BLACK & VEATCH

Value Every Drop

An ROI Framework for Commercial Water Management

Contents

Effective management of water usage, discharge and stormwater is foundational to business goals for growth, resilience and sustainability.

Introduction

Safe, reliable and affordable water is essential for business to thrive. Though renewable, water is a finite resource and becoming more precious. Impacts from climate change, population growth, urbanization, evolving markets, and regulatory and social pressures are driving up its cost and competition.

Black & Veatch helps commercial and industrial enterprises secure the water they need and do more with the quantity they have, while also meeting their water quality requirements. Our **ROI — reevaluate, optimize, innovate** — framework helps clients develop a fresh understanding of their water risks and opportunities, and implement solutions that promote their operational resilience and environmental stewardship.

Managing water more efficiently and productively delivers significant business benefits. Costs and risks are reduced, operational effectiveness improved, and brand image enhanced.[1]

Water Pressure

Even while per-capita consumption is decreasing, demand for safe, reliable, and affordable water is intensifying. It's driven by growing populations and economies worldwide and impacts from pollution.[4] Growing business related to the Internet of Things (such as data centers) and green initiatives (such as the production of EV batteries, which depends on mining) are water intensive. Exacerbating the issue is climate change. More frequent and stronger storms are increasing the devastation from flooding. Less snowpack and shifting rainfall patterns are limiting long-term water supplies in many regions and spreading drought conditions. More heat waves are escalating water and energy usage.[5]

Water stress deteriorates freshwater resources in terms of availability (overdrawn aquifers, decreased surface water levels) and quality (pollution, eutrophication, saltwater intrusion).[6] It compounds risks related to food and energy systems, politics, and aging infrastructure.[7] Because of the stress, governments may be expected to manage demand, such as raising the price of water or capping how much users can draw.[8] The risk in their direct operations and value chains that companies face from water stress is real and substantial.[9]

To address their water quantity and quality issues, businesses in most sectors need to learn how to do more with less.[10] In the process, they can address their water usage, discharge and stormwater issues and needs.

In the 20th century, the world's population quadrupled, but water use increased sixfold.[11]

Population

Water Use

By 2030, it's estimated water supplies will satisfy only 60% of global demand, and less than 50% in regions including China, India, and South Africa.[12]

The commercial and industrial sector is the second largest consumer of publicly supplied water in the U.S., accounting for 17 percent of withdrawals from public water supplies.[2] At issue: freshwater supplies are steadily dwindling. Many of the world's basins could see a supply decline of around 10% by 2030 and up to 25% by 2050.[3]

A Water Management Framework for Maximum ROI

To help companies strategically define and operationally address their water quantity and quality goals and metrics, Black & Veatch provides an easy-to-remember framework: ROI – reevaluate, optimize, innovate.

R-Reevaluate

R O I

Track water usage, loss and quality. Clarify regulatory compliance requirements and risks. Craft an informed and dynamic plan that addresses current challenges and future goals. Tactics include the following:

Water Balance

A comprehensive water mass balance (WMB) tracks both flow and water quality throughout all major users within a facility. This supports an economic evaluation of alternative processes for wastewater treatment and reuse. The WMB is a crucial first step in understanding the big picture of water usage, conservation opportunities, and loss mitigation. It can include chemistry audits and system design.

Companies want their water use and discharge to be as small as possible. Helping them get there, Black & Veatch conducts vulnerability assessments, evaluations and planning – providing a fresh perspective and enabling informed decisions about water risks across geographies, value chains and product portfolios. Considering sources and discharge in tandem with facility operations, BV helps companies understand their options and find a balance between feasible, reliable, and sustainable solutions.

Water Valuation

A water valuation provides a framework to support business continuity and investment decisions. It accounts for "hard" factors such as production rates and water sources, conveyance and/or treatment facilities, plus "soft" factors including climate change and regulatory requirements. The goal is to estimate the value of water by providing a full accounting for risk factors and changes over time.

Condition Assessment

Conducting a condition assessment of facilities and systems, including equipment and technologies, helps to avoid crisis situations. Using a structured condition assessment, companies can spend their water system replacement, repair, and maintenance budget on the right issues at the right time and plan expenditures strategically.

