Accelerating Industrial Reuse

Quantifying the Impact, Technology and Policies Needed in the US

GRUNDFOS | BLACK & VEATCH | WATEREUSE

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Addressing the US Water Crisis

Challenges and Opportunities

Water is one of our most precious resources. It sustains human life and ecosytems, and drives food production. Access to clean water is essential for building communities and maintaining a reliable economy. Water also plays a critical role in industrial processes and cooling systems.

Current Water Challenges in the United States

Water quality and quantity issues are widespread across the US landscape. Droughts in the Western US, saltwater intrusion in coastal areas, flooding events and declining lake levels are becoming more severe and frequent.

Currently, water stress is a major concern. Approximately 60% of the land area and 50% of the population are affected by medium to extremely high water stress annually. The impacts of climate change are evident nationwide. Prolonged droughts and overuse have led to significant declines in Colorado River reservoirs. Although precipitation remains consistent in the Central and Eastern US, rainfall durations are decreasing while intensity increases, resulting in flooding and reduced water storage capacity.

Figure 1 illustrates the projected distribution of water stress across the United States by 2030, indicating that many regions will face high or extremely high water stress.

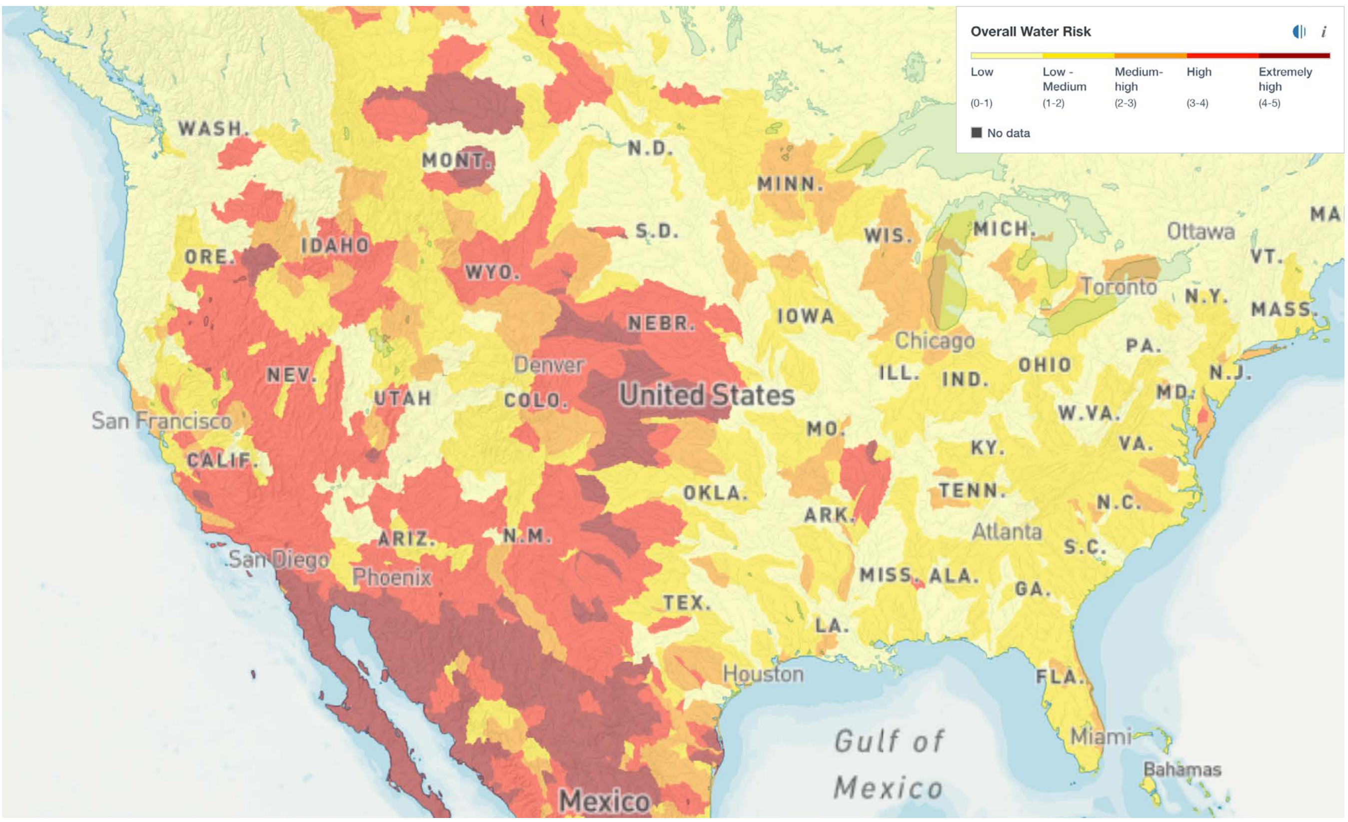


Figure 1. Water stress across United States as the ratio of human demand to available water (WRI Aqueduct).

Approximately

60% of the land area and 50% of the population

are affected by medium to extremely high water stress annually.

