigario signed a contract with ANDRITZ HYDRO for the modernization of four 20 MW pumps at the eponymous hydropower station in Brazil.

At the Mogi Guaçu hydropower project ANDRITZ HYDRO will supply a small repair service on the generator and a 3.5 MW Kaplan turbine.

In January 2012 ANDRITZ HYDRO received an order from ENDESA for the



▲ Cavitation service repair in HPP Taquaruçu



▲ Winding assembly in HPP Cachoeira Dourada

modernization of three generators at HPP Cachoeira Dourada (Hydro News 23).

Furthermore ANDRITZ HYDRO received a contract for the cavitation service repair of various hydropower plants from DUKE Energy. The contract includes the projects HPP Canoas 1 & 2, HPP Jurumirim, HPP Chavantes, HPP Capivara,

HPP Salto Grande, HPP Taquaruçu and HPP Rosana.

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TECHNICAL DATA

HPP Barra Bonita:

Output: 39 MW

HPP Vigário:

Output: 4 x 20 MW

HPP Mogi Guaçu:

Output: 3.5 MW

HPP Cachoeira Dourada:

Output: 3 x 93 MVA

▼ Services on Kaplan runner at Mogi Guaçu project



Olivone

Replacement of main components in a hydropower station in Switzerland



▲ Machine hall



▲ Centrale to be replaced by Powerplant



▲ Contract signing

ANDRITZ HYDRO was recently awarded the contract for the complete replacement of the hydroelectrical production units of Olivone power station by Officine Idroelettriche di Blenio SA (OFIBLE).

The contract comprises hydraulic model tests as well as the supply, installation supervision, and commissioning of the following equipment:

- Two horizontal 4-jet double Pelton turbines
- Two turbine governors
- Four spherical valves including hydraulic control
- Two oil pressure systems for the hydraulic control and the spherical valves
- Two horizontal synchronous generators with cooling system
- Four generator bearings with lifting device and oil cooling system
- Two brushless excitation systems
- Two voltage regulators
- Two 12 kV bus ducts.

Blenio Kraftwerke AG uses the hydropower of the river Brenno and its tribu-

aries. Their hydropower stations were constructed between 1956 and 1963 and include the power stations of Luzzone, Olivone and Biasca, the storage basins of Carassina, Luzzone and Malvaglia, as well as numerous forebays in the catchment area. Luzzone dam was increased by 17 m from 1995 to 1998, which increased the storage capacity from 87 to 107 million m³.

Over the course of the project, ANDRITZ HYDRO will replace the two existing horizontal 2-jet Pelton turbines at the Olivone hydropower station by two more powerful 4-jet double Pelton turbines optimized for the present hydraulic conditions. The new, low-loss generators are perfectly adapted to the higher turbine capacity and speed; the new machinery is designed for primary and secondary control.

By upgrading HPP Olivone, OFIBLE is making a contribution to covering the increasing demand for peak energy and operating reserve for compensating unpredictable wind and solar energy.

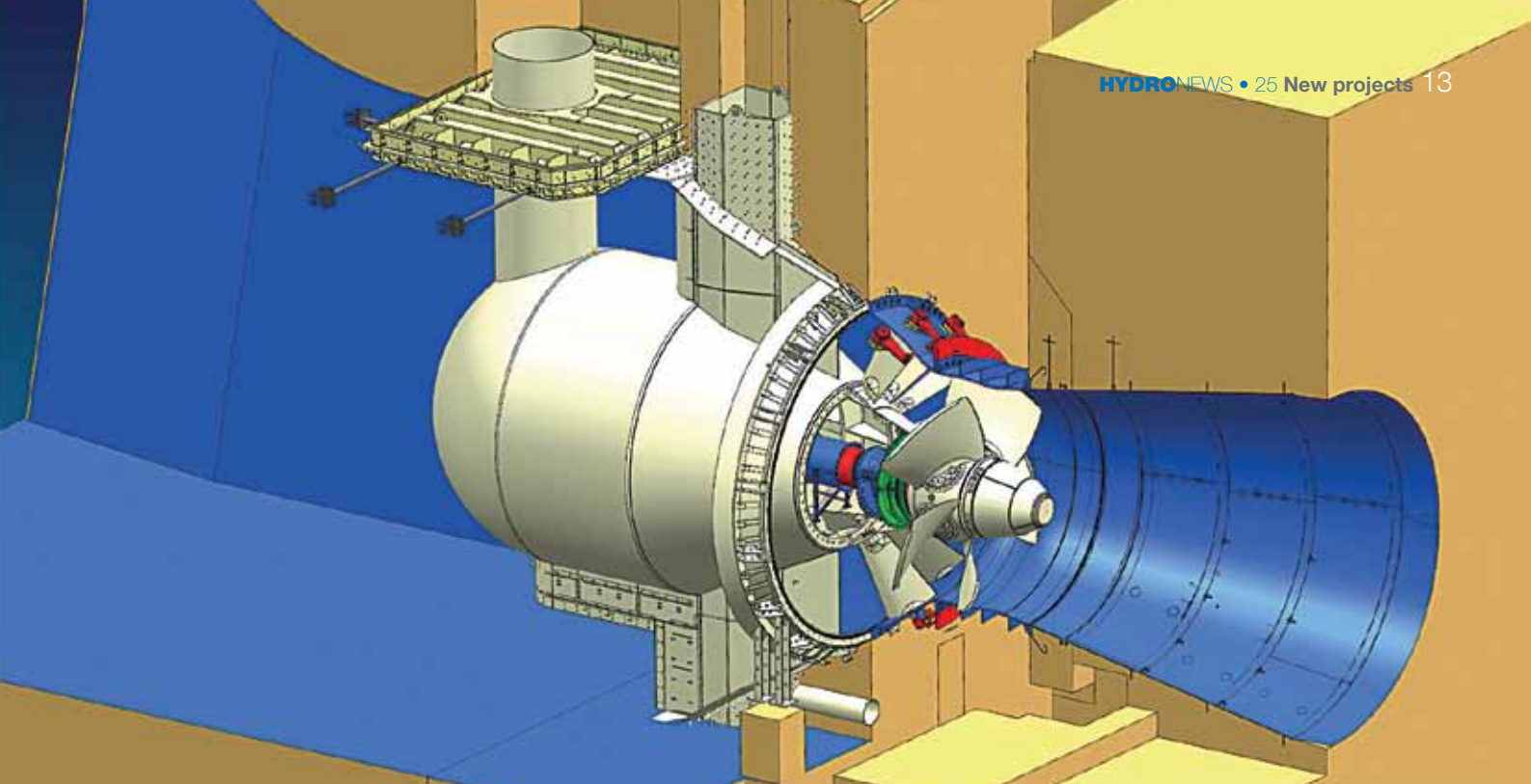
The dismantling of the existing units are scheduled for January 2016 (unit 1) and January 2017 (unit 2). After a conversion period of around one year, the replaced units are due to start commercial operation in February 2017 (unit 1) and February 2018 (unit 2).

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TECHNICAL DATA

Output: 60.5 MW/67 MVA
Voltage: 12 kV
Head: 582 m
Speed: 428.6 rpm
Runner diameter: 2,709 mm





▲ Schematic drawing of turbine

Nam Lik 1

New Order for a hydropower plant in the Lao People's Democratic Republic

In June 2013 ANDRITZ HYDRO signed a contract with POSCO Engineering and Construction Company Ltd. (POSCO E&C) for the supply, erection and commissioning of the electromechanical equipment for the Nam Lik 1 hydropower plant in the Lao People's Democratic Republic.

HPP Nam Lik 1 is located 90 km north of Vientiane in the province of Vientiane, Laos, downstream from the Nam Lik 1-2 dam. It was designed to regulate the outflow within the river as an environmental protection measure.

ANDRITZ HYDRO's scope of supply includes two 32.25 MW bulb turbines, horizontal generators, mechanical auxiliaries, electric power systems, gates and additional equipment.

The Nam Lik 1 hydropower project is being developed by a four-member consortium, consisting of Nam Lik 1 Power Company Ltd, PTT International

Company Ltd, Hydro Engineering Company Ltd. and POSCO Engineering and Construction Company Ltd. (POSCO E&C). ANDRITZ HYDRO's client, POSCO E&C, is the appointed EPC contractor as well.

