

HYDRO NEWS

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MAGAZINE OF ANDRITZ HYDRO



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Latest News

Indonesia



ANDRITZ HYDRO was awarded by PT Perusahaan Listrik Negara (Indonesia) with the supply of electromechanical equipment for HPP Peusangan.

The project scope includes supply, installation and commissioning of four 23 MW Francis turbines, four generators and additional equipment.

Turkey

ANDRITZ HYDRO has received an order as part of a consortium from Kalehan Enerji for supply, installation, and commissioning (scheduled for 2016) of three 235 MVA generators for the new HPP Upper Kaleköy.

The planned hydropower plant has a total output of 636 MW and will cover – with an annual production of approximately 1,470 GWh – the electricity demand for 150,000 households in Turkey.

Ghana

Volta River Authority signed a contract with ANDRITZ HYDRO for the refurbishment of electromechanical equipment at HPP Kpong. The scope includes engineering, installation and commissioning of four 45.7 MW Kaplan turbines, four generators, transformers and additional equipment.

Serbia

In November 2007 Electric Power Industry of Serbia (EPS) awarded a contract to ANDRITZ HYDRO for the rehabilitation of the run-of-river hydropower station Bajina Bašta. In September 2013 unit 4, the last unit, successfully finished its test run. Instead of planned 103 MW, the output of each unit could be increased to 105.6 MW.



On 8 October 2013 unit 4 was ceremonial handed over to EPS. The importance of the project was emphasized by the attendance of the Serbian Prime Minister, Mr. Ivica Dačić, on the event.

Lao PDR

ANDRITZ HYDRO has signed a contract with POSCO Engineering and Construction Company Ltd. (POSCO E&C) for the supply, installation and commissioning of the electromechanical equipment for HPP Nam Lik 1.

The scope of supply includes two 32.25 MW bulb turbines, horizontal generators, mechanical auxiliaries, electric power systems, gates and additional equipment. The hydropower plant will be put into operation within 38 months.

Hydro News on iPad

Since July 2013 the Hydro News is also available for iPads. It is now possible to read the customer magazine everywhere, offline and online, free from any charge.

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





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HIPASE, new product line
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Dear **business friend**

Without innovative hydro-power we will not have a renewable energy future – and ANDRITZ HYDRO is contributing with our people, technology and quality.

With the slow down of the worldwide economy and subdued delays for investments in new installations the project landscape reflects now again a stable performance but on a lower level compared to the peak years before. Still ANDRITZ HYDRO is showing, after an excellent year 2012, a satisfactory development in 2013.

Orders like equipment supply for HPP Xayaburi and HPP Nam Lik in Lao PDR, HPP Upper Kaleköy in Turkey or HPP 5 de Noviembre in El Salvador demonstrate this. Additionally the number of small hydropower stations installed is remaining on a high level.

ANDRITZ HYDRO could win in this sector orders in all regions of the world, from Belgium to Vietnam and from Canada to Chile.

Technological development is nowadays essential to keep the state of the art standard of ANDRITZ HYDRO. For example the automation platform HIPASE is a radical new approach to unifying different device specifications and applying the latest and most modern hardware and software technologies. It is the first time such a product could be developed and will now be introduced to the global market.

Another commitment from ANDRITZ HYDRO is our excellent execution of orders. Timely high quality deliveries are proving our technological competence and our project management skills represent a corner stone of our reputation. We are quite proud of hav-

ing put that many power stations in service – securing the production of environmentally friendly and economically viable green electricity next decades to come.

Recent examples include HPP Myntdu-Leshka (3 x 42 MW) in India, HPP Theun-Hinboun (1 x 220 MW) in Lao PDR, HPP Allai Khwar (2 x 60.5 MW) in Pakistan, HPP Boyabat (3 x 176 MW) in Turkey, HPP Bajina Bašta (4 x 105.6 MW) in Serbia, HPP Kindaruma (3 x 24 MW) in Kenya and HPP Chacayes (2 x 59.5 MW) in Chile.

The trust our customers place in us is based on our solid performance in implementation. It is this which gives us the confidence to tackle new challenges and future demands.

With sincere thanks

M. Komböck

W. Semper

H. Heber

HIPASE

The new product line by ANDRITZ HYDRO Automation

In parallel to hydraulic and electrical energy a permanent stream of information flows through the power plant, which controls, regulates, optimizes and protects this energy conversion process. The comprehensive handling of this information flow is the task of ANDRITZ HYDRO Automation.

For more than 30 years, automation technology has been characterized by rapid digitalization. With the newly developed platform HIPASE, ANDRITZ HYDRO Automation addresses the latest technological possibilities and unifies for the first time in one product the different device characteristics of electrical protection, voltage control and synchronization worldwide.

HIPASE - the homogeneous platform

All hydropower plant units are electrically protected, the generator voltage is regulated and units are synchronized with the grid. For nearly a century

▼ HIPASE device



▲ HIPASE device

this was done by specialized mechanical and electromechanical devices, which have been designed in a technological very different way, by the vary nature of technology at this time.

For several decades, the entire control, regulation and automation systems have been characterized by the electronic computing evolution. Historic mechanical and electromechanical devices are now being superseded by digital electronic and software-controlled devices. Although these different devices are based on the same technology, the currently on the automation market available products are still being built today on completely different platforms, reflecting the historical independent product development.

HIPASE is a radically new approach of ANDRITZ HYDRO, representing a unified product platform for electrical protection, voltage regulation and synchronization for the first time worldwide. HIPASE is based on the latest hard- and software technology and is characterized by a uniform hardware, a uniform user interface and a unified engineering tool.

Over the last 30 years the different technical skills required have been a core competence within ANDRITZ HYDRO. With more than 500 employees involved in the automation business, ANDRITZ HYDRO Automation is the world leader in automation solutions for hydropower plants.

Additional key success factors:

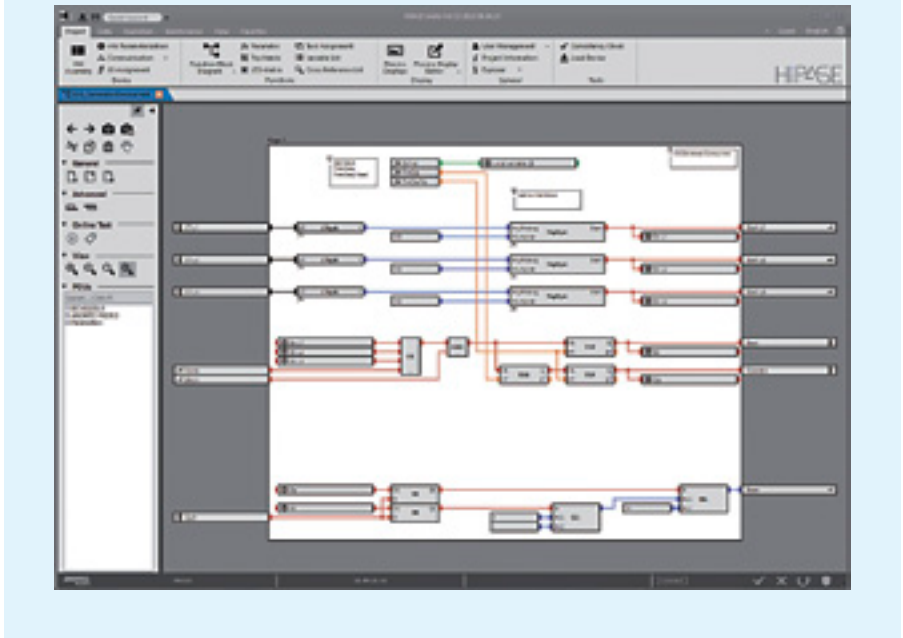
- Bundling a team of highly skilled R&D staff and experienced field engineers for hydroelectric power plant control and regulation under one roof at ANDRITZ HYDRO Automation headquarters in Vienna (Austria).
- Short communication lines and decision-making process have been essential for the unification of technical disciplines which have evolved differently over a very long time.
- Extensive and long-standing technical worldwide turbine and generator know-how as a crucial factor for the successful development of HIPASE.

HIPASE - unified hardware

The hardware of HIPASE is uniformly constructed - each HIPASE device consists of the same rack, the same touch panel, the same power supply, the same central processing and communications unit, as well as common components for digital and analogue in- and outputs. The data acquisition and specific signal outputs for electrical protection, voltage control and synchronization are being realized on dedicated application boards.

For simplified signal and functional requirements previously separated individual devices can now be merged into one HIPASE combination device with multiple application boards.

▼ HIPASE Local operation with touchpanel



▲ HIPASE Functional diagram

HIPASE - uniform local device operation

Each HIPASE device has a full graphic color touch display for local unit operation. The look and feel of the electrical protection, voltage regulation and synchronization is similar to each other.

Via the HIPASE touch display a simple parameterization can be realized and at the same time the touch display is used as elementary process visualization device.

HIPASE - simple and unified engineering

The HIPASE Engineering-Tool is a unified and comprehensive tool for the whole engineering process. All applica-

tions for electrical protection, voltage regulation and synchronization are configured, parameterized and documented with the same tool.

The Engineering-Tool impresses by a simple design according to the latest ergonomic perceptions of the user interface. The menu structure is consistently organized according to the workflow of the engineering process. The simple and intuitive, self-explanatory look & feel is the main key feature.

In a company's all phases of the engineering process - besides the hardware configuration and parameterization it assists the project-specific adaptation of functionalities. Additionally the project-specific graphic design of the touch panel and, the entire procedure of commissioning and documentation of the system is handled by one tool.

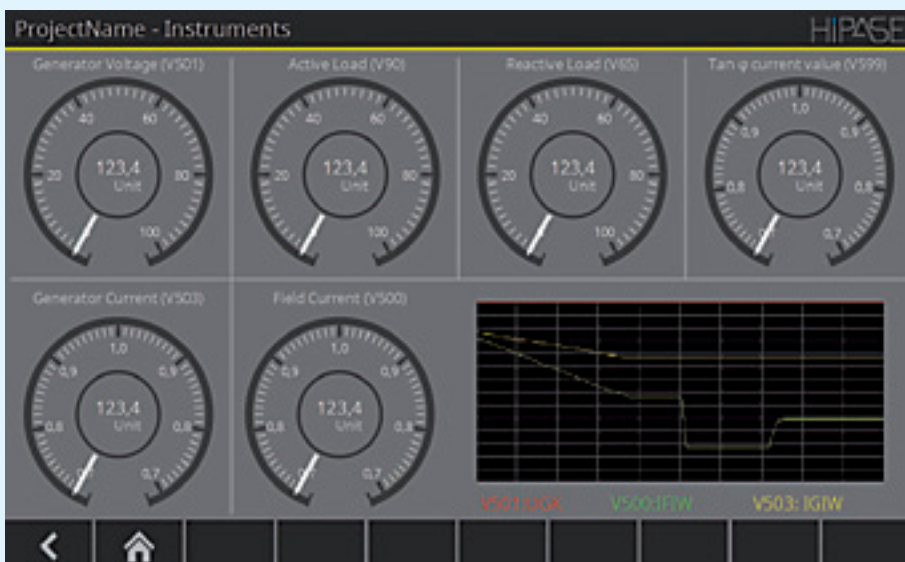
The user interface is designed to be multilingual for international use. It is not limited to specific languages and can be adapted to any desired language.

