HyPower

The magazine for: More. Powerful. Solutions.

3

Issue three
November 2002

Summary

Editorial

Voith Siemens Hydro Power Generation

Expertise for growth.

Dr. Hubert Lienhard
Chairman of the Board of Voith Siemens Hydro Power Generation

Dear clients and partners,
dear readers,

First of all I would like to thank all of you who have sent me comments, information, also critical letters and encouraging e-mails. It was interesting for me to receive all your feedback which we will integrate in our plans and which will help us to grow further. Once more, you will find my e-mail for further feedback at the end of this editorial.

As of September 30, 2002 we ended our fiscal year 2001/2002. We will report the highlights during the coming months. Let me say it has been a rewarding year, but we cannot rest on our laurels; now we must focus on the new year. In November, we will participate in the Hydro 2002 in Kiris, Turkey. As you will see, Turkey is well-known to us; we have installed numerous hydro power plants there as well as in neighboring Iran and in the entire region surrounding Turkey.

This area has shown and will show – we believe – large growth in the coming years. In these countries, hydropower still enjoys the reputation as renewable, green power, matching ecology with economy. I sometimes wonder why we have lost this basic understanding in Europe, an understanding our forefathers had when they utilized hydro resources which in today's modern world of liberalization help to keep our grids stable.

Perhaps it is time to learn from the countries surrounding Turkey, learn from their capability to harvest this clean energy and make use of the natural resources these countries have, eliminating the need to import prime energy for these Megawatthours generated in these hydro power plants.

It is our goal to continue to bring to this important region our know-how and our expertise which Voith Siemens Hydro has acquired during the 135 years of operation in this field. As you will read in this issue we can base our offers on a vast number of contracts in this region but also in other parts of the world. Among those is our contribution to the newest and largest pumped storage plant for VEAG in Germany, a marvel of technology of which we are proud to be given the chance to participate.

As you will agree, this industry has unbelievable chances and opportunities to serve our society. We will use the Hydro 2002 event in Kiris to focus on this region and to bring its expertise to the world.

I hope you will enjoy reading this magazine and we can inspire you in your areas of activity to make things even better.

Sincerely yours,

Dr. Hubert Lienhard

My e-mail address is Hubert.Lienhard@vs-hydro.com.

100 years of hydro electricity in Turkey – 100 years of Voith Siemens Hydro in Turkey

Turkey can look back on a century-long tradition in generating electricity from water. In 1902 the very first power plant was built in the Turkish town of Tarsus: a small hydro power plant equipped with an 60 kW Voith Siemens Hydro turbine installed to supply a privately owned textile factory. The beginning of hydro power generation in this small plant in Tarsus also marked the beginning of Voith Siemens Hydro's presence in the Turkish market – a presence which has continued successfully for 100 years of partnership.

More. Powerful. Solutions.

Situated at the meeting point of two continents, Turkey stands as a bridge between Asia and Europe. The social and economic development throughout the last decades has been considerable. Turkey today is an emerging nation with a massive increase in energy demand. Having installed a total of more than 28000 MW of generation capacity (producing over 122000 GWh), of which nearly 12000 MW are hydro installations (producing over 24000 GWh), Turkey's future electricity demand is predicted to grow by 4% per year.

The main objective of Turkey's energy policy is to meet these increasing demands in line with economic development targets, population growth, industrialization and social changes, in a reliable manner and environmentally compatible. Hydropower development has extensively contributed to meet these demands, and an ambitious development program of hydropower for the years coming is under execution.

Voith Siemens Hydro has been involved in a number of recent hydro power projects in the country. Here's a brief outline:

Borçka

The 306 MW hydro power project is located on the Çoruh river in north-eastern Turkey, close to the border with Georgia. Construction work has begun in September 1999 and is scheduled to be completed within 69 months. Voith Siemens Hydro manufactures and delivers two Francis turbine units including the governor system and turbine inlet valves and is also responsible for the installation and commissioning of the two 153 MW machines.
The respective model acceptance test was successfully performed in June 2000 in Voith Siemens Hydro's hydraulic research laboratory in Heidenheim, Germany. Commercial operation of the first unit is scheduled for April 2005. The contracting authority is the Ministry of Energy and Natural Resources, General Directorate of State Hydraulic Works (DSI).

Ermenek

The 306 MW hydro power project is located on the Göksu river at the Ermenek canyon in mid-southern Turkey and includes the Ermenek dam with the main power station and an auxiliary hydroelectric power plant, Erik. The ground breaking ceremony at the Ermenek site took place in May 2002. Voith Siemens Hydro, as a member of the supplier group for electrical and mechanical equipment is responsible for the mechanical design and delivery of the two 153 MW Francis turbines and spherical inlet valves for the main power station. It is also responsible for the hydraulic and mechanical equipment of the auxiliary power station of Erik. Commercial operation is scheduled to start in April 2007. The contracting authority is also DSI.

Borçka: signing of model acceptance test protocol.

Ermenek ground breaking ceremony.

Suat Ugurlu hydro power station.

Kürtün dam site.

More.
Powerful.
Solutions.

Karkamis: final acceptance.

Karkamis
The 213 MW hydroelectric power plant is located on the Euphrates river, close to the Syrian border. The Karkamis plant comprises six 35.5 MW bulb turbine units, the turbines manufactured, delivered, installed and commissioned by Voith Siemens Hydro.
Commercial operation of the first unit started on December 20, 1999, 11 days earlier than planned.
All other Karkamis units were handed over to the contracting authority DSI at least one month ahead of schedule. On February 7, 2002 the final acceptance protocol was signed.

Alpaslan I
The 167 MW hydro power project is located in eastern Anatolia.
This contract is the most recent one realized in cooperation with Temsan for the contracting authority DSI, as where the hydro power projects Kürtün and Suat Ugurlu, and others.
For Alpaslan I, Voith Siemens Hydro designs, manufactures and will deliver the four 41.75 MW Francis turbines including governor systems and butterfly valves, and will supervise the installation on site and be responsible for the commissioning.

Kürtün
The 80 MW hydroelectric power plant is situated in northeastern Anatolia on the Harsit river. Voith Siemens Hydro delivers the two 40 MW Francis turbines, adapted for synchronous condensor operation, including governor systems and butterfly valves, will supervise the installation on site and be responsible for the commissioning. Main installation has begun in spring 2002 and commissioning of the first turbine is expected to take place soon.

Voith Siemens Hydro also successfully serves the emerging private market in Turkey.
A brief record of recent projects:

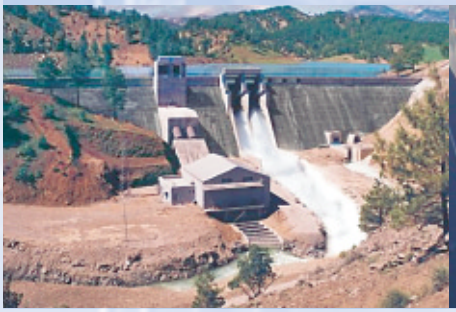
Sucati
This small hydroelectric power plant was erected in 1998/1999. It is operated by the Turkish private company ERE, Elektrik Üretim ve Dagitim Sanayi ve Ticaret A.S. on BOT basis, and equipped with two double-regulated Kaplan bulb turbines and two generators with a maximum output capacity of 5,100 kVA each. It is located near Kadirli, approximately 50 km southeast of Kayseri.
Voith Siemens Hydro was the turnkey contractor and has delivered the entire mechanical and electrical equipment including the control and protection system and the medium-low voltage equipment.

Dinar
Commissioned in November 2000, the small hydro power station Dinar is located about 200 km north of Antalya. Operated by the Turkish private company METAK Enerji VE Ticaret A.S. on BOT basis, the plant is equipped with Francis bulb turbines and two generators with a maximum output capacity of 1,950 kVA each. Voith Siemens Hydro was the turnkey contractor and has delivered the entire mechanical and electrical equipment including the control and protection system and the medium-low voltage equipment.

