Fish Friendly hydroEngine®

a water-to-wire system for low head hydro applications

The Restoration Hydro Turbine (RHT) is a hydroelectric turbine combining high performance, safe fish passage and a short draft tube for simple civil works.

Special fish friendly blades are optimized for low head between 2 m - 10 m (6.5 ft - 33 ft), eliminating the need for fine fish screens thus increasing total plant efficiency while reducing both upfront and operations and maintenance costs.

Single units have capacities from 32 kW to 1,400 kW; with plans to extend to larger units over time. Civil works are simplified due to compactness and availability of configurations such as pit, radial-inflow open-forebay, and spiral case.

How it works

Low number of blades reduces likelihood of strike. Large, blunt leading edge creates a pressure wave and local low velocity zone in advance of the runner blade (a fish saving “force field”), gently decelerating fish which pass gently around the blade. Slanted blade tip reduces relative strike speed, allowing high runner rpm and reducing generator cost. The runner has the same high efficiency as a well-designed conventional propeller blade. Variable speed and variable wicket gates enable double-regulated efficiency curve. The turbine has been designed to enable survival of >99% of fish less than 200 mm in length (such as salmon smolts), despite compact runner diameter of 1m - 3m, enabling simple project logistics.

Key Advantages

- Fish friendly >99% safe passage of fish <200 mm at 7 meters head
- Short draft tube 50% shorter draft tube vs conventional Kaplan turbines
- No cavitation allows turbine placement above tailwater
- Compact delivered as a pre-engineered water to wire solution
Form Factor and Applications

Restoration Hydro Turbines can be installed in a range of settings, including retrofit of existing turbines (for low-cost compliance with environmental requirements, or to improve output of old units), existing non-power dams, irrigation canals, and run-of-river new stream reach developments.

The RHT is available in 3 different configurations:

- Axial-flow pit turbine: both short, open-flow intakes, and pipeline configurations
- Radial-inflow open-forebay turbine: ideal for low-cost, low-head projects, and drop-in retrofits of old low head Francis turbines
- Scrollcase turbine: flexible configuration for tight spaces

Operating Range

RHT turbines are available with runner diameters from 0.55 m to 3.2 m. Units below 2 meters in diameter can be deployed at up to 10 meters of head, with larger units available at lower head ratings; the D3.2 can operate at up to 5 meters of head.

Power Takeoff & Regulation Configurations

Natel’s RHT is available in several different regulation and power takeoff configurations. The correct selection for your project will be driven by flow and head operating characteristics.

- Power Takeoff Options:
  - Direct drive permanent magnet generator: expensive but simple.
  - Gearbox with induction generator or permanent magnet generator: inexpensive and reliable
- Regulation Options:
  - With or without adjustable wicket gates
  - With or without variable speed

Performance

Initial results from analysis of the RHT by ALDEN Research Laboratory:

- Turbine hydraulic efficiency: 89.8%
- Safe fish passage: >99% for fish <200 mm at 7 meters of head