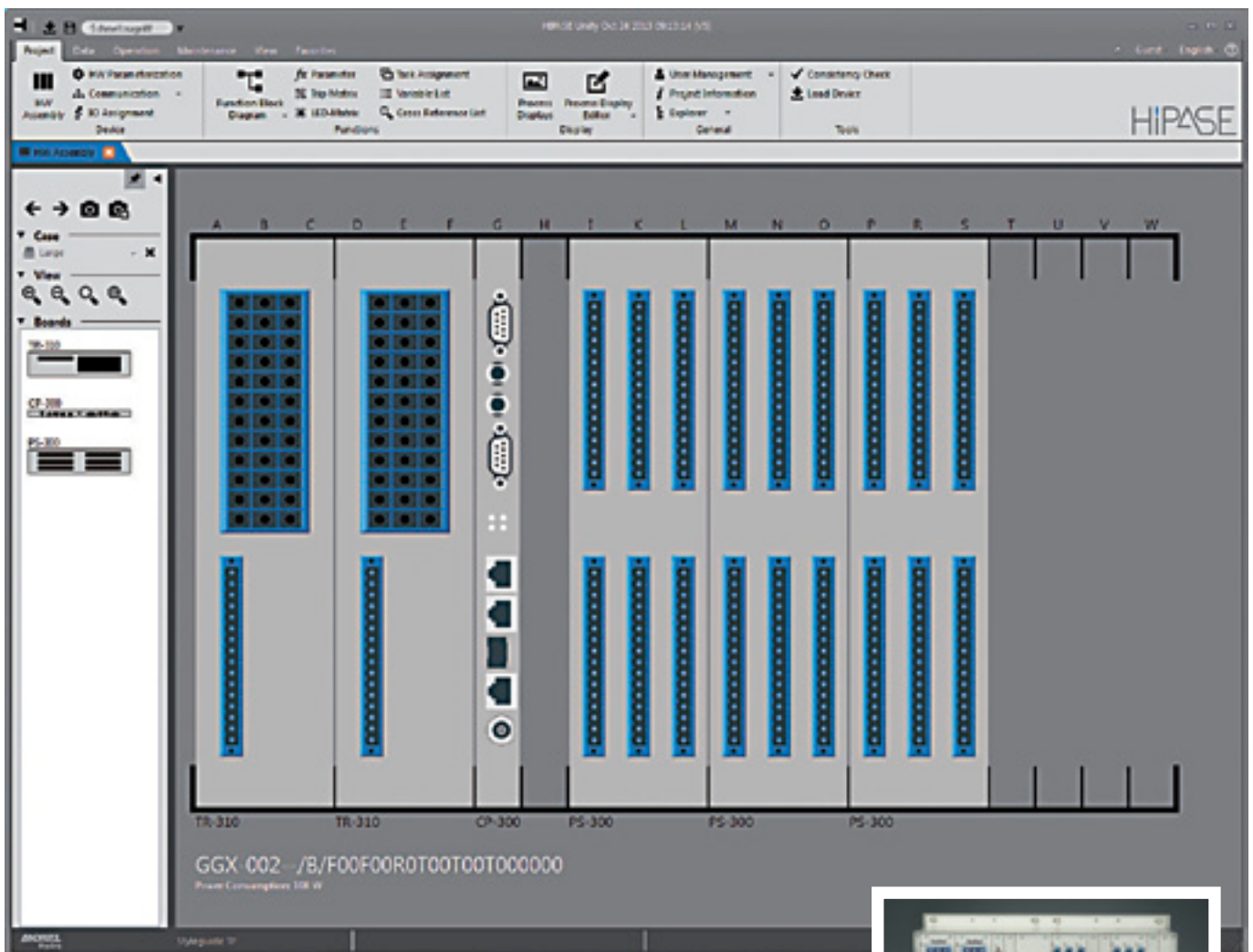
HIPASE - standardized communication

HIPASE supports communication via standard protocols, including Modbus TCP/IP, IEC 60870-5-103, IEC 60870-5-104 and IEC 61850 Ed2.

HIPASE - functional safety

The long-term experience of ANDRITZ HYDRO Automation on electrical protection systems is naturally part of





▲ HIPASE Engineering-Tool - Hardware configuration



the safety architecture of HIPASE. Moreover the safety architecture and the whole development process of HIPASE are based on the requirements of IEC 61508 “functional safety of electronic safety-related systems”.

For functional safety or very high security requirements all signals are being collected twice, calculated twice with decoupled hardware and put out twice. HIPASE is constantly designed in a two-channel architecture. For non-functional safety applications HIPASE can also be used as a single-channel system whereby the second channel is used to double the signals received.

HIPASE - cyber security

Due to the complex network infrastructure of the entire electrical energy production and distribution grid “Cyber Security” is a matter of increasing importance. This significance is highlighted in several documents from major

energy organizations worldwide (e.g. a white paper from Germany’s BDEW and the North American NERC CIP standard). HIPASE is protected against cyber-attacks through comprehensive and integrated security architecture. The security measures in HIPASE are realized by hardware -, as each device is equipped with a TPM (Trusted Platform Module) chip.

HIPASE - prepared for the future

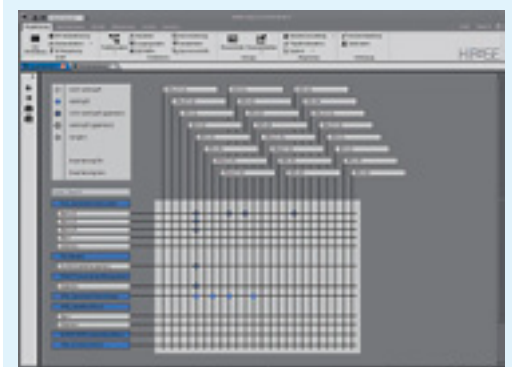
HIPASE, the new unified product platform from ANDRITZ HYDRO, represents the latest technological possibilities with a highly innovative product approach.

It is especially designed for the specific process requirements of a hydropower plant. With the pioneering HIPASE system architecture, ANDRITZ HYDRO Automation is well prepared for new challenges - nowadays and in the future.

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▼ HIPASE Engineering-Tool - Trip Matrix



Georgia

Inauguration of a representative office in a future market

▲ Aerial view on Tbilisi at sunset



▲ Norbert Schwarz (Head of ANDRITZ HYDRO in Tbilisi)

Located between the semitropical coastline of the Black Sea and the snowy heights and alpine meadows of the Caucasus, Georgia covers an area of 69,700 km² with a population of approximately 4.7 mio. people.

Georgians trace their origins back to Noah's great-great-grandson and in classical times to the two kingdoms of Colchis in the west (legendary home of the Golden Fleece) and Kartli in the east. In the early fourth century, Georgia became the second country to adopt the Christian faith after Armenia. Under

the rule of David the Builder in the twelfth century, Georgia reached its zenith and became the major Caucasian power and a center of Christian culture.

In the following centuries Georgia was controlled by Mongols, Turkish and Persians until the Russians annexed all the Georgian kingdoms and principedoms in the 19th century. Eventually, it was incorporated into the Soviet Union in 1922. On 9 April 1989 Georgia declared itself independent of the USSR. Since then the country has made major development by implementing a lot of political and economic reforms.

A country with huge potential

One of these reforms related to the energy sector when the government decided to develop the vast hydropower potential and eventually become an exporter of power to the neighboring countries. In order to cope with the huge hydropower potential, the government launched the privatization process few years ago, opening the market to domestic and foreign investors. The market is totally deregulated for new hydropower plants and all new projects are based on the Build-Own-Operate (BOO) principle with minimal bureaucracy for the developers. The estimated hydropower potential is around 20,000 GWh, with around 300 rivers significant for energy production, and so far only 18% of the potential being utilized.

Nowadays approximately 75% of the national power capacity is generated by hydropower (2,700 MW) with the aim to reach almost 100% in the future. The present development program includes seven large projects with a total installation of 1,830 MW and around 70 small and medium sized projects with capacities below 100 MW each. Presently 30 projects with a total combined capacity of 2,213 MW are under licensing or in a construction phase.



▲ Mag. Konstantin Bekos (Austrian Commercial Counselor Georgia), Norbert Schwarz (Head ANDRITZ HYDRO office in Tbilisi) & KommR. Dr. Richard Schenz (Vice-President of the Austrian Chamber of Commerce)

ANDRITZ HYDRO representative office

In order to cope with this huge investment potential and to closely follow the project landscape, ANDRITZ HYDRO decided to open a representative office in the capital city of Tbilisi by the end of 2012.

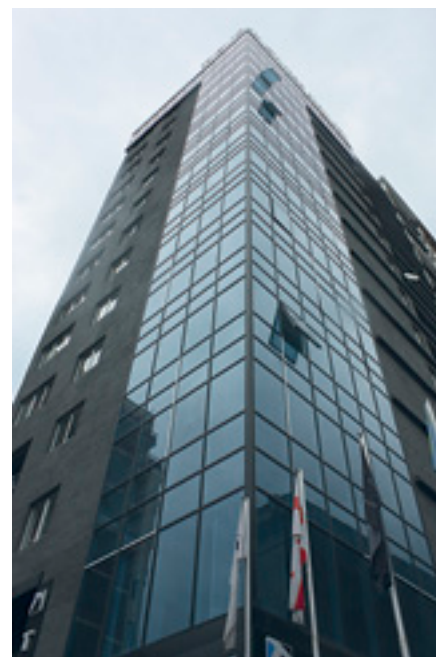
This decision was also supported by the receipt of two orders from private customers, the Compact Hydro power plant Akhmeta (2 x 4.5 MW, complete E&M package) and the engineering contract for HPP Dariali (3 x 38 MW, complete E&M package). These two projects are the first contracts since 1997, when Escher Wyss delivered a 21 MW Francis turbine for HPP Cevrula.

The official inauguration ceremony, in the presence of the Vice President of the Austrian Chamber of Commerce, the Austrian Commercial Counselor for Georgia and representatives of the Ministry of Economy of the Republic of Austria, took place in May 2013.

Our office is located in the Tbilisi Business Building in the heart of the city and is headed by Norbert Schwarz from Market Management Vienna and supported by David Kviriashvili, a young technical engineer who has been working in the Georgian power industry for more than 10 years.

Customer Day

In order to promote the products and solutions of ANDRITZ HYDRO in Georgia and to present the latest developments and technologies in the field of hydropower, ANDRITZ HYDRO was the first company to organize Customer Days. This event took place first time in April 2012 and proved to be very successful with around 100 participants from the Ministry of Energy, various project developers, customers, consulting engineers and financial institutions in attendance. Due to this success and the extremely well received response, we decided to organize a similar event in June 2013 again with around 100 participants from the hydropower business community.



▲ New ANDRITZ HYDRO office in Tbilisi

We believe that ANDRITZ HYDRO has the technical competence and tailor made solutions for the development of the hydropower sector and projects of all sizes and complexity, from small to very large, and consider Georgia as one of the most vital and prospective countries in this region.

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Switzerland

Due to its mountainous landscape and the presence of numerous rivers and streams, Switzerland can be described as the water tower of Europe.

