High performance hydro products and services

American Hydro is a leading supplier and installer of large equipment for the hydroelectric industry, specializing in the design, manufacture, upgrade and servicing of high performance hydro-turbines and pumps.

**American Hydro is a company steeped in a tradition of hydro power.**

We honor this tradition and we build on it. Our engineers are experienced and they know every nuance of the powerful equipment we build. American Hydro has flourished, however, not just due to experienced engineers but by integrating state-of-the-art technology in the design and manufacture of this equipment. Our engineers were the first in the industry to develop powerful three-dimensional finite element analysis and apply it to the structural design of some of the largest turbines in the world. Our engineers were first in adapting this same finite element technique to the analysis of fluid flow, revolutionizing the methods used to design new AMERICAN HYDRO™ runners. We have used these tools for more than thirty years.

But what have we done lately? With this brochure we wish to tell you the story of our new technologies. It is the story of unique Francis turbine designs to achieve unparalleled levels of power, of new powerful draft tube analysis providing revolutionary means to improve performance, and of new methods to improve the aquatic environment surrounding our AMERICAN HYDRO™ turbines. It is a story of numerical manufacturing and robotics that provide the flexibility in design and precision in product necessary to achieve ultimate performance goals.

It is a story from concept to commissioning.

And why do we have such a single-minded goal of turbine improvement? Simply put, the revenues generated by hydro power originate from the turbine. Better turbines provide more revenue. This is the difference our technology will make for you.

All of us at American Hydro value the relationships we have with our clients, our suppliers, and our friends. If you are a customer, let us take this opportunity to thank you for your support. Let us also thank our suppliers whose dedication is so important to the products and services we provide. For those of you who do not know us, we look forward to meeting you, working with you, and welcoming you to the American Hydro family.
American Hydro technology:  
Structural analysis and system dynamics

The power of American Hydro’s structural analysis codes and the effectiveness of our engineering analysts have been established for many years. We work daily to be sure that our new AMERICAN HYDRO™ turbine components and your existing turbine can safely withstand the hydraulic and rotational loadings under extreme conditions.

While structural integrity based on constant loads is critical to turbine design, American Hydro’s ability to evaluate dynamic responses of all system components has been crucial for many of our successful projects. We have eliminated wicket gate vibration problems through careful contouring of the existing gates, and identified penstock frequencies which are avoided by proper selection of the number of runner blades.

Transient turbine or pump operation, such as load rejection, can cause a pressure or speed rise which may damage the waterways or the equipment. American Hydro’s transient computer analysis accurately predicts this behavior. Our engineers use these tools to optimize turbine control system timing and avoid dangerous operation.

Recent advances in upgrading pump-turbines have led to new stay vane modifications which improve performance and significantly extend turbine life. This is not always accomplished by adding material, but also by reshaping the existing vanes, thereby leveling stresses throughout the structure, eliminating dangerous stress concentrations, and reducing hydraulic losses.
CFD analysis of full spiral case, including stay vanes and wicket gates
American Hydro technology:
Computational fluid dynamics (CFD)

Technology is fundamental to every aspect of American Hydro's projects. Our design and analysis technologies must accurately predict the performance of our AMERICAN HYDRO™ equipment before we begin to manufacture. The reliability and precision of our computational tools are critical to the success of your project.

Building on our established expertise to refine runner design using finite element flow and performance analysis, American Hydro has applied the latest “Navier-Stokes” computational fluid dynamic technology to calculate flows throughout the hydro turbine. We have concentrated our efforts to do what is needed and to do it well. We know that the diverging flows in draft tubes provide a daunting challenge to even the most advanced codes, yet this is exactly the turbine component that can dramatically impact performance.

Our approach to this problem has paralleled what we have done for runner analysis. First, develop the best CFD analysis technique and then apply the analysis not to a few jobs, but to every job. Based on joint research with a major university, and more than fifteen years of program verification, American Hydro is using the Navier-Stokes analysis with excellent results.

