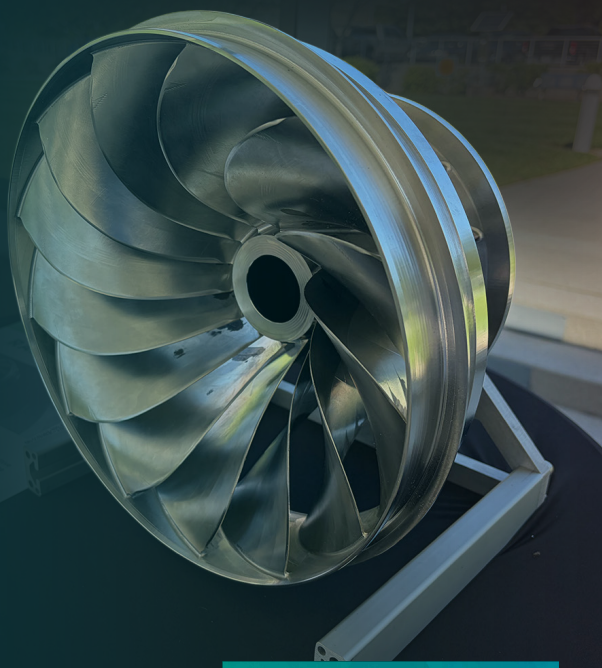
OAK RIDGE NATIONAL LABORATORY

Water Power Technologies



Oak Ridge National Laboratory (ORNL) is providing solutions for more reliable, affordable and secure electricity, ensuring businesses and homes across the nation have power when they need it. Hydropower accounts for 6% of total electricity generation and is the largest source of utility-scale energy storage in the country. With millions of miles of rivers and lakes, the nation stands poised to increase energy dominance through innovative water power technologies.

Research and Development

ORNL's water power technologies efforts focus on developing next-generation hydropower, enhancing the resilience and reliability of the nation's electric power grid, and studying ways to improve the regulatory process for hydropower. These research efforts leverage ORNL strengths in data analytics, high-performance computing, materials science, environmental science, and advanced manufacturing. Focus areas include:

Decision-making tools—Providing tools and technologies to assist planning and optimization of hydropower generation to reduce cost, increase efficiency, provide flexibility, and enhance hydropower contribution to the US electric power grid

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

Early-stage technologies—Exploring new manufacturing approaches, high-performance eco-friendly lubricants, and low-cost monitoring technologies to help accelerate the growth of US hydropower generation

IMPROVING
reliability and performance

BOOSTING
grid stability and flexibility

EXAMINING
hydrology and future water availability

DEVELOPING
technology to add more hydropower

ADVANCING
hydraulics and water management





At ORNL, we use data, technology, partnerships, and expertise to improve water resource stewardship and support federal investment in reliable energy. Our hydropower R&D strengthens the existing US fleet, supply chain, and manufacturing while accelerating next-generation hydropower and pumped storage.

— Water Resources Engineer, **Scott DeNeale**

Recent Impacts

Advanced manufacturing—Exploring innovative approaches to manufacture technologies faster and more affordably, in collaboration with the hydropower industry

Hydropower fleet intelligence—Provides ML-enhanced tools and digital twins to improve the reliability and performance of the US hydropower fleet

Hydropower testing—Identifying needs and benefits of accessible testing to validate new water power technologies

Open hydropower data—Providing easily accessible information about national streams, energy infrastructure, and potential new sites to support sustainable hydropower development

Hydropower resource assessment—Evaluating the potential for new hydropower generation leveraging non-powered dams and water conduits

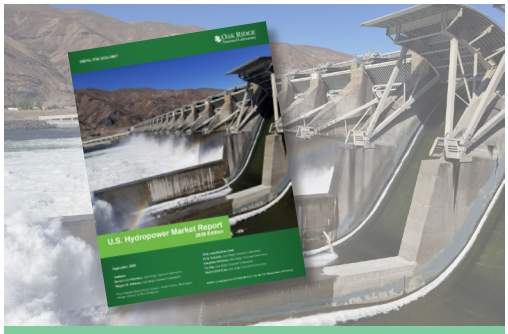
Hydropower Market Report—Provides data-driven understanding of US hydropower fleet and industry trends

Water availability—Projecting future water availability and extreme events to support adaptation and long-term resource planning with the goal of ensuring energy security

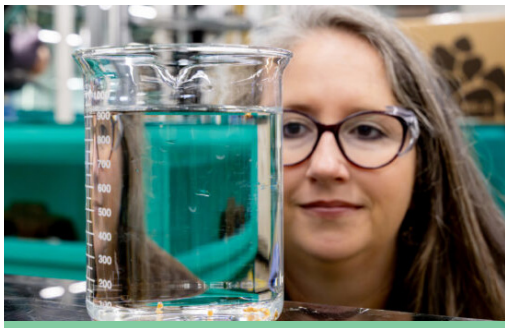
Water quality modeling—Provides open-source tools and data to support the prediction of in-stream temperature, dissolved gas content, and reservoir sedimentation

Monitoring—Modernizing environmental management with eDNA and eRNA technologies to track fish populations and passage

Inertia monitoring—Designing new methods to monitor grid stability using hydropower project signals



ORNL produces the U.S. Hydropower Market Reports, tracking market development and identifying trends and opportunities to grow hydropower.



Researchers are developing novel materials for commercial environmental DNA (eDNA) sampling.

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U.S. DEPARTMENT of ENERGY

OAK RIDGE National Laboratory

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