Hacilar
The plant with an installed capacity of 13.34 MW is currently under construction, commissioning is scheduled mid of 2003. Hacilar is located in Darende-Malatya with two units. Voith Siemens Hydro is the turnkey contractor and delivers the entire mechanical and electrical equipment including control and protection system and medium voltage equipment. Hacilar will be operated on auto-producer basis for 49 years. The owner of the plant is Bilgin Elektrik which already operates Hazar I and II hydro power plants. Those plants were taken over from DSI under the TOR (Transfer of Rights) model and were equipped with Voith Siemens Hydro turbines and shut-off valves in the fifties and sixties.

For more information:
Leopold.Heninger@vs-hydro.com
Adil.Tekin@siemens.com.tr

Sucati hydro power station.



Dinar penstock view.

Hazar: inside power house.

With over 31,000 MW installed nominal capacity, the Islamic Republic of Iran has a leading position on the energy sector in its region. In 1998, the Energy Ministry unveiled its long-term plans to nearly quadruple the capacity of the national grid by 2022. Several hydro power plants are currently under construction and will be completed in due time.

The Islamic Republic of Iran is still forging ahead with its ambitious energy program. Considering the country's feasible hydro power potential, estimated at about 50,000 GWh/year, and a current utilization of less than 15%, the hydroelectric field will certainly be developed extensively.

For hydro power generation government plans foresee an additional 11,700 MW of generation capacity by the year 2022. Voith Siemens Hydro has a remarkable share in this development program.

More.
Powerful.
Solutions.

Sharp growth in the Iranian hydro power market

Shop assembly of high-pressure oil units and digital governors.

Construction site Masjed-e-Soleyman extension.

Major contracts awarded to Voith Siemens Hydro

FARAB, an Iranian contracting company set up in 1992, was awarded with several contracts for hydro power projects in Iran. To date, FARAB has awarded various major contracts to Voith Siemens Hydro, comprising design, manufacture, installation and commissioning of turbines, generators and governor systems.

Digital governor inside view.

Masjed-e-Soleyman Extension

The dam with a height of 180 m and the hydroelectric power plant is located on the Karun river, about 25 km north-east of the city of Masjed in the Khuzestan Province.
The 1,000 MW project, equipped with four 254 MW vertical Francis turbine units, is scheduled to become operational by 2004.

Upper Gotvand

The hydroelectric power plant at the foot of the Gotvand-e-Olia dam will be equipped with four 254 MW vertical Francis turbines. The plant is located on the Karun river, 90 km south of the city of Godarlandar, and its commissioning is planned for 2006.

Karun IV

Also located on the Karun river in the country's south-western province of Khuzestan, Karun IV is yet another 1,000 MW project. The hydroelectric power plant will receive four vertical Francis turbines with an output of 255 MW each. It is scheduled for commissioning in 2006.

Ostour

The 170 MW project is located on the Ghezel Ozan river, near the city of Mianeh in Iran's north-western province of Azerbaijan.
Contracts foresee equipment comprising four 41 MW vertical Francis units.

For more information:
Ernst.Bruckner@vs-hydro.com

Voith Siemens Hydro continues to be the world leader in pump-turbine technology

With almost a century of experience in the design and manufacture of pump-turbines and motor-generators, Voith Siemens Hydro is indisputably the leader in this field of hydro technology. Since the first pumped storage plant was developed in Voith's hydraulic research laboratory in Germany in 1908, Voith Siemens Hydro has been supplying the world's largest and most powerful units, continually breaking through existing barriers. The latest developments, already utilized in current projects, include variable speed technology and wide head range applications.

More. Powerful. Solutions.

Pumped storage plants have been developed as "energy storage systems" capable of quickly responding to fluctuations in power demand. In times of reduced energy demand, excess electric capacity in the grid is used to pump water, previously used to generate power, back into an upper reservoir. This water can then be used to generate electricity when needed.

Guangzhou II, China. Pumped storage power station.

Though all pumped storage plants are based on this main principle, there are no two facilities in the world that are alike. Each plant has its own unique hydrology and physical constraints. Pumped storage plants operate on daily or weekly cycles that vary based on the time of the year and the plant's location. Operating conditions may require a reversible pump-turbine or an optimally designed combination of turbine and pump. In some cases, optimum results may be achieved through a pump-turbine equipped with a fixed distributor, in other cases an adjustable distributor may be necessary. Depending on the required changeover speed, separate turbine and pump units may best be equipped with synchronizing torque converters or a clutch operable at standstill.

Guangzhou II, China.
Pumped storage power station.

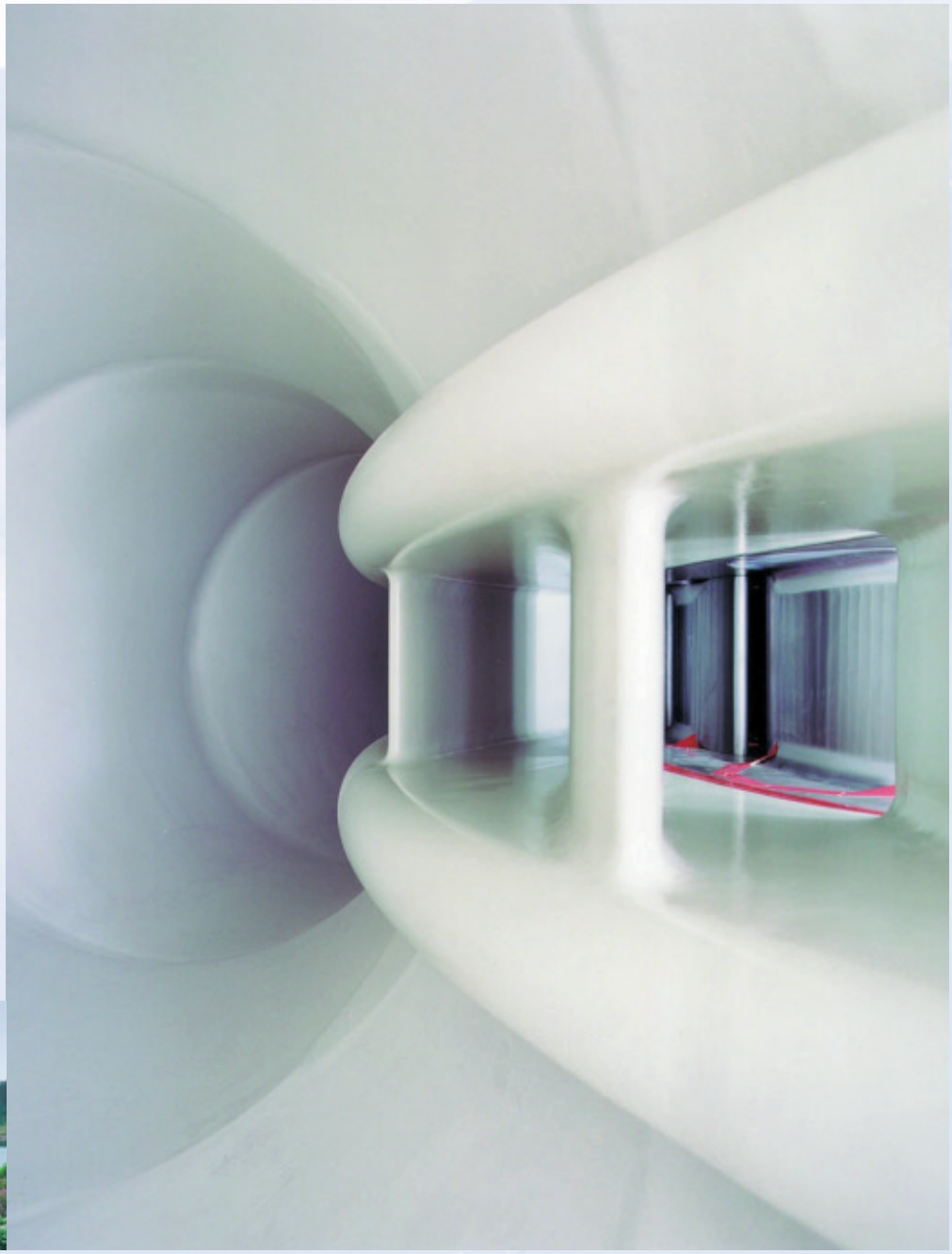
Having installed more than 200 pump-turbines worldwide with a combined output of well over 24,000 MW, Voith Siemens Hydro can offer the right machines for the most variable conditions and pump-turbine technology which has proved to be extremely reliable. Consequently, it does not come as a surprise that Voith Siemens Hydro is involved in today's most important pumped storage projects:

Guangzhou, China

The Guangzhou pumped-storage plant is located about 100 km northeast of the provincial capital of Guangzhou (Canton), and about 200 km north of Hongkong. It is the first high-head, large-capacity pumped storage facility in China. With a total output of 2,400 MW, it ranks among the largest in the world. Guangzhou comprises two groups, each with four 300 MW reversible pump-turbines with a head of 535 m.

