

Marine & Hydrokinetic Technologies

The U.S. Department of Energy's Water Power Program supports the development of advanced water power devices that capture energy from waves, tides, ocean currents, rivers, streams, and ocean thermal gradients. The program works to promote the development and deployment of these new technologies, known as marine and hydrokinetic technologies, to assess the potential extractable energy from rivers, estuaries, and coastal waters, and to help industry harness this renewable, emissions-free resource to generate environmentally sustainable and cost-effective electricity.

The program's research and development efforts fall under two categories: Technology Development and Market Acceleration.

Technology Development

The Water Power Program works with industry partners, universities, and the Department of Energy's national laboratories to reduce the technical barriers to marine and hydrokinetic device development, to improve device reliability and performance, and to understand and evaluate various technology types.

Technology Development, Testing & Deployment

Water Power Program projects support the marine and hydrokinetic technology industry in its design and development of devices and components, as well as the deployment and testing of those devices in the laboratory or in open-water settings. The program supports the development and testing of a wide variety of marine and hydrokinetic systems and components, from earliest-stage proof-of-concept studies through full-scale demonstration projects. Projects are typically funded through competitive awards, which are designed to help devices progress toward commercial readiness along well-defined technology readiness levels. The testing of these devices and components in a variety of settings allows the program to determine baseline costs and performance attributes for different water resources and technology types.

In 2008, the program established two university-led National Marine Renewable Energy Centers to facilitate in-water testing of marine and hydrokinetic devices and components. These centers, one run by Oregon State University and the University of Washington and one by the University of Hawaii, are planned with open-water test berths as well as laboratory facilities that will allow researchers to investigate devices in real-world conditions.



Hydrokinetic technology devices extract energy from domestic rivers, estuaries, and coastal waters.

Oceanlinx, NREL/PIX17208; Ocean Power Technologies, NREL/PIX17114; Kris Unger, Verdant Power Inc., NREL/PIX17209; Hydro Green Energy, NREL/PIX 17211

Research Tools & Models

The Water Power Program develops tools and models that support the design, development, and optimization of marine and hydrokinetic devices. The program conducts projects with industry, universities and national laboratories, including computational modeling of device performance, improvement of mooring design, and research on device array spacing. These projects will help maximize efficient electricity generation at marine and hydrokinetic power plants while mitigating potential environmental effects.

Technology Characterization & Evaluation

The Water Power Program evaluates and assesses information on the cost and performance of marine and hydrokinetic device designs. Activities include

- Evaluation of empirical performance data to compare technologies across types and device designs
- Supporting the development of a standard taxonomy and metrics to describe and compare device performance
- Collection, analysis, and dissemination of information on U.S. and international technologies and projects

Examples of ongoing Water Power Program projects include life-cycle cost of energy analyses for various technology types and participation in international technical standards organizations.

Incentives for Renewable Energy

Federal and state governments encourage the growth of renewable energy technologies by offering financial incentives for their development and deployment. Federal incentives that may be applied to marine and hydrokinetic technologies include:

- **Renewable Electricity Production Tax Credit (PTC)**
- **U.S. Department of Treasury — Renewable Energy Grants**
- **Clean Renewable Energy Bonds (CREBs)**
- **Qualified Energy Conservation Bonds (QECBs)**
- **U.S. Department of Energy — Loan Guarantee Program**
- **Qualifying Advanced Energy Manufacturing Investment Tax Credit**

For more information on federal and state renewable energy incentives, see www.dsireusa.org.

Funding from the U.S. Department of Energy

The Water Power Program funds research and development projects with industry and in partnership with federal, state, industry, national laboratory, and other stakeholder groups. The program uses competitive solicitations, known as Funding Opportunity Announcements, to award funding for research and development projects. Funding Opportunity Announcements are posted on windandhydro.energy.gov/financial.html.

Additional marine and hydrokinetic funding opportunities for small businesses (located in the U.S. with up to 500 employees) can be found through the Department of Energy's Small Business Innovation Research / Small Business Technology Transfer (SBIR/STTR) Program, which offers grants to small businesses to stimulate technological innovation. Small businesses that are funded under these programs retain the rights to any technology developed and are encouraged to commercialize the technology. For additional information on SBIR/STTR opportunities, see www.science.doe.gov/sbir.

Market Acceleration

To accelerate market development and the growth of marine and hydrokinetic technologies, the Water Power Program supports projects to reduce the time and costs associated with siting water power projects, to better quantify the potential magnitude, costs, and benefits of water power generation, and to identify and address other barriers to deployment.

Environmental Impacts & Siting

The Water Power Program recently released a report on the potential environmental effects of marine and hydrokinetic energy technologies, as well as possible options to prevent adverse effects through environmental monitoring and adaptive management. The Report to Congress on the Potential Environmental Effects of Marine and Hydrokinetic Energy Technologies is available on WindandWater.Energy.gov.

The program continues to support research into the effects of marine and hydrokinetic technologies on aquatic ecosystems and marine species by funding studies that examine the potential effects of these technologies on specific species and the larger ecosystems. The program also develops tools to evaluate overall environmental risk.

Resource Assessments

While the energy contained in waves, tides, ocean currents, rivers, streams, and ocean thermal gradients is vast, the exact amount of extractable energy has not been well quantified. The program conducts assessments of these resources in a number of locations within U.S. waters.

Economic Analyses & Market Development

The Water Power Program conducts economic analyses to quantify the benefits of the widespread deployment of effective and cost-competitive marine and hydrokinetic systems. Activities include assessing industry research and development needs, identifying policy mechanisms and market designs that will support accelerated deployment, and providing information and training to potential members of the marine and hydrokinetic industry and other stakeholders.

Program-Supported Marine and Hydrokinetic Projects

The Water Power Program supports dozens of marine and hydrokinetic projects such as the development of tidal and ocean current devices and utility-scale buoys, studies on habitat and marine life, and assessments of energy production potential. For a complete list of Water Power Program projects, see the U.S. Department of Energy's Wind and Water Power website at eere.energy.gov.

Information Resources

- Wind and Water Power Program — windandwater.energy.gov
- Marine & Hydrokinetic Technology Database — windandhydro.energy.gov/hydrokinetic
- Hydrodynamic Testing Facilities Database — windandhydro.energy.gov/hydrodynamic