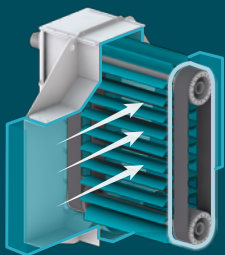


hydroEngine®

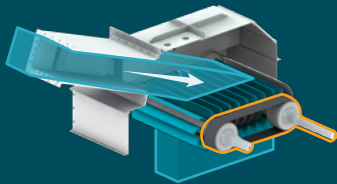
a water-to-wire system for low head applications

The hydroEngine is a hydroelectric turbine designed for high performance at low heads between 7 and 60 feet, or 2 and 20 meters. It has simple civil works requirements and enables cost-competitive projects from 25 kW to 25 MW or more.

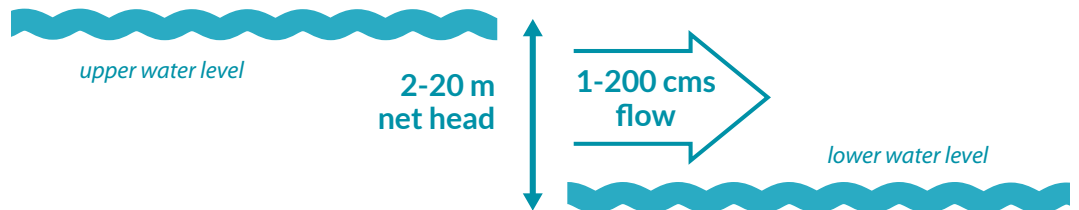
TYPES OF HYDROENGINE



Fully Flooded



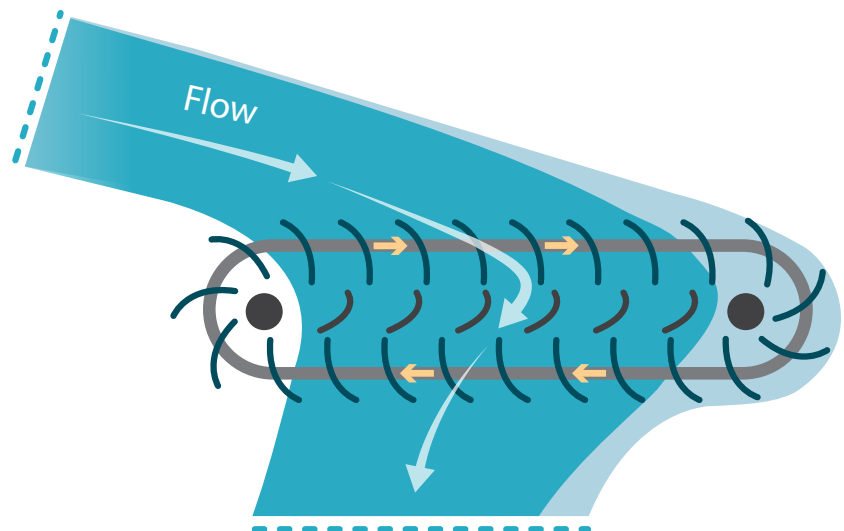
Free Jet



How it Works

The hydroEngine employs a unique linear drivetrain with two parallel shafts. Water flowing through the hydroEngine pushes blades connected to carbon fiber belts, which move in linear paths around the shafts. Either shaft drives a conventional generator.

As with existing turbine technologies, water enters a penstock, passes through the hydroEngine, and, depending on the hydroEngine model used, is returned to the water channel either directly or via a draft tube.



hydroEngine Type

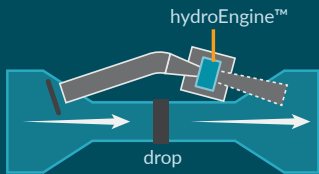
The hydroEngine comes in two families, defined by the orientation of the drivetrain. In the Fully Flooded hydroEngine (FF), the blades move vertically. In the Free Jet hydroEngine

(FJ), the blades move horizontally. The FF allows for significant tailwater variation and requires a draft tube. The FJ has a higher head and flow range and does not require a draft tube.