Today, Switzerland has 565 hydropower plants of a power equal to or greater than 300 kW, which produce an average of 35,870 GWh every year. Around 47% of these are run-of-river power plants, 49% are storage power plants and there is about 4% of pumped-storage power plants. Two thirds of all electricity produced in Switzerland comes from the alpine counties of Bern, Uri, Graubünden, Ticino and Valais. In order to ensure sufficient water supply for the power plants, Switzerland has built numerous dams and water-storage structures, the earliest of which dates back as far as the 19th century. In total, 83% of Switzerland's dams are intended for hydraulic power supply.



▲ View on HPP's Innertkirchen & Handeck at Rätichsbodensee



▲ ANDRITZ HYDRO in Vevey, which celebrates the 150 year anniversary of the first hydro turbine

The former company Ateliers de Constructions Mécaniques de Vevey, a predecessor of ANDRITZ HYDRO, manufactured the first hydraulic turbine in Switzerland back in 1863 exactly 150

years ago. This anniversary was duly celebrated on 27 and 28 September 2013 in Vevey. On this occasion, the region's most important politicians and businessmen met on Friday evening for a buffet dinner in the hydraulic laboratory, the event's main location.

The local population and staff from ANDRITZ HYDRO Switzerland were invited to visit the test rigs. With these models, the real conditions under which turbines normally operate are being simulated. The hydraulic laboratory is the Center of Competence for Pelton turbines. People of all ages were able to get to know what we do, by means of various demonstrations.

This event was a great moment of exchange and cordial togetherness, which will be remembered for a long time.

HPP Innertkirchen 1 (INN1E) & HPP Handeck 2 (HA2A)

ANDRITZ HYDRO recently received an order from KWO, Kraftwerke Oberhasli AG, for two turbine lots and one generator lot as part of the Innertkirchen 1 power plant and Handeck 2 power plant upgrading projects. The order includes the delivery, installation and commissioning of two vertical 6-nozzle Pelton turbines with outputs of 150 MW and 90 MW respectively, as well as a vertical synchronous generator with an output of 165 MVA.

These power plants, built over 60 years ago, are being upgraded in line with present-day considerations. The construction of a second turbine water channel, which runs parallel to the existing one, will reduce the water's flow



▲ Verzasca dam



▲ Machine hall at HPP Gordola

rate, thus also reducing the friction losses in the pressure lines. This allows the power plants to obtain more energy from the water they are using. At the same time, it becomes possible to install an additional machine in each of two ancillary caverns to be situated directly beside the two power plants, thus increasing the total output by 280 MW in all.

With this upgrade of the power plants, KWO is helping to meet the rising demand for peak energy and balancing power to compensate wind and solar energy which normally cannot be planned easily. The additional energy obtained amounts to 70 GWh per annum, thus covering the requirements of more than 14,000 households.

HPP Gordola

In an initial phase, ANDRITZ HYDRO received an order from Verzasca SA, Officina Idroelettrica, Lugano, to overhaul the three vertical-axis Francis turbines at the Gordola power plant. This order is part of an upgrading project and encompasses the dismantling, installation and commissioning of the machines. It also covers the delivery of new components, such as turbine

shafts and intermediate shafts with new coupling components, coupling covers and labyrinth rings. The core of the order consists of the delivery of three new Francis runners and a reserve wheel with an improved hydraulic contour for increased efficiency.

In a second phase, ANDRITZ HYDRO also received an order for the conversion of the three generators – increasing the output by 14%, from 33.3 MVA to 38 MVA. The delivery includes completely new stators, refurbishment of the poles, replacement of the pole windings, new fans, new drive shafts for the intermediate shafts, new coupling fastenings and a complete shaft assembly analysis.

With this power plant upgrade, Verzasca SA (two-thirds of which is owned by the city of Lugano and one-third by the canton of Ticino) is helping to meet the rising demand for peak energy and balancing power and is not so dependent on variable output wind and solar energy. The increased efficiency enables the production of around 6 GWh of additional energy.

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TECHNICAL DATA

Innertkirchen 1:

Output: 150 MW / 165 MVA

Voltage: 13 kV

Head: 665 m

Speed: 375 rpm

Runner diameter: 3,485 mm

Handeck 2:

Output: 90 MW

Head: 457 m

Speed: 333 rpm

Runner diameter: 3,200 mm

Gordola:

Output: 38.8 MW / 38 MVA

Voltage: 10 kV

Head: 255 m

Speed: 600 rpm

Runner diameter: 1,670 mm



Matre Haugsdal

Reconstruction of an underground power plant in Norway

In May 2013 BKK Produksjon AS awarded a contract to ANDRITZ HYDRO for building the Matre Haugsdal hydropower station in Norway.

HPP Matre is located about 80 km north of Bergen in Masfjorden, the municipality in Hordaland County in Norway. The development of HPP Matre started with the creation of the Haugsdal water system in 1952. The plant consists of two hydropower stations in the same machine hall.

The three existing Pelton units, utilizing water from the Haugsdal water system, were completed in 1959. These units will be replaced by the completely new Matre Haugsdal underground power station. The new Matre Haugsdal underground power station is planned

about 500 m inside the mountain from the existing hydropower plant in Matre. The station will get a new headrace tunnel with a new intake in Godbotsvatnet, and a new tailrace tunnel with a new outlet in the Matre fjord. In the power house two Francis units with associated generators will be installed. Each unit will have an output of 90 MW (105 MVA) at a rated net head of 525 m. The nominal output is increased significantly compared with the existing power station, and has been designed for intermittent operation (1-2 start/stop per day).

ANDRITZ HYDRO will supply the steel linings for the headrace and tailrace tunnel as well as two 105 MVA vertical generators and two 90 MW vertical Francis turbines. The main consignment for the generator components will be

delivered from ANDRITZ HYDRO Austria. ANDRITZ HYDRO Italy will provide the turbine equipment in cooperation with ANDRITZ HYDRO Norway which is responsible for the project management, installation and the hydraulic steelworks. The equipment is expected mainly to be transported to site by road while the transport of heavy parts is planned by boat, which will allow the delivery of a full stator for this project.

ANDRITZ HYDRO won this Norwegian renewal project with a high level of efficiency and totally reliable project planning. Commissioning is planned for September 2016.

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▼ Masfjorden from Matre quai



TECHNICAL DATA

Output: 2 x 90 MW / 2 x 105 MVA
Voltage: 13 kV
Head: 525 m
Speed: 600 rpm
Outlet diameter: 1,360 mm





▲ View onto HPP San Pedro II from upstream

San Pedro II

Start of extension work in Spain

In June 2013 ANDRITZ HYDRO signed a contract with IBERDROLA, one of the biggest privately owned multinational electric utilities in Spain, for the supply of engineering, manufacturing, delivery and the supervision of the erection of one bulb turbine and its generator.

HPP San Pedro is located in the north-western part of Spain in the municipality of Nogueira de Ramuín (Ourense) on the river Sil.

The tender for this power plant extension was awarded to ANDRITZ HYDRO in 2008, although IBERDROLA did not have the approval of the Spanish authorities at that time. In 2011 IBERDROLA awarded the contract for the design of the turbine and generator to ANDRITZ HYDRO and enable them to complete the detailed civil engineering made by others and to shorten the implementation period after the contract start. In 2013, after IBERDROLA gained all necessary approvals from the Spanish authorities, the work for the extension of the plant was released.

The existing hydropower plant, constructed 60 years ago, is equipped with

two vertical Kaplan units with a capacity of 32 MW in total. Recently IBERDROLA completed the extension of HPP San Esteban, located upstream of HPP San Pedro. In order to balance the flow of the river Sil and to keep the water level within the required range between the two power plants, the capacity of HPP San Pedro had to be increased as well.

The extension of the power plant is a completely independent construction from the existing installation. It will increase the capacity by 25 MW, produced by one horizontal bulb unit.

The new plant is entirely subterranean and has been arranged between the existing underground power plant and the dam. The limited space has substantially influenced the design of the new power plant. A blind penstock takes the water to the turbine located 85 m off the intake. Due to the installation of a bulb unit the overall dimensions of the power house and its excavation could be kept small. Nonetheless, the conditions mean that the overall arrangement of this new power plant being not typical for a bulb turbine. This is why IBERDROLA conducted intensive

studies to optimize the inflow, the penstock profile and the concept of the downstream channel to ensure hydraulically favorable and acceptable flow conditions for the turbine.

The extension of HPP San Pedro II is expected to be completed in June 2016.

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TECHNICAL DATA

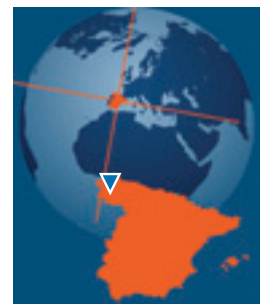
Output: 23.25 MW / 26 MVA

Voltage: 15 kV

Head: 17 m

Speed: 136.4 rpm

Runner diameter: 4,500 mm



Xayaburi

A run-of-river power station for Lao PDR



▲ Upper reaches of the Mekong River

At the end of 2012, ANDRITZ HYDRO won an international bidding process: over the next seven years, we will deliver the entire electromechanical equipment for a new run-of-river power station on the Mekong River with a nominal capacity of 1,295 MW and an annual output of 7,406 GWh. With this project, ANDRITZ HYDRO is supporting the efforts of the Lao People's Democratic Republic to

cover the rising energy needs of its own and neighboring populations through hydropower while reducing the dependency on fossil fuels at the same time. The symbolic groundbreaking for this project was in November 2012.

After the successful delivery of the electromechanical equipment for HPP Nam Theun II, the largest Laotian hydropower station so far, the new order

for the run-of-river power station Xayaburi is a further sign of trust in the modern technology and reliability of ANDRITZ HYDRO's products. HPP Nam Theun II started commercial operation in 2010 and is now considered a pioneering project in the sustainable construction of hydropower stations. In the course of implementing this project, numerous social and ecological measures were executed according to the directives of the World Bank and



▲ Contract signing

the International Monetary Fund. The Xayaburi order includes the delivery of seven Kaplan turbines, each with an output of 182 MW, as well as an additional 68.8 MW turbine. ANDRITZ HYDRO will also supply generators and governors, the automation and additional equipment.

With a planned capacity of 1,295 MW, the Xayaburi run-of-river power station will produce electricity for approximately one million households - in Laos as well as in neighboring Thailand. Commissioning is scheduled for 2019. In contrast to storage power stations, run-of-river power stations only store low volumes of water: with a dam that has a ridge length of 810 m and a height of 49 m, Xayaburi will have a storage space of 225 mio. m³ which will be completely replaced once per day. Xayaburi Power Company Ltd., in which Thai companies hold a

majority interest, functions as the project operator by order of the Laotian government. Financing is handled by a consortium that consists of four Thai banks.

The government of the Lao People's Democratic Republic has been relying on the expansion of hydropower for several years in order to boost the country's economic growth and the population's level of prosperity. The Xayaburi project was approved with the participation of European experts and based on ecological and social measures, including an environmental compatibility study. The Mekong River Commission has constantly been involved in the project since its conception.