Voith Siemens Hydro supplied the complete electrical and mechanical equipment for the second group, including pump-turbines and motor-generators, high voltage starting frequency, PROKON LSX control system. Since commercial operation began two years ago, these units have been operating very reliably for more than 35,000 hours.

Pumped storage station: spiral casing. Goldisthal, Germany.



More.
Powerful.
Solutions.

Goldisthal

Goldisthal, upper reservoir.

Goldisthal, Germany
Goldisthal pumped storage power station is located in southern Thuringia, Germany, on the upper Schwarza river. With a total capacity of more than 1000 MW, it is one of the biggest pumped storage plants in Europe. Voith Siemens Hydro supplied two 270 MW pump-turbine units capable of operating at variable speeds ranging from 300 to 346 rpm. The adjustable speed control of the pumped storage units makes it possible to control input during pumping operations and increase the electricity yield in turbine mode.

Bath County, USA
Situated in a mountainous region in Virginia, USA, Bath County pumped storage plant is currently being modernized by Voith Siemens Hydro specialists. The station consists of two large reservoirs – one 385 meters higher than the other, a massive power house and the huge tunnels that connect them. The upgrading covers the combined turbine/generator scope of supply.
The refurbishment of the stator windings and new runners will push the six 350 MW units installed to an astonishing 480 MW/530 MVA each. After completing the modernization, Bath County will again become the world's most powerful pumped storage generating station.

For more information:
hydrocontact@vs-hydro.com

Streamlining project management and completing

Cana Brava hydro power station.

When the go-ahead was given at the end of May 1999 for the construction of the Brazilian hydro power plant Cana Brava in the north of the federal state of Goiás, expectations were high. The work was to be completed in a record time of 37.5 months, commissioning was planned for August 2002. From the very beginning, Voith Siemens Hydro, responsible for the engineering, the complete electrical and mechanical equipment, installation, tests and commissioning, brought everything to bear on safeguarding the ambitious time goal with its streamlined project management. With overwhelming success.

More. Powerful. Solutions.

Cana Brava hydro power station.

In the late Brazilian summer of 2001, an increasing number of power cuts throughout the country documented an acute energy shortage. Brazil began to suffer from a serious energy crisis. Additional capacities for electricity production were urgently needed.
In view of the extremely tense situation on the Brazilian energy market, the Voith Siemens Hydro project managers responsible for Cana Brava streamlined their planning to the limit. The deadlines for all work packages were brought a long way forward, critical paths in the part-projects were shortened and optimally adapted to the work of the partners, which for its part was also accelerated.

Optimum interface management

Optimum interface management and unconditional support from the client, Tractebel Energia, for the increased efforts finally set tremendous synergies free. In this way, the first rotor blade of the first of the three 150 MW turbines for Cana Brava was delivered considerably earlier than accounted for in the already very ambitious original plans. With the early delivery of the runners, the overall progress of the hydroelectric project speeded up significantly. At the handover of the first turbine, Sérgio Parada, Director of Voith Siemens Hydro's São Paulo location, promised to save at least two months of time.

450 MW project in record time

Cana Brava in operation four months ahead of schedule

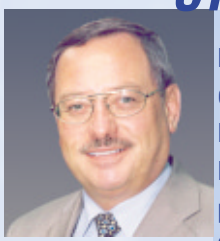
Sérgio Parada was proved to be right. The other two turbine units were also delivered with a considerable time saving. His prognosis even turned out to be quite modest. The Cana Brava hydro power plant, situated on the river Tocantins, went into operation as early as April this year – a full four months before the contractually agreed date. The time gain which had been fought for so hard exceeded all expectations.

The finished power plant will produce more than 2700 GWh per year, enough to supply 1.5 million households in the central-west and north-east of Brazil, chiefly in the federal state of Bahia, and to make a valuable contribution to checking the Brazilian energy crisis.

Contract Manager Amiro de Sousa looks on this achievement with pride: "Everybody remembers the difficulties we had to overcome, but the memory is of a positive result. It is a feeling of personal satisfaction, everyone saw the effort rewarded with success."

For more information:
Camilla.Varussa@vs-hydro.com

Change in the management of Voith Siemens Hydro, Brazil



Edgar Horny

Edgar Horny, President of the Board of Management for Voith Siemens Hydro Power Generation Ltda., São Paulo, Brazil, resigned from the company management on September 30, 2002.

He will continue as an advisor to Voith Siemens Hydro Power Generation Ltda., Voith Paper Máquinas e Equipamentos Ltda. and to Voith Turbo Ltda.

Julio Fenner

Sergio Parada

On October 1, 2002, Julio Fenner became Edgar Horny's successor as President of the Board and, together with Sergio Parada, now constitutes the Board of Management of Voith Siemens Hydro Power Generation Ltda.

Advanced governor technology for Cornetu

The Cornetu hydro power plant in Romania and Kühtai hydro power station in Austria have several things in common. This year, Hidroelectrica, the operator of Cornetu and TIWAG, operator of Kühtai, both awarded contracts to Voith Siemens Hydro to replace the existing analog governors by modern digital governor systems. Moreover, manufacturing, installation and commissioning deadlines meant that the time scheduling for both projects was extremely tight, which posed a major challenge for the respective project teams. Nevertheless, through the unique partnership and cooperation between Voith Siemens Hydro specialists and the clients' staffs, both projects were completed successfully and on time.

Kühtai pumped storage plants.

More. Powerful. Solutions.

Voith Siemens Hydro digital governor in Romania:

When the Romanian Prime Minister Adrian Nastase together with Minister of Industry and Resources, Dan Ioan Popescu and General Director of Hidroelectrica, Eugen Pena, opened the Cornetu power plant in a ceremony this year, just 15 weeks had passed since award of the governor contract to Voith Siemens Hydro.

After manufacturing and delivery, installation of the governors and commissioning was executed in an enormous effort and excellent cooperation between Hidroelectrica, the erection company and Voith Siemens Hydro staff within two weeks.
The scope of supply and services also covered the supply of governor valves, electrical feedback and speed measuring system for the two Kaplan units.

Cornetu hydro power station.

Inauguration of Cornetu. The unit was started by Dan Ioan Popescu, Minister of Industry and Resources, Adrian Nastase, Prime Minister, Eugen Pena, General Director, Hidroelectrica.

and Kühtai

New digital governors for pump turbines in Kühtai

The turbines of Kühtai pumped storage plant are equipped with single wicket gate blade control.
The replacement schedule for the analog turbine governors with engineering and installation works was again quite tight. As part of this project, the previous main functions of the governor, such as opening, speed and power control were to be supplemented by a range of new functions through the upgrade to digital governor technology.
For service and maintenance reasons, data acquisition and storage functionalities were implemented.
Data can be read and displayed on a direct or modem-connected PC.
Drift compensation was another feature to be newly implemented.
Safe behavior, during different modes of operation, was a main requirement also. Therefore, new functions were installed, such as:

- feedback of turbine inlet pressure for damping of pressure oscillations
- blocking of the actual wicket gate opening in case of unallowed pressure oscillations
- redundant speed measuring and speed direction detection

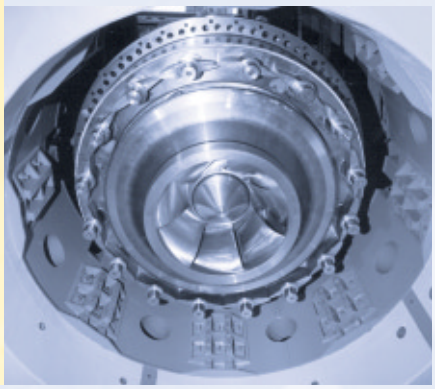
Kühtai pumped storage scheme: aerial view.