An important aspect of the final decisions to award ANDRITZ HYDRO the contract was its global leadership in bulb turbine technology, technical competence, the high quality of equipment and services supplied, and especially all running reference projects in Laos (HPP Huay Ho, HPP Nam Theun 2, HPP Theun Hinboun, HPP Theun Hinboun Extension, HPP Xekaman 3, etc.).

The electricity, generated by HPP Nam Lik 1, will be supplied directly into the national grid for domestic use. It will make an important contribution to the security of electricity supply and opens up the future potential to boost economic growth in Vientiane province. The two bulb turbine units of HPP Nam Lik 1 will have a total installed capacity of

64.5 MW and will meet the electrical energy demands of approximately 200,000 people in Laos from renewable resources.

HPP Nam Lik 1 will be put into operation in 2016.

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TECHNICAL DATA

Output: 2 x 32.25 MW/39.3 MVA

Head: 22.31 m

Speed: 166.7 rpm

Runner diameter: 4,500 mm



Muskrat Falls

Powerhouse and hydromechanical spillway equipment for Canada



© Nalcor Energy

▲ Conceptual Illustration of Muskrat Falls hydropower plant

In December 2013 Nalcor Energy awarded a contract to ANDRITZ HYDRO for the supply and installation of the Muskrat Falls powerhouse and spillway hydromechanical equipment.

The Muskrat Falls hydroelectric development project includes a generating station, located on the lower Churchill River, approx. 35 km west of Canadian Happy Valley-Goose Bay in Labrador, as well as more than 1,500 km of transmission lines and associated infrastructure.

The Churchill River is a significant source of renewable, clean electrical energy; however, the potential of this river has not been fully developed yet. The existing 5,428 MW Churchill Falls generating station, which began pro-

ducing power in 1971, uses about 65% of the river's generating capacity. The remaining 35% are located at two sites on the lower part of the river: Muskrat Falls and Gull Island.

ANDRITZ HYDRO's scope of supply for the Muskrat Falls project includes all mechanical, electrical and other associated hydromechanical equipment, required for the spillway, the intake and the draft tube. The equipment and facilities consist of fixed wheeled gates, bulkhead gates, trashracks, stoplogs, fixed and mobile wire rope hoists, hoist towers and buildings, trash cleaner and selective electrical and mechanical auxiliaries. The scope of this contract is one of the largest in the world, with deliveries totaling 9,000 tons. Due to this large volume, the major fabricated components will be supplied by global

ANDRITZ HYDRO locations in Canada, Europe and China. ANDRITZ HYDRO is committed to achieving all of Nalcor Energy's objectives regarding safety, environment, schedule compliance and quality of materials and workmanship. To that end, quality surveillance activity is reinforced at all manufacturing locations.

Fabrication and delivery will start in early 2014 with the first stage embedded items followed by staged deliveries. This is the second contract for ANDRITZ HYDRO with Nalcor Energy, having earlier been awarded the order to supply four 206 MW Kaplan turbines and generators (Hydro News 23).

ANDRITZ HYDRO is pleased to have secured this contract, which represents a significant step in broadening its portfolio of products on the Canadian market.

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TECHNICAL DATA

Total weight: 9,000 tons

8 draft tube exits

5 spillway bays:

Roller gates: 10.5 m x 23 m

12 intake channels:

Roller gates: 6.5 m x 20 m



Lysebotn II

Replacement of an existing Norwegian hydropower plant

▲ Existing switchyard at HPP Lysebotn

In December 2013 ANDRITZ HYDRO signed a contract with Lyse Produksjon AS for the construction of the new Lysebotn II hydropower station in Norway.

HPP Lysebotn II is located close to Stavanger in southwestern Norway, right at the innermost end of the Lysefjorden. This popular tourist area is well known for outdoor activities, the Lysefjorden itself and impressive rock formations such as Preikestolen, which offers a vertical drop of some 600 m.

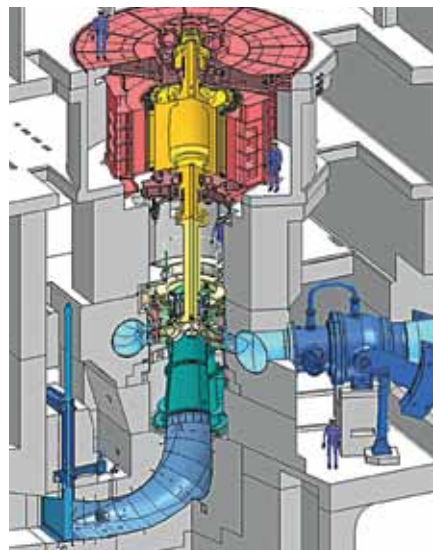
HPP Lysebotn II will replace the existing Lysebotn hydropower plant. The project consists of construction, delivery and installation of a new hydropower plant, with an estimated average annual electricity production of 1.5 TWh. This implies an increased annual energy production of approximately 180 GWh (14%). HPP Lysebotn II will be built as an underground power station with new tailrace tunnel and headrace tunnel leading upwards to the plant's two alternative intake reservoirs, Strandvatn and Lyngsvatn.

Power will be generated by two identical units with 185 MW high-pressure

Francis turbines. Because of the favorable reservoir situation, the generating units are designed for frequent starts/stops to optimize profits in the electricity production.

Changing water levels and the choice of reservoir bring varying gross heads from 686 m to 618 m. ANDRITZ HYDRO will deliver these extreme high head Francis and generator units as well as the hydraulic steelworks and the steel linings.

▼ Schematic model of the turbine and mechanical components



Furthermore, ANDRITZ HYDRO will perform the model testing of the Francis turbines.

ANDRITZ HYDRO won the contract on the back of a successful project record, a high efficiency level and experience, especially in this high-head market segment. The start-up of production is planned for spring 2018.

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TECHNICAL DATA

Output: 2 x 185 MW/2 x 215 MVA
Voltage: 13.8 kV
Head: 665 m
Speed: 600 rpm
Runner diameter: 2,550 mm



Peusangan 1 & 2

First large hydro project in Aceh, Indonesia

▲ Lake Laut Tawar

In August 2013 ANDRITZ HYDRO signed a contract with the state-owned utility PT. Perusahaan Listrik Negara (Persero) (PLN) for electromechanical works at hydropower plants Peusangan 1 & 2.

The project is located in the central region of Aceh province in Indonesia's northwestern Sumatra, approximately 280 km southeast of Banda Aceh. HPP's Peusangan 1 and Peusangan 2 are run-of-river power plants at the eponymous river adjacent to the Lake Laut Tawar.

The hydropower project is jointly financed by the Japan International Cooperation Agency (JICA) and the government of Indonesia. Nippon Koei Co., Ltd. of Japan is the consultant appointed to oversee the implementation of this project.

ANDRITZ HYDRO's scope of supply for HPP's Peusangan 1 and Peusangan 2 consists of vertical Francis turbines, generators, transformers, 150 kV switchyards, EOT cranes and comprehensive

▼ Takengon town



▲ Contract signing team

mechanical and electrical auxiliaries of the plant.

The hydropower potential of Indonesia is estimated to be 75 GW. To date, PLN has utilized approximately 3.9 GW of which 2.3 GW were supplied by ANDRITZ HYDRO.

HPP's Peusangan 1 and Peusangan 2 will be the first larger hydropower plants in this region with an expected annual output of 327 GWh. Once finished, they will play an important role in providing more stable and sustainable electricity supporting the development of local infrastructure and improving quality of life of the local population.

ANDRITZ HYDRO is proud that the combination of global leading-edge expertise, local contracting and execution know-how has made us the preferred partner and market leader for hydro-power projects in Indonesia.

ANDRITZ HYDRO prevailed during challenging contract negotiations against two other international competitors. It is a big success for ANDRITZ HYDRO and

strengthens our position as market leader in Indonesia. It is the first new large hydro project with PLN since HPP Musi in 2004, for which ANDRITZ HYDRO delivered turbines and auxiliary equipment. The project completion is planned for April 2017.

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TECHNICAL DATA

Peusangan 1:

Output: 2 x 23.1 MW/26.5 MVA
Voltage: 11 kV
Head: 205.3 m
Speed: 600 rpm
Runner diameter: 1,200 mm

Peusangan 2:

Output: 2 x 22 MW/25.3 MVA
Voltage: 11 kV
Head: 187.7 m
Speed: 600 rpm
Runner diameter: 1,200 mm



Revin

Generator rehabilitation project in France



▲ Inside the cavern

In October 2013 ANDRITZ HYDRO signed a contract with Électricité de France (EDF), the main energy producer in France, for the electrical rehabilitation of the motor-generators in HPP Revin, one of its largest hydropower plants.