Planning

Sound planning is built on insights from assessment and evaluation efforts. It accounts for the dynamic factors that affect water costs, quality, and supply, inside and outside facilities. It balances resource demands with cost-effective upgrades while maintaining high levels of performance. It sets a roadmap for sustainability that can adapt to evolving conditions and plans, to help companies manage present-day risk and stay on track with their enterprise goals. It can also empower them in the public sphere, to use their plans and studies to help shape policies and regulations.

Regulatory Compliance

Regulatory requirements are challenging on multiple levels. Considerations include effluent disposal guidelines, sludge regulations, local pretreatment programs, regional initiatives, and federal mandates. Stormwater and spill management add to the challenge. Best Management Practices (BMPs), pollution prevention plans and Spill Prevention, Control and Countermeasure (SPCC) plans include essential compliance tools such as water quality modeling, load allocations, regulatory negotiations and permitting. Others include vulnerability assessments and air quality modeling. Permits should be evaluated for renewal, updates, or potential changes.

Sustainability: Worth the Investment

Reducing water use and increasing water efficiency are not new concepts to business. From 1985 to 2017 industrial water usage in the U.S. decreased by 30%, or 64 billion gallons per day.[13] Methods include upgrading equipment, evolving practices, improving processes, stopping leakage, adopting reuse solutions, and using data and analytics technologies. A key benefit: more effective water management aligns seamlessly with sustainability initiatives.

The 2022 CEO Outlook survey by KPMG points to economic recession concerns and the difficulty of measuring progress on ESG (environmental, societal, governance) goals as reasons for a potential pause or slowdown in such initiatives. Nonetheless, KPMG's survey also shows that most CEOs in the U.S. still believe in the value of ESG goals. Black & Veatch offers expertise linking ESG, water and business strategies, helping companies realize their commitments and benefits, including improved financial performance.

A proven tool for helping companies do more with less is Envision™. Developed and managed by the Institute for Sustainable Infrastructure, Envision is a framework and rating system. Adopting it can help organizations measure and track resource usage in projects and identify how water, emissions and energy consumption can be cut toward the goal of sustainable, resilient and equitable infrastructure. Black & Veatch helps clients use the Envision system to manage costs, optimize operations, and advance their environmental stewardship.

O-Optimize

ROI

Upgrade the design of water-related facilities and treatment processes and fine tune performance through integrated, data-empowered solutions. Gain efficiency in water usage, treatment and discharge performance. Tactics include the following:

Facility and System Design

Many factors apply to optimization. One is facility design, which depends on raw water quality, process requirements, chemical conditioning, and discharge requirements. Another is system choices, which may range from conventional treatment for specific chemical contaminants to complex zero-liquid discharge water management schemes. Some companies even choose to lease their treatment equipment.

Monitoring and Diagnostics

A powerful optimization tactic is the aggregation and analytics of data culled from complex and distributed networks; e.g., through Advanced Metering Infrastructure (AMI). Incorporating multiple data sets and linking to dashboards with analyses and calculations enables operational performance to be easily viewed and confidently managed in real time.

Process Design

The quality of water in cooling water systems, the condensate/steam cycle, and auxiliary systems such as process water, utility water, and wastewater systems impact facility operations. With increasing requirements for improved water management and stewardship, treatment and conditioning of water is vitally important. Once the processes in the facility are understood, water reuse can be considered while meeting the quality requirements of the individual pieces of equipment.

Operations and Maintenance

Operations and maintenance (O&M) can be managed to improve water usage and loss without an increase in costs. Improvements that reduce consumption of water, energy, and chemicals can be gained through risk-management practices such as hazard-and-operability review (HAZOP) and failure modes, effects, and criticality analysis (FMECA). The power of 3D models and building information modeling (BIM) along with the ability to link equipment information is a boon for operators and maintenance professionals. Such digital capabilities deliver near-instant access to actionable data and raise confidence in facility performance improvements.