Satisfied faces

The successful works' acceptance by both clients confirmed the quality and efficiency of the Voith Siemens Hydro digital governor systems.
Within a few weeks, both hydro power plants had been successfully updated to advanced technology.

For more information:
Robert.Doppler@vs-hydro.com
Engelbert.Knoll@vs-hydro.com
Wilhelm.Gruber@vs-hydro.com

Kühtai pump-turbine.



Grosio, Italy – fourth unit successfully supplied in 28 months

Erection of the new runner.

The Italian operator Azienda Elettrica Municipale (AEM) di Milano has awarded Voith Siemens Hydro a contract for increasing the power of their most important hydro power plant. One part of the contract comprised the supply and installation of a new Pelton turbine. Once this new turbine, in a total of four, was commissioned in September this year, the plant's overall capacity increased to 450 MW.

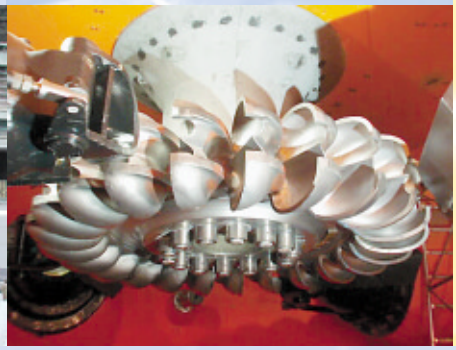
More Powerful. Solutions.

Further to the vertical Pelton turbine with a diameter of 3750 mm, Voith Siemens Hydro's activities comprised the installation of a new control system. Above this, the runners in the existing turbine units were replaced by runners weighing 20 tons each. This replacement allowed the performance of each unit to increase considerably.

The importance of the Grosio project is not only due to the fact that it is the main operative center as far as the electrical production and output of all hydroelectric power plants of Azienda Elettrica Municipale di Milano is concerned, but also because it is the central site of the remote telecontrol of all AEM plants in the Lombardian region of Italy.

For more information:
Gianfranco.Vodopivec@vs-hydro.it

Front view of Grosio hydro power plant.



New runner with deflectors.

Successful model acceptance tests for Middle Marsyangdi and Peixe Angical

In July 2002, successful model acceptance tests were again held in the Central Technology facilities of Voith Siemens Hydro. The model turbines for the hydroelectric power plants of Middle Marsyangdi in Nepal and Peixe Angical in Brazil were on the test stand in Heidenheim, Germany.

Successful model tests and their teams: Middle Marsyangdi and Peixe Angical.

In the presence of the clients, Nepal Electricity Authority for the Nepalese and Enerpeixe for the Brazilian hydroelectric power plant, the model systems were tested under all relevant operating conditions. The guarantees of performance made during the tender process and contract awards were fulfilled in full.

The performance of the Peixe Angical unit was particularly gratifying: the guarantee of the highest performance in an ambitiously short period of just 2.5 years until commissioning was a real challenge of planning and design, construction and manufacture including installation. The successful test run means that the first major milestone has been reached.

Peixe Angical, located in the Brazilian state of Tocantis on the river of that name, will be equipped with three Kaplan turbines, each of which will produce 169 MW with a runner diameter of 8.6 m and a head of 29 m.

The Nepalese hydroelectric power plant uses the water of the Marsyangdi river and is located approx. 160 km west of Kathmandu. This will be served by two Francis turbines, which will each produce 40 MW with a runner diameter of 2.2 m and a head of approximately 100 m.

For more information:
Martin.Giese@vs-hydro.com
Thomas.Kaechele@vs-hydro.com

Modernization of the turbines and generators in the Dychow hydroelectric power plant

Punctually to the 50-year celebrations in September 2002, the official go-ahead was given for the beginning of extensive modernization work in the Dychow power plant in Poland. Built in the 30s, the plant was re-equipped in 1951 and had been in continuous operation since then. Due to this long operation period, wear and tear deteriorated the units to an extent that jeopardized reliable operation. Elektrownie Szczytowo-Pompowe (ESP) entrusted Voith Siemens Hydro with the modernization of the units. Thus, peak power provision and increased annual generated energy are secured.

Two contracts from Warsaw

ESP in Warsaw awarded two contracts to Voith Siemens Hydro to carry out the modernization of three Kaplan turbines and generators, four storage pumps, and one motor including ancillary equipment in Dychow hydro power station in the last two years.

All supplies and services for this project are being provided by Voith Siemens Hydro in cooperation with local partners. The challenging implementation time table is based on the strong commitment of a successful team between ESP and Voith Siemens Hydro which has already proven successful in earlier projects with ESP.

More.
Powerful.
Solutions.

Dychow hydro power plant.

Dychow inside view.

Customized solutions for increased performance

Even though one part of the contract is to renew turbine components, simply replacing old parts with new ones is not enough to increase efficiency. An improved customized hydraulic layout was developed for the given hydraulic profile of the hydraulic machines by application of CFD (Computational Fluid Dynamics).

Extensive tests are carried out to assess the condition of parts to be renewed. Residual life time calculation is executed for the units.

Results

The consequence of this optimization process is that once the modernization is completed, the parameters guaranteed in the contract will even be exceeded partially: turbine performance will increase from 26.1 MW to 31.6 MW (12% increase) and discharge from 110 m^3/s to 122.7 m^3/s. Pump discharge will increase from 17.5 m^3/s to 19.2 m^3/s.

All in all, thanks to a customized Voith Siemens Hydro solution, and proven close cooperation between ESP and Voith Siemens Hydro, the Dychow hydroelectric power plant will in future not only use 100% of its newly installed capacity, but also have a significant increase in operational reliability. Recommissioning for the whole plant is scheduled for 2004.

For more information:
Josef.Gaschl@vs-hydro.com

Solina power plant – maximum client satisfaction after modernization

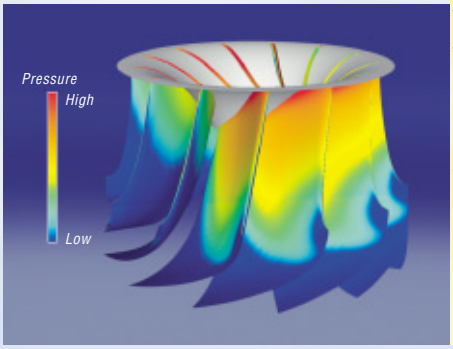
When Voith Siemens Hydro was awarded the contract for the modernization of the units of the Polish hydroelectric power station Solina, the owner, Elektrownie Szczytowo-Pompowe (ESP), was assured of significant improvements in part-load behavior and remarkable increase in performance. Most advanced Voith Siemens Hydro IT technology and special in-house software, helped to provide extremely precise statements on results, timelines, cost and extent of the modernization work before the project was started. Once, modernization work had been completed, the contractually guaranteed parameters were subject to verification, carried out by an independent consulting engineer.

These tests, were carried out by the renowned Institute of Fluid-Flow Machinery at the Polish Academy of Science in Gdansk. Data on runner performance had been awaited with particular interest, as Voith Siemens Hydro had based their hydraulic optimization of the runner design on Computational Fluid Dynamics (CFD) solely.