ANDRITZ HYDRO will supply engineering, manufacturing, delivery and erection of two new stators as well as the refurbishment of two existing stators.

HPP Revin, commissioned in 1975, is located in the northeastern part of France, in the municipality of Saint Nicolas – Les Mazures, a few kilometers from the Belgian border. It is a very strategic pumped storage hydropower plant, the third largest in France (800 MW) and one of the oldest hydro-power plants with reversible Francis turbines.

The Revin project is the first generator rehabilitation project for ANDRITZ HYDRO in France since HPP Chastang in 2000. This newly won project is an opportunity for ANDRITZ HYDRO to come back to the French generator rehabilitation market being the home market of a powerful competitor.

Due to very tough specifications of EDF and the overall dimensions of the stator, the project is a great challenge for ANDRITZ HYDRO. All erection works, including stacking and winding, have to be performed locally in the cavern and EDF required to arrange the maximum available number of French-speaking personnel on site.

ANDRITZ HYDRO's scope of supply includes two new stators for units 1 & 2, one new stator frame, one set of new pole windings and the refurbishment of



▲ Unit 2 of HPP Revin

the existing sets, new brake tracks, refurbishment of pony motors and refurbishment of stators for units 3 & 4.

The on-site refurbishment works will start with unit 3 in March 2015, followed by one each year. The rehabilitation of HPP Revin is expected to be completed in September 2018.

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TECHNICAL DATA

Output: 4 x 200 MVA
Voltage: 13 kV
Head: 240 m
Speed: 300 rpm
Stator inner diameter: 6,900 mm





Dariali

Next important step in the hydropower market of Georgia

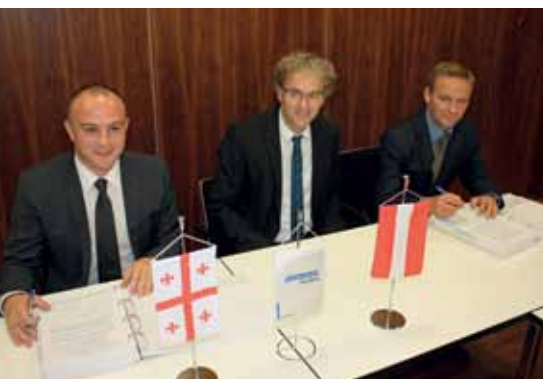
▲ Contract signing team

In October 2013 ANDRITZ HYDRO signed a contract with DARIALI JSC for building the Dariali hydropower plant. This agreement constitutes a significant milestone in entering into the Georgian hydropower market.

Georgia is designated as one of the most attractive future markets for hydropower. This is based on three facts: the rapid economic growth and general economic liberalization, the proximity of the Turkish electricity market and the fact, that only 25% of the feasible technical potential of about 30 TWh per year has been developed.

To use this potential, the special purpose company DARIALI JSC was

▼ Mr. Zurab Alavidze (General Director DARIALI ENERGY JSC.), Mr. Wolfgang Köhldorfer and Mr. Josef Grininger during contract signing



founded by Georgian based construction company Peri Ltd., the state-owned development institution the JSC Georgian Energy Development Fund (GEDF) and the US based tunnel drilling machine producer Robbins.

HPP Dariali is located at an altitude of 2,400 m at the Tergi River in Qazbegi district, near the city of Stepantsminda in northern Georgia.

The landscape is characterized by high mountains and deep valleys, which is typical for the Caucasus region. The capacity of the project is 108 MW and the annual electrical energy generation is estimated at 500 GWh. Around 70% of the generated electricity will be produced during summer months (May – October).

The Dariali hydropower plant is constructed with a 2 km open channel and a 5.6 km headrace tunnel (diameter 5.5 m) to supply water flow to the powerhouse on the right bank of the river. The scope of supply and services consists of engineering, supply of three 37 MW vertical Pelton turbines and three 43 MVA generators including auxiliaries, installation and commissioning. The net head is estimated at 371 m with rated water discharge of 33 m³/sec.

The award-winning and most challenging element of this project is the short duration of only 23 months from the acceptance of the order until hand over of the last unit. This requires top performance in manufacturing, logistics and project management.

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TECHNICAL DATA

Output: 3 x 37 MW/3 x 43 MVA

Voltage: 13.8 kV

Head: 371 m

Speed: 375 rpm

Runner diameter: 2,100 mm



Cethana and Fisher

First major generator refurbishment project in Australia

In July 2013 ANDRITZ HYDRO signed a contract with Hydro Tasmania (Tasmania's premier electrical utility and one of the major hydropower utilities in Australia) for the supply of new generator stators and auxiliary equipment for the hydropower stations Cethana and Fisher.

HPP Cethana is an underground power station, located on the Forth River in Northern Tasmania, Australia. Together with HPP Fisher the two stations are part of the Mersey Forth Power Scheme in Northern Tasmania, though the latter runs as a surface power station on the Fisher River.

The two hydropower stations comprise of one 100 MVA synchronous generator, commissioned 1971 in HPP Cethana, and one 48 MVA synchronous generator in HPP Fisher, commissioned in 1973. Being more than 40 years old they are in need of rehabilitation, upgrade and modernization.

The refurbishment contract includes completely new stators for the units, new air baffles and stator sole plates interfacing with the existing generator.

A comprehensive design review of the complete generator will give a full analysis of the components that can be retained, based on their condition and suitability for their operational life span.

Some challenges of the project are the access and crane restrictions at HPP Cethana, which require a split stator design. The jointing of the three stator parts will be performed in situ on a specially designed stand-jacking system, located above the rotor. Once the winding connections are completed, the stator parts will be lowered by hydraulic jacks.

The delivery of the stator is scheduled for the end of 2014 in order to allow the site works to be started in the beginning of 2015. This project represents another important contract with Hydro Tasmania as ANDRITZ HYDRO is also currently executing various other contracts for modernization and replacement of Kaplan turbines and control systems in a number of their power stations.

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▲ Entrance to the power station tunnel at HPP Cethana



▲ Hydropower station Fisher

TECHNICAL DATA

Cethana:

Output: 1 x 113 MVA

Voltage: 13.8 kV

Speed: 200 rpm

Fisher:

Output: 1 x 48 MVA

Voltage: 11 kV

Speed: 500 rpm

▼ View on the generator at HPP Fisher



Shardarinskaya

First major contract for ANDRITZ HYDRO in Kazakhstan

In December 2013 ANDRITZ HYDRO signed a contract with JSC "Shardarinskaya HPP", subsidiary of the state-owned Kazakh utility company Samruk Energy, to upgrade the electromechanical equipment at the Shardarinskaya hydropower plant, which was originally commissioned in 1967.

HPP Shardarinskaya is located on the Syr-Darya River in southern Kazakhstan close to the border of Uzbekistan and Kyrgyzstan, where the mountains fade into the wide planes around the Aral Sea. The Shardara reservoir covers an area of 900 km² with a total storage volume of 5.2 km³.

The Shardara hydropower system is of utmost importance to secure stable power supplies to the south of Kazakhstan and it is vital for the irrigation of the same area. In December 2012, a loan agreement was signed between JSC Shardarinskaya and the European Bank for Reconstruction and Development (EBRD) to finance the project. As a result the relevant works were tendered in a two-stage bidding process. After a technical and commercial clarification

meeting ANDRITZ HYDRO won the project in the second stage. In December 2013 the contract came into force.

ANDRITZ HYDRO will replace four Kaplan turbines and extend the runner diameter from 5 m to 5.3 m. The power output will be increased by around 20% from the current 26 MW to 31.5 MW per unit. Furthermore, the order includes the supply of new generators and new equipment for automation, control and protection as well as the replacement of the entire electrical power system and other elements of the auxiliary installations within the powerhouse.

This is the first major contract in Central Asia, a region with great expectations of further business opportunities in the near future, and a milestone for ANDRITZ HYDRO.

During Soviet times, large hydropower plants were built in Central Asia, which now need rehabilitation. The positive economic development of the region during recent years has also contributed to making rehabilitation financially feasible.



