



# Water Power Technologies

Hydropower accounts for 6 percent of total electricity generation and is the largest source of renewable energy and utility-scale energy storage in the country. With millions of miles of rivers and lakes, the nation stands poised to increase renewable energy production through water power technologies. Oak Ridge National Laboratory (ORNL) R&D activities are focused on lowering the costs of hydropower, enhancing hydropower's contributions to the resilience and reliability of the nation's electric power grid, and studying ways to reduce environmental impacts and improve the regulatory process for hydropower.

## Research and Development

ORNL's water power technologies research focuses on cost reduction and performance improvement to increase power generation at existing hydropower facilities and accelerate sustainable implementation of new facilities. These research efforts leverage key ORNL strengths in data analytics, high-performance computing, materials science, environmental science, and advanced manufacturing. Focus areas include the following.

**Decision-making tools**—Providing tools and technologies to assist with design and real-time optimization of hydropower generation that reduce costs and increase efficiency

**Data analytics and modeling**—Generating key data and models that enable new R&D and improve the operations, value, and sustainability of entire fleets of hydropower facilities

**Early-stage technologies**—Developing new composite turbine designs, floating membrane reservoirs, and pumped-storage technologies to accelerate the growth of US hydropower generation

3D-printed turbine



**ASSESSING**  
hydropower resources across the nation



**INFORMING**  
with authoritative analyses and tools



**DEVELOPING**  
scalable modular technologies



**ADVANCING**  
the state of the art with industry



**ENABLING**  
new hydropower development



"We are studying ways hydropower can contribute to a resilient and reliable electric grid while protecting river ecosystems."

**Brenda Pracheil, Aquatic Ecologist**



# Recent Impacts

**National hydropower map**—Showcasing hydropower resources across the country

**Standard modular hydropower**—Advancing ecologically compatible, cost-optimized technology designs for small-footprint hydropower generation

**Classification tools**—Providing easy access to key information about national streams and potential new hydropower sites

**Hydropower fleet intelligence**—Enabling hydropower owners to benchmark cost, reliability, and equipment, driving continuous improvement

**Hydropower Market Report**—Offering a comprehensive picture of trends shaping the industry

**Additive manufacturing**—Exploring innovative hydropower technologies with cost-reduction potential in collaboration with industry

**Hydropower as an electric power system enabler**—Modeling and enhancing hydropower capabilities to support a reliable and resilient electric power system

**Pumped-storage technologies**—Developing new systems like membrane reservoirs to increase flexibility and lower the costs of installing new hydroelectric energy storage



*This [visualization](#) of ORNL datasets shows the geospatial distribution and characteristics of current US operational hydropower plants.*



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