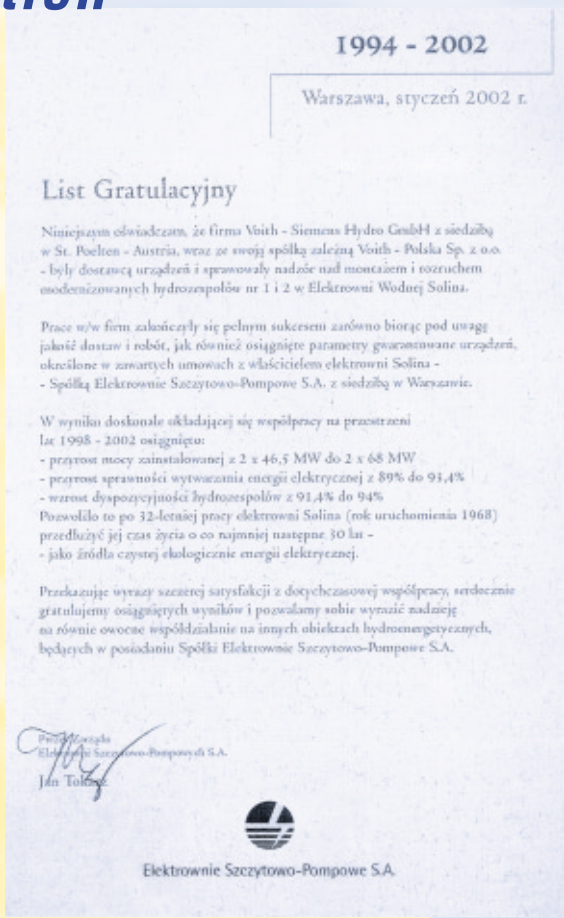
The extensive tests done by the Institute covered efficiencies, dynamic operating behavior and turbine loudness reduction. Results were convincing with all parameters guaranteed in the contract being verified in all areas. ESP now operates two quiet turbine units with remarkably improved performance at their disposal for unlimited operation.

As part of the official opening celebration, Elektrownie Szczytowo-Pompowe expressed their great satisfaction with the hand-over of a letter of appreciation to Voith Siemens Hydro.

For more information:
Josef.Gaschl@vs-hydro.com



Solina CFD runner.



1994 - 2002

Warszawa, styczeń 2002 r.

List Gratulacyjny

Niniejszym oświadczam, że firma Voith - Siemens Hydro GmbH z siedzibą w St. Poelten - Austria, wraz ze swoją spółką zależną Voith - Polska Sp. z o.o. - były dostawcą urządzeń i sprawowały nadzór nad montażem i rozruchem zmodernizowanych hydrozespołów nr 1 i 2 w Elektrowni Wodnej Solina.

Prace w/w firm zakończyły się pełnym sukcesem zarówno biorąc pod uwagę jakość dostaw i robót, jak również osiągnięte parametry gwarantowane urządzeń, określone w zawartych umowach z właścicielem elektrowni Solina - - Spółką Elektrownie Szczytowo-Pompowe S.A. z siedzibą w Warszawie.

W wyniku doskonale układającej się współpracy na przestrzeni lat 1998 - 2002 osiągnięto:
- przyrost mocy zainstalowanej z 2 x 46,5 MW do 2 x 68 MW
- przyrost sprawności wytwarzania energii elektrycznej z 89% do 91,4%
- wzrost dyspozycyjności hydrozespołów z 91,4% do 94%

Pozwoliło to po 32-letniej pracy elektrowni Solina (rok uruchomienia 1968) przedłużyć jej czas życia o co najmniej następne 30 lat - - jako źródła czystej ekologicznie energii elektrycznej.

Przekazując wyrazy szczerej satysfakcji z dotychczasowej współpracy, serdecznie gratulujemy osiągniętych wyników i pozwalamy sobie wyrazić nadzieję na równie owocne współdziałanie na innych obiektach hydroenergetycznych, będących w posiadaniu Spółki Elektrownie Szczytowo-Pompowe S.A.

Jan Tokarz

Elektrownie Szczytowo-Pompowe S.A.

Letter of appreciation from ESP.

Mechanical and electrical modernization for Kiskoere, Hungary

Voith Siemens Hydro in consortium with Siemens RT, Budapest, recently received a modernization contract from Tiszaviz Vizeroemue, KFT, Hungary, for the modernization of mechanical and electrical equipment of Kiskoere hydro power station in Tiszaloek in Hungary.

Kiskoere hydro power plant.

Kiskoere is equipped with four bulb turbine units. Modernization works will start in summer 2003, including modernization of all mechanical and electrical components of the units, such as new runner blades, rehabilitation of runner discharge rings, re-design and parts renewal of distributors, including new wicket gates, new shaft seals, re-wind of generators, installation of new excitation equipment and re-design and renewal of hydraulic, governor, automation and control equipment. The units will be re-worked and re-commissioned at one-year intervals. Completion of re-commissioning is planned at the end of 2006.

Kiskoere is located on the Tisza river and was originally put in operation 1974. The power plant generates around 90 GWh per year. The modernization works thus not only ensure electricity to the public grid of Hungary, but also help the plant to continue to serve its primary purpose for water supply and irrigation.

Technial data:

Runner diameter	4.3 m
Head range	2 - 10 m
Discharge per unit	140 m^3/s
Speed	107.1 rpm
Generator output per unit	7 MW

For more information:
Anton.Huber@vs-hydro.com

Kiskoere hydro power plant.

Higher reliability with improved Pelton turbine nozzle design

After a service life of almost 30 years, the reliability of the two Bulgarian hydroelectric power plants Belmeken und Sestrimo had dropped tremendously. The source of the defect was found to be the dramatically short lifespan of the springs in the nozzle system of the Pelton turbines. Within a short contractual period of just six months for the modernization of the first turbine, Voith Siemens Hydro specialists adapted highly sophisticated Pelton nozzle design to ensure highest operational reliability.

Belmeken hydro power plant.

More.
Powerful.
Solutions.

When the state electricity company NEK (Natsionalna Elektricheska Kompania EAD) entrusted the project for the modernization of a total of 32 turbine nozzles to Voith Siemens Hydro, the task was obvious: a re-design of the actuating mechanism inside the nozzles had to be carried out with the constraint of the given dimensions of the unchanged nozzle body in order to achieve significant improvements of the force transmitting system by reducing the load on the springs.

By application of simultaneous engineering, time and mechanical constraints could be met and even exceeded. In this way, the critical parameter – the too high load on the springs – was reduced to a level, enabling significant increase of lifespan and reliability of the units. Excellent cooperation between NEK and Voith Siemens Hydro ensured that all targets set could be achieved.

For more information:
Rupert.Emsenhuber@vs-hydro.com

Nozzles in workshop.

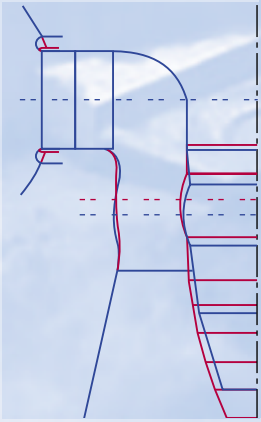
Kaplan turbine rehabilitation – San Men Xia anti-erosion research project

The San Men Xia Hydropower Station is located on the middle reaches of the Yellow River in Henan Province, China.

There have been two major problems in this power station:

1. The sandy water (max. sand content over 100 kg/m^3) passing through the turbines during the flood season cause serious erosion damage to the wet components of the turbines.
2. Runner blade cracks – 80% of the blades in this station have developed cracks, and one blade even broke during operation.

Layout comparison between original and modernized design



In order to solve the above problems, San Men Xia awarded the rehabilitation contract for the No. 1 unit to Voith Siemens Hydro in 1997.
This rehabilitation was combined with a research project addressing the problem of sand erosion of the turbines. Following the contract award in 1997, Voith Siemens Hydro optimized the hydraulic design, confirmed in a model test carried out in 1998. The runner blades with coatings (tungsten carbide hard coating and polyurethane soft coating) were made in Voith Siemens Hydro Heidenheim and the other equipment with coatings was manufactured at the Shanghai Hydro-Power Equipment Company (SHEC) – Voith Siemens Hydro's operation in China. The unit was re-commissioned in December 2000.