▲ Contract signing

The challenge for ANDRITZ HYDRO will be to implement an efficient local set up within a short period of time. Site mobilization is scheduled for October 2014 and dismantling of the first unit will start within the year after contract signature. Completion of the refurbished hydropower plant is scheduled for June 2017.

This project will help clients and business partners in the region to recognize the reliability of the ANDRITZ HYDRO equipment and services.

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TECHNICAL DATA

Output: 4 x 31.5 MW/35 MVA

Voltage: 10.5 kV

Head: 22 m

Speed: 115.4 rpm

Runner diameter: 5,300 mm

▼ Powerhouse





▲ Aerial view of hydropower plant



▲ Powerhouse

Safe Harbor

First hydropower project on the Susquehanna River in the USA

In September 2013, Safe Harbor Water Power Corp. assigned a contract to ANDRITZ HYDRO for the refurbishment of two generators, which are greater than 80 years old, at the Safe Harbor hydropower plant in Pennsylvania, USA.

Power generated from the Safe Harbor project is used primarily to meet peak demands for electricity in the grid and to operate the railroad system in the area. Continuous operation occurs when the river flow equals or exceeds the plant's maximum water-handling capacity of 3,115 m³/s.

HPP Safe Harbor is located on the Susquehanna River, which starts in Lake Otsego, New York, and flows through the entire state of Pennsylvania into the Atlantic Ocean via the Chesapeake Bay in Maryland. 448 km in length, the Susquehanna River is one of the largest rivers in the northeastern US.

Throughout history, the Safe Harbor area has always played an important role in the lives of those living nearby. Many intriguing reminders have been left of these early inhabitants. Petroglyphs (inscriptions and carvings) are still visible on the Big and Little Indian

rocks in the river, about half a mile below the Safe Harbor dam.

This is the first large scale hydro service contract for ANDRITZ HYDRO on the Susquehanna River System. The generator modernizations will be completed on two of the 14 units in the powerhouse. ANDRITZ HYDRO will supply new generator stator frames, cores and windings, new rotor spiders and rims, new packing boxes, refurbished rotor poles and bearings, complete unit disassembly, installation and the reassembly.

Furthermore, ANDRITZ HYDRO is the original equipment manufacturer of these units. ANDRITZ HYDRO Canada provides the best value for the customer given their knowledge of the original design. Safe Harbor Water Power Corp's goal is to extend the life of unit 3 and unit 7. ANDRITZ HYDRO will assure a preeminent refurbishment.

The award of this project shall also give a substantial reference to ANDRITZ HYDRO for future work on the Susquehanna River System.

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TECHNICAL DATA

Output: 2 x 36 MVA
Voltage: 13.8 kV
Speed: 109 rpm
Stator diameter: 7,925 mm



Kpong

Important rehabilitation contract in Ghana

▲ Machine hall with four generating units

In July 2013, after an international competitive bidding process, ANDRITZ HYDRO signed a contract with Volta River Authority, a 100% state-owned public entity of Ghana, for the Kpong retrofit project. Kpong is the second largest hydroelectric dam built in Ghana, and it covers about 12% of the country's electricity production.

The existing power generation system in Ghana is dominated by two stations, HPP Akosombo (912 MW) and HPP Kpong (160 MW), both located on the Volta River below Lake Volta, 80 km from the city of Accra. The tailrace of HPP Akosombo forms the head pond for HPP Kpong. Together both hydropower plants supply about 70% of the national electricity.

The contract covers the modernization of the entire hydropower station. ANDRITZ HYDRO will carry out the design, manufacturing, supply, erection, and testing as well the commissioning for the retrofit of electrical and mechanical equipment at HPP Kpong. This comprises generators and excitation equipment, turbine and auxiliary equipment, governors, generator transformer, powerhouse station service facilities as well as hydromechanical equipment.

The main objective for the rehabilitation of HPP Kpong is to ensure continuous supply, improve service delivery and increase sustainable power generation with stabilized energy security. The old equipment and auxiliary parts will be upgraded and replaced with modern equipment to enhance efficiency and ensure a prolonged life for the plant. The rehabilitated turbines will be operated as base-load units. With upgraded governors it will be possible to increase their role in frequency control on the interconnected grid.

Before the contract was signed, the plant was thoroughly inspected by ANDRITZ HYDRO specialists to ensure smooth and timely execution of the key elements. Assessments of the turbines showed only marginal improvement could be achieved here, so greater emphasis was placed on the generators. As a result the stators will be recored and the rotor poles will be completely replaced.

During the execution phase the units will be shut down one by one and put back into operation after having been dismantled, rehabilitated, re-assembled and commissioned. The project will be completed within 43 months.



▲ Kpong hydropower plant



▲ Contract signing

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TECHNICAL DATA

Output (max.): 4 x 46.23 MW
Voltage: 13.8 kV
Head: 11.75 m
Speed: 62.5 rpm
Runner diameter: 8,238 mm





Promising Results

From tidal turbine testing at EMEC in Scotland

Delivering reliable and sustainable technology for the generation of energy from tidal currents is the primary objective of ANDRITZ HYDRO Hammerfest. Thus, in proving the functionality of the demonstrator device, the tidal turbine HS1000 at the European Marine Energy Centre (EMEC) is a major milestone in realizing the commercial potential of this technology.

The first machine of its kind, the HS1000, represents the forerunner of the commercial tidal turbines that will be installed in the near future in order to harness energy from strong water currents generated by the lunar tides (Hydro News 22). This machine was installed at EMEC's tidal test site in December 2011 and the installation was carried out in three stages, using a special offshore construction vessel in a 32-hour operation in the middle of

winter. With measured wind speeds exceeding 100 knots at times, meticulous planning was required to take advantage of each weather window as it was presented.

During the first 12 months of operation, the turbine underwent extensive testing, with particular focus on comparing measured loads and performances with figures calculated during the project design phase. Results were very positive, with the turbine performing as expected and loading remaining within the design envelope. Specifically, it was clear that the turbine could export in excess of 3 GWh to the grid annually.

Following this initial 12-month period, the turbine was retrieved for inspection and maintenance. The machine was found to be in excellent condition, with only some minor modifications being made on internal components. These

maintenance activities took place using local workshops and labor, and the re-installation was carried out utilizing local vessels, operated by various companies based in Orkney. In its own right, this maintenance operation has provided extremely valuable experience and essential knowledge required for commercialization.

Since re-installation in late August 2013 the turbine has been operating continuously in a bid to prove its reliability. The original target was to operate continuously for 6 months, and export at least 1 GWh to the grid. At the time of writing, energy export is more than 1.2 GWh firmly surpassing the performance targets deemed necessary for the commercial operation of this technology.

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▼ Mobilisation at EMEC port



▲ Transport to test site



▲ Installation at EMEC site

TECHNICAL DATA

Type: HS1000
Output: > 1 MW
Rotational speed: 10.2 rpm
Rotor diameter: 21 m





▲ View of Bajina Bašta hydropower station



▲ Handing over ceremony

Bajina Bašta

Final taking over of last unit in Serbia

In November 2007 Serbia's state-owned hydropower provider EPS (Electric Power Industry of Serbia) awarded a contract to ANDRITZ HYDRO for the refurbishment of the run-of-river power station Bajina Bašta. The investment was made by Drinsko Limske power plants Bajina Bašta (DLBB), the owner of the hydro power plant, in cooperation with the Germany-based KfW Bank. The refurbishment of the 4 x 105.6 MW hydropower station was successfully completed recently.

HPP Bajina Bašta is located on the Drina River, on the border between Bosnia and Serbia. With 420 MVA it is the second largest hydropower plant in Serbia and was originally commissioned in 1966. A pumped storage plant on the same location increases the total output to approximately 1,000 MW. The power plant covers approximately 8% of the country's total electricity demand.

HPP Bajina Bašta refurbishment project consists of design, uprating, manufacturing, transport, installation and commissioning of four 105.6 MW Francis turbines, generators, control and excitation systems, main transformers, medi-

um voltage and outdoor high voltage switchgear.

The refurbishment of the fourth and last unit of HPP Bajina Bašta brought this important project to a successful end. Despite many difficulties that occurred during implementation, like damage during transportation of one of the completely new power transformers, the works were completed on time and to the full satisfaction of DLBB.