Factors Contributing to Water Stress

Ensuring access to high-quality water where and when it is needed is a key challenge. Six major factors hinder this access:

1. Unsustainable surface water withdrawals lead to decreased stream flows, loss of aquatic habitat wetland areas and salt water intrusion.
2. Climate change intensifies droughts and floods, affecting both water quantity and quality.
3. Rapid urban and industrial growth increases water demand in already water-scarce areas.
4. Around 40% of US surface water bodies are classified as impaired due to sediment, nutrients, pathogens or industrial contaminants. This also affects the ecological value of these water bodies (Erickson, et. al, 2025).
5. Groundwater depletion results in extraction from deeper aquifer layers, causing land subsidence and irreversible loss of storage capacity.
6. Water rights and resource management are governed at the state level, lacking a unified national policy. Existing laws favor agricultural use over sustainable water management.

Industrial Water Demand and Emerging Trends

Over the past five years, industrial water demand has significantly increased, driven by sectors such as food production, manufacturing, power generation and technology. The technology sector, including data centers and semiconductor fabrication, is closely linked to rising power generation needs.

It is estimated that approximately 4.4% of US power generation currently supports data centers, with projections indicating this could rise to over 6% to 12% by 2028 (Shehabi, et. al, 2024).

Municipal Water Supply and Industry Demands

Traditionally, industries have relied on municipal water supplies for cooling and processing needs. According to the 2025 Black & Veatch Water Report, around 40% of large and medium-sized municipalities reported increased interest from industries seeking water services. Of these, 67% were technology-related (Black & Veach, 2025).

While approximately 75% of municipalities in 2023 and 2024 felt confident in meeting new water demands, this figure dropped to 65% in 2025. The primary concern was insufficient water supply or distribution capacity to support industrial growth.

Cooling Demands and Sustainable Solutions

Consumptive use of water is any use that removes water from its source and makes it permanently unavailable for other uses. Cooling is the primary water use in power and technology sectors. AI chips generate significant heat, requiring advanced cooling systems, which are often highly water consumptive processes. Combined-cycle natural gas plants also demand large volumes of cooling water. Natural gas power generation plants' consumptive water demands are different from coal and nuclear where many of the cooling systems rely on "once through" cooling systems. These systems have very high total water demand but low consumption, as most of the water is returned to the lake or stream. Many natural gas plants are located near urban centers and use water consumptively for cooling and steam production. Natural gas water consumption competes with water supplies that would be available for other industrial uses (technology, food and data centers). As shown in Figure 2, consumptive use by coal and nuclear is currently well below the consumptive use of natural gas and is projected to be consistent or decreasing over the next five years. In contrast, consumptive water use by natural gas power generation is expected to increase over 60% in 2030.

Food and beverage (not including agricultural irrigation water consumption), data centers and semiconductors are well below the consumptive use of power generation. Between food and beverage, data centers and semiconductors, data center cooling use is expected to have the highest increase in the next five years. Data center water use is expected to increase approximately 30% over the next five years (Figure 3).

These new demands place additional strain on already limited water resources. We cannot create new water, so solutions such as decentralized water circularity offer a sustainable approach for users. This includes water conservation, reuse and impact mitigation strategies.

Addressing the US water crisis requires coordinated efforts across sectors and levels of government. By adopting sustainable practices and innovative technologies, industries and communities can work together to secure America's water future.

WATER CONSUMPTION

2030 | 2029 | 2028 | 2027 | 2026 | 2025

FIGURE 2

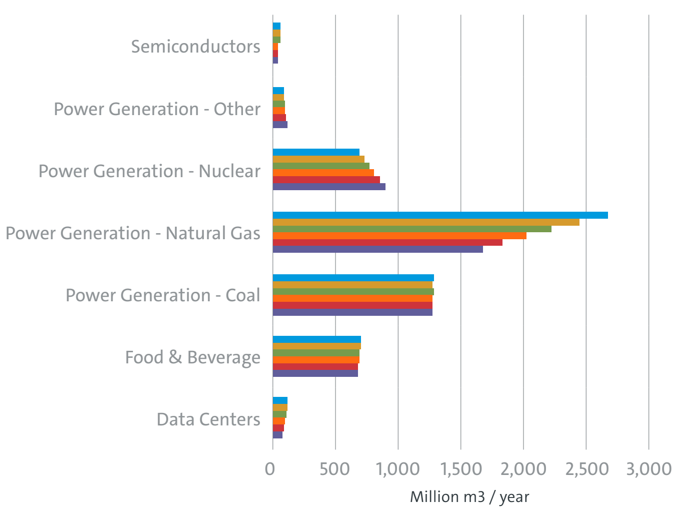
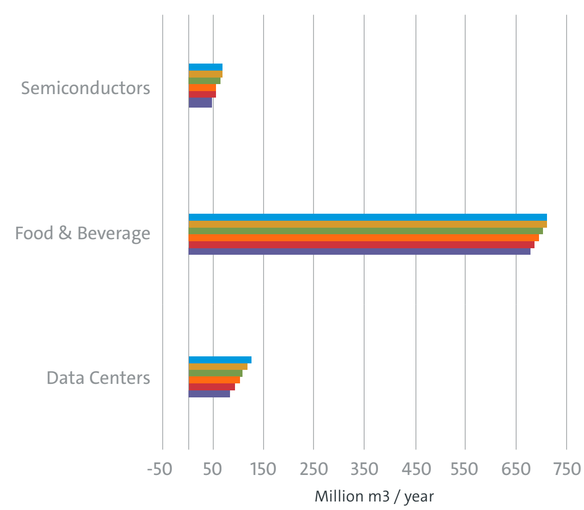


