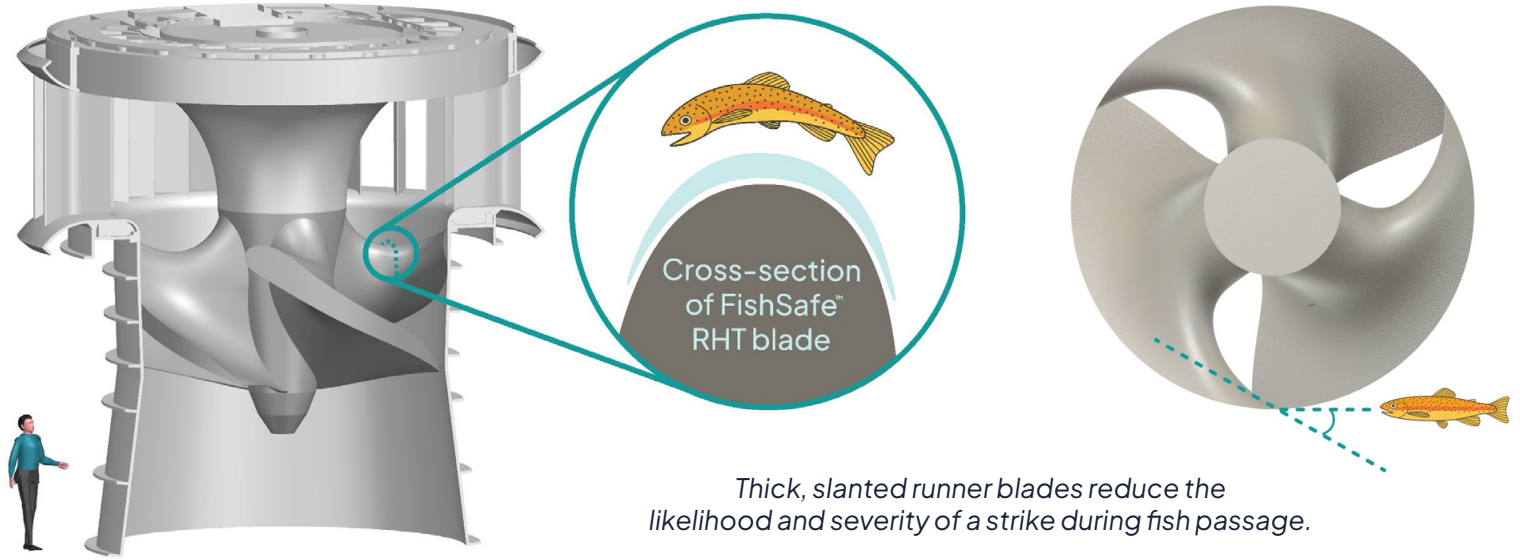
Natel

High-performance, FishSafe™ engineering

Restoration Hydro Turbine Design

Natel Energy is a California-based engineering and technology company specializing in the hydraulic design of high-performance, FishSafe™ turbine runners. Natel's patented FishSafe™ Restoration Hydro Turbine (RHT) designs feature thick, forward-swept blades that allow fish to pass directly through the turbine, eliminating the need for fine screens, nightly shutdowns, or other compromise solutions. By enabling 98–100% fish passage survival at the same speed and power point as conventional turbines, FishSafe™ RHTs facilitate straightforward equipment replacements with little to no change in civil works or generator specifications.



Thick, slanted runner blades reduce the likelihood and severity of a strike during fish passage.

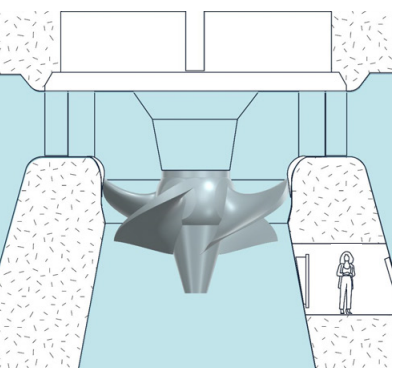
Broadly applicable
Francis, Kaplan, and propeller-style designs for a range of head heights

High performance
Peak hydraulic efficiency up to 94%

FishSafe™
98–100% demonstrated fish passage survival

Natel works in partnership with established turbine manufacturers to provide FishSafe™ runners or turbines of any diameter **for sites with a wide variety of head and flow characteristics**. FishSafe™ RHTs can be directly integrated with existing civil works, providing the lowest cost option for meeting downstream passage requirements while simultaneously modernizing aging plants. We have demonstrated exceptional fish passage survival for a range of aquatic species, including eel, salmonids, sturgeon, and alosines.

Read our **peer-reviewed papers** demonstrating downstream passage survival →



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Natel High-performance, FishSafe™ engineering

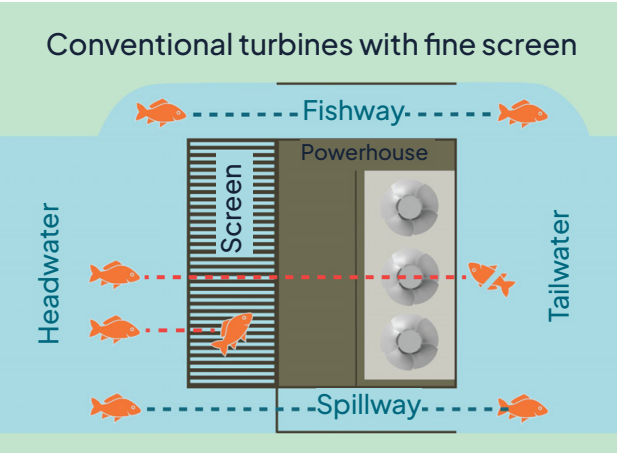
By delivering exceptional downstream fish passage survival and up to 5× longer blade life in sediment-laden environments, Natel's FishSafe™ turbines provide a smarter, more cost-effective path to plant modernization.