Whether it is matching runner designs to difficult draft tubes, redesigning piers, designing new guide vanes, or calculating the increase in dissolved oxygen from American Hydro's turbine aeration system, our draft tube analysis is providing tremendous improvements in optimizing the performance of our AMERICAN HYDRO™ turbine designs.
Three-dimensional cutaway rendering of a Francis turbine
The American Hydro facility is designed from the ground up to provide a manufacturing environment that produces high quality hydromechanical components cost effectively and in less time than by conventional means. Making all of this possible is American Hydro's expertise in computer and manufacturing integration. Engineered designs created with specialized software are input directly into work centers equipped with CNC milling or flame-plasma cutting machines for complete accuracy. This “paperless” production approach eliminates errors and improves quality.

- Over 123,000 square feet set on 38 acres
- 200 ton crane capacity
- Access by rail or road
Manufacturing
Skoda* Vertical Boring Mill

- 500 ton, 52 ft. diameter table capacity.
- Direct numerical control.

* Skoda is not a trademark of American Hydro Corporation.
Ingersoll* Horizontal Boring Mill

• 26 ft. vertical travel.
• 54 ft. horizontal travel.
• Direct numerical control of three axis and two axis rotary table.

* Ingersoll is not a trademark of American Hydro Corporation.
**Blast Room**

- Size: 20 ft. x 20 ft. x 30 ft.
- Media: Carbon steel shot, stainless steel shot and glass beads.
- Qualified for lead paint removal.

**Waldrich* Six Axis Machining Center**

- Five axis simultaneous CNC control.
- 30 ft. horizontal travel.
- 14 ft. vertical travel.
- Head swivels +/-135°.

*Waldrich is not a trademark of American Hydro Corporation.
Toshiba* Vertical Boring Mill

- 28 ft. turning diameter.
- Live spindle for milling and boring operations.
- Direct numerical control.

*N toshiba and Niles are not a trademark of American Hydro Corporation.
American Hydro: Manufacturing

American Hydro engineers are committed to the fabricated construction and fully computerized machining processes required to produce high precision rugged equipment. Our proven product quality and performance have validated this approach, and we never stop re-creating the techniques which keep American Hydro at the forefront of the industry.

When you visit our shop you will see new installations of large machine tools. These new tools help us grow our business and shift more manufacturing processes to numerical machining. Evidenced here is the continuing development of techniques which improve quality and cut costs. Numerical gas and plasma arc cutting in three dimensions has dramatically reduced machining time. Robotic grinding provides precise surfaces and eliminates tedious hand work. Fiber optic communications reduce spurious signals to machine tools. Modern shot blasting facilities remove hazardous lead-based paint in a manner which is safe for our employees and for the environment.

Machining runner components

Top, right top and bottom: Welding on runners
American Hydro:
Manufacturing

The computer driven hot-forming and numerical machining techniques developed by American Hydro engineers have resulted in cost-effective manufacturing to exacting tolerances.

From the initial plate cutting to the final shaft fit up and dynamic balancing, your AMERICAN HYDRO™ turbine runners or pump impellers can be manufactured entirely in our shop. We control the schedule and the quality and you benefit from a successful project.
Rugged reliability. This is the foundation of our new AMERICAN HYDRO™ turbine design. Experienced engineers know the pitfalls and never compromise on structural integrity. Hydro turbines have to work and they have to last.

American Hydro can design you a new AMERICAN HYDRO™ turbine to improve fish passage or to re-oxygenate the water.

We can replace your old open flume turbine with a modern, custom AMERICAN HYDRO™ design to increase output significantly while eliminating nagging structural problems.

We can replace your propeller unit with a full Kaplan runner to provide highly efficient operation over a wide range of heads and flows.

