Alstom’s products power the four highest capacity hydro power plants in the world. We’ve also equipped bulb, Kaplan, Francis, Pelton and pumped storage hydro projects of every size in almost every country where there is water.

Not only do we have water to wire capabilities but we provide the wire as well. Simply put, we offer turbines, generators, control systems, hydro-mechanical equipment, balance of plant and services offered as turnkey plants or individual components, as well as advanced electrical grid solutions to transmit power from the hydro power plant to the neighborhood sub-station. No other company can do all of this for customers.

With a presence in 70 countries, hydro service centres around the world and a network of global technology centres in Brazil, Canada, China, France, India and Switzerland, Alstom is close to its customers so we can serve them better.
Alstom’s experience designing large units, the breadth of its scope of supply and technology that increases reliability and reduces cost has made it a leader in the low head hydro power market.

Low head hydro power plants – typically under 60 m – include bulb-, Kaplan- and propeller-driven plants. Their limited environmental footprint and availability of sites to equip are drivers behind the increasing demand for such plants.

**An experienced partner**
Alstom’s product design, project management and integration experience provide peace of mind for customers because Alstom has:
- designed some of the biggest low head units ever built;
- equipped more than 23 GW of low head projects around the world;
- over 100 years’ of hydro project management and integration skills.

Not only does Alstom have low head projects on every continent, it supplied the electro-mechanical equipment for the world’s first tidal power station – the iconic La Rance in France.

Through Alstom’s Plant Integrator™ approach, the company offers hydraulic turbines, generators, control systems, hydro-mechanical equipment, balance-of-plant and electrical grid solutions, as well as a full range of services for the plant’s full lifecycle. We offer these products and services as integrated solutions or individual components for new hydro power plants or retrofits.

**High reliability**
Alstom has developed technologies such as oblique elements which increase reliability and it has implemented downstream gates which reduce cost for low head hydro power plant owners and operators.

**Low environmental footprint**
Hydro is the leading source of renewable energy, providing predictable carbon-free power generation. Low head hydro power plants, when used in run-of-river configurations, virtually eliminate the need for reservoirs, greatly decreasing their environmental footprint.

Alstom also offers a number of additional environmentally friendly features such as oil-free hubs and self-lubricating bushings which eliminate the possibility of petroleum-based lubricants leaking into the aquatic ecosystem. Also, fish-friendly runner designs greatly increase survival rates of fish passing through the turbine.
Clean Power, How Alstom is helping you meet the challenges of energy sustainability

CLEAN POWER CLEAR SOLUTIONS™

Our power generation offering is based on a deep understanding of power markets and our customers’ needs. It is organised around three levers to maximise the return of assets over their entire lifecycle.

REDUCING COST OF ELECTRICITY

It takes competitive assets to keep electricity affordable. We enable power companies to compete successfully in the market place and provide affordable electricity to consumers. We help you reduce the cost of electricity through:
- Efficiency improvements
- CAPEX reduction / scaling up
- Capacity Factor increase
- Lead time reduction
- Competitive O&M

LOWERING ENVIRONMENTAL FOOTPRINT

Clean generation is one way of demonstrating environmental responsibility. Another is lowering resource usage, visual impact and noise pollution. In both cases, we can help you meet or exceed regulations and environmental standards. That is why Alstom innovates in the following areas:
- Renewable portfolio
- Natural resource optimisation
- Pollutants control
- Land use, visual impact and noise
- Water intensity reduction & recyclability

INCREASING FLEXIBILITY & RELIABILITY

Intermittent power generation is a growing challenge of energy security, as is maintaining an aging installed base and adapting it to changing market conditions. We help you tackle both issues so that you can enjoy dependable operations with:
- Maintainability and outage time reduction
- Operational and fuel flexibility
- Designs and service for improved availability and reliability
- Energy storage
Hydropower is the most important source of renewable energy in the world.

Clear Solutions meet the challenges of energy sustainability

**OUR COMMITMENT TO OUR CUSTOMERS**

**REDUCING COST OF ELECTRICITY**

- Fewer but larger units mean less cost for customers

**LOWERING ENVIRONMENTAL FOOTPRINT**

- Small reservoirs reduce land lost to flooding

**INCREASING FLEXIBILITY & RELIABILITY**

- Maintenance-free oblique elements and stator core pressing system increase generator reliability
Bulb hydro power plants

With over 300 bulb turbines installed around the world, Alstom is a leader in this market and especially in bulbs over 6 m in diameter. Alstom’s largest diameter bulb is currently 7.8 m for the Xiajiang hydro power plant in China.

Bulb turbines

Bulb turbines, the most efficient solution for very low heads – that is typically under 25 m, can provide outputs of up to 100 MW. Usually double-regulated, bulbs can support a wide range of head and discharge which is important when they are used in run-of-river situations where the flow varies with the season and reservoir volume is limited.

Bulb turbines have a straight water passage through the draft tube which improves the unit’s overall performance and also results in a low submergence which in turn reduces size and cost of civil works.

