



HYDROPOWER & HYDRAULIC STRUCTURES

Pumped Storage Hydropower

Decades of global pumped storage experience to fill any project role.



BLACK & VEATCH

As Wind and Solar Energy Production Rises, It Drives the Need for Large-Scale Energy Storage

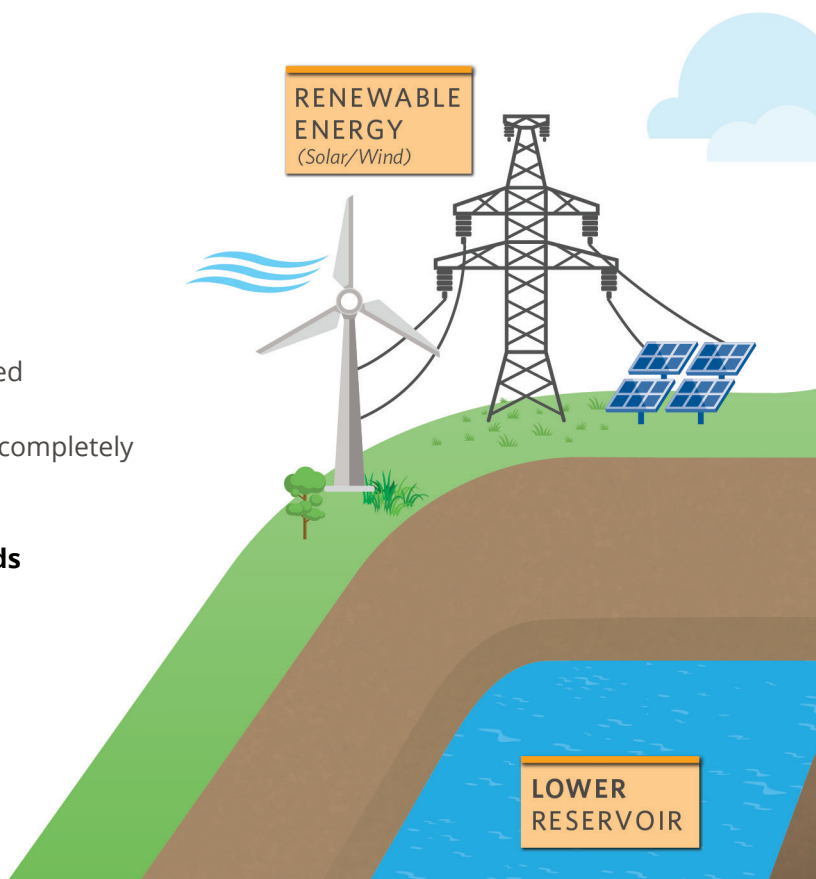
With more than 25 years of experience on pumped-storage facilities around the world, Black & Veatch can fill any project role, including Engineer of Record and Owner's Engineer, providing critical technical capabilities and full turnkey EPC.

Pumped storage hydropower implemented by Black & Veatch is a safe, efficient, long-life, and proven solution that facilitates the shift to renewables by balancing generation with demand and supporting electric grid efficiency and stability.

Benefits of Pumped Storage Hydropower

Pumped Storage Hydropower

- **Balances generation and demand**
Stores and dispatches energy as needed
- **Improves transmission efficiency**
Uses existing transmission lines more completely
- **Stabilizes the electric grid**
Saves equipment from damage
- **Shifts power supply over long periods**
Reduces the need for curtailment



Services

Transient Analysis of Water Conductor Systems and Hydraulic Systems

Black & Veatch performs transient analysis modeling for the preliminary and detailed design of pumped-storage as well as pumping station, hydroelectric and hydraulic structures. With expertise also in Computational Fluid Dynamics and physical modeling, Black & Veatch delivers a clear understanding of flow characteristics and the impacts of pumped storage.