After refurbishment the output increased by 13% and the annual energy generation rose by 40 GWh. Two of the four units are also operating back-to-back with two 315 MVA pump storage units. As a result of the refurbishment works, the vibration behavior of the original units was also significantly improved.

In October 2013, the official handing-over ceremony of the fourth unit to the owner took place. The Serbian Prime Minister Mr. Ivica Dačić, the German Ambassador in Serbia, government officials of the Serbian State and senior management members of EPS/DLBB, as well as journalists were amongst the attendees. With the successful

and timely completion of this project ANDRITZ HYDRO has again proven its leading position as a supplier of equipment for hydroelectric plants.

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TECHNICAL DATA

Output: 4 x 105.6 MW/109.5 MVA

Voltage: 15.56 kV

Head: 66.5 m

Speed: 136.4 rpm

Runner diameter: 4,336 mm

Step-up transformers:

Output: 4 x 112 MVA

Voltage: 15.56 kV/242 kV



Iovskaya

First unit successfully handed over in Russia

In July 2011 ANDRITZ HYDRO signed a contract with Kolsky Branch of JSC TGK-1 (Regional Utility - Territorialnaya Generiruyushchaya Kompaniya No 1) for the modernization of the Iovskaya hydropower plant in Russia (Hydro News 23).

HPP Iovskaya is part of the Nivskiy Cascade in the Murmansk oblast and is located on the edge of the Arctic Circle. The reservoir spans an area of 5,240 km². It is fed by the Kowda River (Russian: Ковда, Finnish: Koutajoki close to the Finnish border). HPP Iovskaya is the second hydropower plant of the Kovdinsky Cascade and was commissioned in 1960.

ANDRITZ HYDRO's scope of supply includes two double regulated Kaplan turbines with seven runner blades, automation (control, protection, excitation and governor), a new generator winding as well as the renewal of the balance of plant equipment.

In order to improve cavitation behavior, to reduce the tremendous vibrations and to increase the turbine output, the runner diameter of the new turbine needed to be increased from 4,500 mm to 4,600 mm. That all targets were reached could be demonstrated to our client during the first month of operation.

The complexity of the rehabilitation works was challenging, with ANDRITZ HYDRO being responsible as a general contractor on a "turn-key basis". This task required a lot of coordination work between the client, the design institute, the installation company and a number of different ANDRITZ HYDRO locations involved in this project. Another challenge was the remote location of HPP



▲ Unit 1 supplied by ANDRITZ HYDRO

Iovskaya, with harsh and biting climatic conditions.

The first unit was successfully synchronized and the load tests were performed to the full satisfaction of the customer at ambient temperatures of up to -20 °C.

In December 2013, the 72-hour test run of the first unit was successfully finished and the Taking Over Certificate (TOC) was signed by representatives of TGK-1 and ANDRITZ HYDRO in an on-site ceremony.

In January 2014 the official inauguration took place, attended by regional press and local politicians, management of the TGK-1 Kola branch, suppliers and TGK-1 power plant team.

Simultaneously, after 20 years of operation, unit 2 was taken out of service and disassembly work commenced. Hand-over of this second modernized unit is scheduled for September 2014.



▲ Unit 1 and 2 at Iovskaya hydropower plant

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TECHNICAL DATA

Output: 2 x 50 MW
Head: 32 m
Speed: 136.36 rpm
Runner diameter: 4,600 mm



Tatar

Unit 1 & 2 started their commercial operation in a Turkish hydropower plant

▲ View to powerhouse and spillway

In February 2011 ANDRITZ HYDRO was awarded a contract by Darenhes Elektrik Üretimi A.Ş. for the execution of the Tatar dam and hydropower project.

HPP Tatar is located on the Peri Suyu, a tributary of the Euphrates River in eastern Anatolia, a Turkish region. It is a multipurpose project, designed to provide storage for irrigation and an annual power production of 368.74 GWh.

ANDRITZ HYDRO's scope of supply consisted of engineering and design

▼ Lifting of rotor unit 2



▼ Rotor unit 2



works, manufacturing, transport, installation, commissioning and training on turbine, generator and electrical equipment as well as the purveyance of an automation and protection system. In addition a 161 kV switchyard and two feeder stations were part of the contract.

One of the challenges of this project was to achieve commercial operation of the first unit after 23 months followed by the second unit one month later.

The project was managed by a consortium of ANDRITZ HYDRO in Austria (Linz, Weiz and Vienna) and in Turkey. ANDRITZ HYDRO in Linz supplied hydraulic components, such as the turbine and hydraulic governor. Our location in Weiz provided the generator. The ANDRITZ HYDRO headquarter in Vienna took overall responsibility as consortium leader and was also responsible for the supply of the protection, automation and excitation system. ANDRITZ HYDRO Turkey was in charge of the delivery of the 161 kV switchyard and the supply of special components for the generator and turbine. Moreover, ANDRITZ HYDRO Turkey was responsible for the complete execution of the project on site.

The Ministry of Energy and Natural Resources, Enerji ve Tabii Kaynaklar Bakanlığı, approved readiness for commercial operation of unit 2 in November 2013, and one month later for unit 1.

With this project ANDRITZ HYDRO emphasizes once more their competence on the Turkish market.

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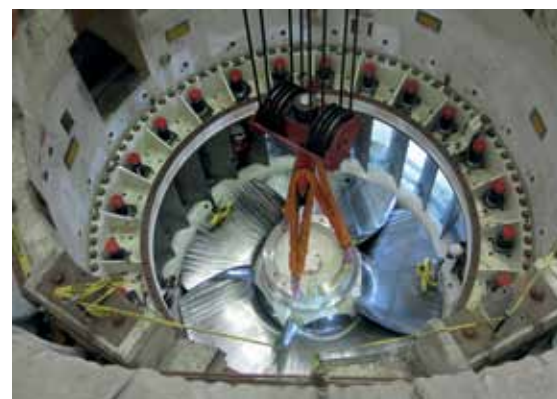
TECHNICAL DATA

Output: 2 x 65.59 MW/76.15 MVA
Voltage: 13.8 kV
Head (max.): 64.50 m
Speed: 166.7 rpm
Runner diameter: 3,500 mm





▲ Spillway



▲ Runner lifting

Paloona

New Kaplan runner for an Australian hydropower plant

In 2011 ANDRITZ HYDRO was awarded a contract by Hydro Tasmania for the rehabilitation and upgrade of two Kaplan units – HPP Paloona and HPP Meadowbank.

Since drinking water is also taken from the river where these machines operate and the units have been in operation for a long time without major outages, the risk of an oil spill tipped the balance for the project in favor of ANDRITZ HYDRO, which offered its environmental friendly oil-free Kaplan runner concept in combination with a high pressure hydraulic power unit.

The scope of ANDRITZ HYDRO consists of model testing for the Hydro Tasmania Kaplan fleet, design and supply of an oil-free Kaplan runner, guide vanes and guide vane regulating mechanism, facing plates, shaft seal, servomotors for the runner and guide vane regulating mechanism, inner top cover, hydraulic power unit and digital turbine governor.

Installation and refurbishment of components which are to be re-used is to be completed by Hydro Tasmania.

Paloona hydropower station is the seventh and last station in the Mersey-Forth scheme, located in the north of Tasmania, an island southeast of Australia. The station was commissioned in 1972 and is equipped with one Kaplan turbine.

Main challenges for the installation are the restricted space at the site, a tough installation schedule to keep the outage time of the power station short, and limited crane capacity, as well as the unknown condition of the existing components. After fingerprint measurements the strip-down of the machine started in September 2013. Since that time, on-site machining as well as refurbishment of re-used components has been completed to fit the new state-of-the-art design.

Hydro Tasmania faced the challenges with very accurate planning of the site activities and involvement of ANDRITZ HYDRO experts in establishing the installation sequence. During installation, ANDRITZ HYDRO is assisting with technical advisory and commissioning services. In December 2013 the re-installation of this unit started and the



▲ Powerhouse

runner was lifted into position. The unit is scheduled to be put back into operation mid-2014. With the successful completion of the HPP Paloona project ANDRITZ HYDRO gains an important reference in the Australian market.

