



Hydropower's Promise: The Opportunities and Challenges of Hydropower for Mitigating Climate-Driven Scarcity

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Demonstrated benefits of hydro during extreme weather events: California

- August 2020 Extreme Heat Wave
 - Hydro project operators adjusted their water operations
 - Increased supply from hydro projects in- and out-of-state
- Summer 2021
 - CAISO backstop procurement included 3 hydro resources (~130 MW cumulatively)
 - CAISO's procurement from the Hetch Hetchy hydro facility was the 3rd greatest capacity designated at 121.42 MW (behind only Genesis McCoy BESS at 132.5 MW, and Russell City gas-fired facility at 350 MW)

Demonstrated benefits of hydro during extreme weather events: Nationwide

- Provision of **blackstart service** to restore grid stability following outages
 - According to a 2021 DOE report, while hydroelectricity represents <7% percent of the nation's electric generation capacity, it comprises ~40% of blackstart resources
 - Combustion turbines provide most blackstart service in the U.S., but dependence on available fuel supply comes with exposure (e.g., Feb. 2021 extreme cold event)

Hydroelectricity provides day-to-day benefits

- Provides ancillary services beyond blackstart
 - Operating reserves (spinning/non-spinning)
 - Regulation service (maintain system frequency)
- Provides ramping flexibility
 - According to a 2021 DOE report, in nearly every Balancing Authority Area assessed, hydropower was used more than any other resource type for hourly ramping flexibility
- Can serve as a battery, storing wind/solar that exceeds forecasted amount
 - Pumped storage has life cycle and operating benefits over other battery types

Obstacles to hydro development, production, and maximized use:

- Transmission issues in the West
 - Limited transmission capacity—evolving frameworks
 - See FERC Docket No. ER21-1790
 - Wildfires and de-energization measures
 - Transmission disruptions caused by other weather conditions (e.g., 10/28/20- ice storm in Texas Interconnection, hurricane in Eastern Interconnection)
- Drought & water rights issues (competing uses)
 - Renegotiation of operations agreements (e.g., coordinated operations agreement governing Central Valley Project and State Water Project)
- Licensing, permitting, and financing obstacles
 - FERC jurisdiction over non-Federal hydro projects
 - Federal facilities under Reclamation, ACoE, and TVA jurisdiction
 - Many additional Federal, state, tribal, and local permitting authorities

Strategies to avoid envt'l impacts in hydro development & production, and to maximize projects' efficiencies:

- Siting considerations: closed-loop pumped storage; utilizing existing infrastructure (non-powered dams, transmission)
 - Examples: San Vicente Energy Storage Facility (CA); Llano County project (TX)
 - FERC Order No. 858 (2019)
- Operations and planning considerations
- Water conservation technologies
- Conditions imposed on FERC licenses

Grid operators' planning & wholesale market enhancements may further hydro's contributions:

- Expansion of energy imbalance markets
- Creation of market products to value flexibility
- Improved transmission frameworks
- Recognition of pumped storage's unique operations
 - FERC Order No. 841
- Improved resource adequacy frameworks

References & suggested reading:

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- *Hydroelectric Licensing Regulations Under the America's Water Infrastructure Act of 2018*, Order No. 858, 167 FERC ¶ 61,050 (2019).
- *Cal. Indep. Sys. Op. Corp.*, 175 FERC ¶ 61,245 (2021).
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