Geotechnical and Dam Engineering

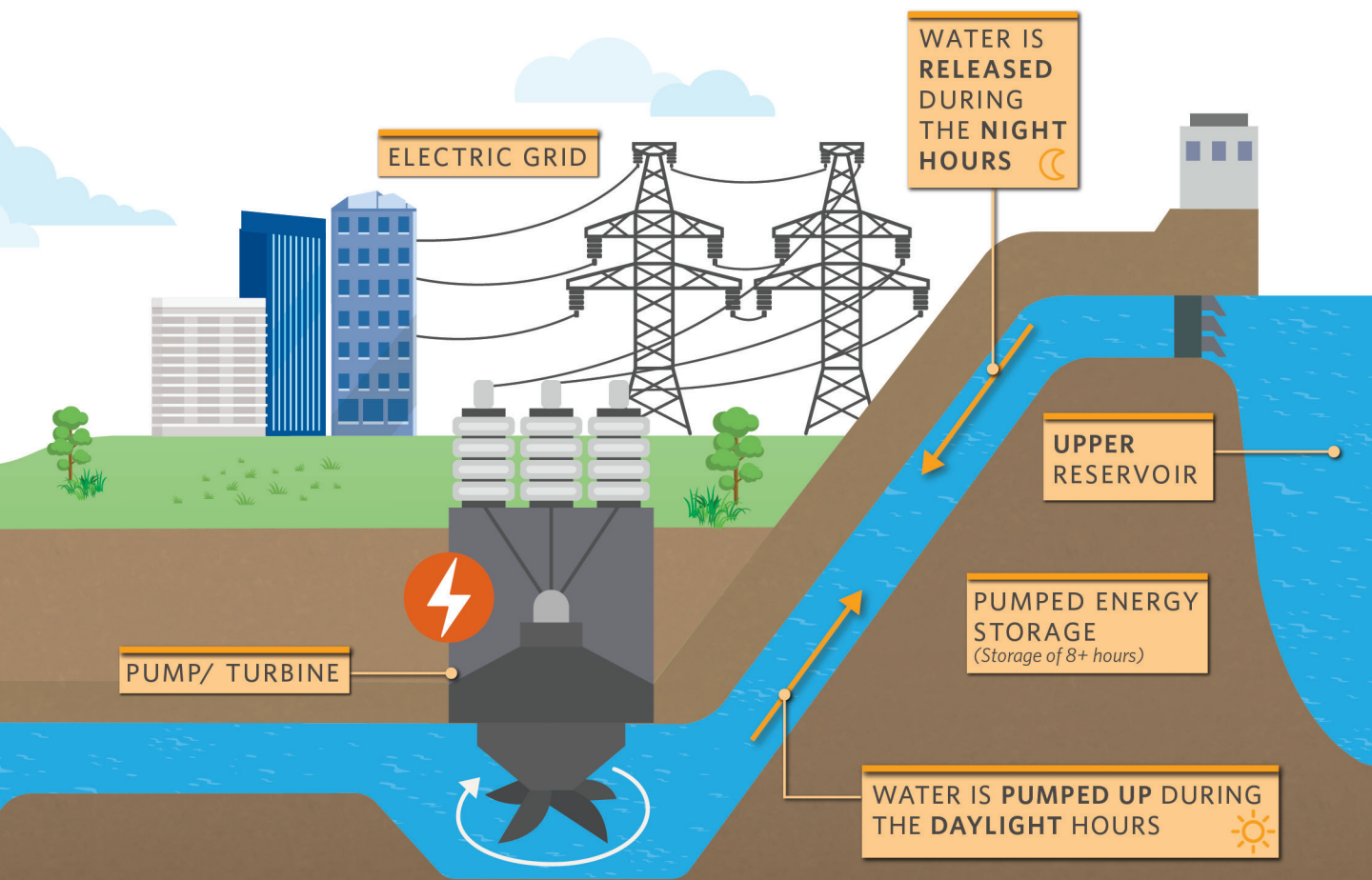
Black & Veatch has designed and provided construction management services for more than 100 dams in 20 countries. Coupling experience on practically every size and type of dam with state-of-the-art information technology, project controls and safety programs, Black & Veatch can greatly reduce project risks.

Tunnel and Underground Structure Engineering

Black & Veatch is at the forefront of tunneling technologies and best practices, having designed and managed the construction of more than 650 miles of new and rehabilitated tunnels worldwide. Our experience encompasses all types, configurations, sizes, locations, ground conditions, and tunneling methods.

Pump/Turbine Motor/Generator Procurement

Black & Veatch procures major power plant equipment on a global basis taking an approach that prepares technical specifications with real-time market surveying, early vendor consultation, risk identification, and cost-effective commercial terms and conditions. Black & Veatch also can procure and install equipment on a turnkey basis.



Experience Highlights

Client/Owner Project/Plant Name	Year Completed	Size MW	Location	B&V Scope
San Vicente Pumped Storage Project San Diego County Water Authority	Ongoing	500	California	Feasibility Study, Preliminary Design
Elmhurst Quarry Pumped Storage Project Dupage County	2014	500	Illinois	DBOF RFP
Lake Hodges Pumped Storage San Diego County Water Authority	2013	40	California	Consulting Services and Design Review
Optimized Pumped Storage to Support Renewable Energy Development Maui Electric Confidential Site	2011	100	Hawaii	Expert Consulting Services
Ingula Pumped Storage Project Scheme Eskom	2011	1,332	South Africa	Due Diligence Review
Site Selection Study Using GIS Approach Confidential Transmission System Owner	2010	NA	Midwest USA	Expert Consulting Services
Braamhoek Pumped Storage Project Eskom	2006	1,332	South Africa	Cost Estimating Services
R. B. Russell Pumped Storage, Static Start System for 75 MW Pump-Turbine Units Corps of Engineers	2003	75	Georgia	Final Design
Carters Pumped Storage: Turbine Rehabilitation, Governor and Exciter Replacement, Synchronous Start on Pump/Turbine Units Corps of Engineers	2003	560	Georgia	Final Design
River Mountain Pumped Storage AES Corporation	2001	724	Arkansas	Primary Design
Diamond Valley Lake Project Metropolitan Water District of Southern California	2000	40	California	Final Design
Elmhurst Quarry Pumped Storage Project Dupage County	1994	250	Illinois	Feasibility Study
Stanley Canyon Pumped Storage Project City of Colorado Springs	1994	263	Colorado	Preliminary Study
Mingtan Pumped Storage Project: Balance-of-Plant Electrical and Mechanical Design Voith Hydro Inc	1993	1,650	Taiwan	Final Design
Gregory County Pumped Storage Project State of South Dakota	1990	2,400	South Dakota	Feasibility Study
Rocky Point Pumped Storage Project Natural Energy Resources Company	1987	1,000	Colorado	Feasibility Study, Licensing
Spring Creek Pumped Storage Project City of Redding	1986	100	California	Feasibility Study, Licensing