Comprehensive solutions for Mini Hydro
Voith HyComplete
Mini hydropower is nearly endless, ecologically and commercially sustainable

Complete water-to-wire solutions up to 1.2 MW designed and manufactured by Voith HyComplete
There is tremendous potential in small hydro sites – thousands of existing low-head hydro sites and underutilized resources waiting for retrofitting or upgrades. Energy recovery, as well as new run-of-river sites, provide outstanding potential. The HyComplete product line represents comprehensive solutions for the sustainable generation of electricity from these resources. Standardized products for individual applications offer an attractive blend of high performance, quality and cost efficiency.

Benefits of Mini Hydro
+ Economically viable
+ Available globally with benefits for remote communities
+ Low environmental footprint and risks
+ Easy to operate and to service
+ High-quality energy resource
+ Long lifetime of power plant
+ Sustainable renewable resource with lowest CO₂ footprint
The right solutions for every application

Run-of-river

The most common application is the use of water resources in rivers with natural or man-made head and to turbinate a portion of this water. Depending on the head and flow range, Kaplan, Francis, Pelton and other most common technologies are applicable.

Low head hydropower

As a special type of run-of-river, low-head hydropower has a tremendous potential on waterways around the world. More than 85% of the existing dams are not yet electrified, and the majority of them have low heads. It is a question of an economic and ecological solution that makes these sites bankable. Voith’s answer is the StreamDiver.

Key requirements

- Cost-efficient concepts and products
- Compact, pre-assembled parts to shorten erection time
- High-performance and flexible hydraulics

Key requirements

- Low impact to civil structure
- Environmentally friendly solution
- Keep waterway management capabilities
Key requirements

- Flexible integration into existing infrastructure
- Compliant with safety or usage requirements (e.g. drinking water treatment)
- Cost-efficient solution

Energy recovery

Capitalizing on the potential of underutilized power plants and industrial assets, such as drinking or sewage water treatment plants, has become more and more popular. The PipeRunner, StreamDiver and eQ Solutions (Francis or Pelton for higher heads) cover a wide range of possible applications.
Voith is your water-to-wire partner for the whole project duration – and beyond

Early project check
You have identified a site and want to understand its potential for profitability. We can assist you or put you in touch with the experts who can!

Solution development
Finding the best solution for a site is not straightforward. Whether you are a project owner or an engineer, Voith and its partners will support you by developing a comprehensive solution that considers your site-specific requirements.

Financing support
Voith can also support owners who have a profitable project but are interested in further optimization. We have the resources to support you in finding equity and other financing options.
During the design phase of your project, the interfaces to the equipment supplier are crucial. Voith’s project design office will manage or assist you with these interfaces.

Voith can provide a comprehensive package from the hydropower resource up to the grid connection point.

Our industry is ever-changing, and there is always new knowledge to be gained. Voith can support you with training on plant operation and a myriad of special topics around hydropower.

We know our products and how to service them. We can provide service packages to suit your requirements and save operational costs, downtime and risks.
In many respects, Mini Hydro requires smart and innovative concepts to find the best solution for a specific site and save time and cost on all aspects of the project.

**eQ Solutions**
eQ Solutions is comprised of simplified, highly standardized turbine-generator units and their auxiliary systems. The system is pre-assembled to allow for fast and easy erection at the site. With integrated controls and actuators, it provides a compact and reliable water-to-wire system.

**Design features**
- Vertical Kaplan unit
- Double-regulated (guide vane and runner)
- Directly coupled synchronous generator (gear box as option)
- Highly efficient hydraulic design
- Short erection time due to pre-assembled parts on mounting frame
- Modular and compact concept

<table>
<thead>
<tr>
<th>Head range</th>
<th>2 to 10 m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow range</td>
<td>2 to 20 m^3/s</td>
</tr>
<tr>
<td>Output</td>
<td>Up to 1 000 kW</td>
</tr>
</tbody>
</table>
**eQ Francis**

- Horizontal Francis unit
- Single regulation (guide vanes)
- Directly coupled synchronous generator
- High-quality runner technology
- Optimized and standardized steel parts
- Simplification of auxiliary systems

### Design features

<table>
<thead>
<tr>
<th>Head range</th>
<th>20 to 100 m</th>
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</thead>
<tbody>
<tr>
<td>Flow range</td>
<td>0.5 to 3 m³/s</td>
</tr>
<tr>
<td>Output</td>
<td>Up to 1 200 kW</td>
</tr>
</tbody>
</table>

**eQ Pelton**

- Horizontal or vertical Pelton unit
- From 1 to 6 nozzles
- Jet deflector for load rejection
- Directly coupled synchronous generator
- Compact turbine-generator unit
- Simplification of auxiliary systems

### Design features

<table>
<thead>
<tr>
<th>Head range</th>
<th>Up to 350 m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow range</td>
<td>Up to 1 m³/s</td>
</tr>
<tr>
<td>Output</td>
<td>Up to 1 200 kW</td>
</tr>
</tbody>
</table>
“Personally, I see great potential in the StreamDiver technology – especially for ecologically sensitive regions and existing infrastructures like our dam.”

Mikael Krane
Power plant manager at Skellefteå Kraft, Sweden

StreamDiver

The StreamDiver provides an industry-wide unique design that allows for simplification of the entire powerhouse design. Lubrication and cooling water systems are not required, and actuation systems for control and startup are reduced to a minimum. A flexible and modular integration into the civil infrastructure, ease of installation and maintenance allow cost savings throughout the project phase.

