

VOITH SIEMENS
HYDRO POWER GENERATION

Pelton turbines



Expertise in hydro

with engineered reliability

The future belongs to hydropower. It conserves our fossil fuel reserves, is in abundant, self-renewing supply, is non-polluting and produces no waste streams. The world's hydropower potential from rivers and reservoirs amounts to no less than 15 billion MWh per year – and only about 20 percent of this has been developed so far.

Hydropower is not only environmentally friendly, but also cost-effective. Hydropower plants have the highest operating efficiency of all known generation systems. They are largely automated, and their operating costs are relatively low. Hydropower plants also play an important role in water resource management, in preventing flooding, making rivers navigable, solving irrigation problems and creating recreation areas.

Voith Siemens Hydro Power Generation is a leader today in hydropower equipment and services. As an experienced partner to power-plant operators, we provide fast, creative and cost-effective solutions. We offer everything from individual components to complete customized concepts, from turnkey delivery of new plants to the modernization of existing power stations, truly your best choice for one-stop shopping.



Riksheimdal, Norway



Competence and capabilities

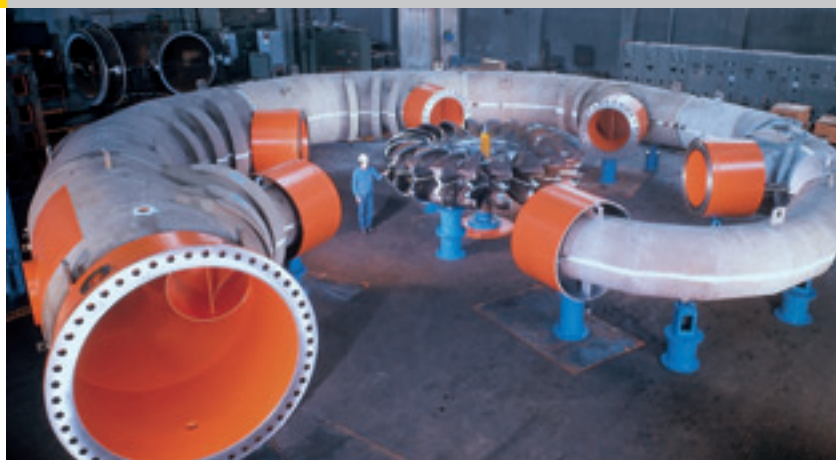
- Consulting, engineering, erection and commissioning
- System/plant assessments
- Service, modernization and rehabilitation of existing hydropower plants
- Complete equipment, installation and services for hydropower plants
- Francis, Pelton, Kaplan, bulb turbines, pump-turbines, standard and custom
- Storage pumps, radial, semi-axial and axial-flow pumps
- Generators and motor-generators, excitation systems
- Frequency converters, protection systems, switchyards for all voltages, transformers
- Power plant automation, control centers for hydropower plants and cascades, including plant management and diagnostic systems
- Shut-off valves

As your complete hydroelectric partner, Voith Siemens Hydro Power Generation also covers your service needs. In keeping with our comprehensive hydropower expertise, we have a worldwide customer service network on which you can always depend for enhanced operating results.

With our Integrated Services (IS) concept, we provide you with customized support right down the line – from project planning through implementation to plant commissioning and service.

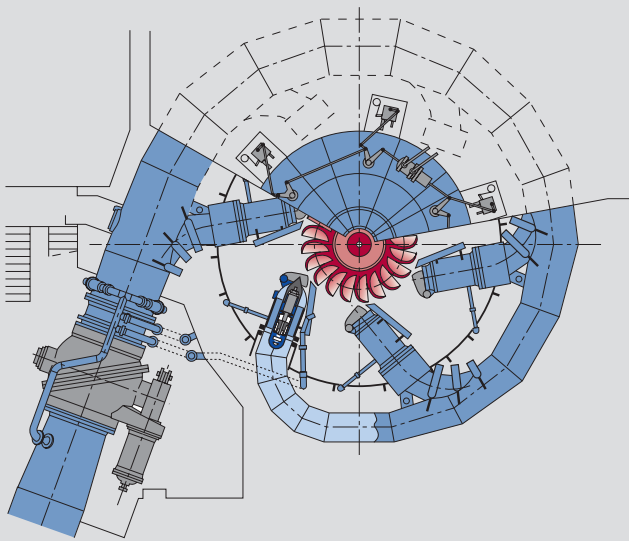
Why take chances? Profit from

Engineered reliability.



