



Water System Solutions for Industrial Facilities

Configuring the right water system, including desalination, for efficient power generation.



BLACK & VEATCH

Qualifications and Experience Highlights

For a complete evaluation of your water system, start with Black & Veatch. We are a recognized leader in the global water and wastewater markets, particularly in water reuse and desalination. From water balance reviews, updates and water quality studies to specification development and detailed design engineering, and from construction, commissioning and startup to asset management, our water systems expertise can get you moving in the right direction.

Our Expertise Encompasses:

Water Resource Assessment and Planning

Whether it's to protect, expand or diversify water supplies, our experience encompasses groundwater, surface water, stormwater, and wastewater sources.

Total Water Management

Our expertise extends from intakes to outfalls, and covers everything in between including zero liquid discharge (ZLD), finished water quality and corrosion control in the distribution system.

Technology Identification and Evaluation

We develop a clear picture of treatment options and identify best-fit solutions to drive cost-efficiency as well as meet quality, safety and environmental requirements.

Existing Infrastructure Synergy

Our ability to capitalize on existing facilities allows us to expedite permitting and scheduling and control costs.

Delivery Flexibility

Our capabilities range from traditional consulting services to alternative delivery models. We help clients develop the appropriate project execution strategy, allocate risk and minimize costs.



Select Projects — Experience Summaries

Black & Veatch has identified water reduction and wastewater reuse opportunities in numerous water management studies.

Water Management/Sourcing

Luminant — Comanche Peak Water Balance Study

We performed the study as part of a licensing effort for a new nuclear station. We looked at the impact on the Brazos River watershed (water quantity and quality) based on plant configuration and water/ wastewater treatment methods.

Koch Industries — Enid/Fort Dodge/Dodge City/Beatrice Ammonia/Urea Production Facilities

We produced new water balances for each of the facilities, and evaluated water/ wastewater issues of concern. Internal reuse and treatment options were considered.

Citgo Lemont Refinery — Raw Water Treatment Study

We performed a treatability study for the refinery's raw water system. Options to replace the lime softener and minimize RO scaling were considered.

FirstEnergy — Fort Martin 2 x 550 MW Power Station, Hatfields Ferry 3 x 575 MW Power Station, and Harrison Station 3 x 650 MW Power Station

We produced updated the water balance for each station, and evaluated conceptual wastewater treatment options and costs for flue gas desulfurization wastewater treatment.

Brazos Electric — Jack County Generating Station 2, 2 x 1 Combined Cycle Power Station, 1240 MW

The study considered options for zero liquid discharge wastewater treatment system.

Lubbock Power & Light — Reclaimed Water Study

The study looked into replacing the city's water supply to municipal power stations with treated effluent water from the city's wastewater treatment plant.

Tenaska — IGCC Water Supply Evaluation

We evaluated supplying treated wastewater effluent from the city of Decatur, Illinois, to a new integrated gasification combined cycle facility.

ExxonMobil — San Ynes Groundwater Management Study

We evaluated the feasibility of treating produced water at the ExxonMobil Santa Ynez Unit for facility water needs. Water demands included process makeup, boiler makeup, fire and service/utility water, and potable water. The study focused on required treatment approaches along with expected challenges.

Select Projects — Experience Summaries

With more than 40 years of desalination experience, Black & Veatch has worked on facilities with a total capacity of more than 500 MGD. Our experience also includes renewable power and energy-recovery solutions to offset desalination's energy requirements.

Desalination Studies/Evaluations

East Bay Municipal Utility District — Richmond Advanced Recycling Expansion (RARE) Study

We evaluated then implemented advanced membrane treatment facilities including MF and RO of secondary effluent to produce 4 million gallons per day (MGD) of high-quality, high-pressure boiler make-up water at Chevron's refinery in Richmond, California.

Tseung Kwan O Desalination Plant, Hong Kong — Feasibility Study

We developed the study, including energy efficiency options, and were appointed Owner's Engineer for the first stage of the plant, which will have an initial capacity of 36 MGD. Our scope includes evaluating a trunk feed system for fresh water transfer and providing operation supervision. The plant will use landfill gas for power generation.

Spence Hypogene — Selection Phase Study

The study involved the selection and design of a seawater desalination facility with 800 L/s capacity. It included engineering for marine works (intakes, outfalls), Class 3 CAPEX, OPEX and construction schedule estimates, HSEC planning, and risk review.