American Hydro starts from this foundation. It is precisely our comprehensive knowledge of turbine design which allows us to apply new technologies and innovate. We innovate to reduce your overall project costs and to improve your revenues, without sacrificing rugged reliability.

Kaplan runners, propellers, Francis turbines, pump-turbines: American Hydro can supply the turbine or the complete equipment package. Our technology enhances your revenues; our experience ensures your success.
127° Kaplan runner (6 MW)
American Hydro’s Seagull™ turbine is a perfect combination of advanced technology, innovative design and rugged construction. Working with our first Seagull turbine customer we developed a high performance, low maintenance unit which could replace antiquated quad-runner turbines. To be economically feasible the new turbine had to achieve high capacity with no change to the basic open-flume powerhouse layout.

Although each new Seagull™ turbine is custom designed, every customer benefits from the design concepts of our first unit: Two bearings mounted immediately adjacent to the runners, a dry pit for all the wicket gate mechanisms, rugged single pedestal mounting, and all hydraulic passages designed using advanced Computational Fluid Dynamics. Our Seagull turbines have proven themselves as extremely robust, low maintenance units. They are workhorses which produce outstanding annual revenues. If your open flume unit is unreliable or you are looking to increase capacity, we would be pleased to size a Seagull turbine for you.

American Hydro: Seagull™ turbines

Far left: Seagull™ turbine components in shop
Left: Structural analysis of draft tube

Installation of a Seagull™ turbine
American Hydro welcomes the opportunity to provide turnkey upgrades for your power plant. Working with trusted partners, we will replace, rehabilitate and upgrade your entire electrical and mechanical systems. New electro-mechanical instrumentation and station controls can link with your operations center to facilitate remote operation.

Turbine rehabilitation at American Hydro is directed by experienced turbine engineers. Our approach is to use the existing parts if the design is sound, and to redesign and improve if modern technology will result in reduced maintenance and better availability. New bearing materials, better wicket gate linkage, and improved shafting systems can all contribute to reducing your operating costs.

But what about revenues? Let us emphasize that the revenues generated all originate from the turbine. While capacity increases of 10-15% are relatively commonplace, American Hydro’s design and manufacturing technologies can often provide substantially more. A difference of 10% in capacity can mean increasing station revenue with no additional cost. This difference goes straight to your bottom line and may double your profits. We make a better turbine and you make more profit. It is that simple.
Hydro plant upgrades are unique opportunities to provide valuable new sources of electrical capacity and energy. The additional generation developed through a plant upgrade can be realized at a far lower cost than other sources of new power.

Environmental impacts of plant upgrades are minimal, and in some cases upgrades can improve the local ecosystem. The new generation created from a hydro plant upgrade consumes no scarce resources, produces no greenhouse gases, and leaves no dangerous waste products behind.

American Hydro’s experience and technology will help you unlock the unused potential of your hydro plant.

American Hydro: Rehabilitation and total plant upgrades

205" Francis runner (12 MW)

Far left: 152" Propeller runner (5 MW)
Left: 70" double discharge Francis runner (23 MW)
Bottom left: Adjustable water-lubricated bearing
Right:
72° Propeller runner (4 MW)

Far right:
Distributor assembly
American Hydro:
Pump-turbines and pumps

For new and upgraded pump-turbines, American Hydro has made dramatic improvements in turbine power at the crucial lower heads while not requiring more motor power for the pump. These improvements, achieved through integration of stay vane, wicket gate and runner designs, have resulted in significant capacity increases. Cycle efficiency increases of 10% are not uncommon. The startling increases in station revenue are further enhanced by elimination of vibration, fatigue cracking, cavitation and excessive noise and by reductions in pump back and start-up times.