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TECHNICAL DATA

Output: 2 x 31.5 MW/35 MVA

Voltage: 11 kV

Head: 30.78 m

Speed: 187.5 rpm

Runner diameter: 3,930 mm



Austria Wöllbach and Eisenhutgrabenbach



In December 2013 ANDRITZ HYDRO received orders from the private investors Kraftwerk WOELL GmbH for HPP Wöllbach and WKW EISENHUTGRABENBACH GmbH for HPP Eisenhutgrabenbach.

Both hydropower stations are located in the high-alpine area on the tributaries of the upper reaches of the Mur River in the province of Styria, Austria. ANDRITZ HYDRO will supply a 3-nozzle horizontal Pelton turbine, synchronous generator (400 V), the penstock connecting pipe and an inlet valve as well as being responsible for the erection and commissioning for each hydropower station. After deduction of the ecological flow the turbines will only have approx. 5% of the rated unit flow in the winter. These low flows were the reason for selecting 3-nozzle arrangements for the turbines with an applied technology based upon model testing. The run-of-river power stations are equipped with intake rakes of COANDA type and penstocks made of ductile cast iron pipes.

The start-up for each power plant is scheduled for the summer of 2014.

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TECHNICAL DATA

Wöllbach:

Output: 280 kW
Head: 212 m
Speed: 1,000 rpm
Runner diameter: 590 mm

Eisenhutgrabenbach:

Output: 322 kW
Head: 243.2 m
Speed: 1,000 rpm
Runner diameter: 640 mm

Brazil Salto Curucaca



In December 2013, ANDRITZ HYDRO INEPAR DO BRASIL S.A., in consortium with WEG and IESA, was awarded a turnkey contract by Santa Maria Companhia de Papel e Celulose for the electro-mechanical expansion of the 7.34 MW Salto Curucaca hydropower plant. It is located at the Jordão River in the state of Paraná, in southern Brazil.

It will be enlarged with an additional power house, equipped with two

units with a total installed capacity of 29.7 MW. ANDRITZ HYDRO will supply Francis turbines, valves, automation, electrical and mechanical auxiliaries and will also carry out the erection. WEG and IESA will deliver the generators, transformers, hydro mechanical and lifting equipment.

Commercial operation is expected to begin during the second half of 2015.

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TECHNICAL DATA

Output: 2 x 15.31 MW
Head: 57.37 m
Speed: 360 rpm
Runner diameter: 1,800 mm

Norway Govddesåga

In August 2013, SKS Produksjon AS awarded a contract to ANDRITZ HYDRO for the delivery of the complete "Water to Wire" solution to the new Govddesåga hydropower station in Norway.

At present, Norway owns some 900 hydropower plants, which produce an average of 130,000 GWh of electricity each year. It is the sixth largest hydropower producer in the world. The country plans to build several more compact and mini/micro compact units through to 2021 under the green certificate system.

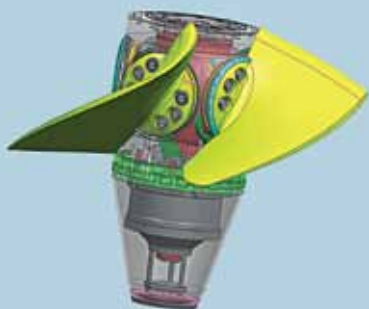
HPP Govddesåga is located in the Beiarn municipality, Norway, in Nordland County, north of Saltfjellet and south of Beiarfjorden. It will utilize the drop of height between Govddesåga at 546.5 m above sea level and Arstaddalsmagasinet, 324 m above sea level. Three Francis units with associated generators and a total output of 29 MW will be installed and will produce an average annual production of about 58 GWh. ANDRITZ HYDRO is going to supply two small generators produced by sub-suppliers and the 20 MVA generator produced by ANDRITZ HYDRO Bhopal in India. ANDRITZ HYDRO Ravensburg, Germany, will provide the turbine equipment in cooperation with ANDRITZ HYDRO Norway, which is also responsible for project management. SKS Produksjon AS annually produces some 1,800 GWh of hydroelectric power from 12 regional power plants.

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TECHNICAL DATA

3 Francis vertical units
Output: 18 MW/8 MW/3 MW
Head: 220 m
Speed: 750 rpm/1,000 rpm/1,500 rpm
Runner diameter:
1,035 mm/660 mm/430 mm

Mexico San Rafael



In September 2013, ANDRITZ HYDRO Spain received an order from Acciona Ingeniería S.A.U. to supply three hydraulic Kaplan turbines for the newly constructed San Rafael hydropower plant in Mexico.

HPP San Rafael will be located on the Santiago River, near the town of San Rafael in the Nayarit province of western Mexico. ANDRITZ HYDRO Spain is responsible for the supply of turbines, generators and associated equipment, including detailed engineering, procurement, manufacturing, transportation to site, erection and commissioning.

The manufacturing and preassembly of the main turbine components will be carried out at the ANDRITZ HYDRO workshop in Algete, Spain. An exception is the spiral case, which will be produced at the ANDRITZ HYDRO workshop in Morelia, Mexico. Indar, based in Guipúzcoa, Spain, is in charge of the generator supply. Currently, the manufacturing of the main components is in progress.

HPP San Rafael will be handed over to the customer in July 2015.

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TECHNICAL DATA

Output: 3 x 8.54 MW
Head: 15 m
Speed: 180 rpm
Runner diameter: 3,100 mm

Turkey Cileklitepe

IC İçtas Enerji awarded a contract for the supply of electromechanical equipment for the Cileklitepe hydropower plant in Turkey to a consortium of ANDRITZ HYDRO France and Turkey, following the development of HPP Girlekik Mercan (13 MW) in 2007 and HPP Yukari Mercan (15 MW) in 2003.

HPP Cileklitepe is located in the province of Espiye, about 40 km south of the town of Ericek, in the eastern Black Sea region of Turkey. To produce energy from 2 x 12.4 MW vertical four jets Pelton turbines, the hydropower plant will use the water of the

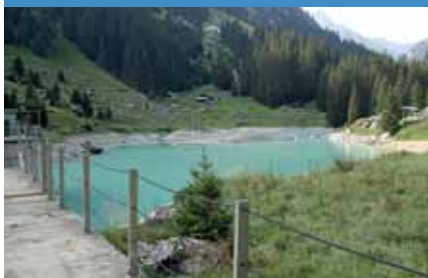
Kavaduva River. The waterway consists of a 3.2 km canal, a 2.3 km tunnel of 3 m in diameter and it ends in a 1,000 m long penstock of 1.25 m in diameter. With this contract IC İçtas Enerji, one of the major Turkish hydropower companies, confirms its confidence in ANDRITZ HYDRO's efficient and reliable equipment.

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TECHNICAL DATA

Output: 2 x 12.44 MW
Head: 456.33 m
Speed: 750 rpm
Runner diameter: 1,150 mm

Switzerland Russein



In 2013 Axpo AG awarded a contract to ANDRITZ HYDRO for the supply of electromechanical equipment for HPP Russein.

After 67 years of operation HPP Russein (built in 1946/47) will be extended. The hydropower plant is located between the towns of Disentis and Sedrun in the canton of Grisons, in southeastern Switzerland. The Russein creek runs on the left-hand side of the Rhine River. Between the dam reservoir Barcuns and the electrical power station the creek's resources are used to produce energy.

Axpo Hydro Surselva AG, together with the communities of Sumvigt and Disentis as well as the canton of Grisons are involved in this project. ANDRITZ HYDRO's scope of supply

includes the delivery, erection and commissioning of two 12.1 MW vertical six-jet Pelton turbines, including turbine governor, cooling water system, bifurcation pipe, DN800/PN50 ball valve (Adams) and a 13.5 MVA generator. The extension will increase the water flow from 4m³/s to 7m³/s. Furthermore, the height of the existing dam, located at Barcuns, shall be elevated by 5 m and the penstock will be renewed at the same time. After realization of this project the output will be increased from 11.6 MW to 24.2 MW.

This project represents a further step in the implementation of renewable energy supply. About 17,000 households will benefit from renewable energy after the inauguration, due in spring 2015.

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TECHNICAL DATA

Output: 2 x 12.1 MW/2 x 13.5 MVA
Voltage: 6.3 kV
Head: 392 m
Speed: 750 rpm
Runner diameter: 1,045 mm

Indonesia Cianten 1, Cianten 1B and Cianten 3

In May 2013, ANDRITZ HYDRO received an order from PT. Jaya Dinamika Geohidroenergi (JDG) for the supply, transport, installation and commissioning of the complete electromechanical equipment for Cianten 1, Cianten 1B and Cianten 3, three hydropower plants located in West Java, Indonesia.

