

## Pump hydro turbines



### Pump turbines can respond almost instantly to sharp variations in power demand

This means we are able to provide a solution adapted to our customers' specific needs -- wherever they are located in the world.

Our complete line of pump turbines are suited for heads ranging from 5 m to 1,200 m with production potential

ranging from 50 MW to 500 MW for all types of applications.

Our pump turbines are adapted to the specific characteristics of each pumped-storage plant. To cover the **complete head range** (from 5 m to 1200 m), we use **axial, mixed or centrifugal flow runners**.

We've also invested heavily in pump turbine R&D to meet the need for high-speed pump turbines at very high heads.

#### Why choose Alstom pump turbines?

Alstom has the strongest market base for designing optimised pump turbines for new projects.

We've built an **extensive pump turbine hydraulic design portfolio** with **more than 50 pump turbine prototypes**. Between 2000 and 2009 alone, we commissioned 14 major pump turbine projects.

#### Alstom pump turbine features

##### Single-stage centrifugal units for heads up to 700m

We've improved the performance and reliability of this type of unit, offering:

- **Pumped-storage plant configurations** that allow turbine dismantling from above, below or in the middle of the pit
- Self-pumping **bearings** and water lubricated bearings, as well as traditional oil-lubricated white metal coated bearings
- Different types of **governing control system configurations**, using an actuating ring to control all synchronised wicket gates, or using individually actuated wicket gates to optimise plant stability at start-up
- A selection of **inlet valves**

##### Double and multi-stage centrifugal units for heads over 700m

Get the assurance of good hydraulic efficiency and minimal stress and vibration thanks to our double-stage pump turbine with two adjustable distributors, one for each runner. These offer:

- Adjustable power output
- Better runner efficiency than with single-stage high heads
- Less vibration
- Better stability
- Reduced civil engineering costs as the unit submergence can be reduced

#### Success stories

As the clear world leader Alstom has been providing pump turbines for over 50 years and has supplied a total of 139 pump turbine units to date with a total capacity of 22,000 MW, including:

- **Zhanghewan** (China), 2007, 4 x 255 MW - Head: 305 m
- **Afourer II** (Morocco), 2005, 2 x 176 MW - Head: 576 m
- **Alqueva** (Portugal), 2000/2012, 4 x 129 MW - Head: 76 m
- **Yangyang** (South Korea), 2005, 1 x 250 MW - Head: 800 m
- **San Chong** (South Korea), 2001, 2 x 390 MW - Head: 423 m
- **Bissorte II** (France), 1983, 4 x 138 MW - Head: 1,112 m