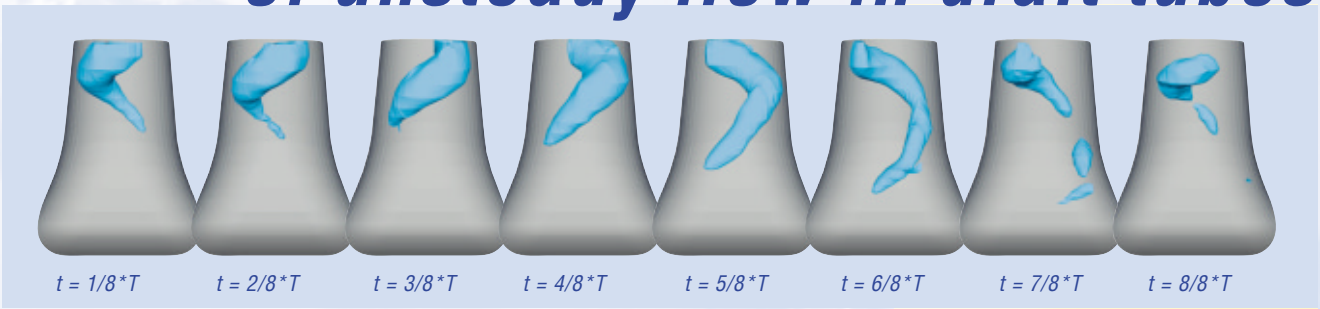
	Old	New
Output	50 MW	60 MW
Blade No.	8	7
Runner diameter	6000 mm	6100 mm
Hub ratio	0.55	0.53

After returning the modified unit to operation, Voith Siemens Hydro/SHEC and San Men Xia made three joint inspections on May 29, 2001, November 6,2001 and May 8, 2002 respectively.

The inspections show that the unit operates stable at all heads and meets the design output. The actual efficiency is improved significantly. No cracks appear on the blades. The rehabilitation has reached the expected goals. With regard to the anti-erosion program, after one and a half years of operating experience, it is confirmed that both coatings have helped to significantly reduce sand erosion. The tungsten carbide has shown particularly good anti-abrasion performance. The long-term comprehensive effect of the coating will be further verified during the next two years of operation.

For more information:
Michael.Liu@vs-hydro.com

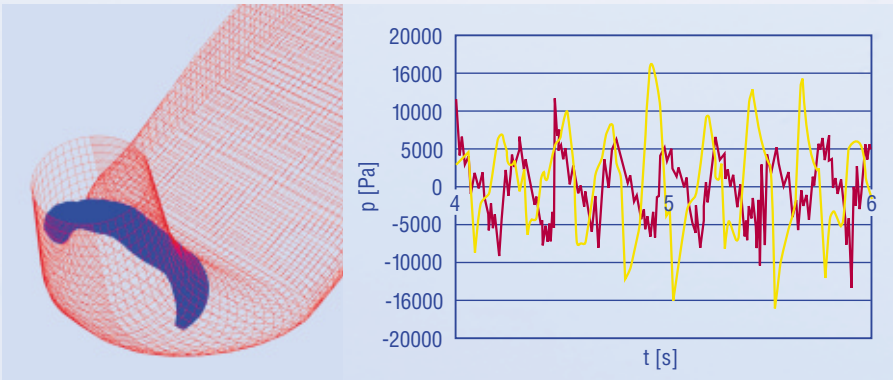
Numerical calculation of unsteady flow in draft tubes



Calculated vortex rope at different times.

The numerical calculation of the flow in the components of hydraulic turbo machines has become a standard during the past decades. The implementation of this approach in the hydraulic turbine design process has led to the development of powerful machines. One weak point of the traditional process previously used was the purely steady calculation. In particular, the flow conditions under part load could not be adequately described in this way. This meant that under unfavourable circumstances, pressure pulsations could arise with serious consequences. Voith Siemens Hydro has now developed an improved calculation process.

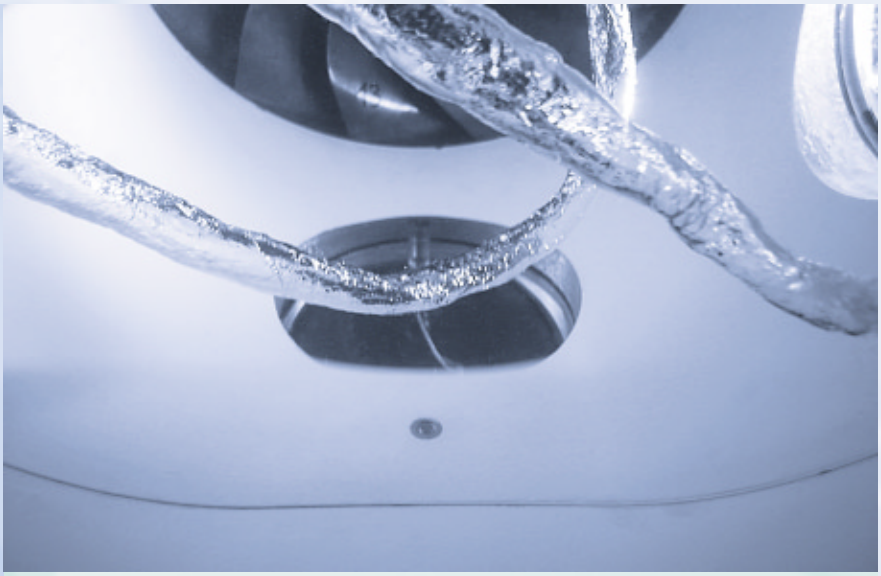
Draft tube mesh and pressure pulsations.



Deficits in the conventional calculation process

The entire turbine is conventionally separated into single components – spiral casing, tandem cascade, runner, and draft tube – and each component is then calculated in steady mode, thus neglecting pressure pulsations, i.e. time-dependent variations in the flow. As a result, part-load operation of Francis and pump-turbines – in turbine mode – is frequently accompanied by such incalculable pressure pulsations. Especially within the range of the natural frequency of the mechanical components or the water circuit, these pulsations can cause severe damage to the machines and lead to fluctuations in the rotational speed and the torque of the runner. Worst case, a destabilizing effect on the electrical grid could be the consequence.

Bifurcating cavitating vortex rope in the model test stand.



The need for a holistic approach

When applying the conventional analytical method, the fluid and gaseous phase in the draft tube, responsible for pressure pulsations, is incalculable. Voith Siemens Hydro specialists realized that the synergetic complexity of the whole system with various components interacting could not be broken down to separate elements: under conditions of part-load operation, the flow regimes of both components can never be separated properly. Instead, a holistic approach considering the runner and the draft tube together was needed.

Breakthrough in Heidenheim

Throughout the past year, an extensive research program has been conducted at Voith Siemens Hydro in Heidenheim covering theoretical foundations, numerical calculations and experimental measurements. Researchers have developed sophisticated physical models, fundamental for the explanation of the decisive fluid-gaseous phenomena. Comparisons of the numerical results with experiments performed at our test stands revealed excellent agreement with regard to both, visually observed flow phenomena and quantitative data.

Outlook

The research project provided a detailed insight into the complex flow situation and the far-reaching comprehension of the formerly incalculable pressure pulsations. This will enable Voith Siemens Hydro specialists to improve the part-load behavior of Francis and pump-turbines, with regard to both, rehabilitation projects and the development of new hydraulic turbines.

For more information:
Thomas.Scherer@vs-hydro.com

Hydrovision 2002, Portland,

View of the Portland cityscape from the Willamette River.

Over 2000 participants from 51 countries attended the Hydrovision 2002 conference held at the Oregon convention center in Portland, Oregon. The conference presented opportunities to learn, network and share with those in the hydropower industry.