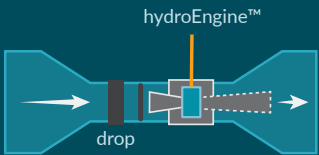
Natel Energy, Inc.
2401 Monarch St.
Alameda, CA 94501
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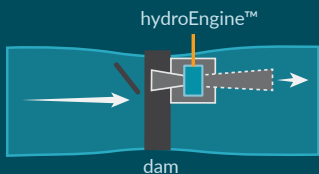
TYPES OF INSTALLATION



Run of river



Over canal



In dam or weir

Technology Advantages

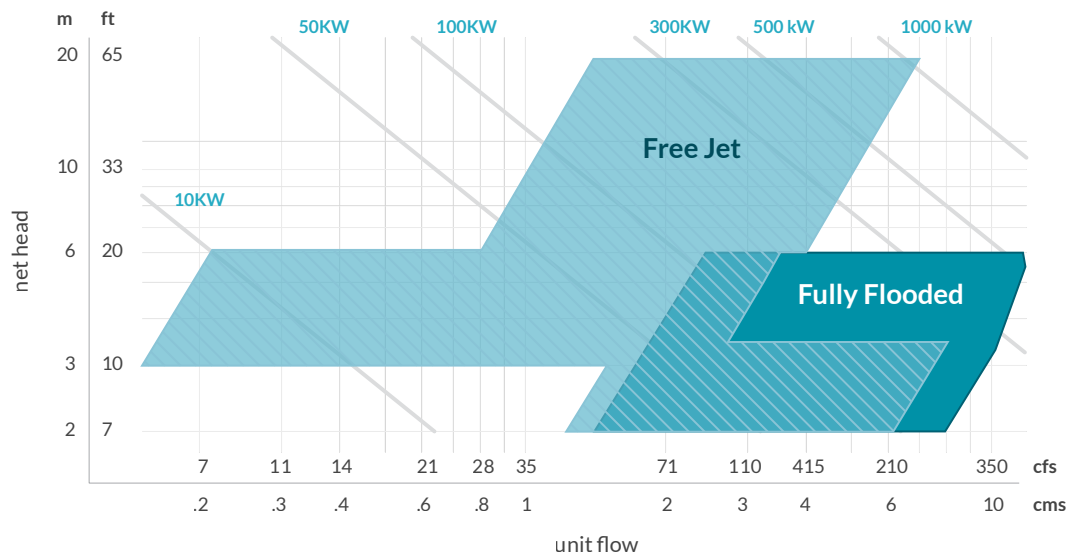
Natel's hydroEngine can be installed in a range of settings, including irrigation canals, existing dams, and run-of-river with a minimum of civil works. Additionally, the modular design of the hydroEngine ensures easy maintenance and repair: the hydroEngine's drivetrain is mounted on an extractable cassette that can be easily removed from the engine case.

The hydroEngine is sold as a water-to-wire package, including generator and SCADA compliant controls.

Key advantages include:

- No cavitation, reducing site excavation
- Fish-friendly
- Quick and inexpensive maintenance
- Delivers high performance at low head

Operating Envelope



Operations

The hydroEngine has demonstrated 80% hydraulic efficiency in laboratory and field tests; and has accumulated over 5 years and 10,000 hours of operations and testing. First commercial units were commissioned in 2015 and 2016.

Several different configurations have been installed and grid-connected including:

- A 35 kW stream setting
- Irrigation canal drops, from 25 - 250 kW
- A thermal power plant cooling water outfall

The hydroEngine is manufactured in a 60,000 square foot facility in Alameda, California, co-located with extensive design and testing facilities.

The hydroEngine is a flexible, modular, easy-to-install hydroelectric turbine designed for low heads that significantly reduces construction costs and defines a **new class of sustainable, utility scale, distributed hydropower.**

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