Structural measures to ensure sediment transport and fish migration in the Mekong are considered to be

major challenges during the implementation. Planned remedies include fish passes, fish locks, side channels and separate outlets that facilitate the sediment transport. Only after a careful consideration of all accompanying factors that need to be taken into account for such large projects did ANDRITZ HYDRO decide to participate in the bidding process.

The Mekong River is also called "Mother of Water". Its exact length has never been measured, but is said to lie between 4,300 km and 4,900 km. Originating in the Tibetan highlands, it spans China, Burma, Laos, Thailand, Vietnam and Cambodia down to the well-known delta estuary in the south.

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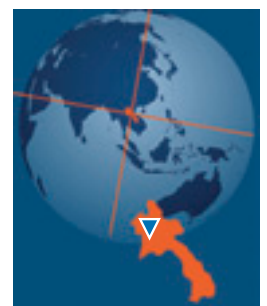
TECHNICAL DATA

Output (max.): 7 x 182 MW / 1 x 68.8 MW
Voltage: 16 kV
Head: 28.5 m
Speed: 83.33 rpm / 150 rpm
Runner diameter: 8,600 mm / 5,050 mm

▼ Site visit



▼ Foundation work





Spray 1

Huge milestone for ANDRITZ HYDRO in Canada

▲ Downstream view

On 24 October 2012, ANDRITZ HYDRO achieved a significant milestone in the Canadian market with the signing of a Master Service Agreement (MSA) with TransAlta for their hydro fleet modernization and Life Extension Program (LEXT), an upgrading program of 13 plants and 20 generation units. TransAlta is Canada's largest publicly-traded generator and marketer of electricity and renewable power.

The first success under this MSA was the award of the Spray unit 1 rehabilitation project on 15 May 2013. The hydroelectric facility is close to Canmore in Alberta (Canada). A three-

▼ Draft-tube cone and lower cover before refurbishment



phase approach to Service and Rehab was key to securing Spray order. At first, ANDRITZ HYDRO carried out a detailed condition assessment on the existing unit. Based on this work, a budget proposal was prepared to support TransAlta's financial evaluation of the rehabilitation. ANDRITZ HYDRO then prepared a detailed scope of work and pricing that served as the basis for the contract.

Since HPP Spray is primarily used to provide electricity during periods of peak electrical demand, one of the requirements was to operate the turbine at a minimum power of no more than 18% of rated maximum for long periods of time. This project is consequently technically challenging because it goes against conventional Francis design practice to consistently operate turbines inside the part-load operating zone.

ANDRITZ HYDRO's scope of supply includes the cover and bottom ring, new guide vanes, a shop tower assembly, a new generator stator core, coils and winding, a brushless excitation device, and the refurbishment of several other components including the main inlet valve.

The go-ahead for this contract work could not have been successful without the cooperation and open communication between engineers and managers of each respective company. Vigilance in keeping this relationship strong will help ensure that future projects may be secured under this strategic MSA.

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TECHNICAL DATA

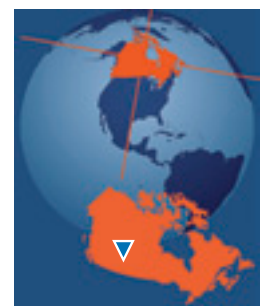
Output: 56 MW / 62.2 MVA

Voltage: 13.8 kV

Head: 266.7 m

Speed: 450 rpm

Runner diameter: 1,575 mm



VERBUND Grenzkraftwerke

Modernization of five run-of-river hydropower stations on the rivers Inn and Danube

ANDRITZ HYDRO has been awarded a contract by the binational VERBUND Hydro Power AG subsidiaries Österreichisch-Bayerischen Kraftwerke AG and Donaukraftwerk Jochenstein AG to renovate the secondary technology in five run-of-river hydropower stations on the rivers Inn and Danube.

All five of these hydropower stations (Oberaudorf-Ebbs, Braunau-Simbach, Schärding-Neuhaus, Passau-Ingling and Donaukraftwerk Jochenstein) are operated by VERBUND Tochter Grenzkraftwerke GmbH. It is one of the largest contracts for secondary technology awarded to ANDRITZ HYDRO Automation to date.

The project's scope includes the following secondary equipment for:

- 19 generating sets (Kaplan or bulb turbines) including turbine governor
- 24 gates
- three 110- and 220-KV substations
- remote stations
- water management
- auxiliaries reservoir simulator.

The NEPTUN concept will be implemented at all sites, because it is based on international standards. As a result it ensures an integrated system with a consistent structure for communications, and provides the basis for future expansion. In 2012, a redundant SCADA system (250 SCALA) was installed as part of the modernization project. The new control system will now be implemented in phases without interruptions in operation.

In future, the water management system and units and gate operation will be han-

dled by the new controller. In case of an emergency a level controller takes over the water management. In addition to the modernization of block and generator protection systems, a backup protection system with auxiliary power supply is also to be installed. Furthermore, the consumption protection systems at Oberaudorf-Ebbs, Braunau-Simbach, and Jochenstein hydropower stations will be renovated.

The shared concept of voltage compounding for the 19 thyristor compound excitation devices (THYKO) guarantees, by virtue of voltage addition in the direct-current circuit, the greatest level of dynamic control during normal operations as well as a sufficiently high sustained short-circuit current were a fault to arise.

In order to optimize the system and for training as well as simulation, a simulator with a variety of reservoir models will also be provided. One of the major challenges is advance planning with regard to staffing, since the systems will be put into operation at up to three hydropower station sites at the same time. The entire project is scheduled to end in early 2018.

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TECHNICAL DATA

Oberaudorf-Ebbs:

Output: 2 x 32.6 MW

Voltage: 110 kV

Gate: 3

Braunau-Simbach:

Output: 4 x 25.6 MW

Voltage: 110 kV

Gate: 5

Schärding-Neuhaus:

Output: 4 x 24.8 MW

Voltage: 220 kV

Gate: 5

Passau-Ingling:

Output: 4 x 24.3 MW

Voltage: 110 kV

Gate: 5

Jochenstein:

Output: 5 x 28.9 MW

Voltage: 220 kV

Gate: 6

▼ HPP Jochenstein



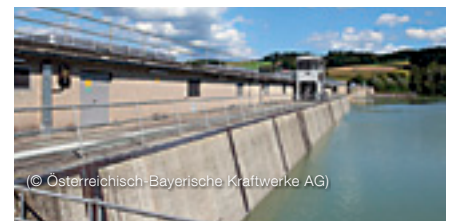
▼ HPP Oberaudorf-Ebbs



▼ HPP Schärding-Neuhaus



▼ HPP Passau-Ingling



Djoué

Clean energy for green Brazzaville, Republic of Congo

▲ Gravity dam of Djoué

In March 2013, the Délégation Générale aux Grands Travaux (DGGT), a national construction commission created to watch the development of Congo's energy infrastructure, awarded ANDRITZ HYDRO Switzerland a contract for the rehabilitation and modernization of HPP Djoué.

Located less than 10 km from its city center, HPP Djoué supplies Brazzaville with electricity and is strategically important for electricity generation in the Republic of Congo. The complex is built at the Djoué River, a tributary of the majestic Congo River, on which roaring waterfalls can be admired from the roof of HPP Djoué's surge tanks. The water intake is built inside a gravity dam to retain water for Brazzaville's electricity demand.

Since its construction in the 1950's, there have been many incidents. The

▼ Fisherman on the Djoué water detention dam



most important one occurred in April 2007, when the power plant was flooded up to the control room. The hydropower plant has been out of operation since then and the tailrace channel is totally silted up due to the Congo River's biannual floods.

The main challenge of this project is to increase the plant's power output by over 25% to reach 2 x 9.06 MW at the generator terminals by raising flow rate and installing new turbine-generator units equipped with propeller-type turbines. Speed and voltage governors will be replaced, dam equipment, particularly the water intake valve machinery, will be rehabilitated and the turbine main inlet valves will be replaced. Other powerhouse equipment - such as the overhead crane, the drainage and cooling systems - will be renewed. Furthermore, particular care will be given to the hydraulics, the headrace tunnel, and the penstocks, in order to guarantee the safety of the entire complex. The surge tanks will also be restored. Finally, another very important aspect will be the installation of a new control room, replacing the old one that was destroyed by the flooding. The switchyard will be entirely rehabilitated in order to better distribute the power throughout the network of the Republic of Congo.

The duration of the contract is 22 months for the commissioning of the first unit and 25 months for the second



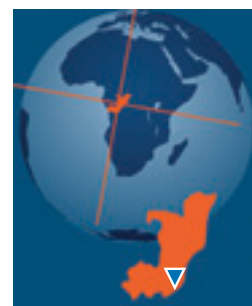
▲ HPP Djoué before rehabilitation

unit. This important rehabilitation project will give this strategic power plant a new lease on life and will supply the Congolese population with a clean source of renewable energy.

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TECHNICAL DATA

Output: 2 x 9.06 MW
Head: 24.09 m
Speed: 300 rpm
Runner diameter: 2,420 mm



Teesta Low Dam III

A breakthrough large hydro project in India

HPP Teesta Low Dam III is owned by National Hydro-electric Power Corporation Ltd., (state owned company), which is the leading hydropower company in India. It is located in the east of India, in the state of West Bengal and close to the tourist destination of Darjeeling (a famous hill station).

The contract was awarded to ANDRITZ HYDRO on 30 July 2004. In May 2013 the HPP was commissioned.

ANDRITZ HYDRO started its large hydro business in India in early 2000. This was the second project signed for local execution (the first was HPP Neriamangalam for the Kerala Electricity Board in the south of India). In a real sense, the signing of this contract paved the way to the large hydro market in India.

Runner blades were supplied by our factory in Ravensburg (Germany) and the remaining parts were delivered through local procurement and manufacturing. Storage and preservation of huge quantities and volumes of material at intermediate stores for a very long period of time was a real challenge for the execution team. The units took a long time engineering front due to dead slow work on the civil engineering front. So we decided to go for signature analysis of critical installation parameters by partially dismantling and reassembling the rotating parts of turbine and generator of all four units



▲ Power house of HPP Teesta Low Dam III

before dry commissioning activities started.

All four units were commissioned with grid connection within 100 days of water availability. The ANDRITZ HYDRO team worked very hard to achieve the tough target set by the client and even compensated for some delays elsewhere. The synchronization of the last unit (U#4) took place on 31 March 2013. This project is the first that was commissioned by ANDRITZ HYDRO India with gas Insulated switchgears (220 KV).

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TECHNICAL DATA

Output: 34 MW / 36.67 MVA

Voltage: 11 kV

Head: 21.34 m

Speed: 136.36 rpm

Runner diameter: 5,200 mm



Santo Antônio

12 bulb type units and 24 excitation systems for Brazil's fifth largest hydropower plant



▲ Bulb generator at HPP Santo Antônio

At this point we want to mention the client's written commendations for ANDRITZ HYDRO Inepar site team for their efficient and competent support of the bulb units and the 4,000 and 8,000 hour revisions.

Recently SAE received the permission from the local authorities to increase the installed capacity from 3,150 MW to 3,568 MW, which will lead to a total number of 50 installed bulb units at HPP Santo Antônio. The commercial operation of the additional six units is planned for 2016.