JDG is a newly-established independent hydropower producer in Indonesia with a strategic plan to become a major independent power producer in



the emerging compact hydro energy market in Indonesia.

The order for these three plants completes the cascade of four plants on the Cianten River, developed by JDG.

The order for Cianten 2 was already awarded to ANDRITZ HYDRO in 2012 and is currently undergoing completion. All three new plants are scheduled to be completed in 12 months.

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TECHNICAL DATA

Cianten1/Cianten 1B/Cianten 3:

Units: 2/2/2
Output: 950 kW/3,200 kW/2,910 kW
Head: 27.70 m/95.52 m/56.70 m
Speed: 600 rpm/750 rpm/600 rpm
Runner diameter: 816 mm/780 mm/904 mm

France Fontenil, Semine, Lavalette and Vallico

In 2013 the ANDRITZ HYDRO mini-COMPACT office in Toul, France, received orders for five standardized Francis turbines with a horizontal shaft arrangement, including ancillary equipment, for four hydropower stations in France and Italy.

EDSB, a local electrical agency, awarded a contract to ANDRITZ HYDRO for the Fontenil hydropower project located in the city of Briançon, France. The order consisted of the supply of two turbines, which were installed in 2013.

HPP Semine is a private hydroelectric power plant in the region of Jura, France. ANDRITZ HYDRO's scope of supply consisted of the adaption of an old turbine. The order was confirmed in April 2013 and the plant was commissioned in December 2013.

Furthermore, the city of Saint-Etienne in France placed an order with ANDRITZ HYDRO for the supply of a turbine at HPP Lavalette. This turbine is designed to pump the compensation water of HPP Lavalette dam, which is used as the reservoir of the city's drinkable water. In December 2013 the erection was realized on site.

For the Vallico hydroelectric power plant, which is located in northern Italy, ANDRITZ HYDRO is currently in progress adapting the aged turbine.

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TECHNICAL DATA

Fontenil/Semine/Lavalette/Vallico:

Output: 1,183 kW/422 kW/256 kW/141 kW
Head: 55.21 m/21 m/48.55 m/13.55 m
Speed: 750 rpm/428 rpm/750 rpm/600 rpm
Runner diameter: 630 mm/820 mm/440 mm/556 mm

Austria Rothleiten



The Frohnleiten Energie- und Liegenschaftsverwaltung GmbH (FEL) runs HPP Rothleiten in the Austrian province of Styria. Since 1925, five Francis turbines have discharged the water of the Mur River.

After investigations about suitable forms of rehabilitation or reconstruction and upgrading, it was finally agreed to build a complete new hydropower station. In September 2013, the contract between FEL and ANDRITZ HYDRO Germany for the delivery of the complete electromechanical equipment was signed. The new run-of-river power plant will include a three-section weir. The power house equipment consists of two horizontally installed bulb turbines (runner diameter of 3,650 mm) and direct coupled medium-voltage synchronous generators (6.3 kV). A comprehensive electrical infrastructure with turbine governor, automation and excitation is also included in the scope of supply from ANDRITZ HYDRO. In addition to the improved flood protection, hydrogeological and ecological accompanying measures will be implemented.

During the construction period the operation of the old power station is to be maintained. The start of commercial operation of the new plant is scheduled for summer 2015.

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TECHNICAL DATA

Output (approx.): 2 x 5.1 MW
Head: 5.71 m
Speed: 120 rpm
Runner diameter: each 3,650 mm

Mexico Las Truchas



In April 2013, Primero Empresa Minera in Mexico awarded the contract for the supply of the second 7 MW unit of Las Truchas hydropower plant to a consortium of ANDRITZ HYDRO France and ANDRITZ HYDRO Mexico.

HPP Las Truchas is located in the state of Durango in northern Mexico. Seven years ago ANDRITZ HYDRO installed the first Pelton unit at the plant.

As a result of the highly satisfactory technical and economic performance of the first unit, the client decided to expand the hydropower plant by installing a similar second unit. The contract for unit 2 includes the supply of one horizontal two jet Pelton turbine, the generator, control and protection systems, the power transformer, 34.5 kV switchyard and the erection as well as commissioning and training.

The start of commercial operation is scheduled for July 2014.

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TECHNICAL DATA

Output: 7.3 MW
Net head: 699.38 m
Speed: 900 rpm
Runner diameter: 2,400 mm

Italy Molino Rizzoni

At the beginning of October 2013, ANDRITZ HYDRO and IDRO-ELETTRICA MOLINO RIZZONI, an independent power producer, signed a contract for the delivery, installation and commissioning of one Mini Compact Kaplan turbine with an asynchronous generator, including the electrical equipment and automation at HPP Molino Rizzoni.

HPP Molino Rizzoni is a new hydropower plant located in the province of Emilia Romagna in northern Italy.



The realization of this small hydro resource was made possible because of renewable energy incentives, which support the Mini Hydro range in Italy. This is the first order in Italy since the incorporation of Hydreco Engineering SAS into the ANDRITZ HYDRO group in 2013.

The turbine, speed increaser and mechanical Balance of Plant will be provided by ANDRITZ HYDRO Toul, France. ANDRITZ HYDRO Italy will supply the electrical power systems (EPS), automation and scada.

The commissioning of the equipment is scheduled for June 2014.

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TECHNICAL DATA

Output: 860 kW
Head: 4.1 m
Speed: 150 rpm
Runner diameter: 2,400 mm

Austria Air transport of a turbo generator stator



At the end of July 2013, ANDRITZ HYDRO received an order for the manufacturing of a 112 MVA spare stator turbogenerator for a project in Florida, USA.

The time schedule was tight and ANDRITZ HYDRO, with its manufacturing center in Weiz, Austria, was the only company capable of guaranteeing the delivery at highest quality within three months.

To keep the downtime of the power station short unusually it was decided to transport the 90 ton heavy stator by aircraft rather than by ship as is more commonly done. Therefore, one of the largest transport aircraft currently flying, an Antonov 124 was hired.

After two stopovers (in Ireland and Newfoundland) the Antonov landed in Florida and the stator was immediately installed. Only two weeks later the generator was operating again.

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TECHNICAL DATA

Output: 95 MW/112 MVA
Voltage: 13.8 kV
Speed: 3,600 rpm

China Shi San Ling

In September 2013, State Grid Xinyuan Beijing Shi Sanling Pumped Storage Power Co., LTD signed a contract with ANDRITZ (China) Ltd. for the supply of one stator for unit 3 at the Shi San Ling pumped storage power station.

The Shi San Ling pump storage plant is located in Changping county, 40 km north of the urban district of Beijing, and has a total capacity of 4 x 222 MVA. The power generated from the plant is fed into Beijing-Tianjin-Tangshan grid through two 220 kV transmission lines. Furthermore, the



plant provides frequency regulation and reactive power modulating, and emergency power source for grid functions. It therefore plays an important role in improving the quality and operational stability of the grid. The scope of supply comprises of one new stator including a new oil cooling system, new surface air cooler, generator top covers, upper guide bearing upgrading and spare parts. ANDRITZ (China) Ltd. will supply the stator frame and core. The stator winding will be produced by our ANDRITZ HYDRO factory in Weiz, Austria.

The site activities started in April 2014 with commissioning due in October 2014.

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TECHNICAL DATA

Output: 4 x 222 MVA

Voltage: 13.8 kV

Speed: 500 rpm

Finland Mankala

ANDRITZ HYDRO Finland has signed a contract with Oy Mankala Ab (part of Helsinki Energia Oy) for upgrading three Kaplan turbines at Mankala run-of-river hydropower plant, which was originally commissioned in 1950.

The scope of supply for ANDRITZ HYDRO includes new oil-free runners, shafts, guide vanes, high pressure units, oil heads and the service of



major parts. In addition to the three Kaplan turbines, under the terms of the contract the existing auxiliary turbine, which enables black start capability of the plant, will be refurbished.

The aim of the project is to raise the output by 2.5 MW to a maximum output per unit of 12.5 MW. After the rehabilitation, efficiency will be increased by 4% points which means an extra supply of electrical energy to the Finnish grid. All model tests have been realized at ANDRITZ HYDRO's hydraulic laboratory in Tampere, Finland.