Winfried Stach, Director, Hydro Automation, York, explaining automation concepts as the moderator of the interactive session on automation.

Individual presentation sessions

Voith Siemens Hydro's exhibition booth focused on the individual products and technology that are involved in the Integrated Services solution for project evaluation, planning and implementation. These products and services were depicted in photos and descriptions of some of the projects currently under way in the North American market. As a highlight for those customers interested in the details of Voith Siemens Hydro's most recent technological developments and service approach, presentations were available in a separate room at the conference center. These individual presentation sessions provided the venue necessary to discuss and explore the Integrated Services Tool Box, Automation and Waterview.

Alan Roth (right), Vice President Marketing and Sales, Mississauga, during booth duty.

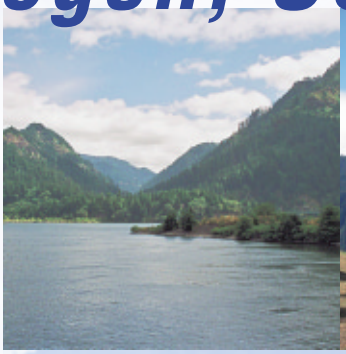
Expertise shared

The conference offered 8 sessions each day in 9 different tracks focusing on every aspect of hydropower. Voith Siemens Hydro specialists presented a technical paper "Application of Fish-Injuring Shear Criteria and Computational Fluid Dynamics to Investigate Fish Survival in Kaplan Turbines" and served as moderator for the interactive session on automation entitled "Automation/Remote Control: How much is enough?"

Voith Siemens Hydro's booth in the exhibition hall.

More Power. Solutions.

Oregon, USA – a review



View of the Columbia River at the Bonneville Power Plant.

Bonneville Power Plant – Powerhouse No. 1.

A tour guide from the US Park Service provides answers during the tour of Bonneville.

Historic tour

Voith Siemens Hydro provided a picnic lunch for participants during the tour of the historic Bonneville Power Plant organized by the U.S. Army Corps of Engineers. Approximately 100 attendees spent a beautiful sunny day in the Columbia Gorge, learning about the history of the project along with the technical and environmental enhancements that have been made to produce electricity with respect and reverence to the needs of the river system. Voith Siemens Hydro and its predecessor companies in the United States have been a part of the Bonneville Hydro projects from the first 518 MW powerhouse completed in 1938 to the second 558 MW powerhouse completed in 1982 and the current rehabilitation of the first powerhouse.

Celebrate Science Party

The sponsorship of events at the conferences provided a chance for all attendees to socialize and experience the conference city. Voith Siemens Hydro's sponsorship of the Thursday evening event "Celebrate Science Party" held at the Oregon Museum of Science and Industry provided an enjoyable evening of relaxation and learning. Complete with an Omnimax theatre and interactive displays including a submarine, the museum allowed time to socialize during the dinner provided and to explore the advances in science and industry. The event proved to be so popular that it was difficult for everyone to leave at the end of the evening.

For more information:
Carol.Rose@vs-hydro.com

The OMSI Museum, site of the Celebrate Science Party.

Succsessful IAHR symposium

For the 21st Symposium of the International Association of Hydraulic Research (IAHR) in Lausanne, Switzerland, from September 9-12, around 170 participants could share progress in hydraulic research in the hydro industry in a relaxed engineers' atmosphere. In a round of technical sessions, Voith Siemens Hydro's international set of speakers presented latest inside view on:

IAHR opening ceremony.

Numerical Investigation of the Flow in a Pelton Turbine
Reiner Mack, Winfried Moser (Heidenheim)

Experimental Analysis and Numerical Calculation of the Rotating Vortex Rope in a Draft Tube Operating at Part Load
Thomas Scherer, Peter Faigle, Thomas Aschenbrenner (Heidenheim)

The Importance of the Unsteady Friction Term of the Momentum Equation for Hydraulic Transients
Hans Günther Poll (Sao Paulo, Brazil)

Development of New Generation of High Speed Reversible Pump-Turbines
Hidetoshi Yamanaka, Yutaka Kimoto (Kawasaki, Japan),
Armin Schuh, Martin Giese, Gilbert Grosse (Heidenheim)

Development of a Broad-Band Micro Hydraulic Turbine
Morihito Inagaki, Akira Suzuki, Mitsuhiro Ishiguro,
Tadashi Tsukamoto, Shoichi Yamato, Kengo Izutsu, Michihiro Nishi (Kawasaki, Japan)

A Case Study in Resonant Hydroelastic Vibration: The Causes of Runner Cracks and the Solutions Implemented for the Xiaolangdi Hydroelectric Project
Richard K. Fisher, Werner Gfeller (York, PA; USA)
Ulrich Seidel, Gilbert Grosse, Roland Klinger (Heidenheim)

Succsessful symposium: the IAHR participants.

Co-authored papers were:

Design Optimization of Hydraulic Machinery Bladings by Multi Level CFD-Technique
R. Schilling, S. Thum, N. Müller,
S. Krämer,
Voith Siemens Hydro:
N. Riedel, W. Moser

Simulation of Vortex Rope in a Turbine Draft Tube
Albert Ruprecht, Thomas Helmrich,
Voith Siemens Hydro:
Thomas Aschenbrenner,
Thomas Scherer

For more information:
Stefan.Riedelbauch@vs-hydro.co

SHEC to participate in EP China 2002

From Nov. 13 to 16, 2002, Voith Siemens Hydro's Joint-Venture company SHEC of Shanghai will be presenting itself at Electric Power China 2002.

The booth will be located within the German Pavilion in the Beijing China International Exhibition Centre. The event is organized by the China Electricity Council International.

For more information:
Clare.Chen@vs-hydro.com

EP China 2002
中 国 国 际 电 力 展

Upcoming: international seminar in Vienna

The bi-annual event of the Vienna University of Technology's Institute for Waterpower and Pumps will feature a series of paper presentations under the theme of "Hydro power plants – safety and/or risk?"

Within the three days program from November 27-29, 2002, Voith Siemens Hydro will present a paper on "Runaway speed of double regulated Kaplan turbines – aspects of different safety philosophies and solutions" (authors are A. Oeguenc, H. Buchmaier, J. Klein of Voith Siemens Hydro in Heidenheim, Germany).

More information on the event can be found under www.tuwien.ac.at/wup/tagung2002

TU WIEN
Technische Universität Wien
Vienna University of Technology

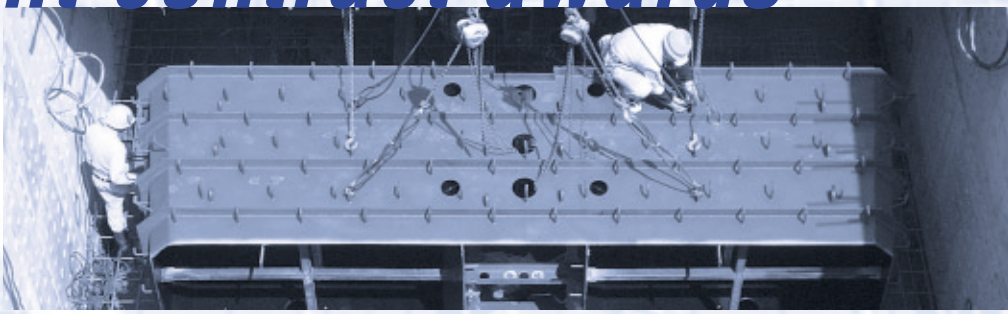
More.
Powerful.
Solutions.

