

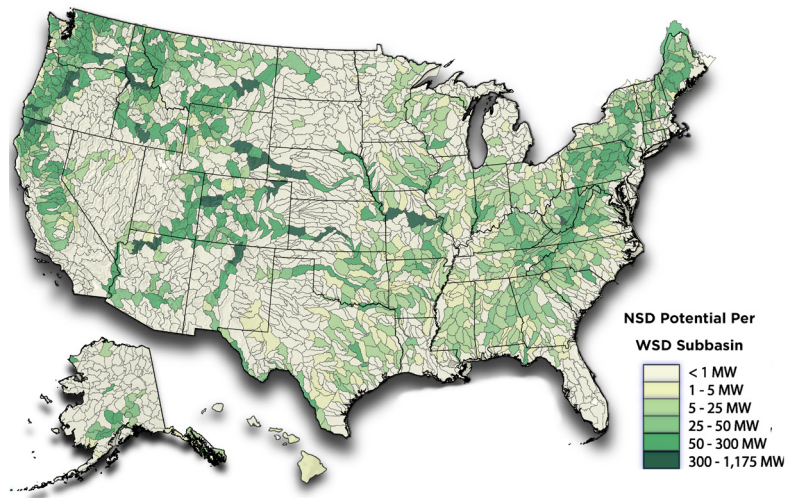
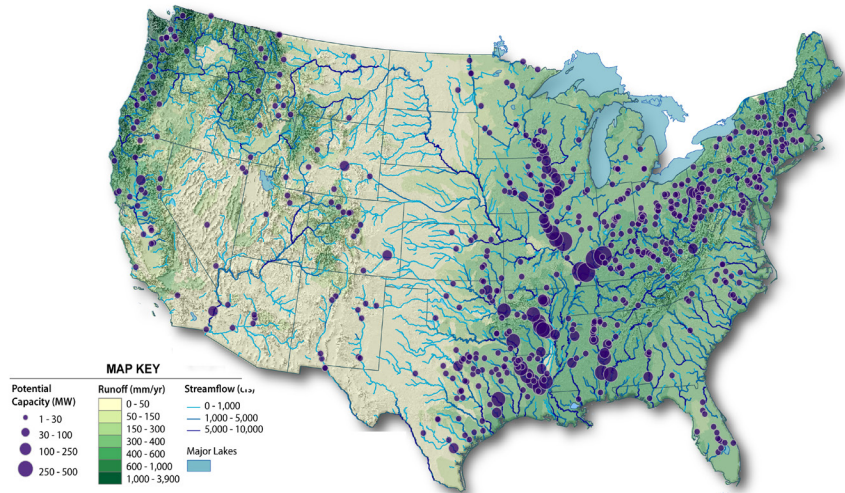
Leveraging Untapped U.S. Hydropower Potential

Through its HydroNEXT initiative, the U.S. Department of Energy (DOE) invests in the development of innovative technologies that dramatically change the way we think about hydropower by lowering cost, improving performance, and promoting environmental stewardship of hydropower development. HydroNEXT is pursuing a comprehensive technology research, development, demonstration, and deployment strategy across three resource classes to increase the contribution of clean, renewable hydropower to the nation's energy mix: existing water infrastructure, undeveloped streams, and pumped-storage hydropower.

Existing Non-Powered Dams

Opportunity: A DOE assessment found that more than 90% of U.S. dams are used for services, such as regulating water supply and controlling inland navigation, and lack electricity-generating equipment. The assessment found that existing U.S. non-powered dams could provide up to 12 gigawatts (GW) of clean, renewable hydropower capacity from 50,000 suitable non-powered dams.

Approach: By investing in innovative modular systems, power stations can be added to many of these facilities at a lower cost than creating new powered dam structures, providing power for U.S. households



Top: Non-Powered Dams (2012 Study). Non-powered dams with potential capacity are identified by purple circles.

Below: New Hydropower Development (2014 Study). Areas of potential capacity are identified by shades of green. *Photo credit: Oak Ridge National Laboratory*

while avoiding increases in carbon dioxide emissions.

New Stream-Reach Development

Opportunity: A DOE assessment of potential U.S. stream-reach hydropower development concluded that when federally protected lands are excluded, potential

hydropower development opportunities in U.S. rivers and streams total approximately 65 GW of capacity. The study analyzed more than 3 million undeveloped U.S. stream-reaches and found that a tremendous opportunity exists in stream segments where hydroelectric facilities or other types of existing water infrastructure are not currently developed.

Approach: Through investments in innovative design and construction methods, as well as optimized materials that limit environmental disturbance, much of this hydropower potential may be tapped.

	Existing Water Resource Infrastructure		Low Impact New Development
Resources	Powered Dams	Non-Powered Dams	Undeveloped Streams
Opportunities	~4 GW-10 GW	-12 GW	-65 GW



Young's Creek Hydro Project in Washington State, 2011 (7.5 megawatts) *Photo credit: Snohomish County Public Utility District*



The Grand Coulee Dam provides nearly \$2 billion in annual economic activity. *Photo credit: U.S. Department of the Interior Bureau of Reclamation*

FY 2016 Highlights

Non-Powered Dams (NPD): In its fiscal year 2016 budget request, DOE proposes to solicit and competitively select projects that focus on new hydropower technologies for non-powered dams. This effort will identify and demonstrate new technologies associated with powertrain and civil works that will minimize construction costs and environmental impacts.

The objective of the HydroNEXT initiative is to lower the cost and environmental impacts of hydropower development. To leverage new hydropower potential at existing water infrastructure and undeveloped stream reaches, the Hydropower Technologies subprogram is focusing on investments in new construction methods and materials, increased turbine efficiencies and biological performance, and standardization and modularization of powertrain components.

Pumped-Storage Hydropower (PSH): DOE proposes to solicit and competitively select projects that will advance conceptual designs for modular and small PSH. This effort will focus on the ability to use commercial off-the-shelf pumps, turbines, piping, tanks, and valves to achieve reductions in PSH deployment costs, as well as on hybrid PSH technology designs that combine water storage with other forms of energy storage.

Demonstrations: DOE proposes to identify and leverage existing federal, university, or industry hydro-mechanical test facilities for full-scale performance and reliability testing of low-impact powertrains and components.

Market Acceleration and Deployment: HydroNEXT will continue activities to help lower barriers to deployment of innovative water power technologies,



Significant potential exists for new low-impact hydropower development. *Photo credit: Snohomish County Public Utility District, iStock and Fotosearch, Ryan A. McManamay*

including the development of biological design tools to help engineer more sustainable hydropower turbines.

Key Water Power Program Accomplishments

New Vision for Hydropower: In April 2014, DOE announced that it was looking toward the future of the hydropower industry by initiating the development of a long-range national *Hydropower Vision*. This landmark vision will establish the analytical basis for an ambitious roadmap to usher in a new era of growth in sustainable domestic hydropower over the next half century.

Assessment of Energy Potential from New Stream-Reach Development in the United States: DOE's *New Stream-Reach Development Assessment* provides a national picture of the remaining hydropower development opportunities in U.S. rivers and streams. This study leverages recent advances in national geospatial data sets to provide the highest fidelity national study yet. In addition to identifying technical power potential, it explores social, economic, and environmental attributes of the stream reaches.

Interagency Collaboration: DOE completed the first two-year phase of interagency activities through its Memorandum of Understanding for Hydropower with the U.S. Army Corps of Engineers and the Interior Department's Bureau of Reclamation. ■

HydroNEXT is focused on leading-edge research, development, demonstration, and deployment of innovative technologies that generate cost-effective renewable electricity from a wide range of hydropower resources.