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Nonexhaustive Taxonomy of Hydropower and Pumped Storage Hydro Facilities

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Photo from U.S. Department of Energy

U.S. Hydropower Potential

- Existing hydropower assets provided 6.5% of the electricity generated in the United States in 2023, or 240 terawatt-hours (TWh), from 80 gigawatts (GW) of electric generating facilities. Another 23 GW of pumped storage hydro (PSH) provided 6 TWh of flexible electric generation. These assets provide cost-competitive, low-carbon, reliable, and flexible energy to the grid across the United States.
- Hydropower has the potential to increase its contribution to the nation's clean generation portfolio.
  - At the end of 2022, the U.S. hydropower development pipeline included projects to construct 117 new facilities with a combined capacity of 1.2 GW, as well as 96 PSH projects, with a combined power storage capacity of 91 GW.
  - In addition, 23 active upgrade projects would increase the capacity of the existing fleet by 254 megawatts (MW).

Sources: U.S. Hydropower Market Report 2023 Edition (osti.gov) EIA, Electric Power Monthly (February 2024).

Impact of the Inflation Reduction Act

- The Inflation Reduction Act (IRA) became law in August 2022 and includes production and investment tax credits through at least 2032 that incentivize investment in clean energy (including hydropower and PSH).
- The 10+ year time horizon for the tax credit supports hydropower projects' relatively long development schedules. In May 2023, the U.S. Department of the Treasury (2023) released guidance that indicates for a project to qualify for the domestic content bonus under the IRA, "all manufacturing processes with respect to any steel or iron items that are Applicable Project Components take place in the United States" and a minimum percentage of the costs of manufactured products and components "are attributable to manufactured products (including components) which are mined, produced, or manufactured in the United States."

Creating a Taxonomy for Hydro

- The National Renewable Energy Laboratory (NREL) has published periodic technical reports and presentations that disaggregate the cost and performance of major product components for a variety of technologies, including land-based and offshore wind, photovoltaic, and battery energy storage systems.
- NREL has partnered with staff from the Pacific Northwest National Laboratory (PNNL) and members of the U.S. Department of Energy's Water Power Technology Office (WPTO) to create a nonexhaustive taxonomy of the major products and components of hydropower and pumped storage systems.
- The taxonomy is intended to provide insight into the manufactured products and components in a hydropower or pumped storage facility to help inform WPTO's research and development planning within the hydropower supply chain.

Nonexhaustive Taxonomy for Hydropower and PSH

Nonexhaustive taxonomy of key **manufactured products and components** and **steel/iron products** within a hydropower or pumped hydro facility:

Manufactured Product	Manufactured Product Component
Turbine/Pump Runner	Spiral/Scroll Case
	Vanes
	Bottom Ring
	Wicket Gates
	Runner
	Draft Tube
	Shaft
	Head Cover
	Bearings
	Flow Control and Isolation Mechanisms
Motor/Generator	Stator
	Rotor
	Windings
	Poles
	Generator Shaft
	Thrust Bearing
	Brake Ring/Disc
	Guide Bearings
	Ventilation and Cooling System
	Exciter
Generator Step-Up Transformer	Containment/Main Tank
	Cooling System
	Deenergized Tap Changer (DETC)
	Load Tap Changer (LTC)
	Bushings/Insulators

Steel/Iron Product
Steel or Iron Rebar for the Reservoirs, Upper and/or Lower
Steel or Iron Rebar, Plating and Piping in Water Conveyance (Penstock Piping)
Steel or Iron Rebar in Powerhouse and Foundation, Spiral Case, Discharge Ring, and Draft Tube
Steel or Iron Rebar in Canals
Powerhouse Structure Gates, Stoplogs, Screens, and Embedded Structure Parts, Foundation Plates, and Anchors

- The taxonomy created relies on a variety of reference material to inform the table entries, including the Hydro Advancement Project (HAP) Best Practice Catalog 2.0 (2012), the Hydropower Vision Report (2022), PNNL's Pumped Storage Hydropower Policy and Market Tool built on work by NREL, Stark et al. (2024), Oladosu and Sasthav (2022), and Oladosu, George, and Wells (2021).

Thank You

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