In addition to their most frequently used run-of-river application, bulbs can also be used in tidal applications like La Rance tidal power station in France which Alstom equipped.

Low speed horizontal generators

Alstom has designed and manufactured 83 MVA generators for the most powerful bulb units ever built – the Santo Antônio and Jirau hydro power plants on the Madeira River in Brazil. Their horizontal orientation provides a very small air gap between the rotor and stator. Alstom technology and experience with large bulb units ensures the air gap is maintained, avoiding potential outage-causing rotor-stator contact.

Alstom’s bulb generator stator frames have special V-shaped elements that support extreme loads. They provide the necessary stiffness yet have enough flexibility to protect against stator core buckling and do so with less height than other design concepts, allowing overall dimensions to be optimized.
hydro power plants
for a range of applications

Kaplan & propeller hydro power plants

With references dating back to 1925, Alstom is an experienced and established player in both the Kaplan and propeller hydro power plant market. This breadth of experience enables Alstom to propose the best suited technology for customers’ specific applications.

Kaplan turbines are double-regulated which means they are an efficient solution over a wide range of head and discharge. This is important given that they are often used in run-of-river configurations where the flow varies significantly with the season. Unlike Kaplan turbines, propellers have fixed blades. While this single regulation slightly limits their individual flexibility, they have other advantages such as smaller hubs which increase performance and welded blades eliminate adjustment mechanisms, decreasing maintenance requirements. Alstom’s specific propeller designs can bring big output increases in retro-fit applications.

Kaplan & propeller turbines

Kaplan and propeller turbines usually support heads from 20 to 60 m with outputs up to and above 250 MW. Their vertical configurations allow larger runner diameters (over 10 m), enabling higher unit power. Alstom’s Kaplan and propeller turbines are available in 4-blade configurations for lower heads in the Kaplan range and 5- or 6-blades for higher head Kaplan applications.

Low speed vertical generators

Alstom’s lengthy experience in large low-speed generators, coupled with strong in-house calculation tools enable us to design some of the most advanced generators in the industry. Alstom’s low-speed generators often employ short and stiff shaft lines which reduce the height needed for the powerhouse and, as a result the civil works required to build the powerhouse. The optimised shaft lines also reduce losses and improve mechanical behaviour.

Alstom’s maintenance-free oblique elements and stator core pressing system provide unprecedented generator reliability.
Full Scope of Supply through Alstom’s Plant Integrator™

1. Generator and excitation system
2. Turbine and speed governor
3. Control system
4. Hydro-mechanical equipment (downstream gates)
5. Balance-of-plant (overhead crane)
6. Electrical grid solutions
Control, hydro-mechanical, BOP & Services

As a plant integrator, Alstom has the experience, competence, complete product portfolio and full range of services to be the single point of contact for hydro power plant operators’ and owners’ electro-mechanical equipment and services needs.

Control systems
Control systems are the intelligence of power plants. Alstom’s control systems cover the entire plant from distributed control systems to turbine speed governors and generator excitation.

Hydro-mechanical equipment
Alstom’s downstream gates reduce material and civil works costs compared to upstream safety gates. They also protect against runaway conditions and provide downstream isolation during unit de-watering. At almost 14 m³, Alstom designed and manufactured the largest downstream gates in the world for the Santo Antônio bulb hydro power plant in Brazil.

Alstom also provides a complete range of hydro-mechanical equipment including gates, valves, trash racks and cranes for all hydro power plant needs.

Balance-of-plant (BOP)
Alstom provides energy evacuation and electrical and mechanical auxiliaries for hydro power plants.
Alstom Hydro PlantLife® is fully dedicated to helping customers manage, protect and maximise their investment throughout the lifetime of their equipment, regardless of manufacturer, age or condition.

**Services**

Hydro power plant operators need to maintain plant availability and optimum efficiency and they will likely want to increase plant performance at some point during its lifetime. Assessing, maintaining, upgrading and replacing equipment may all be necessary from the first years of operation to any point in the plant’s lifecycle.

Alstom operates in more than 70 countries and has the broadest range of hydro solutions and services on the market. This truly global presence means Alstom Hydro Services experts can provide your plant, wherever it is, with the highest level of service and support.

To ensure plant operators and owners can achieve and maintain optimum performance, the Alstom Hydro PlantLife® programme – a comprehensive asset management programme, offers customised and off-the-shelf service and retrofit solutions, suitable for fleets, plants and components. PlantLife® is built on three pillars:

- **Assess**: schedule diagnosis and supervise plant performance
- **Secure & Extend**: maintain plant availability and increase its lifetime
- **Reset & Upgrade**: provide a hydro power plant with a second lease of life and optimise its performance and efficiency

**Supporting you anytime, anywhere**

Alstom Hydro Services local teams, backed up by the entire Alstom Thermal Services network, are able to restore plants back to service in the shortest possible time.