Design features
- Highly efficient propeller turbine (runner regulation as option)
- Direct-driven permanent magnet synchronous generator
- River-water lubricated bearing design with outstanding lifetime
- Completely oil- and grease-free operation
- Modular design for sites with high flow (parallel generation of multiple units)
- Civil concepts with flexible integration into existing structures
- Additional options such as variable speed and fail-safe stop mechanisms

Head range Up to 8 m
Flow range Up to 14 m³/s
Output Up to 850 kW
The Voith PipeRunner is designed to provide clean power from industrial water applications (e.g. sewage or drinking water treatment plants). Its focus is flexible integration, easy access and the use of standardized, off-the-shelf components.

**Design features**
- Horizontal propeller unit (runner regulation as option)
- Highly standardized tubular design with off-the-shelf generator units (synchronous and asynchronous)
- In-pipe arrangement with high settings allows for easy access
- Special application in drinking and sewage water treatment plants
- Higher heads through serial arrangement
- Higher flow through parallel arrangement

**Functions**
- Low voltage switchgear assembly
- Unit and line protection and synchronization
- Central plant control (common control functions)
- Automatic voltage regulator (AVR)
- AC/DC auxiliary supply
- Alarm and remote monitoring system
- Additional options for island operation, UPS, variable speed, additional excitation and stand-alone container solutions

**Head range**
Up to 20 m

**Flow range**
Up to 4 m³/s

**Output**
Up to 250 kW

**Standard voltage ratings**
400 / 480 and 600 / 690 V

**Standard power ratings**
Up to 1 200 kW

**Standards**
IEC / ANSI

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Source: The Tokyo Electric Generation Co. Ltd.
Have a look at our global experiences

“The engineers are more than satisfied – even impressed – by the StreamDiver prototype, which should show new ways for small hydro especially.”

Stephan Benda
Project manager at Verbund, Austria

Nussdorf, Austria

- Successfully completed pilot project
- Five years of maintenance-free operation
- More than 40,000 hours of operation
- Inspections and testing confirmed robust and efficient design

<table>
<thead>
<tr>
<th>Mini Hydro technology</th>
<th>StreamDiver</th>
</tr>
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<tbody>
<tr>
<td>Commissioning</td>
<td>2012</td>
</tr>
<tr>
<td>Plant output</td>
<td>314 kW (max. 450 kW)</td>
</tr>
<tr>
<td>Head range</td>
<td>3.6 m (max. 4.7 m)</td>
</tr>
<tr>
<td>Flow range</td>
<td>10 m³/s</td>
</tr>
<tr>
<td>Units</td>
<td>1</td>
</tr>
</tbody>
</table>
Ijental, Switzerland

- Vertical eQ Pelton unit with 2 nozzles
- High-head eQ Solutions design (beyond 200 m)
- eQ Solutions design: electrical actuators for nozzles and jet deflector

Floresti 1 (Unit 3), Romania

- Horizontal eQ Francis unit
- Low-head Francis unit
- Complete water-to-wire supply from Voith (mechanical and electrical scope)

Egasaki, Japan

- Complete electromechanical equipment
- Connection integrated into existing system
- Propeller units (non-regulated) in serial arrangement
- Low voltage protection and control equipment

<table>
<thead>
<tr>
<th></th>
<th>2017</th>
<th>2015</th>
<th>2003</th>
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<tbody>
<tr>
<td>eQ Pelton</td>
<td></td>
<td>eQ Francis</td>
<td></td>
</tr>
<tr>
<td>348 kW</td>
<td>761 kW</td>
<td>80 kW</td>
<td></td>
</tr>
<tr>
<td>282.3 m</td>
<td>30.7 m</td>
<td>14 m</td>
<td></td>
</tr>
<tr>
<td>0.14 m³/s</td>
<td>3 m³/s</td>
<td>0.7 m³/s</td>
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<tr>
<td>1</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>
Turbine-generator units from 50 to 1200 kW

Compact and modular

2 - Head range

350m

0.3 - m³/s

15 - Flow range

Comprehensive water-to-wire solutions
The benefits making the difference

**HyComplete**

<table>
<thead>
<tr>
<th>Economical</th>
<th>Simply reliable</th>
<th>Environmentally friendly</th>
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</thead>
<tbody>
<tr>
<td>Making projects viable</td>
<td>Proven technology</td>
<td>In harmony with nature</td>
</tr>
<tr>
<td>+ HyComplete focuses on reducing total cost of ownership</td>
<td>+ Tested and manufactured according to global Voith standards</td>
<td>+ Reduction of oil usage (including oil-free designs)</td>
</tr>
<tr>
<td>+ High standardization and simplification of the power house design to reduce costs</td>
<td>+ Downsized from state-of-the-art designs</td>
<td>+ Fish friendly plant designs</td>
</tr>
<tr>
<td>+ Maximization of pre-assembled system and parts to shorten project lead and construction time</td>
<td>+ Longstanding expertise with hundreds of references</td>
<td>+ Small and compact with reduced footprint and simplified erection (especially necessary in remote areas)</td>
</tr>
<tr>
<td>+ Flexible and high-performance application due to premium hydraulic designs</td>
<td>+ Innovative and modern solutions for remote condition monitoring</td>
<td>+ Sustainable renewable energy source</td>
</tr>
<tr>
<td>+ Comprehensive solution and support from development to realization</td>
<td>+ Global network of partners and expert contacts</td>
<td></td>
</tr>
</tbody>
</table>

**About the company**

Voith Hydro is a leading full-line supplier and trusted partner for equipping hydropower plants. The Voith Group Division develops customized, long-term solutions and services for large and small hydro plants all over the world. Its portfolio of products and services covers the entire life cycle and all major components for hydropower plants from generators, turbines, pumps and automation systems to spare parts, maintenance and training services, as well as digital solutions for intelligent hydropower.