Krishnapatnam UMPP 6 x 660 MW Supercritical Power Plant, India

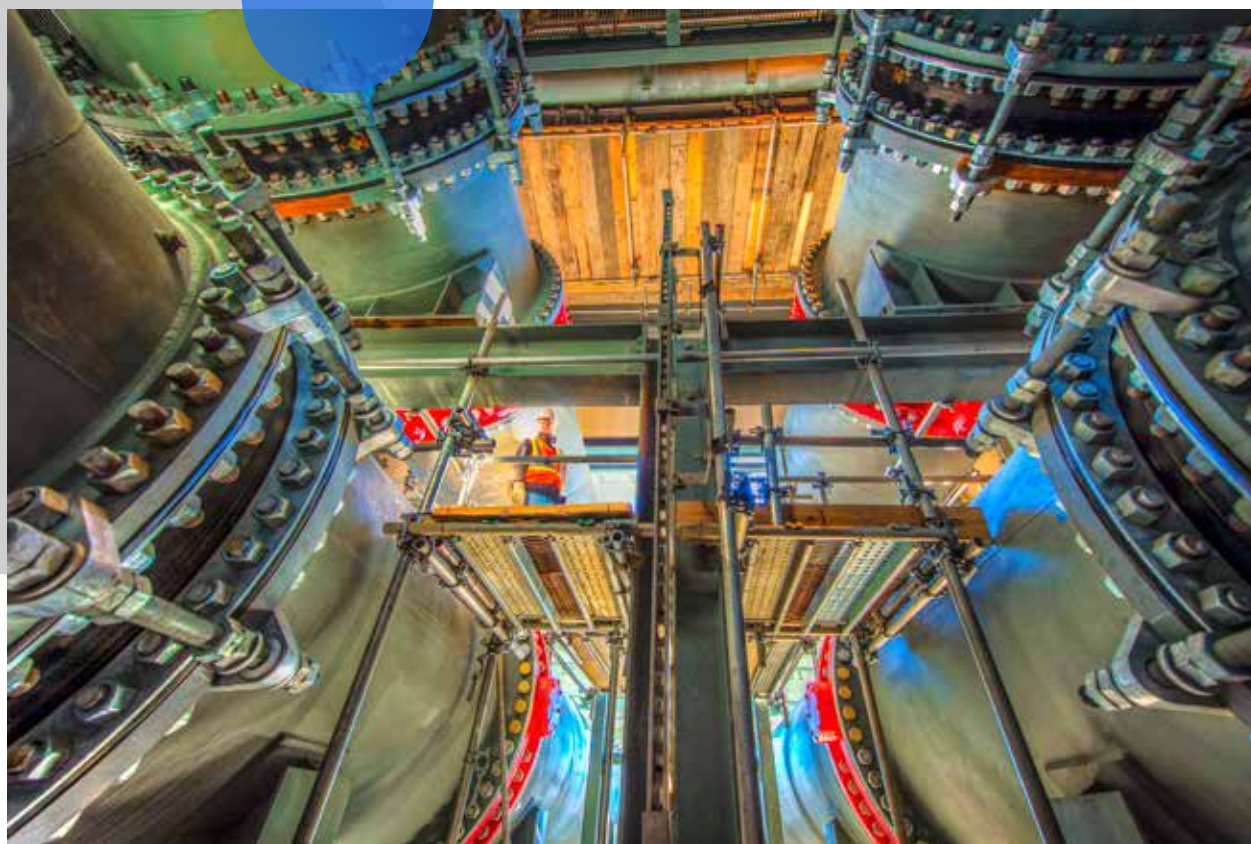
Our evaluation considered alternatives involving MEDTVC and seawater reverse osmosis (SWRO) in order to produce 7-8 MGD for: potable water; service water; HVAC makeup water; firewater; combined-heat-and-power; dust suppression water; and demineralization system makeup water.

Tuas Power, Singapore — Power and Desalination Hybrid Project

The project involved the generation of 200 MW of power and 16-26 MLD of potable water using MED and SWRO.

CODELCO (Corporacion Nacional del Cobre) — Radomiro Tomic Mine, Chile

We reviewed the technical documentation of a proposed 1920 l/s SWRO plant, plus marine works and a pipeline/pump station package



Market Leadership in Desalination

The value that clients gain from our leadership in desalination includes the following.

Energy Efficiency — recovering the latent pressure in the concentrate stream of membrane systems

A Black & Veatch-led research project for the American Water Works Research Foundation identified opportunities for energy savings within desalination facilities.

Water Recovery — using membranes that yield higher water recovery rates, thus less waste flow

Black & Veatch designed reverse osmosis (RO) membrane systems to produce 4 MGD of high-purity water for a Chevron refinery in California.

Lower Capital Costs — using large-diameter RO membranes

Using 18-inch diameter RO vessels, instead of the standard 8-inch system, on the Bundamba Water Reclamation Facility helped to optimize the project's cost and schedule.

Innovation — pushing the frontiers of knowledge and application

Black & Veatch piloted skids to evaluate RO design, including cleaning programs and antiscaling formulas.