For more information please contact Alstom Hydro Services

- North America: hydroNAMservice@alstom.com
- Latin America: hydroserviceLAM@alstom.com
- China/South-East Asia: HydroAsiaService@alstom.com
- India/Asia: hydroINDIAservice@alstom.com
- Russia/CIS: HydroRussiaAndCisService@alstom.com
- North Europe: HydroServiceNorthEurope@alstom.com
- South Europe/Africa/Middle-East: HydroServiceSouthEurope@alstom.com
Global Technology Centres

Alstom’s Global Technology Centres ensure that the most innovative solutions are available across the whole range of Alstom’s hydro products to address evolving market needs.

All of the Global Technology Centres are standardized on the latest CFD (computational fluid dynamics) and FEA (finite element analysis) software. Leading industry software is complemented by sophisticated Alstom-designed applications.

CFD and FEA simulations are validated by scale model tests in one of Alstom’s hydraulic test laboratories in Brazil, China, France or India. Alstom’s lab in Grenoble, France has the industry’s only reversible bulb test rig which means that Alstom is the only company that can fully test tidal bulb turbines. Hydraulic test labs simulate the conditions found in a hydro power plant, enabling Alstom’s engineers to test and refine designs and guarantee performance prior to manufacture and installation.
and local expertise
customer confidence

Key References

**SANTO ANTONIO (BRAZIL)**
19 x 75 MW bulb
7.5 m runner diameter, 100 rpm
15 m head
Alstom scope: turbines, generators, control, hydro-mechanical

**QIAOGONG (CHINA)**
4 x 64 MW bulb
7.5 m runner diameter, 83 rpm
14 m head
Alstom scope: turbines, generators

**LA SARCELLE (CANADA)**
3 x 46 MW bulb
7 m runner diameter, 86 rpm
11 m head
Alstom scope: turbines, generators

**XIAJIANG (CHINA)**
5 x 45 MW bulb
7.8 m runner diameter, 71.4 rpm
9 m head
Alstom scope: turbines, generators, BOP

**LOWER JURALA (INDIA)**
6 x 40 MW bulb
5.3 m runner diameter, 125 rpm
20 m head
Alstom scope: turbines, generators, control, BOP

**BRILLIANT (CANADA)**
1 x 120 MW Kaplan
11.2 rpm
30 m head
Alstom scope of supply: turbine, generator

**BAIXO IGUACU (BRAZIL)**
3 x 119 MW Kaplan
9.7 m runner diameter, 4-blade, 66.7 rpm
16 m head
Alstom scope: turbines, generators, control

**LONGKOU (CHINA)**
4 x 100 MW Kaplan
6-blade, 94 rpm
31 m head
Alstom scope: turbines, generators

**OWEN FALLS (UGANDA)**
2 x 41 MW Propeller
5-blade, 136 rpm
21 m head
Alstom scope: turbines, generators, control, hydro-mechanical equipment, BOP, transformers, switchyard
Alstom, an experienced partner for highly reliable low head hydro power plants.

Experience
We are the hydro equipment leader that:
• Designed and manufactured the most powerful bulb units ever built for Santo Antônio and Jirau hydro power plants on the Madeira River in Brazil
• Designed and manufactured the world’s largest downstream gates for Santo Antônio
• Equipped the world’s first tidal bulb hydro power plant at La Rance (France)
• Supplied the world’s four highest capacity hydro power plants
• Installed over 23 GW of low head projects
• Installed over 10 GW of low head projects since 2000
• Has over 100 years of experience and innovation serving customers around the world

Capabilities
We offer everything that a hydro power plant owner needs:
• Turbines, generators, control systems, hydro-mechanical equipment and balance of plant offered as integrated plants or individual components for new plants or retrofits
• Services to manage, protect and maximise their investment throughout the lifetime of their equipment
• Advanced electrical grid solutions to transmit power from the hydro power plant to the neighborhood sub-station

Reach
We are where our customers are:
• Present in 70 countries
• Hydro services sales offices and hydro field services centres in 16 countries
• Hydro engineering/manufacturing in 11 countries
• Hydro Global Technology Centres in 6 countries on 4 continents
Alstom

Alstom is a global leader in the world of power generation, power transmission and rail infrastructure and sets the benchmark for innovative and environmentally friendly technologies.

Alstom builds the fastest train and the highest capacity automated metro in the world, provides turnkey integrated power plant solutions and associated services for a wide variety of energy sources, including hydro, nuclear, gas, coal, wind, solar thermal, geothermal and ocean energies. Alstom offers a wide range of solutions for power transmission, with a focus on smart grids.

Power generation

**Alstom Power** offers solutions which allow their customers to generate reliable, competitive and eco-friendly power.

Alstom has the industry’s most comprehensive portfolio of thermal technologies – coal, gas, oil and nuclear – and holds leading positions in turnkey power plants, power generation services and air quality control systems. It is also a pioneer in carbon capture technologies.

Alstom offers the most comprehensive range of renewable power generation solutions today: hydro power, wind power, geothermal, biomass and solar. With ocean energies, we are developing solutions for tomorrow. Alstom is one of the world leaders in hydro power, the largest source of renewable energy on the planet.