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TECHNICAL DATA

5-blade turbine:	6 x 71.05 MW
4-blade turbine:	6 x 74.8 MW
Generator:	12 x 82.25 MVA
Voltage:	13.8 kV
Speed:	100 rpm
Rotor diameter:	7,500 mm
Stator diameter:	9,700 mm



▲ Bulb turbine at HPP Santo Antônio

HPP Santo Antônio is located in western Brazil at the Madeira River in the state of Rondônia. With an installed capacity of 3,150 MW Santo Antônio is one of the largest hydropower plants in the world equipped with 44 bulb type units. Currently these units are the biggest bulb type generators ever built with a generator stator diameter of 9,700 mm.

In 2012 the supplier consortium GICOM, formed by ANDRITZ HYDRO, Voith Hydro, Alstom Power, Bardella and Siemens, handed over the completed first of four powerhouses with eight units each to the client SAE (Santo Antônio Energia).

ANDRITZ HYDRO highlights of 2012 and 2013:

- First bulb generator unit of Madeira hydroelectric complex starts commercial operation on 30 March 2012. Unit 4 was handed over to SAE and the local authorities ANEEL by ANDRITZ HYDRO, 90 days ahead of contract schedule.
- With the handover of unit 8 the first power house (right bank) was completed in December 2012.
- In January 2013 unit 11 was handed over 13 days ahead of contract schedule.

- In February 2013 ANDRITZ HYDRO completed 50% of the erection with the lowering the runner for unit 19.
- In September 2013 the main erection of powerhouse four started with the lowering of the stay column parts of unit 33.
- Unit 24, located in powerhouse three, will be handed over at the beginning of January 2014, 50 days ahead of contract schedule.

By accepting the responsibility for contracting unit 38 instead of the originally agreed unit 41, ANDRITZ HYDRO once again showed their strong support for the supplier consortium GICOM. This change of one unit between Alstom Power and ANDRITZ HYDRO was only possible due to strictly meeting the tight fabrication schedule by ANDRITZ HYDRO Inepar and their manufacturing partner IESA.

▼ Generator bearings for HPP Santo Antônio



Deriner

New equipment for an underground powerhouse in Turkey

▲ Deriner Dam

As a member of five consortium partners Hydro Vevey Ltd., formerly Sulzer Hydro Ltd., awarded a contract for Deriner hydropower station with commencement on 8 January 1998 to ANDRITZ HYDRO.

With great pride, after 15 years of contract execution phase and huge civil engineering delays, in July 2013, ANDRITZ HYDRO received a Provisional Acceptance Certificate (PAC) for three units from the General Directorate of the State Hydraulic Works. DSI is the primary executive state agency of Turkey and responsible for planning, managing, execution and operation of the nation's overall water resources.

HPP Deriner is located on the lower course of the Çoruh River in northeastern Turkey, upstream of the completed HPP's Muratlı and HPP Borçka. It is part of the Çoruh River regulation plan that shall include 10 dams. With a high of 249 m the Deriner dam is the highest one in Turkey and the sixth highest dam in the world.

The underground powerhouse complex, which has been excavated on the right bank of the Çoruh River at a depth of approximately 100 m, has a width of 20 m, a length of 126 m and a height of 45 m. The scope of supply from ANDRITZ HYDRO included four vertical Francis units with an installed production capacity of 670 MW, four 3,600 mm inlet valves, turbine governors, various cranes and auxiliary equipment.

HPP Deriner's annual electrical generation of 2,118 GWh will cover approximately 1.1% of the total energy production in Turkey. Politically, this project got more and more interesting as finally

▼ Runner unit 1 suspended and under preparation for move



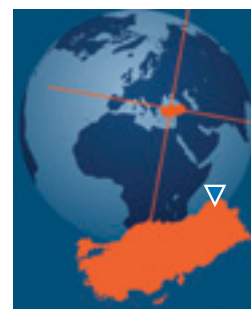
the president of Turkey, Mr. Abdullah Gül, visited the Deriner hydropower station on 13 June 2013.

The last PAC was signed by DSI in October 2013.

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TECHNICAL DATA

Output: 4 x 170.8 MW
Head: 198 m
Speed: 200 rpm
Runner diameter: 4,365 mm



Wei Tuo

The world first two-blade bulb units in successful operation in China

ANDRITZ HYDRO China has successfully commissioned two twin-bladed units for HPP Wei Tuo in southwest China.

The new design concept was well engineered and implemented and the units are now running with smooth operation and are fully meeting the customer's expectations. So far, this is the first and the only hydropower plant in the world with a two-blade units operation.

HPP Wei Tuo is located approximately 23 km upstream from the confluence of the Fu Jiang River, the Jia Ling Jiang River and the Qu Jiang River and is also a famous scenic spot – the Fishing City. The Fishing City is a historic site known for fighting against the invasion from the Mongolian Empire and thus a famously heroic city which achieved feats of war in ancient times.

In 2005, in order to improve the navigation condition and water transportation capacity, Cao Jie navigation and electricity junction project (Cao Jie project), which is located 26 km downstream of the confluence of the these three rivers, was launched.

With the completion of the Cao Jie project, HPP Wei Tuo faced the fate of abandonment in the year 2011, as the head was reduced from 10 m to 3.4 m. In early 2009, ANDRITZ HYDRO China offered a two-blade bulb solution. In December 2009, ANDRITZ HYDRO China was awarded a contract for a two-blade turbine model test and the supply of two new runner blades and hub covers for refurbishment of two four-blade units in order to adapt to the head change. By merely changing the four-blade runner to a two-blade runner, the unit is designed for an output of



▲ Commission of first two-blade runner

3.56 MW at a head of 3.4 m and an annual utilization of 5,771 hours. The main challenge in that project was the design, the delivery and the implementation costs of the two new blades and the covers for the remaining two holes.

In addition, the finishing of the manufacturing of all blades supplied was completed by ANDRITZ FOSHAN by a team with comprehensive qualities and high levels of expertise. Thanks to their and high levels of efforts the high quality products were delivered perfectly on time.

With the final completion and overall smooth operation of this project ANDRITZ HYDRO has again strengthened its leading position as a supplier of hydroelectric equipment for hydro-power plants. The project management team wants to thank all those col-

leagues who have provided their utmost engagement in order to reach this complete success.

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TECHNICAL DATA

Output: 2 x 3.56 MW
Head (max.): 5.3 m
Speed: 93.75 rpm
Runner diameter: 5,300 mm



Ashta 1 & 2

Take-over of world's largest HYDROMATRIX® plant in Albania

▲ Upstream side view of turbine-generator units in raised position (maintenance) at HPP Ashta 2

After the inauguration of HPP Ashta 1 on 18 September of last year and the start of the commercial operations for Ashta 1 & 2 by the end of 2012, Energji Ashta, a joint venture of VERBUND Hydro Power AG and EVN, has issued the "Taking Over Certificate" for Ashta 2 on 20 June 2013 and subsequently taken over the entire Ashta plant.

The timely and successful taking over of the world's largest HYDROMATRIX® plant brings the ambitious and fast paced Ashta project to a successful end. The two plant stages are located at the Drin River near the city of Shkodra in Albania. Each one of them

▼ Turbine-generator units in raised position (maintenance) at HPP Ashta 1



features 45 turbine-generator units with a total capacity of 53 MW. ANDRITZ HYDRO supplied the HYDROMATRIX® – turbine generator units, the hydraulic steel structure, the medium voltage equipment and the control system. During the last months ANDRITZ HYDRO's site personnel and engineers field-tested and optimized the joint plant control system, which allows the fully automated operation procedure of both stages in close cooperation with the upstream HPP Vau I Dejes. The performance tests verified that the guaranteed values exceeded the contractual requirements of the turbine-generator units in Ashta 1 as well as in Ashta 2 significantly.

The first half year of commercial operation of HPP Ashta 1 and 2 confirmed the good performance of the entire equipment supplied by ANDRITZ HYDRO.

As part of the take-over process, the turbine-generator units went through a rigorous testing regime which culminated in a continuous 3-month long reliability run of all 90 units. Both plants passed this endurance test and recorded minimal outages which amounted to less than a fifth of the allowed outage threshold values. The world's largest HYDROMATRIX® plant has thereby

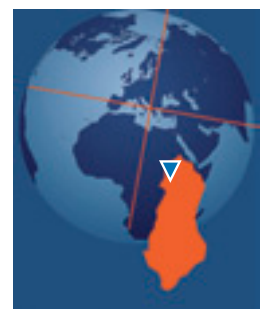
proven its reliability. Despite delays in construction due to major flood events in 2010, the project was completed within three and a half years. During its 35 year-long build-operate-transfer concession, Energji Ashta will deliver more than 240 GWh of annual energy and will significantly improve the energy supply situation in Albania.

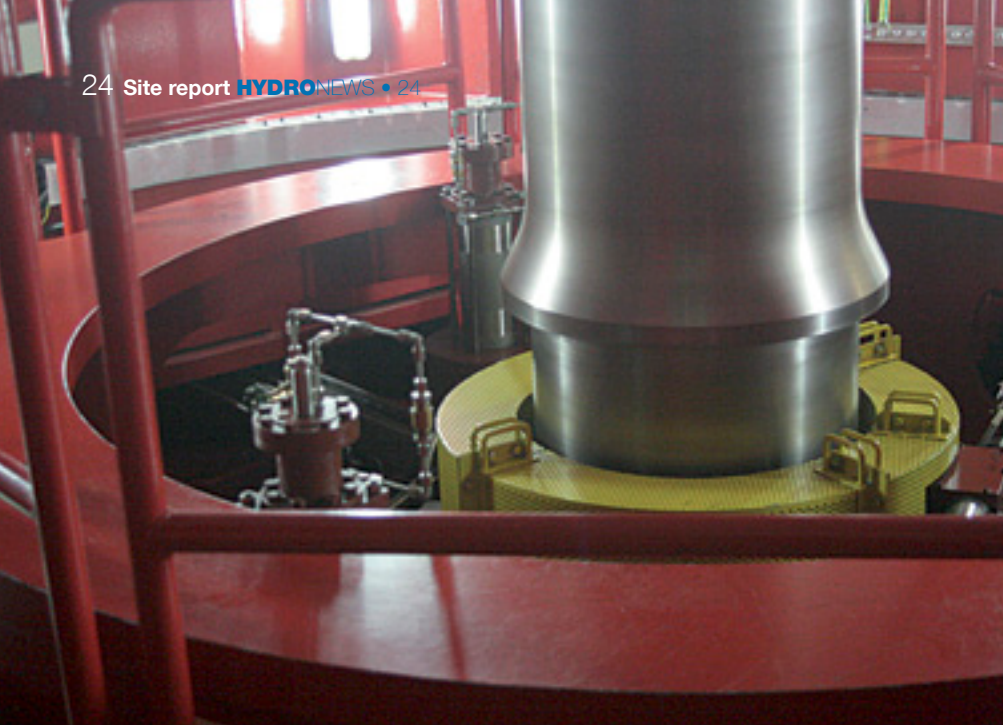
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TECHNICAL DATA

Output: 53 MW
Head Ashta 1: 4.98 m
Head Ashta 2: 7.53 m
Number of TG-units: 45 + 45





▲ Detail view new turbine unit 3



▲ Handing over of certificate to ANDRITZ HYDRO - Dr. Jagob & Mr. Simon Ngure (Managing Director & CEO)

Kindaruma

Final taking over in Kenya ahead of schedule

Ahead of schedule, on 19 July 2013, a new third unit, two upgraded units and the rehabilitated common equipment at Kindaruma hydropower plant were finally taken over by Kenya Electricity Generating Company Ltd.