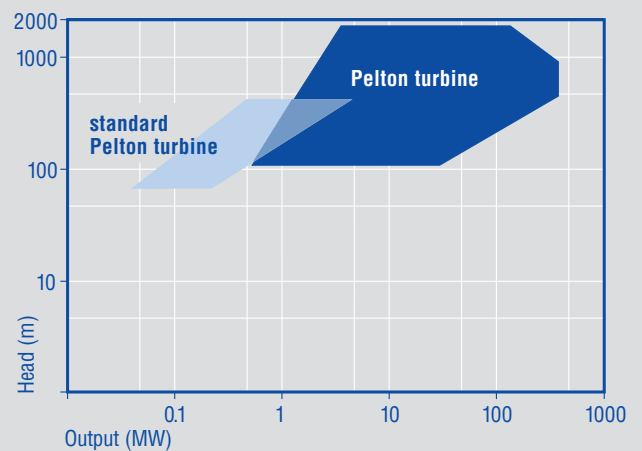
Characteristics and latest technology

Right from the beginning, Pelton turbine development has always been synonymous with Voith. Since the turn of the 19th century, thousands of Pelton turbines have been supplied by Voith Siemens Hydro Power Generation, including the world's largest and most powerful. These are in service around the globe in numerous hydropower plants.



*Restitución
Electroperu, Lima, Peru.
Six-jet turbines,
largest distributor-inlet
diameter of 2400 mm.*

Application range

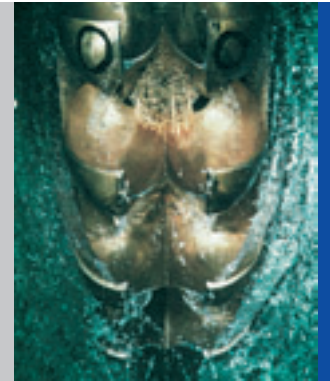


Characteristics

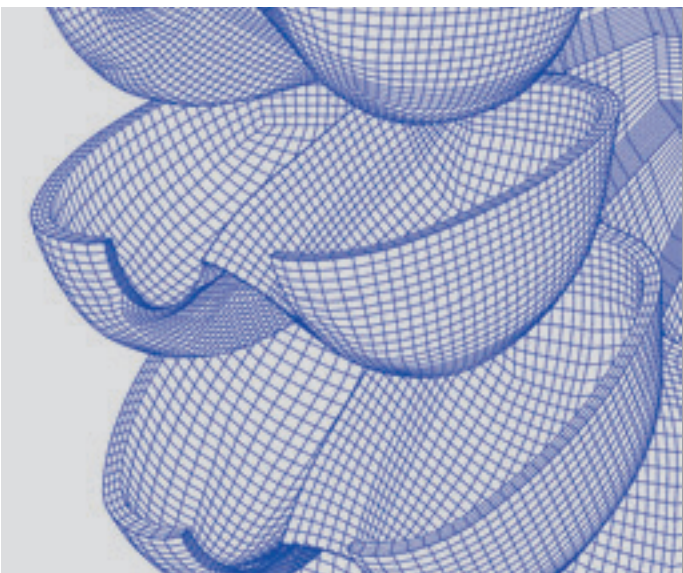
A broad manufacturing program offers an economical solution for any requirement. Large, custom-built Pelton turbines for high output ranges are our speciality, but cost-effective standard machines for small hydro power plants are also available.