Pump-turbines installed between 1960 and 1990 represented a relatively new technology. Initially, designers adapted pump impellers for use as pump-turbine runners. Francis turbine wheelcase designs were improved to accommodate the more rigorous pump-turbine environment. These machines have served our industry well, but now provide valuable opportunities for improved reliability and increased revenues. Today’s technology provides true pump-turbine designs and equipment that optimizes hydraulic performance while strengthening the entire machine.
American Hydro has applied the technology developed for pump-turbines to achieve impressive increases in pump efficiency and capacity. For cooling water pumps at fossil or nuclear plants the increased pump capacity may be leveraged into a significant increase in total plant capacity and energy production. The economics of these pump upgrades can compare quite favorably with improvements to the primary generators.

The upgrade of large pumps used for water distribution and irrigation can increase flow while reducing maintenance and operating costs. American Hydro pump upgrades have eliminated cavitation, solved chronic vibration problems, and dramatically improved bearing life.

New AMERICAN HYDRO™ pump impellers, designed and manufactured to our exacting standards, provide smooth, high efficiency operation that may eliminate bearing problems that plague many condenser cooling water pumping plants. As an added benefit, the new AMERICAN HYDRO™ impellers can operate at the lower intake river levels that can occur in the summer months when the full capacity of the fossil plant is most needed in hotter climates.
Services
American Hydro offers a broad range of engineering analyses to the hydro turbine industry. Primary to our business are studies to determine rehabilitation and upgrade options for hydro stations and hydro equipment. We have completed hundreds of these studies and are able to evaluate your hydro plant quickly and accurately. However, our engineering analysis is much more...

Turbine Aeration and Dissolved Oxygen Enhancements Engineered Using Two Phase Navier-Stokes Calculations

Hydraulic System Transient Analysis

One Unit 25% Load Rejection

Energy Production and Financial Impact Based on River System Analysis

8 Year Project Analysis Three Unit Upgrade

Life Evaluation through Fatigue and Fracture Mechanics Analysis

Structural Redesign Using Static and Dynamic Finite Element Analysis
American Hydro:
Hydro plant surveys, field testing, project management, field service & field machining

American Hydro provides engineered turnkey solutions for the rehabilitation and upgrade of your hydro power plant assets.

Our fully equipped field crews can develop a program to cover all aspects of on-site mechanical, from disassembly to commissioning, including site machining of embedded components to ensure critical alignments and tolerances are achieved. American Hydro’s fleet of field machining equipment reduces project costs and outage times.

Above: Installation of 110” Francis runner (15 MW)
Left: Brake ring machining
American Hydro:
Site service

American Hydro’s experience in the management of mechanical projects in the hydro power industry is well established. Turnkey projects are supported by a network of partnerships for the supply of a wide range of hydro turbine upgrades, complete turbine and turbine generator sets, as well as balance of plant.

We manage each of our projects by assigning a project manager as a single point of contact. Project managers follow our Integrated Project Methodology based on PMBOK* (Project Management Body of Knowledge) principles.

American Hydro’s technical field advisors have many years of experience on all types of hydro equipment. This experience is backed by our team of hydro engineers in York, to support the unexpected. From mobilization to commissioning our hydro team is ready to support your needs.

American Hydro’s extensive portable on-site machining and inspection tools can analyze and correct all alignment/tolerance issues. Our team of highly trained welders can repair all welding needs based on OEM best practice.

We deliver innovative engineered solutions which enhance the performance and lifespan of equipment, thus improving the efficiency of our customers’ operation.

CUSTOMER BENEFITS

Safety & Environmental
- Custom safe work plans for specific projects
- OHSAS 18001 and ISO 14001 Certified

Quality of refurbishment
- Premium engineering and design
- Global repair facilities and on-site machining
- Responsive to customers’ standards and preferences
- Complete mechanical overhauls
- ISO 9001 certified

Timely execution
- Global resources - local support
- Local single point of contact
- PMI* (Project Management Institute) management structure
- IPMM (Integrated Project Management Methodology)
- PMP* (Project Management Professional) trained personnel

On budget
- Over 140 years of experience provides excellent engineering expertise to consult and evaluate each project which ensures the project’s success.