In a Black & Veatch-optimized facility, everything is connected and aligned: planning, design, operations, maintenance, asset management, and data management. Controls, data analytics, and machine learning are leveraged to manage water resources efficiently, effectively, and economically.

I-Innovate

R O I

Adopt new management approaches and treatment technologies. Tactics include the following:

Asset Management

The use of the ISO 55001 standard applies to any asset-intensive industry. The standard helps companies maximize the value of their assets by balancing performance, cost, and risk. Effective asset management guides how projects are categorized and prioritized such that the investment is spent on the highest-priority portfolio activities.

Business intelligence is an asset management game-changer because it provides actionable insight. It allows a company to quickly gain actionable insight into the quality and quantity of its resources, operational performance, facility performance, regulatory compliance, asset lifecycles, and even into the asset itself in the form of a digital twin. It supports vulnerability assessments to win stakeholder trust. Information is displayed in a single view that is easy to understand and distribute so the people who need it can make informed and reliable management and investment decisions. By adopting asset management along with business intelligence tools, companies can unlock the value of their data.

Process Intensification

Process intensification enables companies to achieve more with what they have. That is, increase treatment capacity, improve resource recovery, and gain higher water quality while using less energy and fewer chemicals with a smaller footprint.

Partnerships

Commercial entities looking to cut O&M costs can make a capital contribution to a utility to help build a facility (such as a recycled water plant, microgrid, etc.) in exchange for a discounted long-term rate. Additionally, they may ask for preferential rights for access to the commodity that would help with having a “guaranteed” water source in those areas where water scarcity is an issue.

Desalination

Desalination is a worthy alternative-water-supply technology. It encompasses wastewater, seawater, and brackish water sources. Assessing desalination as an option includes source water characterization, technology identification and evaluation, power synergy, and bench- and/or pilot-testing to determine the most cost-effective and reliable application. Desalination’s operating efficiency can be increased, its energy requirement reduced, and water quality improved.

Energy recovery devices (ERDs) can offset energy use for desalinated seawater, brackish and reclaimed waters. The devices recover part of the excess pressure on the concentrate stream of a reverse osmosis (RO) skid. Hybrid membrane systems, which have high pressure RO and lower pressure nanofiltration (NF) membranes, yield less energy cost of operation.

Drawing on Black & Veatch’s water expertise, commercial and industrial organizations can explore innovative opportunities to meet their water needs and goals with greater efficiency.

Water Reclamation and Reuse

With freshwater resources becoming more precious and potable water becoming more expensive, the use of reclaimed water is increasing, especially as it can meet even the most stringent requirements for reuse. Water reclamation may involve the reuse of treated wastewater for irrigation, industrial process water, cooling water, fire protection, and/or aquifer recharge. The energy efficiency, water recovery, and robustness of reuse make it worth exploring as a water use reduction and sustainability option.

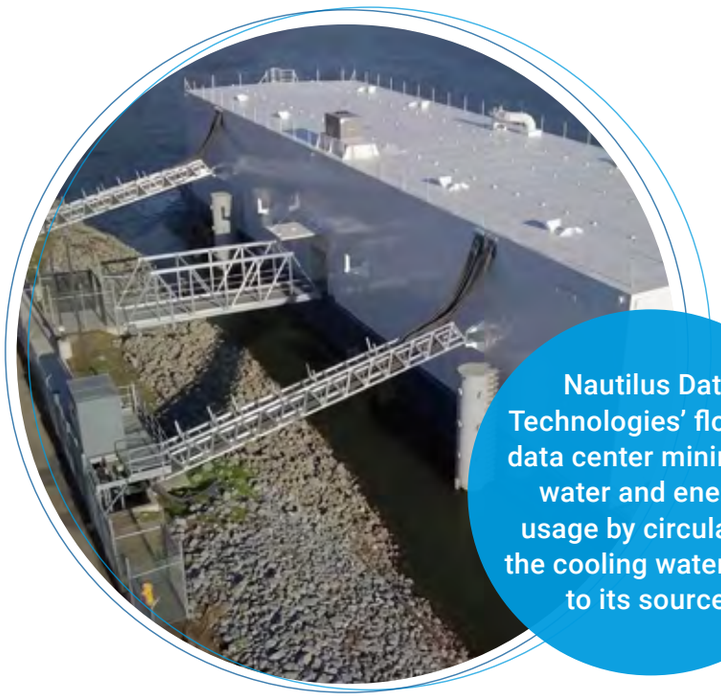
Zero-liquid discharge (ZLD) is an attractive reclamation option. Addressing water scarcity and discharge limits, ZLD solutions can be developed using a blend of wastewater minimization practices and cost-effective treatment. They include the use of side stream softening, filtration, brine concentrators, crystallizers, dewatering systems, high efficiency reverse osmosis (HERO™), and solar evaporation ponds. Implementing thermal- and membrane-based ZLD systems, as well as disposal wells and evaporation ponds, can minimize treatment, squeezing every drop from a facility.

