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VOITH

Kaplan turbines

Harnessing the power of water

Generating electricity from the power of water represents large amounts of clean, renewable energy. Seventy-one percent of the earth's surface is covered by water. So far, the installed world´s hydropower potential is 4 million GWh/year. There remains a huge hydropower potential of 16 million GWh/year.

1 Uglichskaya, Russia

2 Embretsfoss IV, Norway

3 Saratov, Russia

Cover picture: Estreito, Brazil

Hydropower is a clean, renewable and environmentally friendly energy source – with low carbon dioxide emissions. Hydropower plants have the highest operating efficiency of all renewable energy generation systems. They are largely automated, and operating costs are relatively low. Hydroelectric power plants also play an important role in water resource management, flood control, navigation, irrigation and in creating recreational areas.

Customer focused and innovative

Voith is a leading full-line supplier as well as trusted partner for equipping hydropower plants all over the world. Our portfolio of products and services covers the entire life cycle and all major components of hydropower plants:

- Generators
- Turbines
- Pumps
- Automation systems
- Spare parts
- Steel structural components
- Maintenance and training services
- Digital solutions for intelligent hydropower

A world-class laboratory

Using state-of-the-art technologies and innovative digital solutions, we are committed to developing customized long-term solutions in hydropower in the years to come. At the Voith Hydro Engineering Center, scientists, engineers and measurement technicians access more than 100 years of know-how and can make use of one of the most modern hydraulic laboratories in the world. Combined with the deep domain knowledge that evolved over decades from more than 40 000 units delivered to customers, this environment paves the way to innovations of the existing product portfolio as well as new technologies.

Global experts

As part of our international network, each Voith facility operates under the same cutting-edge platform and is equipped with consistent best-in-class processes and tools. This network also ensures that we can meet special customized requirements – from individual components to project planning, through project management and plant maintenance.

With branches and production facilities for electrical and hydraulic machines and components in Europe, Asia, North and South America, we are close to our customers and active in all major hydropower markets worldwide.

Technical reliability with highest quality standards

Voith has been known for quality right from the start. We strive to continuously meet our own high aspirations in terms of quality: Our global certification is based on well-known international standards (ISO) for quality management environmental protection as well as occupational health and safety. Moreover, we have developed our own methods for quality assurance and work according to them. In this way, future generations will continue to benefit from the quality of our work.

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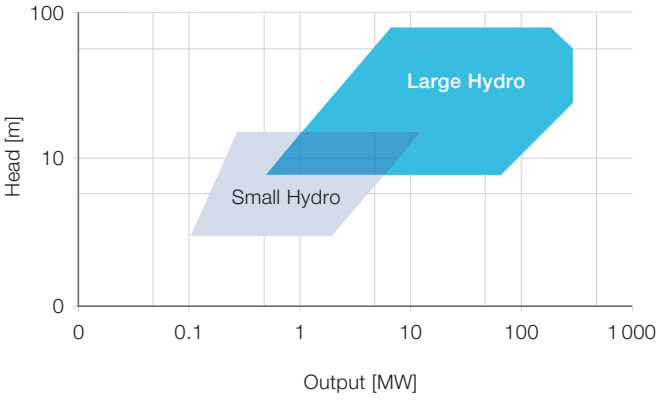
Characteristics

From the beginning, Kaplan turbine development has always been synonymous with Voith.

In 1913, the company was the first to recognize the importance of Victor Kaplan's invention and, in partnership with him, developmental tests were performed in the Voith research laboratory. Since then, thousands of Kaplan turbines have been developed, model tested and finally left our manufacturing facilities, among them the world's largest and most powerful.

Kaplan turbines are used primarily for low heads and large flow rates. Our stepped program offers the best economical solution for any requirement. Large custom-built Kaplan turbines for high output ranges are Voith's specialty. For smaller hydropower plants, Voith delivers attractively priced systems in a standardized design – and individually adjusts them to accommodate their environment.