* PMBOK, PMI and PMP are not trademarks of American Hydro Corporation.
American Hydro: Maintenance, overhaul and refurbishment solutions

Site services offered but not limited to:
- Site surveys of existing plants
- Complete disassembly and reassembly of hydro turbines
- In-place machining of all embedded components
- Turning, milling, grinding on site with our extensive fleet of portable precision machine tools
- FARO Laser Tracker surveys and complete unit alignment of stationary parts
- Extension and embedment of new discharge rings
- Stay ring and guide vane modifications or replacement
- Stator realignment
- Installation of oil lube systems as well as cooling systems
- Governor replacement
- Cavitation repair
- Performance testing
American Hydro has earned a reputation for providing quality site services that meet or exceed the requirements of the hydroelectric industry. Our experienced Field Service Representatives work closely with our Engineering and Project management teams and have the necessary capabilities and resources to assure that work is carried out to the highest possible standards.

Our field service teams are fully trained to insure each project is completed successfully and in accordance with the most stringent health, safety and environmental requirements in the industry.

Right:
Turbine installation

Below:
Critical valve installation
Safety is of the utmost importance to American Hydro whether in our shops or at a customer’s site.

Protecting the health and safety of employees, customers, guests, contractors and the environment is the primary goal of all of us at American Hydro. This goal is met through the development of a comprehensive and effective environmental health and safety plan that endeavors to eliminate unsafe conditions and minimize the impact of hazardous situations. Our program benefits the company and the community by reducing illness and injury, preventing property damage, and preserving the environment.

To meet this commitment, American Hydro employees observe five key Safety Values:

- My colleagues’ and my own safety is paramount
- No task or activity is so important or urgent it cannot be undertaken safely
- I will only undertake tasks that I am trained, competent and properly prepared for
- I will never cut corners nor take shortcuts at the expense of safety
- I will stop the job if I believe it is unsafe to continue.
Welding turbine components in the American Hydro manufacturing facility
American Hydro: Customer relationships

American Hydro has excellent relationships with many valued customers. We are pleased to respond to their specifications with comprehensive and competitive proposals. A number of our clients have chosen to work with us exclusively. In these cases we develop formal or informal partnering arrangements to best suit their needs. If you have not yet worked with American Hydro, we believe you are in for a most pleasant surprise. Our sales and engineering staff welcome the opportunity to work with you to better develop the project scope and objectives before your procurement process begins. Once we have your confidence and project award, our philosophy is to supply what you ordered. We never begin a project expecting to increase scope. We want your project to be a complete success: meeting budget, exceeding performance guarantees and on time. This is the way American Hydro builds its business.

Eliminating the Unexpected
American Hydro will custom design all new equipment and engineer any refurbishment and installation services before we submit our quotation. Our approach is to understand all the project details before bidding and to inform you of those details in our proposal. American Hydro works to eliminate all “adders” which might otherwise develop during the project. Our up front engineering allows us to make a most competitive bid and eliminates unwelcome “surprises.”

American Hydro customers overseeing turbine installation

Customer inspections of manufacturing at American Hydro’s facility
American Hydro: In our community

We’re more than just advanced technology and massive precision manufacturing. American Hydro is part of a larger community which has supported and nurtured our business. Each member of our American Hydro family reaches out to support our York community.

Community Involvement
- York County School of Technology - Apprenticeship Program
- York Strand-Capitol Performing Arts Center
- York College of Pennsylvania - Engineering Co-op Program
- SE Pennsylvania Manufacturers Association
- Annual picnic and open house
- Youth Soccer sponsor

Above:
Photos from the American Hydro family picnic

Right:
Youth league playing at the American Hydro soccer field
American Hydro, a Wärtsilä company, is a leading supplier and installer of large equipment for the hydroelectric industry, specializing in the design, manufacture, upgrade and servicing of high performance hydro-turbines and pumps.

www.ahydro.com