Water Recycling and Reuse Snapshots

- Because of fracking's significant water intensity, public and regulatory pressure, and high costs, the oil and gas sector's spending on water reuse reached $1.5 billion, or 64% of industrial water reuse spend, in 2017.[14]
- In 2017, hygiene, health and nutrition brand conglomerate Reckitt Benckiser implemented recycling to achieve zero wastewater discharge and reduce water use at its Hosur, India, facilities, saving more than 7,200 m3 of water annually.[15]
- In 2016, Ford installed a system to recycle used water from office washrooms, canteens, and manufacturing operations at an India-based assembly plant. The recycled water is used in the plant's paint shop and for landscaping, resulting in zero wastewater discharge at the plant.[16]
- Investing in water efficiency at its Gatorade bottling facility in Tolleson, Arizona, PepsiCo reduced its water use by more than 100 million gallons annually and realized savings of 1.5 million annually.[17]
- Chevron recycled or reused 98% of produced water at its Appalachian operations through water-sharing partnerships with local operators, decreasing its freshwater consumption and limiting disposal to injection wells.[18]
- Frito-Lay's Casa Grande facility in Arizona uses a membrane bioreactor and reverse osmosis system to treat and recycle 648,000 gallons of water a day. Implementation of the technology helped to achieve a 90% reduction in water and electricity usage at the facility.[19]

Data Centers:
A Zero-Water Use Case Study

The typical data center requires a significant amount of water to operate – 3 to 5 million gallons per day.[20] If used for evaporative cooling, it's consumptive and therefore lost to the atmosphere. It's a challenge as competition intensifies between communities and business for reliable and affordable supplies. At the Port of Stockton in California, Black & Veatch helped Nautilus Data Technologies (Nautilus) meet the challenge with a zero-water consumption, low-energy use, small-footprint solution. For the 7-megawatt project, Black & Veatch delivered a due diligence report, provided commissioning oversight, and verified the cooling, electrical and mechanical systems performed as designed.



Nautilus Data Technologies' floating data center minimizes water and energy usage by circulating the cooling water back to its source.

Nautilus' commercial, water-cooled center is a floating facility. It incorporates the company's patented TRUE™ (Total Resource Usage Effectiveness) technology to minimize water and energy waste. The central concept of the technology is that it circulates the cooling water back to the source. As a result, the center consumes no water and produces no wastewater. Whether an ocean, lake or river, the source is used as a heat sink. No refrigerants, chemicals for treatment, cooling towers or air handlers are needed. Additionally, the technology is energy-efficient, requiring less than a third of the power than a traditional air-conditioned facility would use for cooling. Sited on a barge, Nautilus' center has a small footprint. Plus, it features a modular design. The company can deploy more facilities in the same area, using the same connectivity and much of the infrastructure, saving costs.

Finding the optimal water usage level for a data center takes careful consideration of the available water supply and technical expertise. Black & Veatch's proven processes and expertise can uncover potential in a company's operations and resources to achieve their maximum value.