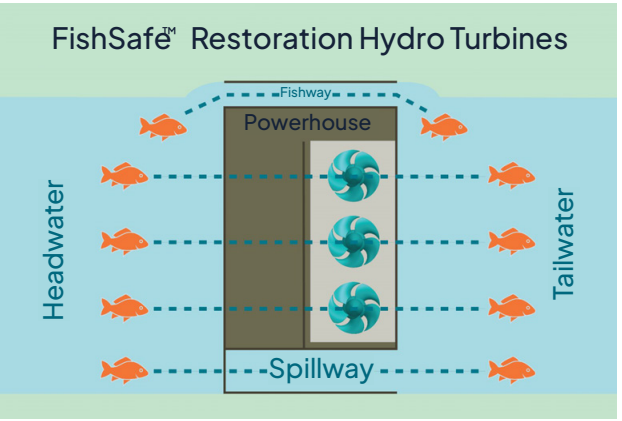
Savings in both CapEx and OpEx enable *two to ten times* the accelerated return on investment:

- **Eliminate costly fish passage measures**. Meet downstream passage requirements at no extra cost, saving money spent on fine screens or lost to plant shutdowns.
- **Lower maintenance costs**. In addition to eliminating fine screen cleaning costs, the unique shape of FishSafe™ blades minimizes sediment wear and extends service life, saving owners money on blade repairs.
- **Generate more power**. Increase output by up to 10% by avoiding flow losses to bypasses and head losses to fine screens.

Read the **peer-reviewed paper** comparing the cost of FishSafe™ turbines to the cost of traditional fish exclusion measures.

Contact us at info@natelenergy.com



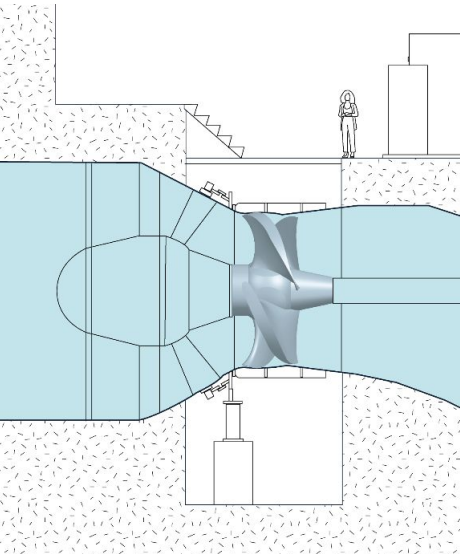


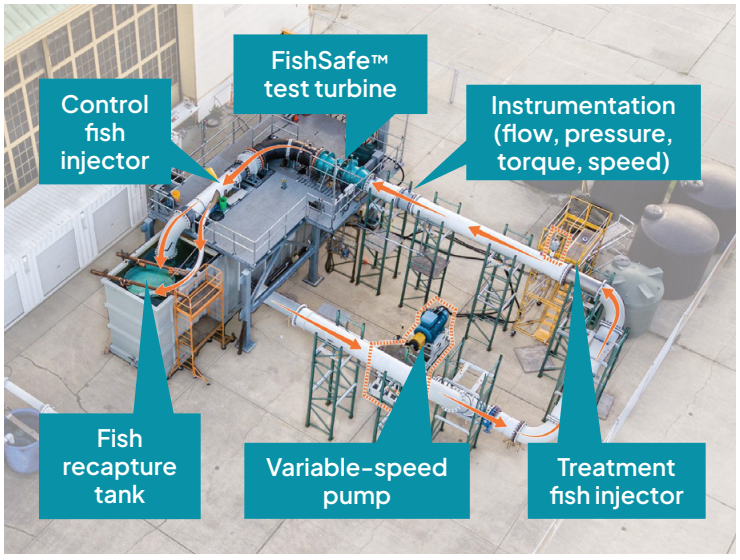
FishSafe™ turbine runner design

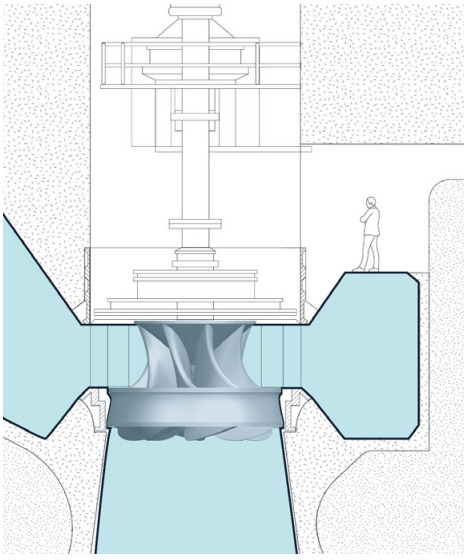
Performance & fish passage scale-model lab testing

Design feasibility studies

Natel offers engineering design and analysis services that include proprietary computer simulations and scale-model testing of both hydraulic performance and fish passage survival. Our team tailors each FishSafe™ runner to meet an individual site's targets for cavitation, efficiency, and species-specific passage.







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