Recent contract awards

Accounting for one third of the world's hydroelectric power with its turbines and generators, Voith Siemens Hydro Power Generation is a true global player. Recent contracts awarded to Voith Siemens Hydro operating units all around the globe underline its position as a worldwide leading company for hydropower equipment:

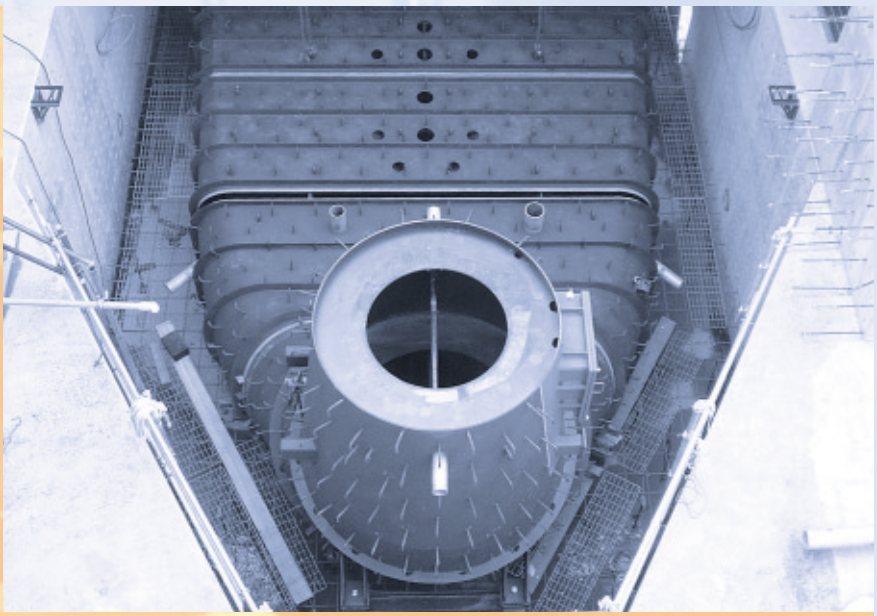
Pedra do Cavalo, Brazil
The hydro power station Pedra do Cavalo, located on the Paraguaçú river in Brazil's north-eastern federal state of Bahia, will be supplied in full by Voith Siemens Hydro's Brazilian unit in São Paulo. The 165 MW project will be equipped with two Francis turbines, designed to generate 82.5 MW each at a head of 105 m, and two generators with an output of 90 MVA. Both units are scheduled for commissioning in August and October 2004 respectively and will be able to cover the complete annual electricity demands of about 290,000 households.

Baglihar, India
The 900 MW Baglihar project is located in the north of India. Voith Siemens Hydro, as a consortium leader, will supply three vertical generators with an output of 168 MVA each, excitation systems, bus ducts, phase transformers, switchgear and cables. The contracting authority is the Jammu & Kashmir State Power Development Corporation.

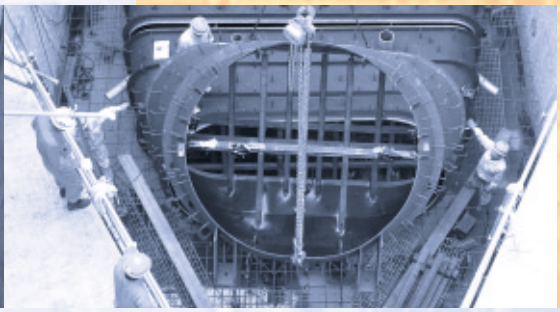


Site assembly of the draft tube liner at the Tomada hydro power station.

Final assembly of the draft tube liner before embedment at Tomada hydro power station.



Shin-Asaka, Japan
The small Shin-Asaka hydro plant, located in the Fukushima prefecture in central Japan, will be the heart of an irrigation project. Voith Siemens Hydro's Japanese unit, Voith Fuji Hydro K.K., Kawasaki, will supply the entire electrical and mechanical equipment, including a 2.4 MW horizontal Francis turbine and the generator. Voith Fuji Hydro is responsible for the balance of plant, erection and supervision of the power station, scheduled for commissioning in July 2003.



Tomada, Japan
Tomada hydro power station will be part of a multi-purpose dam project in the Okayama prefecture.
Besides being responsible for erection and supervision, Voith Fuji Hydro will provide all electrical and mechanical equipment, including a 4.8 MW vertical Francis turbine and the generator. The commissioning is scheduled for February 2005.

Shin-Taishaku, Japan
Shin-Taishaku Power Station is part of a re-development project of an aging dam in the Hiroshima prefecture and will include the utilization of a 10.08 MW vertical Francis turbine. Most of the power station equipment such as turbine and generator will be supplied by Voith Fuji Hydro. Commissioning is planned for June 2006.

The invigorating power of water

Modern people tend to begin and end their day in the bathroom. This was not always the case: until well toward the middle of the nineteenth century, even intellectuals and the aristocracy were not convinced of the value of a daily bath. Water was regarded as a carrier of disease and excessive hygiene was considered to be a health risk. Yet for thousands of years before the cleansing, relaxing and invigorating properties of water had been known throughout the ancient world.

Essay

People have enjoyed bathing in every era of the world's history. All cultural regions built their own bathing facilities, but long before that people were using natural rivers, ponds and pools for ritual bathing or on account of their healing properties.

One of the best-known examples is in Turkey; the snow-white sintered terraces of Pamukkale. These cascades, consisting of sparkling limestone deposits, located deep in the countryside bordering the southern Aegean Sea, have been celebrated since time immemorial for the regenerative powers of their waters, which contain calcium and are slightly radioactive. The water emerges from the ground at a temperature of 35 degrees Centigrade and cools as it flows over the cascades, so that the calcium is precipitated and forms these wonderful natural basins as the deposits build up.

In the Islamic cultural regions, the development of bathing had a primarily religious significance. For this reason, there were baths in the mosques. The true believer visited them mainly as ritual, with the pleasure of bathing a secondary consideration. Cleansing of the soul and the body are closely linked in Islam. The prophet called for believers to pray five times a day and to wash themselves each time before prayer. If no water is available, for instance in the desert, the use of sand is permitted.

Pamukkale terraces in Turkey.

Turkish hamam bath.

Ganges river in India.

Today's Turkish baths are more secular in character, but a cultural experience none the less. Whoever has relaxed in the "hamam" will have learned to value this pleasant for of total physical and mental relaxation. The alternation of rooms heated to various temperatures, refreshment in ice-cold water, resting in dimly lit rooms and the deep penetration of the pleasantly scented soapy water massaged with a brush into the pores of the skin by the bath attendant – all this restores the well-being of the guest to a most remarkable degree.

Japanese onsen.

Now let us turn to Hindu culture in India. Every year, millions of people make the pilgrimage to the holy city of Varanasi (Benares) on the Ganges river. To bathe in the river, which is considered holy at this point, is to be cleansed of the sins one has committed and granted absolution. The bells ring, the priests chant hymns and the hypnotic scent of the innumerable flowers scattered on the water accompany this age-old spiritual rite, which is still practised with great awe and respect.

In Japan people have for several millennia bathed communally every day in exceptionally hot water, for reasons of hygiene and also social contact. In many cases thermal springs (onsen), of which there are many in Japan, supply the water. It is either piped into the buildings, or the bathing and regeneration process is enjoyed in the open air. The bather cleanses his or her body prior to, before the actual ceremony. One sits on a small stool and soaps one's body thoroughly with the onsen cloth from one's own small vat. After rinsing down, one plunges into the actual bath, which is usually at a temperature that the average European finds unbearably hot.

The traditional Japanese bathtub is made of wood, the temperature being maintained at a constant level by a metal boiler located inside, regardless of how many bathers at a time are seeking relaxation from the day's hectic stress.

As we can see, despite all the cultural and ritual differences that have grown up between the peoples of this world, they have always remained aware of the healing and purifying power of water and have also learned, in the most prosaic way, to use this natural element purely for their own pleasure and delight.

VOITH SIEMENS
HYDRO POWER GENERATION

Voith Siemens Hydro
Power Generation GmbH & Co. KG
Alexanderstraße 11
89522 Heidenheim/Germany
Tel. +49 7321 376848
Fax +49 7321 377828
www.more-powerful-solutions.com

Editorial coordination:
Barbara Fischer-Aupperle

10000 www.msw.de