Data Centers Valuing the Drop

- **Apple:** Apple's Clean Water Program reduces water consumption by redesigning data centers to use 80% less water for cooling than previous centers. Mineral filter media used in data centers in Oregon and Nevada help to recapture more water used in cooling and reduce water discharge by 30%.
- **Google:** Google's data centers in Finland use seawater for cooling. In Belgium, they use canal water. Air-cooling technology was implemented in Ireland to reduce the company's freshwater use.[21]
- **Microsoft:** The company plans to cut water consumption in its evaporative cooled data centers by 95% by 2024.[22]

Golf's Swing at the Green

Golf is a global game. More than 60 million people play on approximately 40,000 courses worldwide. Participation is growing, rising the fastest in Asia followed by Great Britain, Ireland, and North America. Women are taking up the sport in greater numbers, and millennials are showing interest. Among the reasons driving the sport's popularity: golf is becoming a center of expertise in water management, conservation, and biodiversity. Course owners and managers along with various associations have taken steps to both manage water more effectively and grow the game.[23 24 25 26 27]

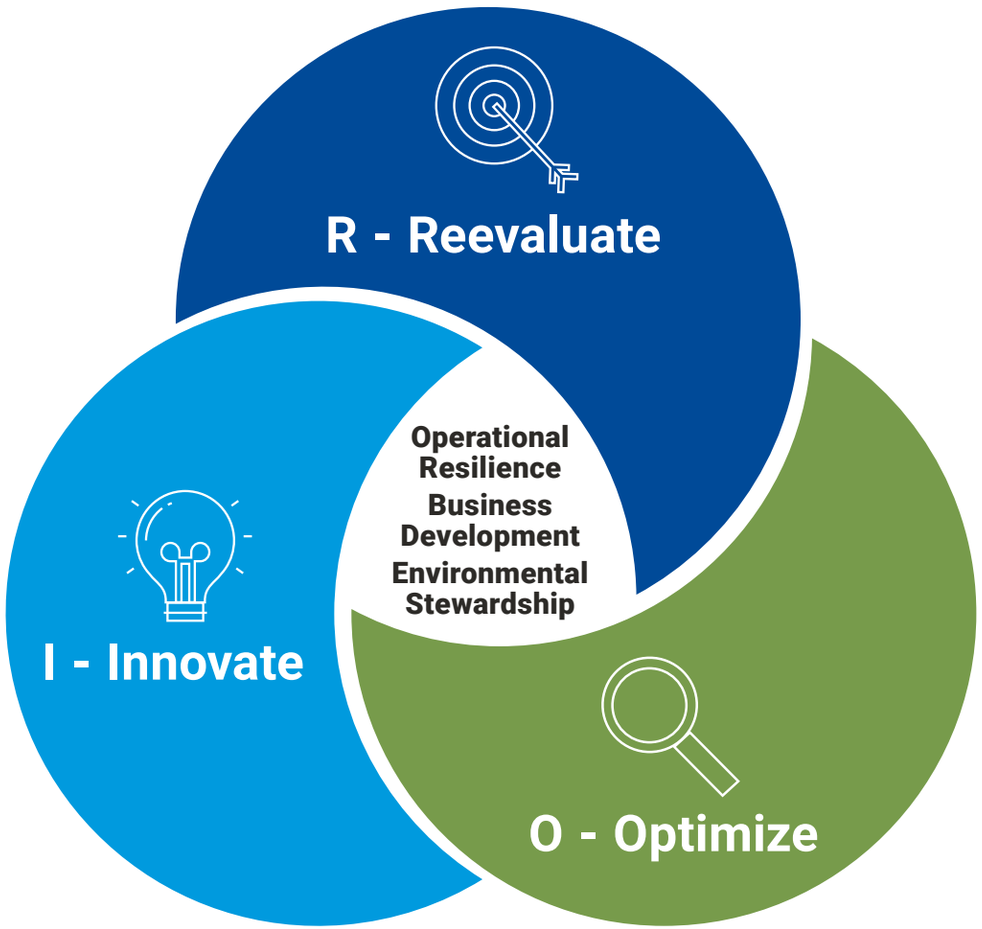
- New turf grasses have been developed that are drought and disease resistant and grow well using non-potable water.
- Dependence on chemicals is down, promoting healthier soil and cutting pollution in aquifers.
- Water reclamation and reuse is up. Also supporting the industry's supply security: stormwater harvesting and smart irrigation systems.
- Irrigation of the landscape surrounding the fairways and greens is being eliminated. Instead, natural landscaping is being embraced, using green infrastructure such as wetlands. Letting Mother Nature provide the hazards supports biodiversity and provides opportunities for carbon sequestration.