HPP Kindaruma is part of the Seven Fork Cascade, located 160 km north-east of Nairobi on the Tana River. It was commissioned in 1968 and was the first major power station in independent Kenya. Designed for three turbine generator units, only two vertical Kaplan units were installed. With the new third unit and the two upgraded ones the power output of the station was increased from 40 MW to 72 MW.

One of the key winning key factors was our challenging overall project schedule, which showed a significantly shorter execution time as well as a much lower demand for outage days compared with the schedules of our competitors.

A complex financing and sourcing concept was required. The generators were manufactured in the ANDRITZ HYDRO

generator workshop in Sweden according to the design which was created in Weiz (Austria). Mechanical components such as the intake gate and propeller type runners were designed in Linz (Austria) and manufactured in the ANDRITZ HYDRO workshop in Spain. For the design and sourcing of the electrical power systems Austria was again responsible.

Hence a total of 11 ANDRITZ HYDRO locations in nine different countries contributed to the Kindaruma success story. Excellent team spirit and cooperation of the project team as well as a very proactive approach to managing the ample challenges and risks made it able to complete all four penalized sections of work on or ahead of schedule.

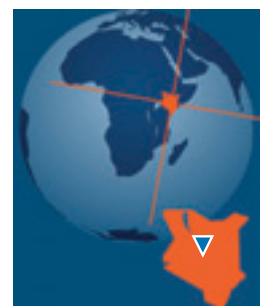
In the presence of the Austrian Ambassador in Kenya, the senior management of KenGen, ANDRITZ HYDRO and numerous TV teams and journalists, the rehabilitated power station was handed over from ANDRITZ HYDRO to KenGen at the Kindaruma site on 23 July 2013.

With this big achievement ANDRITZ HYDRO Service & Rehab has completed an important project reference for the East African region and for the whole of Africa.

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TECHNICAL DATA

Output: 3 x 24 MW / 28.2 MVA
Voltage: 11 kV / 132 kV
Head: 36 m
Speed: 214.3 rpm
Runner diameter: 3,100 mm



Iffezheim

Successful extension of a German run-of-river power station



▲ Generator installation

Iffezheim is the biggest run-of-river power plant at the river Rhine and one of the biggest in Europe.

In October 2007 ANDRITZ HYDRO received a contract from Rheinkraftwerk Iffezheim (RKI) Ltd. (a subsidiary of the German and French based utilities EnBW and EdF) for the extension of the existing HPP Iffezheim. It covers the engineering, supply, installation and commissioning of a new large bulb turbine-generator unit, which should be incorporated in a new separate powerhouse.

The scope of supply was managed by ANDRITZ HYDRO Ravensburg (Germany) providing the project leadership and the bulb turbine including mechanical auxiliaries. ANDRITZ HYDRO Weiz (Austria) was in charge of the bulb generator including auxiliaries and ANDRITZ HYDRO Vienna (Austria) provided the protection equipment.

A further contract has been awarded to ANDRITZ HYDRO Vienna (Austria) for engineering, supply, installation and commissioning of a new automation system for the whole power station, the four old bulb turbine units (former Escher Wyss turbines) and the new automation system of unit five.

In order to allow an early start of all the engineering works for unit five, the contract documents were signed in October 2007 and fully released in December 2007. As one of the first activities a model test report was elaborated for the new turbine based on the leading technology and the comprehensive experience of ANDRITZ HYDRO in the field of hydraulic bulb turbines.

From the beginning, the civil works were confronted with a number of challenges and surprises in the form of some “discoveries” of geological issues, non-documented debris from the construction of the old power station and other issues. The outcome was a substantial delay in the civil construction and affected the overall project and the equipment installation program.

Irrespective of all these delays, the parties agreed to stick to the original supply schedule for all major components and ANDRITZ HYDRO successfully managed to deliver ontime. In the case of HPP Iffezheim the parts needed to be delivered and stored for a couple of months. The new unit was put into operation with a delay of around 20 months.

Since the commercial operation started, the new bulb turbine-generator unit has been running smoothly. The 148 MW power station is now able to produce approximately 860 GWh per year, providing 75,700 people with renewable green energy.

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▲ Turbine runner installation

TECHNICAL DATA

Output: 38 MW / 38.85 MVA

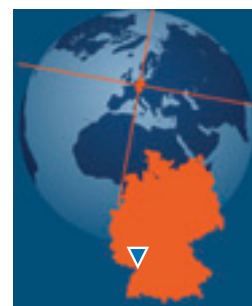
Voltage: 6.5 kV

Head: 10 m -13.2 m

Speed: 83.33 rpm

Runner diameter: 6,800 mm

Stator diameter: 7,500 mm



Coca Codo Sinclair

Largest hydropower plant of Ecuador under construction

▲ Nozzle pressure test

In June 2011 Harbin Electric Machinery Co.,Ltd. awarded a contract to ANDRITZ HYDRO for the supply of core components for HPP Coca Codo Sinclair (Ecuador), which is owned by Empresa Pública Estratégica Hidroeléctrica.

▼ Runner coating in Kriens (Switzerland)



The hydropower plant is located at the Coca River drainage area between Chaco and Lumbaqui, about 130 km away from the capital, Quito.

Beneath the very interesting contractual setup (Hydroelectrica Coca Codo Sinclair EP as project owner, SinoHydro as EPC contractor, Harbin as Turbine supplier and ANDRITZ HYDRO as core component supplier) this is the first time that 50% of the total scope of the nozzles are to be manufactured out of Chengdu TianBao Heavy Industry Co.,Ltd.

ANDRITZ HYDRO's scope of supply includes engineering design and supply of 48 nozzles and eight Pelton runners plus one spare runner. To withstand the extremely severe water conditions and in order to extend the lifetime of nozzles and runners, these parts are being coated in the ANDRITZ HYDRO workshop in Kriens (Switzerland). By using a hard coating on runners and related components the damage being done as a result of abrasive erosion is significantly decreased.

With its 8 x 187.7 MW Coca Codo is the largest hydropower plant in Ecuador, supplying 35% of the country's total energy demand and saving

approximately two billion liters of imported Diesel for thermal power plants per year.

Furthermore, this project is another great reference in ANDRITZ HYDRO's list of testimonials.

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TECHNICAL DATA

Output: 8 x 187.7 MW
Head: 604.1 m
Speed: 300 rpm
Runner diameter: 3,349 mm



Strasbourg & Gerstheim

Twelve excitation systems under refurbishment in France



© Médiathèque EDF

▲ View on HPP Strasbourg

HPP Strasbourg has been successfully completed. The first system is currently being manufactured and will be delivered by end of 2013. The first commissioning is scheduled for May 2014 and the last beginning of 2019.

This project is an important reference and a technical challenge for ANDRITZ HYDRO as it comes just prior to the upcoming RenouvEau great rehabilitation program by EDF. During this program, 400 units will be renovated at 200 HPP's for the next 14 years.

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TECHNICAL DATA

Output: 12 x 25 MVA

Voltage: 3.6 kV

Speed: 100 rpm

In December 2012, EDF awarded ANDRITZ HYDRO a contract for the refurbishment of 12 excitation systems at HPP's Strasbourg and Gerstheim.

Following the complex project of La Coche in 2009, and Auzat-Soulcem in 2011, EDF selected ANDRITZ HYDRO for the renewal of very complex installations with medium and high excitation current output.

The HPP's Strasbourg and Gerstheim are located in Northeastern France in the Alsace department on the Rhine River, which flows beside the famous cultural city of Strasbourg, well known for its Christmas market and Cathedral. The river marks the border between France and Germany along 200 km. ANDRITZ HYDRO will carry out the complete rehabilitation of the excitation

systems for Strasbourg and Gerstheim hydropower plants, which are scheduled from 2013 to 2019.

HPP Gerstheim, located 20 km south of Strasbourg, was first commissioned in 1967 and HPP Strasbourg followed in 1970. Both HPPs have the same configuration and are being remotely supervised by HPP Kembs, located near the city of Mulhouse.

The scope of works includes the whole engineering, manufacturing, delivery and commissioning of six THYNE 4 systems for Strasbourg as well as six THYNE 5 systems for Gerstheim, for 12 bulb groups with a power of 25 MVA each.

The project execution was launched at the beginning of 2013 and the engineering phase of the systems for



Austria Illspitz



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In June 2012, the consortium consisting of ANDRITZ HYDRO Germany and ELIN Motoren GmbH Austria was awarded with the contract for the supply of the complete electromechanical equipment for HPP Illspitz.

In the state of Vorarlberg, right above the junction of the rivers Ill and Rhine the public utility Feldkirch established an additional hydropower station and thereby will accomplish a duplication of their own power production out of the renewable energy source water power. At the same time, numerous of ecological accompanying measurements were implemented with the entire project, such as remuneration, groundwater enrichment, renaturation as well as two upstream and one downstream fish migration passages. The scope of supply for ANDRITZ HYDRO comprises two Compact bulb turbines with a 2,850 mm runner diameter each. Part of the project includes the two governors, respectively oil bearing units, a large electrical infrastructure, turbine and generator control cubicle, the remote control cubicle, a water level control cubicle and an uninterrupted power supply unit with 24 VDC. The start of the commercial operation is scheduled for summer 2014.

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TECHNICAL DATA

Output (approx.): 2 x 3.6 MW
Head: 8.9 m
Speed: 157.9 rpm
Runner diameter: 2 x 2,850 mm

Turkey Yanbolu

At the beginning of July 2012 ANDRITZ HYDRO received an order for the delivery and installation of three Francis units from Pamuk Elektrik.

HPP Yanbolu is located in Trabzon Arsin on the river Yanbolu and is a run-of-river power plant. The customer, Pamuk Elektrik, belongs to Nuh Enerji and is a sister company of Kudret Enerji, which has previously realized HPP Kuşluk together with ANDRITZ HYDRO. The project at Yanbolu hydropower plant will be carried out by a consortium of ANDRITZ HYDRO in

France and Turkey and Leroy Somer (France). The scope of supply includes three Francis turbines, their generators and an inlet valve as well as automation and electrical power systems.

The start of commercial operation is scheduled by mid 2014.

Dominique Leleux
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TECHNICAL DATA

Output: 2 x 6.73 MW / 1 x 3.05 MW
Head: 112.5 m
Speed: 750 rpm / 1,000 rpm
Runner diameter: 875 mm / 650 mm

Belgium Lixhe

Since 1979 the Belgium utility company EDF Luminus has operated the HPP Lixhe on the river Meuse with four single regulated Straflo-turbines.

In order to use extreme part load operating ranges, more effective and to hold a constant head water level even at low discharges in future, two of four Straflo-turbines will be replaced by double-regulated bulb turbines. A challenge is the fact, that the new turbines have to be placed between the existing stop logs so that the remaining two Straflo-turbines can be operated without interruption during the erection phase of the new turbines.

