



Achieving American Leadership in the Hydropower Supply Chain

Summary

In 2020, hydropower accounted for 36.7% of U.S. renewable electricity generation and 7.3% of total electricity generation. While the existing U.S. supply chain effectively supports the nation's hydropower fleet—the fourth-largest in the world, alongside the third-largest pumped storage hydropower (PSH) fleet—refurbishments, upgrades, and new development are required to modernize and expand the fleet and facilitate a clean, emissions-free U.S. electricity grid by 2035.

To achieve these goals, researchers compiled a report examining the U.S. hydropower energy supply chain, including raw materials, processed materials, components, subcomponents, and recycling.

Hydropower's Role in Clean Energy

Hydropower is a clean, renewable, domestic energy source that enables seamless integration of other energy sources and acts as a force multiplier for other renewables. Hydropower plants contribute significantly to the flexibility and security of electricity systems by providing dispatchable energy

on demand. Facilities can ramp up or down and start and stop quickly, as needed, to power homes and businesses.

Achieving the nation's clean energy goals will require substantial growth of all renewable resources and long-duration energy storage, especially PSH, which accounted for 93% of grid-scale energy storage in 2019.

Key Findings and Opportunities

The report identifies several key U.S. hydropower supply chain challenges and opportunities to help decarbonize the grid and create jobs and economic opportunity for U.S. workers. A combination of increased refurbishments and upgrades—partly connected to the wave of relicensing expected to take place during the 2020s—and construction of the new hydropower capacity needed to achieve clean energy goals may drive growth in U.S. demand for hydropower components and related services.

- At the end of 2020, 62 U.S. hydropower plants had plans to start refurbishment and upgrades between 2021 and 2024. The estimated capital

investment from these projects is \$4.4 billion.

- There were 183 new projects in the U.S. conventional hydropower development pipeline at the end of 2020 with a combined capacity of 863 megawatts (MW). For PSH, the development pipeline included 63 projects with combined proposed capacity of 46.7 gigawatts (GW).
- There were 151 GW of conventional hydropower and 30 GW of PSH under construction worldwide at the end of 2020, with an additional 456 GW of conventional hydropower and 102 GW of PSH pursuing permitting or undergoing feasibility evaluations.
- Given the size of the U.S. development pipeline relative to the global pipeline, U.S. hydropower supply chain participants will likely pursue export opportunities while also supporting domestic fleets.

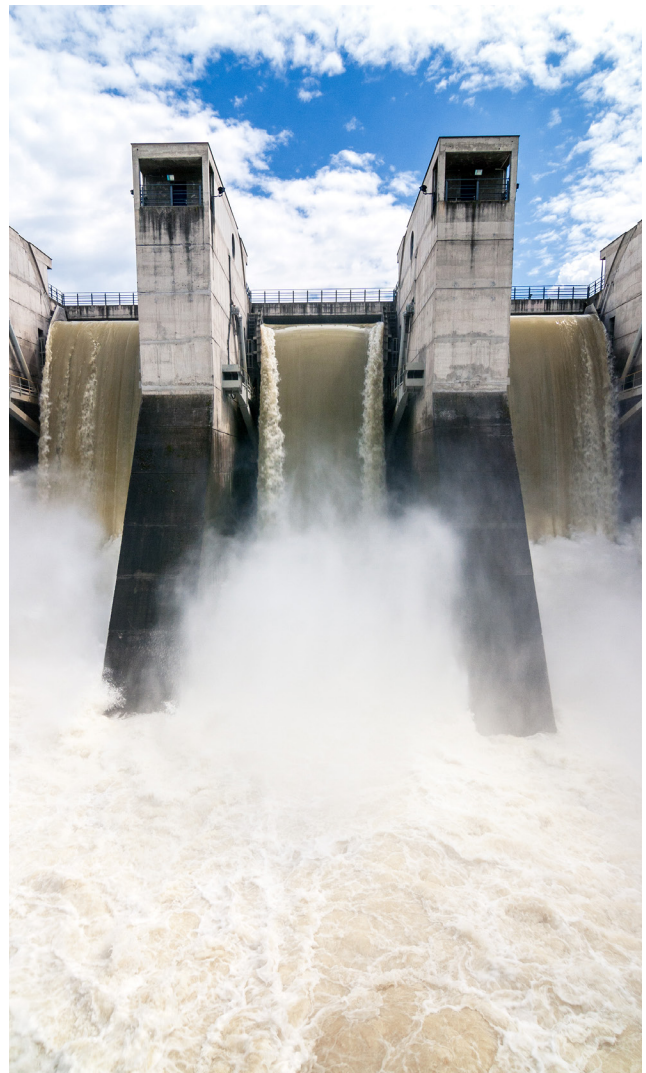
The U.S. hydropower supply chain faces vulnerabilities related to securing large components with long lead times, managing global disruptions, and maintaining a well-trained workforce.

- The U.S. hydropower supply chain includes manufacturing facilities for two of the three largest global hydropower turbine and generator suppliers, located in York, Pennsylvania, and Spokane, Washington. Several other smaller turbine suppliers also manufacture their products in the United States. However, large steel castings/forgings and generator windings for large units are difficult or impossible to source domestically and have long lead times.
- Ongoing global supply chain disruptions have made the vulnerabilities involved in global, multi-tier supply chains more apparent. For instance, controls, automation devices, and other small subcomponents involving microchips, which are mostly imported, can significantly delay projects.

- Finding and training workers for the hydropower industry, including the supply chain, is a critical challenge. The types of positions for which hiring is difficult include skilled trades, such as machinists and welders, and engineers.

Policy Next Steps

The report identifies several key U.S. hydropower supply chain challenges and opportunities to help decarbonize the grid and create jobs and economic opportunity for U.S. workers.



Enact legislation to provide tax incentives to support domestic clean energy manufacturing and deployment, including incentives for clean energy production, building new manufacturing facilities, and for the ongoing operation of those facilities.

Increase the domestic content of hydropower components in the Buy American Act, in accordance with trade agreements. Consider how to maximize Buy American Act provisions to support rehabilitations and upgrades of federal hydropower plants.

Support modernization of the existing hydropower fleet, powering non-powered dams, and development of pumped storage hydropower. ■

Download the full document and the corresponding other documents that are part of the DOE response to the supply chain executive order at:
www.energy.gov/policy/supplychains