Awards

Koch Fertilizer Plant Expansion, Koch Industries, Enid, Oklahoma

- Water for 2060 Excellence Award, Oklahoma Water Resources Board (2017)

Escondida Water Supply Project, BHP Billiton, Chile

- Industrial Desalination Plant of the Year, Global

Water Awards, Global Water Intelligence (2017) Groundwater Replenishment System (GWRS) Initial Expansion, Orange County Water District, Fountain Valley, California

- Water Environment Federation (WEF), Project Excellence Award (2016)
- Global Water Awards, Distinction Award, Water Reuse Project of the Year (2016)
- American Academy of Environmental Engineers & Scientists, Honor Award for Design (2016)

Black & Veatch

- Desalination Company of the Year, Global Water Awards, Distinction Award, Global Water Intelligence (2016)

Claude “Bud” Lewis Carlsbad Desalination Plant, California (Black & Veatch was Independent Engineer)

- Desalination Plant of the Year, Global Water Awards, Global Water Intelligence (2016)

Silicon Valley Advanced Water Purification Center, Santa Clara Valley Water District, City of San Jose, California

- Water Reuse Project of the Year, Global Water Awards, Global Water Intelligence (2015)
- Project of the Year, Large Category, WaterReuse Association (2014)

Butler Drive Water Reclamation Facility, Peoria, Arizona

- Winner: Project Merit Awards (Water/Wastewater), EBJ (2009)
- Project of the Year, Large Category, WaterReuse Association (2009)
- Public Works Project of the Year, Environmental Category, American Public Works Association (2009)

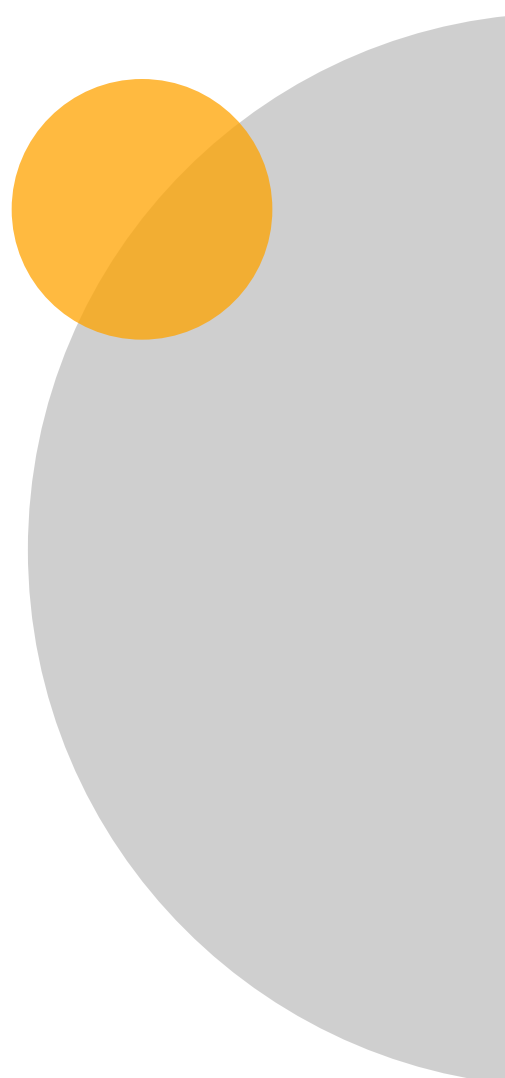
Bundamba Advanced Water Treatment Plant, Stage 1A and 1B, Ipswich, Queensland, Australia


- Winner: Project Achievement Award, International Project, Construction Management Association of America (2008)
- Grand Honour Prize, Innovation Awards, International Water Association (2008)

Water Project of the Year, Global Water Awards, Global Water Intelligence (2008)

Patent-Pending

In cooperation with General Electric, Black & Veatch introduced a hybrid system combining desalination with power generation in a single, integrated facility, based on gas turbines in a combined cycle format. The configuration uses thermal desalination to produce power and water efficiently.





Black & Veatch is an employee-owned engineering, procurement, consulting and construction company with a 100-year legacy of innovations in sustainable infrastructure.

- 10,000+ Professionals
- 110+ Offices
- Six Continents
- 7,000 active projects worldwide
- 7th Largest Employee-Owned Company (US)
- \$3.7 billion revenue in 2019

About Black & Veatch

Founded more than 100 years ago, Black & Veatch is a leading engineering, consulting and construction company. We create and deliver sustainable water, power and advanced communications solutions, expanding the frontiers of infrastructure while improving the quality of life in communities worldwide.

With an established office in Houston, we are practiced in the water and wastewater challenges of the Gulf Coast. As a global enterprise, we bring foremost technical expertise and the latest innovations in water. Together, our regional understanding and industry leadership allow us to deliver exceptional value to our Houston clients through timely, cost-effective and sustainable solutions.