Two double regulated Compact bulb turbines, each with a runner diameter of 2,600 mm, meet the above requirements in an optimum way. Therefore,

a consortium of ANDRITZ HYDRO Germany and ELIN Motoren GmbH (Austria) was awarded the contract for delivery of the complete electromechanical equipment in November 2012. Besides the Compact bulb turbines, the governor and their respective oil bearing units and the synchronous generators, it also includes a large electrical infrastructure as well as the disassembly of two of the existing Straflo-turbines. The disassembly works at HPP Lixhe are completed and the delivery of the main turbine components shall start by end of 2013.

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TECHNICAL DATA

Output: 2 x 3.41 MW
Head: 7.65 m
Speed: 176.47 rpm
Runner diameter: 2,600 mm



Canada Okikendawt



Hydro Mega and the Dokis First Nation formed the Okikendawt Limited Partnership in 2009, in order to develop, build and operate a 10 MW hydroelectric facility at the Portage Dam on the French River in Ontario (Canada).

At the end of 2012, ANDRITZ HYDRO received the contract for the supply, installation and start-up of a water-to-wire equipment package featuring two double regulated ECOBulb turbines.

The Okikendawt project will have the largest, most powerful ECO-Bulb turbines delivered worldwide. The turbine will be supplied by ANDRITZ HYDRO France using stators manufactured by ANDRITZ HYDRO India.

Technical highlight will be the converter technology in order to meet the interconnection requirements of the local utility.

Site activities are scheduled to begin during the summer of 2014 with commissioning in early 2015.

Diana Ruess
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TECHNICAL DATA

Output: 2 x 5,234 MW
Head: 9 m
Speed: 138.5 rpm
Runner diameter: 3,350 mm

Guatemala Renance II

In October 2012 ANDRITZ HYDRO Spain received an order from Cobra Infraestructuras Hidraulicas for the supply of four six-nozzle vertical Pelton turbines, four generators and four main inlet valves for HPP Renace II in Guatemala.

Renace II hydropower station is located downstream of HPP Renace I, close to the cities San Pedro and Coban, in the Alta Verapaz state (Guatemala). This area is inhabited by Mayan Indians, who show a high degree of respect for



the environment. Manufacturing, pre-assembly and testing of the main turbine and valve components are being performed at the ANDRITZ HYDRO workshop in Algete (Spain). Alconza Berango, which is located in Vizcaya (Spain) will deliver the four synchronous generators.

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TECHNICAL DATA

Turbine:

Output: 30.4 MW
Head: 342 m
Speed: 450 rpm
Runner diameter: 1,640 mm
Nozzle: 6 x 206 mm

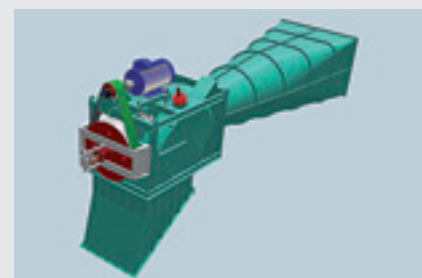
Main valve:

Type: Spherical
Diameter: 1,500 mm

France Osselle, La Malate & Vitry

Since the incorporation of the TOUL site into the group, ANDRITZ HYDRO received three orders for projects in France, thus bringing the benefit of its longstanding experience to the Mini Compact Hydro market.

The first order, HPP Osselle, awarded by SPER, an independent power producer, consists of the supply of three Kaplan turbines with a siphon type construction, to replace the three old Francis turbines of the existing power plant. Another independent power producer, ELM S.A.S, sent an order for two axial Kaplan turbines for HPP La Malate, with its open flume type construction. These two projects are both located in the Doubs region, which is suitable for the development of hydropower. GCE, a company specialized in construction industry, awarded the third contract, HPP Vitry, where ANDRITZ HYDRO has to deliver three Kaplan turbines with a siphon type construction.



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TECHNICAL DATA

Osselle:

Output: 167.5 kW
Head: 1.85 m
Speed: 121 rpm
Runner diameter: 2,000 mm

Vitry:

Output: 130.4 kW
Head: 2.60 m
Speed: 205 rpm
Runner diameter: 1,400 mm

La Malate:

Output: 420.5 MW
Head: 2.10 m
Speed: 91 rpm
Runner diameter: 2,800 mm

Switzerland Tobel Oberschan



The village-union of Oberschan recently placed a purchase order with ANDRITZ HYDRO for a new vertical Pelton turbine. The order includes the supply, the installation and the commissioning of a vertical four-jet Pelton turbine with a power output of 118 kW, as well a control system, it includes, the inlet valve, pipework and an asynchronous generator.

In 1916 the electrics-union Oberschan built the small hydropower plant Tobel, which has been in operation until now. This old machine is still working, but

after almost 100 years the commune Wartau decided on having the unit replaced by a new power plant.

The water of the Mühlbach and Schmittendrain creek is used for this hydropower plant. The downhill distance between HPP Oberschan and HPP Tobel is approximately 69.2 m. The Mühlbach creek supplies the waterflow through an intake at "Untere Mühle" (Badeck). This water is conducted by gravity-flow line to the compensation reservoir Mühlebunt. The commissioning of the new power plant is scheduled for autumn 2013.

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TECHNICAL DATA

Output: 118 kW
Head: 58 m
Speed: 600 rpm
Runner diameter: 510 m

Romania Paraul Bailor

At the end of July 2013 ANDRITZ HYDRO and HYDROSILVANIA, represented by Mrs. Virginia Farkas, signed an order for the delivery, installation and commissioning of two vertical Pelton / generator units including the electrical equipment.

The scheme is a run-off-river power station in the country of Bistrița-Năsăud, located close to the village Anies (Romania). ANDRITZ HYDRO will deliver two six nozzle vertical Pelton



turbines, air cooled generators (880 kVA & 690 V), inlet valves (DN700/PN16), hydraulic oil pressure units, the control measuring protection equipment of the turbine/generator set, AC-DC distribution system, LV-circuit breakers to the generator, 690 V bus bar system, LV-circuit breaker to the transformer, the control equipment for the intake (Tyrolean type weir) and the cabling for the supply and erection of the equipment. The commissioning of the equipment is scheduled for mid-April 2014.

Edwin Walch
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TECHNICAL DATA

Output: 2 x 776 kW
Head: 76.8 m
Speed: 428.6 rpm
Runner diameter: 800 mm

Bulgaria Kadievo

At the beginning of August 2013 ANDRITZ HYDRO was awarded by NAT 2004 Ltd. to deliver, install and put into operation the equipment for the low head run-of-river power station Kadievo.

HPP Kadievo is located on the Vacha River close to the city of Plovdiv (Bulgaria).

ANDRITZ HYDRO will deliver a four-blade bevel gear bulb turbine, a low voltage synchronous generator (1,500 kVA, 400V), a hydraulic oil pressure unit, control-visualization-



measuring and protection equipment of the turbine/generator set, LV-circuit breakers for the generator, a 400 V bus bar system with AC-DC distribution as well as the trash rack, an automatic hydraulic trash rack cleaning machine and a chain conveyor system for the debris.

Commissioning of the equipment is scheduled for the end of 2014.

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TECHNICAL DATA

Output: 1.32 MW
Head: 5.72 m
Speed: 210 rpm / 750 rpm
Runner diameter: 1,950 mm

Brazil Barra Bonita

In March 2013 ANDRITZ HYDRO Inepar received an order from AES Tietê, part of international group AES Corporation, to refurbish unit 1 of HPP Barra Bonita.

In the last few months ANDRITZ HYDRO Inepar has successfully finished the refurbishment of HPP Nova Avanhandava and HPP Limoeiro for AES Tietê. The Barra Bonita hydro-power plant is located on the Tietê River between the towns of Barra Bonita and Igarçu do Tietê, 290 km from Sao Paulo city (Brazil). HPP Barra Bonita was built over 50 years ago and consists of four vertical Kaplan turbines with a combined output of 35 MW.



The scope includes amongst other items the refurbishment of the turbine, supply of a new discharge ring, modernization of the generator by replacing the core and stator winding, renewal of the roller intake gates, supply of power cables and panels, new static excitation system and protection, installation and commissioning. Start-up is scheduled for September 2014.

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TECHNICAL DATA

Output: 140.76 MW

Canada Beechwood



In February 2013, ANDRITZ HYDRO Canada was awarded a contract for the refurbishment of the unit 1 Kaplan turbine at NB Power's Beechwood generating station which is situated on the Saint John River in New Brunswick (Canada).

Originally provided by Dominion Engineering Works in 1957, the main objective is to restore the operation of the turbine, which has been operating with its blades locked in a fixed position since the 1970's. The project started in June 2013 and is planned to be completed in March 2014. The work consists of the disassembly and reassembly of the unit, inspections and refurbishment of the components of the turbine and the conversion to self-lubricated materials throughout. The 5.5 m Kaplan runner, fully assembled, is currently on its way to a refurbishment shop, lying 550 km away.

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TECHNICAL DATA

Output: 33.5 MW
Voltage: 13.8 kV
Head: 17.4 m
Speed: 109.1 rpm
Runner diameter: 5,537 mm

Lebanon Markabi/Bekaa



ANDRITZ HYDRO received an order from the Republic of Lebanon / CDR and ONL for the rehabilitation of generator #1 at HPP Markabi (Lebanon).

The Markabi underground power plant is first inline of three power plants in a cascade generating electricity and irrigation to the surrounding area. The scheme takes water from the Litani River (Bekaa valley) at 858 m above sea level from Karaoun dam (storage volume 220 mio. m³). The refurbishment

is contracted by the Lebanese Council for Development and Re-construction (CDR).

The scope for ANDRITZ HYDRO is defined by the upgrading from 21.25 to 24 MVA and comprises a new stator, new pole windings, rehabilitation of rotor, exciter and bearings, new coolers and cooling pipes.

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TECHNICAL DATA

Output: 1 x 24 MVA
Speed: 600 rpm



Canada Beauharnois

In June 2012 ANDRITZ HYDRO was awarded a contract from Hydro Quebec for the replacement of five excitation systems at the Beauharnois hydropower plant. This order followed the successful delivery of the excitation systems for HPP La Tuque.

The HPP Beauharnois is located at the St. Lawrence River approximately 40 km southwest of Montreal in the province of Quebec (Canada). The hydropower plant consists of 36 units with a total installed capacity of 1,853 MW. The units were put into operation from 1932 to 1961.

The contract consists of the delivery of five THYNE 4 systems including spare parts as well as commissioning, support and training. ANDRITZ HYDRO Austria completed the design work in October 2012. After manufacturing at ANDRITZ HYDRO in Graz (Austria) the successful factory acceptance test of the first system was done together with the customer in December 2012. The first unit was then delivered in January 2013. The remaining ones will be supplied on a yearly basis until 2017.



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TECHNICAL DATA

Output: 36 x 52 MW
Head: 24.4 m
Speed: 94.7 rpm

Czech Republic Dalešice and Mohelno

A contract for the refurbishment of the control systems of HPP Dalešice and HPP Mohelno has been awarded to ANDRITZ HYDRO in 2013. Both hydropower plants are located in south Moravia (Czech Republic).