> ***"People are recognizing that the best golf courses, run by the most profitable businesses, are those that are planned, designed and managed with resource efficiency, ecological richness and community integration in mind. A good course is one that responds to the landscape, climate and its location—embracing its natural and cultural assets, instead of trying to change them."[29]***
>
> — Jonathan Smith, Chief Executive, Golf Environment Organization

Golf's sustainable approach is helping the sport draw investment, create jobs, and promote healthy activity for people of all ages while protecting biodiversity and sequestering carbon.[28]

Integrated Water Solutions

Water disruptions cost companies $301 billion in 2020, five times more than it would have cost to address their water issues proactively.[30] Putting Black & Veatch's ROI framework into action, commercial and industrial enterprises can effectively align their usage, discharge, and stormwater management solutions with their operational and strategic goals for business success.



R - Reevaluate

Gain a fresh perspective to enable informed decisions about water risks across geographies, value chains, and product portfolios. Find the right balance between feasible, reliable, and sustainable solutions for the enterprise.

O - Optimize

Align facilities and processes and fine tune performance operationally and strategically through integrated design, digital, and O&M solutions.

I - Innovate

Adopt new management approaches and treatment technologies to invest in the right priorities at the right time, gain resource efficiencies, and maximize the value of assets.

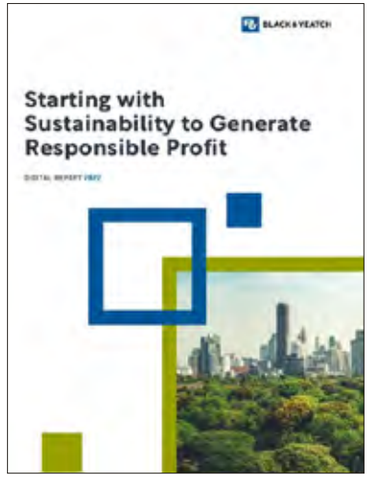
Conclusion

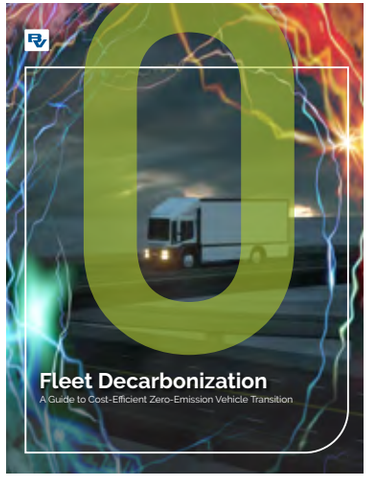
Water is central to commercial and industrial business success. Confronted with ever-evolving regulatory requirements, climate risks, and competition for access to safe, reliable water supplies, companies are focusing on their water consumption, waste and efficiency, to value every drop. Insightful planning, operational optimization, and adoption of innovative solutions and approaches are important strategies to help companies confidently identify, implement, and manage technical and financially sustainable solutions for their water needs and mitigate the water-related risks to their operations.

Black & Veatch has developed water and power strategies and solutions for more than 100 years. We have been a force behind some of the world's first, largest, and most advanced facilities and systems for water, wastewater, and stormwater collection, storage, treatment, distribution, and disposal. What is not seen can make all the difference. Our systems-based approach enables strategic and data-driven planning, treatment, and asset management solutions that meet the return on investment and resource quality, efficiency, and productivity commercial entities need for resilient, sustainable growth.

At Black & Veatch, our mission is to build a world of difference through innovation in sustainable infrastructure. We help businesses and organizations identify, evaluate, and deploy new technologies to benefit the triple-bottom-line — people, planet, prosperity.

Read Our eBooks to Stay Ahead of the Curve





Want to work on your commercial water ROI?

Contact us

End Notes

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