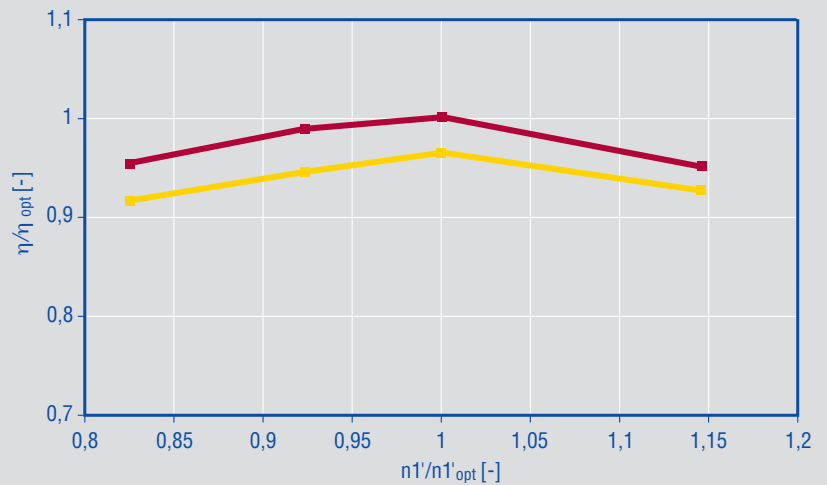
Simulated flow through Pelton runner



Actual flow through model



Comparison of predicted and measured efficiency



The flow simulation of Pelton turbines is by far the most complex and difficult of all hydraulic turbomachinery simulations.

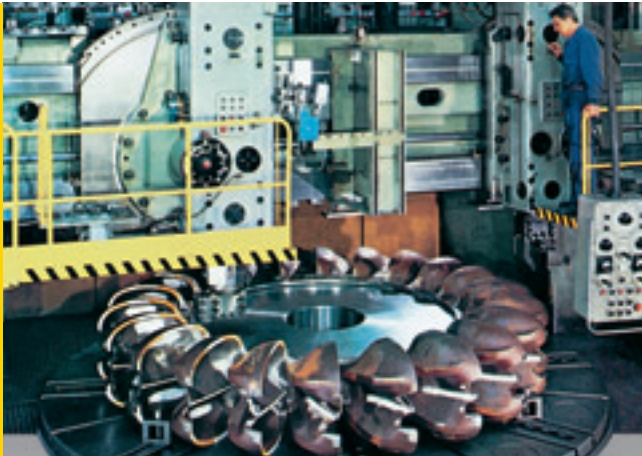
Pelton turbines involve a number of special flow characteristics which are extremely difficult to simulate. The jet bucket interaction is fully transient and depends on the moving geometry of the buckets. Even more challenging is the multiphase system of air and water that governs the formation of the free jet and the flow through the buckets. In the past, developing a flow simulation that would allow a realistic analysis of these phenomena seemed to be a task not to be solved.

Voith Siemens Hydro's numerical development group has finally overcome these major problems in simulating the bucket flow typical for the Pelton hydraulic. Simulation results and experimental data have shown a remarkable congruence. Today, designers have new insights into complex bucket flow phenomena providing a solid foundation for the development of new bucket profiles, that result in improved Pelton turbines.

Normalized efficiencies:

- simulation
- model test

References and milestones



Paute, Ecuador



Yang Zhuo Yong, China

- 1870** Beginning of hydro turbine manufacture.
- 1903** First Pelton turbine.
- 1924** Walchensee power plant, Germany:
First high-head power plant in the country.*
- 1960** Naturns, Italy:
Pelton turbine at a head of 1129 m.
- 1964** New Colgate, USA:
Largest Pelton turbines, (runner outside diameter 5.44 m, bucket width 1.1 m).

* Francis double-spiral turbines with 18 MW and twin Pelton turbines with 15 MW.



Walchenseewerk, Germany



San Giacomo sul Vomano, Italy

1972 - Chivor, Colombia:

1977 Largest Pelton power plant in the country:
8 x 151 MW.

1985 Carona, Italy:

3 horizontal Pelton turbines are replaced
by one vertical machine (48 MW) while
preserving historical structures.

1998 San Giacomo sul Vomano, Italy:

With an output of 282 MW, a runner
diameter of 4.4 m, a jet diameter of
315 mm and a bucket width of 1.1 m,
among the largest of its kind in the world.

2001 - Breakthrough in 3D-simulations

2002 for Pelton turbines.

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