The Dalešice hydropower station is equipped with four sets of reversible Francis turbines for a 90 m head (clay-sealed rock-fill dam) and synchronous generators. Its installed capacity of 450 MW and 60 seconds startup time plays an important role in the regulation of the Czech power grid.

The Mohelno run-of-river hydroelectric power station is equipped with two turbine sets of 1.2 MW and 0.6 MW. The Mohelno reservoir balances the runoff from HPP Dalešice, and serves as its lower basin. The refurbishment is planned for 2014 and 2015. After that, both power plants will be equipped with state-



of-the-art ANDRITZ HYDRO control systems, allowing error-free operation for the coming years.

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TECHNICAL DATA

Dalešice:

Output: 4 x 112.5 MW
Head: 90.7 m – 60.5 m
Speed: 136.2 rpm
Runner diameter: 800 mm

Mohelno:

Output: 1.2 MW / 0.6 MW
Head: 35.0 m – 20.5 m
Speed: 750 rpm
Runner diameter: 800 mm

Austria Reißeck II

VERBUND Hydro Power AG has awarded ANDRITZ HYDRO a contract to supply the control equipment and protective infrastructure in the new pumped storage power plant Reißeck II in Carinthia (Austria).

PSPP Reißeck II will connect the hydraulic systems of the power station groups Malta and Reißeck/Kreuzeck, which currently operate separately, thereby putting existing resources to more efficient use. The Reißeck II pumped storage power plant will have a total capacity of 430 MW, based on two generating units, in turbine and pump mode.

The scope of delivery encompasses project planning, installation, and

startup of the control systems of both generating sets, including functional areas such as the draft tube flap gate, spherical valve, and cooling water system.

Additionally the contract includes the new installation of hydraulic protection for the penstocks, which requires a high degree of know-how by the entire project team. Together with the awarded excitation system, the Neptun concept will also be installed at PSPP Reißeck II.

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TECHNICAL DATA

Output: 2 x 215 MW
Head: 730 m

Austria Schwarzach, Wallnerau & St.Veit

In August 2012 ANDRITZ HYDRO received an order from VERBUND Hydro Power AG for the refurbishment of the electrical protection system for generators and transformers in HPP Schwarzach and the automatic voltage regulator (AVR) for the four generators in HPP Schwarzach and two generators in HPP Wallnerau. This year VERBUND Hydro Power AG extended the contract with the refurbishment of the AVR and protection system for HPP St.Veit, which is the downstream plant of HPP Schwarzach.

The aim is to replace the old secondary equipment by state of the art digital systems and keep the existing primary equipment. The main challenges for ANDRITZ HYDRO are the tight schedule from signing the contract until the erection and commissioning of the first units as well as the integration of the new systems into



the existing equipment and the new control system. Due to the perfect cooperation between ANDRITZ HYDRO, VERBUND Hydro Power AG and third parties as well as the great performance of the workshops it was possible to cover all given dates without any delay.

In April 2013 the commissioning trial run of two generators in HPP Wallnerau and one generator in HPP Schwarzach was completed. The finalization of the project is planned for April 2015.

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TECHNICAL DATA

Schwarzach:

Output: 4 x 30 MW

St. Veit:

Output: 2 x 8.8 MW

Wallnerau:

Output: 2 x 7.2 MW

Germany Neuötting & Perach

The hydropower plants Neuötting and Perach are part of a cascade consisting of 13 run-of-river power stations and operated by the Austrian utility VERBUND Hydro Power AG at the Inn River located in Bavaria. The Neuötting plant was built in 1951 and Perach in 1977.

During an EU-wide bidding process, ANDRITZ HYDRO was awarded the

contract for the delivery of a seamless secondary technology. By 2016 both hydropower stations will be equipped with modern system components from the NEPTUN product family. The scope of supply includes the modernization of the unit controller, the digital turbine governor including efficiency optimizing, and a complete renewal of the sensors, including an overhaul of the oil hydraulic units, as well as the delivery of seven static excitation systems (THYNE 5) for the main units and the auxiliary unit. The new control technology will continue to guarantee the un-

manned, fully automated operation of the hydropower stations.

The modifications are carried out during regular operations. In the extremely short time period of seven months between order assignment and startup, the first unit was modified and reconnected with the grid.

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TECHNICAL DATA

Neuötting:

Output: 3 x 10 MVA / 1 x 1.2 MVA

Speed: 68.2 rpm

Perach:

Output: 3 x 8 MVA

Speed: 68.2 rpm



MINI COMPACT HYDRO

New standardized range of products from 20 kW

▲ Pelton turbine at HPP Bolgenach

With the development of a new range of standardized equipment, ANDRITZ HYDRO offers competitive and reliable solutions for micro and small hydropower plants. These products complete the range of COMPACT HYDRO solutions and confirm the position of ANDRITZ HYDRO as a global leader in this sector.

At the beginning of 2013, ANDRITZ HYDRO decided to expand its product portfolio by acquiring the turbine business of Hydreco Engineering (former THEE created in 1983). This company located in Toul (France), is an established supplier of small hydro turbines, especially for low and medium heads, with more than 450 installed units.

Based on highly standardized turbines developed by Toul's staff - according to specific needs of discriminating users regarding small hydropower plants- and through the input of high hydraulic performances thanks to the expertise of ANDRITZ HYDRO - the group is now able to improve its offer. The first half of this year has already confirmed this strategy as private producers as well as big facilities positively welcomed this solution.

The acquisition of this skilled business in Kaplan and Francis turbines, together with the existing significant know how from ANDRITZ HYDRO Jonschwil (Switzerland) in small Pelton turbines allows us to offer suitable and economical solutions for any kind of small

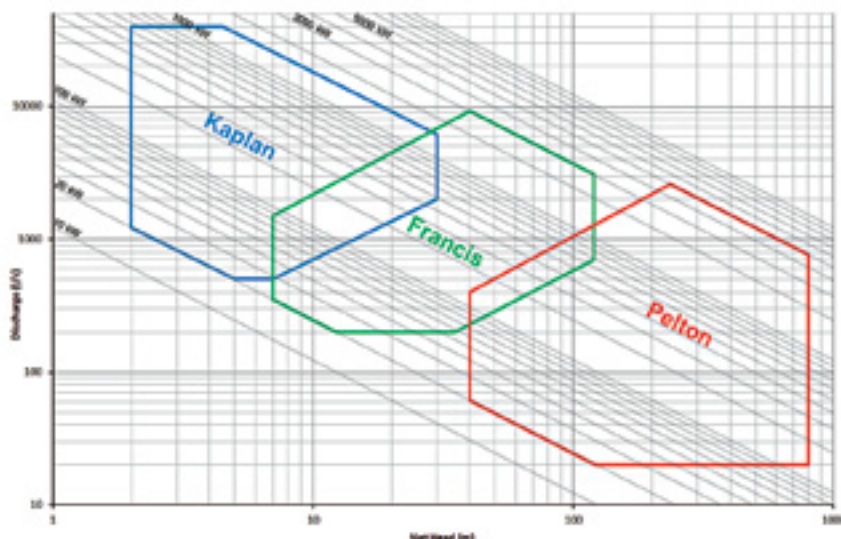


▲ Francis turbine

hydropower plant, ranging from 20 to 5,000 kW. In addition to the generating group, ANDRITZ HYDRO also provides Automation and Electrical Power Systems through the business unit of Schio (Italy), which has developed an integrated modular concept. The MINI COMPACT HYDRO consists of a water to wire turnkey package for a low investment and the best utilization of hydraulic resources. ANDRITZ HYDRO thus reaffirms its intention to be a key player in micro and small hydro. To date, ANDRITZ HYDRO has been awarded with more than 30 contracts, despite an extremely competitive market, based on its experienced resources specially dedicated to this equipment.

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▼ MINI COMPACT HYDRO range



the world congress
advancing
sustainable
hydropower
21-24 May 2013
Sarawak, Malaysia

IHA World Congress

Kuching, Malaysia

Over 500 participants from industry, civil society, NGO's, academia, finance, and other fields coming from about 60 countries, convened the International Hydropower Association's 2013 World from 21-24 May, 2013 in Kuching (Malaysia).

The Congress delegates discussed key questions relating to the future of hydropower. Topics ranged from investors and markets, working with project-affected communities, integration of hydropower with other renewables, expectations from modern energy systems, coordination of water and other energy policies, as well as the incorporation of sustainability into business practice, the relationship between hydropower and climate change and the meaning of social aspects to this sector.

Wolfgang Semper, Chairman of the Hydro Equipment Association (HEA), outlined the equipment manufacturers' perspective during the course of a "CEO Roundtable on what is modern hydropower". He suggested that "modern hydropower" entails a range of elements, including new forms of equipment for a variety of situations, new features in power plants and innovative approaches to new technologies.

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Events in the Brazilian Market in 2013

Following its policy of taking part in events and other activities promoted by the Brazilian electric sector, ANDRITZ HYDRO Inepar and ANDRITZ HYDRO Brazil have participated in the most important trade fairs in 2013.

The National Seminar on Large Dams in Porto de Galinhas (Pernambuco state), the ERIAC – Cigré's Iberian-American Regional Meeting in Foz do Iguaçu (Paraná state), the SIMPASE – Electrical Systems Automation Symposium in Belo Horizonte (Minas Gerais state) or the HydroVision Brazil in São Paulo (São

Paulo state) are just a few examples from our event calendar during 2013. ANDRITZ HYDRO was on site with stands in many events, presentations of technical papers developed by its employees and offered institutional lectures on several occasions. Making sure that our brand names are being spread throughout the country is central to our concept of being the largest supplier of hydropower equipment in the world is demonstrated.

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HydroVision 2013

Denver, USA

The HydroVision 2013 exhibition took place in Denver, Colorado (USA) from 23 - 26 July. ANDRITZ HYDRO served as Gold Sponsor for the conference allowing our brand to be front and center in multiple places throughout the conference facility.

ANDRITZ HYDRO hosted our third "Technical Seminar" showcasing the wide range of services that ANDRITZ HYDRO provides to the US market. On Wednesday, 24 July, ANDRITZ HYDRO hosted customers, consultants and friends at ANDRITZ HYDRO NIGHT, held at the Wings Over the Rockies Air & Space Museum. Our guests enjoyed touring the museum and the many hands on exhibits followed by a



delicious meal and a night of entertainment. HydroVision 2013 proved once again to be a valuable resource for strengthening our brand in the US hydro market and highlighting our ever-increasing range of services.

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EVENTS:

HydroVision Russia

04 - 06 March 2014

Moscow, Russia

www.hydrovision-russia.com

Asia 2014

11 - 13 March 2014

Colombo, Sri Lanka

www.hydropower-dams.com

Power-Gen Africa

17 - 19 March 2014

Cape Town, South Africa

www.powergenafrica.com

Your partner for renewable and clean energy



Water has always been a source of fascination and inspiration. But to us at ANDRITZ HYDRO, it means even more because it represents a constant challenge to create up-to-date techno-

logical innovations. Utility companies from all over the world value our know-how and commitment, and trust in the safety and reliability of our tailor-made energy generation solutions. From equip-

ment for new, turnkey hydropower plants, and the refurbishing and overhaul of existing installations, to comprehensive automation solutions. **We focus on the best solution – from water to wire.**