

The Water Power Technologies Office (WPTO) advances innovative technology to spur new hydropower development and catalyze increased performance at existing facilities, and drives U.S. leadership in new wave and tidal energy with the goal of delivering low-cost power and resiliency to the nation’s power grids.

Economic Highlights

Water power has provided significant benefits to the U.S. economy and national security for over 100 years.

- Hydropower is the nation’s largest renewable energy source, accounting for 7% of total U.S. generation, powering 21 million homes, and providing 87,000 American jobs. The U.S. government owns half of the nation’s hydropower capacity.
- WPTO research and development (R&D) drives technological advances that could produce 50 to 65 gigawatts (GW) of baseload capacity – doubling current U.S. capacity for pumped storage, fostering \$148 billion in investments and 23,000 new jobs by 2050.

Water power R&D enables technology breakthroughs that can produce further benefits to the U.S.

- New technologies can drive new hydropower and pumped-storage generation, increase generation across the existing fleet, and improve hydropower’s ability to balance variable generation and respond quickly to grid instability or power outages.
- Developing one third of the available wave energy off Pacific states with U.S.-made equipment could meet up to 30% of West Coast electricity demand, while ensuring the U.S. is the global industry leader.
- Wave and tidal power supports national security objectives by delivering on-site power for defense bases and Navy hardware, as well as to remote communities and coastal and marine industries.

FY 2018 Priorities

FY 2018 Program Focus

WPTO R&D will focus on –

- Innovative hydropower and pumped storage designs for existing systems that drive cost reductions, increase generation, and improve environmental performance.
- Cost reduction and the improved performance of emerging wave, tidal, and current energy technologies.
- Analysis and data to prioritize R&D for hydropower and marine energy and help assess the costs and value of hydropower’s flexibility and reliability services to the grid.

Program Strategy

- Marine and Hydrokinetic (MHK) – R&D and testing to drive major cost reductions and performance gains, including improved hull design, advanced controls, power take-offs for low-velocity, high-torque environments and prototype testing in tank and open water; partnering with the Navy for base power and remote sensing hardware applications.
- Hydropower – R&D into improved turbine and civil works designs to increase hydropower generation from existing facilities and develop significant new resources from standardized modular designs, as well as support U.S. grid reliability. Research partnerships with the U.S. Army and Department of Interior to enable pioneering, long-term industry-led solutions.

Activity Highlights

- Advanced MHK System Design and Validation – R&D to accelerate cost reduction and energy capture gains for wave and current energy systems, including advanced controls, improved early-stage design models, and aggregation of data to reduce development costs.
- MHK Instrumentation Modeling and Validation – R&D under competitively-selected, industry-led projects to reduce costs and improve performance for instruments designed to operate in harsh marine environments.
- Standard Modular Hydropower Systems – Early-stage R&D into new, modular hydro designs that can lower installation cost and environmental impacts of new hydropower generation.
- Advanced Hydropower Turbine Design Tools – R&D into basic science informing improved hydropower turbine design and evaluation, and development of tools to increase generation and reduce impacts at existing and new facilities.
- Hydropower Grid Reliability Support – Research and analyses to further increase hydropower’s ability to support grid reliability through integrating multiple run-of-river facilities and analysis to understand the costs and value of hydro’s flexibility and grid services.

FY 2018 Budget Request

Budget Authority (Dollars in Thousands)	FY 2018 Request
Hydropower Technologies	11,650
Marine and Hydrokinetic Technologies	8,750
Total, Water Power Technologies	20,400

WPTO accelerates commercialization of next-generation water power technologies to provide domestic, secure, and reliable energy to power millions of U.S. homes and businesses in all 50 states.

Major Accomplishments and Goals

WPTO Accomplishments

- WPTO's Wave Energy Prize catalyzed the largest leap in wave energy device technology, with a five-fold performance increase over state-of-the-art devices and the potential to reduce energy costs by 50% by 2030.
- WPTO-Navy-industry partnership tested nation's first grid-connected open ocean wave power project with 98% uptime over 19 months, surviving two hurricanes.
- WPTO streamlined regulatory permitting for private investment at U.S. Army Corps of Engineers (USACE) non-powered dams by brokering an agreement with the Federal Energy Regulatory Commission and USACE.
- WPTO developed the *Hydropower Vision Roadmap* with industry, identifying growth potential and grid benefits of hydropower and pumped storage hydropower.
- WPTO developed the first comprehensive database of every U.S. hydropower facility, revealing long-term performance trends and identifying sites in greatest need of modernization.

WPTO Goals

- Continue driving early-stage R&D improvements in reliability, cost, and performance of wave and tidal energy systems through advanced structures, controls, and power take-off systems.
- Support research and testing of wave and tidal systems to understand device-ocean interactions and improve early-stage designs.
- Provide standardized, modular hydropower civil works and turbines to allow development of significant new hydropower.
- Provide targeted R&D in hydropower turbines and generators for existing facilities to operate more efficiently, reduce impacts, and minimize maintenance.
- Validate closed-loop pumped-storage technologies to expand site availability and minimize impacts.
- Provide information to regulators for streamlining regulatory and permitting processes.

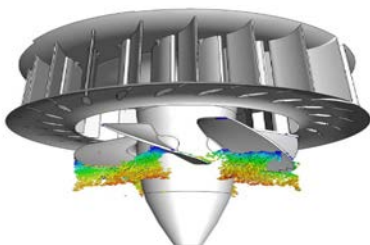
Success Stories



Carderock, Maryland – The Wave Energy Prize catalyzed a major technology leap in wave energy. The winning team, who built their device in a garage, showed a five-fold improvement in device efficiency and the potential for a cost-competitive industry. Ninety-two teams registered for the prize, and four teams exceeded the DOE goal of doubling energy capture from wave energy devices. DOE partnered with the U.S. Navy on the competition, with final tests occurring at the Naval Surface Warfare Center's Maneuvering and Seakeeping Basin in Carderock —the nation's most advanced wave-making facility.



O'ahu, Hawaii – The Northwest Energy Innovations (NWEI) wave energy converter (WEC) device, the nation's first grid-connected WEC device to be independently tested by a third party in the open ocean, demonstrated continuous survivability for 19 months during testing with 98% availability. The scaled-device validated performance models - a critical step in the design process - while increasing knowledge of operations and maintenance costs. Lessons learned have fed into NWEI's next-generation device design, which includes optimizing the float, moorings, and heave plate. The device also endured Hurricanes Ignacio and Lester, displaying survivability in extreme conditions.



Turbine Biological Design Tools Project – Fundamental research that WPTO supported through its national laboratories in computational fluid dynamics, advanced sensors, and targeted biological experimentation is now being used by the hydropower industry in the design and deployment of new turbines. This work will ultimately increase generation and improve fish passage efficiency of hundreds of new and rehabilitated turbines across the U.S. and impact billions of dollars of infrastructure investment.