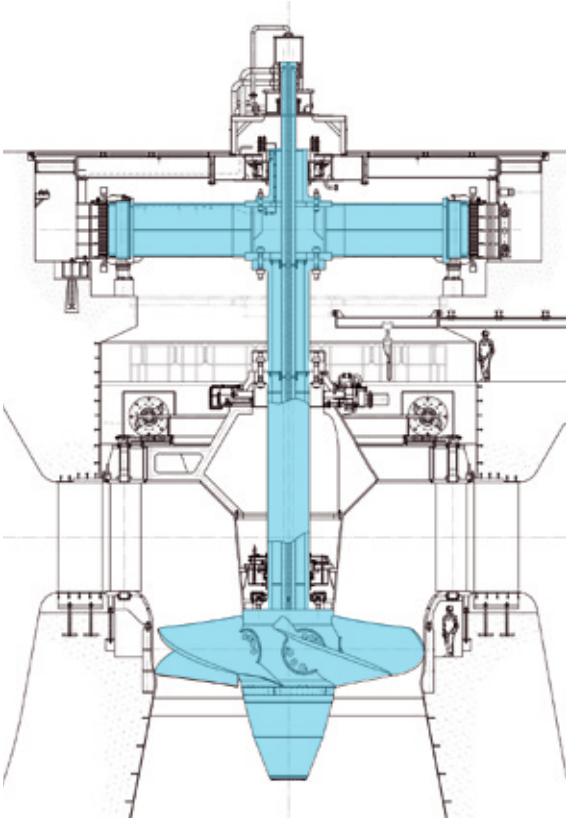
Application range Kaplan turbines



1 Aimores, Brazil

2 Workshop, St. Poelten, Austria

Kaplan turbine state of the art layout



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References in recent years

1870 **Beginning of the hydropower turbine manufacturing.**

1916 **Development of Voith Kaplan model turbine.**

1922 **First prototype Kaplan turbine, Austria.**

1928 **Ryburg-Schwörstadt, Germany:**
Most powerful and largest Kaplan turbines of their time with an output of 35 MW and a runner diameter of 7 m.

1952 **Jochenstein, Germany / Austria:**
Runner diameter 7.4 m.

1958 **Três Marias, Brazil:**
Kaplan turbines under a head of 50 m with eight runner blades.

1960 **Aschach, Austria:**
Runner diameter 8.4 m.

1964 **St. Martin, Austria:**
Kaplan turbines under a head of 75 m with seven runner blades.

1973 **Toyomi No. 2, Japan:**
Kaplan turbine with an output of 61 MW at a head of 24.5 m.

1978 **San Lorenzo, El Salvador:**
2 x 92.4 MW Kaplan turbines with an operating head of 30 m.

1979 **Nova Avanhandava, Brazil:**
Kaplan turbines with an output of 112 MW.

1 Peixe Angical, Brazil

2 Holtwood, USA

3 Lajeado, Brazil

1980 **Taquarucu, Brazil:**
5 x 103 MW Kaplan turbines at a head of 21.9 m.

1981 **Aswan II, Egypt:**
4 x 67.6 MW Kaplan turbines with an operating head of 20.1 m.

1988 **Yacyretá, Argentina:**
The largest and most powerful Kaplan turbines in the western world rated at 154 MW with a runner diameter of 9.5 m.

1995 **Rocky Reach, USA:**
Most advanced fish-friendly designed Kaplan turbine in the industry.

1999 **Aimores, Brazil:**
3 x 112.3 MW Kaplan turbines at a head of 25.8 m with a runner diameter of 8.47 m.

2001 **Ping Ban, China:**
3 x 138 MW Kaplan turbines at a head of 34 m.

2002 **Lajeado, Brazil:**
Kaplan turbine with an output of 183.5 MW at a head of 34 m.

2002 **Peixe Angical, Brazil:**
3 x 168.8 MW Kaplan turbines at a head of 24.3 m with a runner diameter of 8.6 m.

2005 **Cao Jie, China:**
4 x 128 MW Kaplan turbines at a head of 20 m with a runner diameter of 9.5 m.

2006 **Holtwood Expansion, USA:**
2 x 59.2 MW Kaplan turbines at a head of 15.5 m.

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1 Estreito, Brazil

2 Budarhals, Iceland

2007 Uglichskaya, Russia:
Kaplan turbine with an output of 70 MW with a runner diameter of 9 m.

2007 Estreito, Brazil:
8 x 138.7 MW Kaplan turbines at a head of 18.94 m with a runner diameter of 9.5 m.

2008 Akkats, Sweden:
Two new 75 MW-turbines with five blade design under a maximum head of 46 m.

2008 Cheonpyeong Ext., South Korea:
Kaplan turbine with an output of 60 MW at a head of 22.3 m.

2010 Ferreira Gomez, Brazil:
3 x 86.5 MW Kaplan turbines at a head of 16.2 m.

2010 Embretsfoss IV, Norway:
Kaplan turbine with an output of 49.5 MW at a head of 16 m.

2011 Budarhals, Iceland:
2 x 40.1 MW Kaplan turbines at a head of 36.2 m.

2011 Saratovskaya, Russia:
2012 Modernization and uprating of nine Kaplan turbines with an output of 68 MW with a runner diameter of 10.3 m.

2013 Radag Albbruck Dogern, Germany:
Modernization of three 27.9 MW Kaplan turbines with a rated head of 8.8 m.

2013 Rosegg St. Jakob, Austria:
2 x 43.4 MW Kaplan turbines at a head of 22 m.

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2014 **Bergeforsen, Sweden:**
Modernization of two 45.7 MW Kaplan turbines with at rated head of 22.6 m.

2015 **Vamma12, Norway:**
Kaplan turbine with an output of 129.2 MW at a head of 27.7 m.

2017 **Ottmarsheim G4, France:**
Modernization of a 42.2 MW Kaplan turbine with a rated head of 15 m.

2018 **Tornillito, Honduras:**
2 x 92.7 MW Kaplan turbines at a head of 53 m.

2019 **Ana Cua, Argentina / Paraguay:**
3 x 89.9 MW Kaplan turbines at a head of 18.9 m.

2020 **St. Pantaleon, Austria:**
2 x 30.25 MW Kaplan turbines at a head of 20 m.

Vamma, Norway

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