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TECHNICAL DATA

Output: 3 x 12.5 MW

Head: 8.5 m

Speed: 107.1 rpm

Runner diameter: 4,660 mm

China Zangmu



In 2013 ANDRITZ (China) Ltd. signed a contract with HUANENG TIBET GENERATION Co. Ltd. to supply the automation system for Zangmu hydropower plant and a local control center in China.

Zangmu is the largest hydropower plant in Tibet with a crest level of 3,314 m above the Yellow Sea. It is located on the middle stream of the Yarlung-Tsangpo River, which flows in the world's largest and deepest canyon, the Yarlung Tsangpo Grand Canyon, and meets the river Ganges in Bangladesh.

ANDRITZ (China) Ltd.'s scope of supply for HPP Zangmu includes one compact SCALA server, two gateway controls, nine local control units and 34 sets of TM 1703 for auxiliary local control.

The control center consists of redundant SCALA servers, three operator workstations, two AGC/AVC servers, one web server, one on-call server, one engineering server and redundant gateways.

The Zangmu project will be a key for ANDRITZ (China) Ltd. to enter the hydropower market of Tibet in the near future, providing a full range of products from water to wire.

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TECHNICAL DATA

Output: 6 x 85 MW

Head: 53.5 m

Speed: 136.4 rpm

Austria Dionysen

In October 2013, VERBUND Hydro Power AG awarded ANDRITZ HYDRO a contract for the refurbishment of the generators at the Dionysen hydropower station in Austria.

Located on the Mur River, in the Austrian province of Styria, the run-of-river hydropower station consists of two units, which were originally commissioned in 1949. In 2001 a modernization of the vertical Kaplan runners took place. After 65 years of operation, the generators exceeded their life span.



With this upgrade performance and efficiency of both generators will be enhanced. ANDRITZ HYDRO's scope includes the renewal of main generator parts, like the stator, the rotor body, rotor poles, brakes and fans and oil and brush dust exhauster. The generator shaft and the bearings will be refurbished and re-used. In addition, the contract contains dismantling, reassembling and the commissioning of the generators. The stator and poles will be produced in Weiz, Austria.

For each unit a maximum outage time of four months has been agreed. Start-up for unit 1 is scheduled for November 2014.

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TECHNICAL DATA

Output: 2 x 10 MVA
Voltage: 6.3 kV
Speed: 214 rpm

Austria Sölk

VERBUND Hydro Power AG has awarded ANDRITZ HYDRO the contract for the renewal of the control systems for the Sölk hydropower station situated in the federal state of Styria in Austria.

The core of Sölk hydropower station is the short-term storage in Grosssölk valley, for which an arched wall was constructed for a storage level at an elevation of 901.8 m above sea level of the Adriatic. This storage is supplied by the waters of the streams Kleinsölkbach, Donnersbach and Walchenbach. The powerhouse is equipped with one unit with an in-



stalled capacity of 30 m³/sec. (overload 34 m³/sec).

ANDRITZ HYDRO's scope of supply comprises the replacement and functional installation of the unit's control system, the replacement of the cooling water control, and adjustments in the existing systems (external forebays, alerting of staff on duty and redundant power station control). These systems had already been replaced by ANDRITZ HYDRO in 2000.

Together with the order covering the electronic and mechanical turbine governor, ANDRITZ HYDRO has gained a major share in the renewal of the largest unit in Styria.

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TECHNICAL DATA

Output: 1 x 61 MW

Austria Kreuzbergmaut & Fritzbach

Salzburg AG has awarded a contract to ANDRITZ HYDRO for the replacement of the secondary technical equipment at Kreuzbergmaut power station in the Austrian province of Salzburg.

This project concludes the control system renewal of the "Mittlere Salzach" series of hydropower stations.

The scope of supply also comprises the replacement of electrical protection equipment as well as exciter systems of the hydropower stations of St. Johann, Urreiting and Bischofshofen for two units, each.



In addition, ANDRITZ HYDRO was awarded the contract for the supply of automation equipment for HPP Fritzbach, a cooperation project between Salzburg AG and Österreichische Bundesforste. The scope of supply here includes machine automation for the new, six-jet Pelton turbine as well as the sub-automation of the shut-off valves in the new inlet structure.

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TECHNICAL DATA

Kreuzbergmaut:

Output: 2 x 9.98 MW
Head: 10.8 m
Runner diameter: 3,650 mm

Fritzbach:

Output: 1 x 5.4 MW
Head: 160 m

HYDRO AUTOMATION DAY 2013

International launch of HIPASE



HYDRO AUTOMATION DAY has been a key event on the calendars of ANDRITZ HYDRO Automation clients for years. On November 21, 2013, it took place at "Palais Ferstel" in Vienna, Austria.

More than 300 people from 27 countries participated in this customer event, which was established many years ago. The number of visitors marked a new record.

As is traditional, the event started with keynote presentations from ANDRITZ HYDRO management and customer presentations, dealing with several topics of automation technology in hydro-power plants.

The highlight of the day was the first presentation of the new product platform HIPASE – solely developed by ANDRITZ HYDRO. HIPASE is the first



worldwide product which implies all functions of protection, excitation and synchronizing devices in one common platform. It includes a common engineering tool, which symbolizes the future of hydropower plant automation.

world premiere of HIPASE and all technical sessions in the afternoon offered the best opportunity for very intensive discussions and exchange of experience between all participants.

The world premier was supported by specific HIPASE presentations of the hardware and the engineering tool, two live presentation booths, a HIPASE showcase with three devices and the latest available marketing material (Hydro News 24, HIPASE folder and movie). The customer presentations, the

A gala-dinner at the Viennese Hofburg supported by the musical show "Falco meets Amadeus" represented a closing highlight of this very successful day.

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Each year in spring, hydro-power conventions and trade fairs take place all over the world representing the continuous interest and growth of the hydropower market. These events are a good opportunity for investors and municipalities to find comprehensive professional information on the latest trends. As a global leading supplier for electromechanical equipment and services for hydropower plants, ANDRITZ HYDRO participated in selected events.



Asia 2014

Colombo, Sri Lanka

The vibrant city of Colombo, Sri Lanka, has been selected as the venue for ASIA 2014 the Fifth International Conference on Water Resources and Hydropower Development in Asia.

The conference focused on the needs, priorities and future plans of Asia. ANDRITZ HYDRO participated with six paper presentations, a booth and was

co-host for the Welcome Conference Dinner. Our presentations were focused on successful Asian projects, turbine technology, coating and the new unified product platform for protection, excitation and synchronizing - HIPASE. ASIA 2014 once again underlines ANDRITZ HYDRO's strong position in the Asian hydropower market.



HydroVision Russia

Moscow, Russia

HydroVision Russia took place in parallel with Russia Power and attracted more than 5,300 attendees from 55 countries.

ANDRITZ HYDRO participated at HydroVision Russia the fifth time. Together with ANDRITZ PULP & PAPER and our turbo generator business unit we promoted our portfolio to the Russian market with a booth and four paper presentations.

POWER-GEN Africa

Johannesburg, South Africa

Africa is currently one of the most interesting energy markets globally. After a successful launch in 2013, the POWER-GEN Africa conference and exhibition took place for the second time.

Together with the co-event DistribuTech more than 2,300 people from 69 countries worldwide participated. The event activities of ANDRITZ HYDRO included a session chair, four technical paper presentations and a booth.

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EVENTS:

Renewable Energy World Asia

10 - 12 September 2014

Kuala Lumpur, Malaysia, [Booth R2108](#)

www.renewableenergyworld-asia.com

Hydro 2014

13 - 15 October 2014

Cernobbio, Italy, [Booth 308](#)

www.hydropower-dams.com

Viennahydro

26 - 28 November 2014

Vienna, Austria, [Booth 16](#)

www.viennahydro.com

Valves

Lifetime safety and reliability



ANDRITZ HYDRO is a globally leading supplier of electromechanical equipment and services for hydropower plants. Valves are primary safety elements at hydropower plants and ensure tight sealings in waterways for maintenance purposes on hydraulic machinery. We have a long-term experience in water-hydraulic

controls. No matter which type of valve, size or pressure rating: safe and functional design combined with strictest requirements at material selection, manufacturing and installation, guarantee the satisfaction of our customers.

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