FIGURE 3



Figures 2 and 3 show the data for annual water use by market. The time horizon is the same in both figures. Figure 2 includes Power Generation, which is further sub-divided. Since Power Generation has such significantly higher water consumption, Figure 3 displays the same data with just Semiconductors, Food and Beverage and Data Centers included.

Estimating Water Savings Potential

Applying a Decentralized Water Efficiency Approach and Circularity at the Process Level

Technological advancements have enabled the decentralized treatment of wastewater to turn it into a valuable water resource for industrial processes. Contemporary methods can treat wastewater from light industries' processes in a way that the reclaimed water meets minimum quality requirements for the same or other processes. This way, wastewater can be repurposed as a safe alternative water source and replace freshwater. By treating the water so it is 'fit for purpose,' the treatment levels match the use case, avoiding overtreatment that wastes energy and chemicals. The initial water quality and the required water quality for the process — either by performance or by legislation – influence the choice of technology or the combination of technologies.

	How does it work?	What can it remove?	Common technologies
MBR	MBR combines secondary treatment with low pressure membrane filtration (either microfiltration or ultrafiltration) to produce high quality effluent. Please see definition of micro and ultrafiltration under membrane filtration below.	Suspended solids and turbidity Organic material (Biochemical oxygen demand, chemical oxygen demand, total organic carbon) Nitrogen (if configured) Phosphorus (if configured)	
Water softening	Chemical, physical or electrochemical process that removes hardness molecules such as calcium and magnesium from water.	Hardness such as calcium and magnesium	Pellet softening, ion exchange, CARIX, nanofiltration, reverse osmosis, etc.
Mechanical filtration	Sieving mechanism removes suspended solids, colloidal particles and turbidity greater than filtration size.	Suspended solids, turbidity and particles, and undissolved pollutants	Media filtration (e.g., sand filtration), disc filtration, mesh filtration.
Activated carbon adsorption	Activated carbon adsorbs and removes various pollutants.	Pollutants and chemical compounds including organics, pesticides, heavy metals, chlorine compounds, un-wanted odors and flavors.	Anthracite, Granular Activated Carbon (GAC) and Powdered Activated Carbon (PAC)
Membrane filtration	A separation process that uses semi-permeable membranes to remove particles and other impurities from water	Microfiltration (MF): Particles bigger than 10-.01 µm such as suspended solids. Ultrafiltration (UF): Particles bigger than 0.1-0.01µm such suspended solids and some molecular contaminants from the water. Nanofiltration (NF): Particles bigger than 0.001-0.01µm such as medium-sized dissolved organic molecules, heavy metals, desalinate water and soften water. Reverse osmosis (RO): Particles bigger than 0.001-0.0001µm such as dissolved salts like chloride and sodium, minerals, heavy metals, chemical compounds, bacteria and other impurities from the water. MF or UF are often used as a pretreatment for RO.	
Disinfection	Aims to remove, deactivate or kill harmful microorganisms.	Pathogens such as bacteria, viruses and protozoa, etc.	UV photolysis, chlorination, ozonation, peracetic acid and hydrogen peroxide

Figure 4: The figure shows a variety of treatment methods that enable “fit-for-purpose” water quality.

Improved Water Efficiency

Improving water efficiency requires a comprehensive company strategy that prioritizes sustainability, efficiency and conservation while considering water circularity, safety and the water-energy nexus. Implementing closed-loop systems in which water is continuously recycled, treated and repurposed reduces wastewater and water consumption, protecting both production continuity and alleviating water stress in the US Regarding the additional energy use from implementing decentralized water circularity, it is estimated that reclaiming 80% of industrial wastewater would result in a 4.1% increase in industrial energy consumption (Procházková M et al.(EU)).

Upgrading to high-efficiency reverse osmosis systems can reduce water usage by

20-25%

in filtration processes.

Water Efficiency Strategy and Tactics

Decentralized water circularity in industry consists of three key strategies:

Reduce entails minimizing water use wherever possible to improve water efficiency. Significant cost savings can often be achieved by training employees, monitoring water consumption, implementing feedback mechanisms, eliminating unnecessary processes and avoiding wasteful water use. These water-saving practices are typically inexpensive and comply with food safety and regulatory requirements.

Reuse of water entails treating water to allow for multiple uses. Water can be reused in a variety of non-potable applications, including industrial processes, cleaning, irrigation and cooling systems.

Reclaim means recovering and reusing valuable water resources from wastewater streams. A 'fit-for-purpose' evaluation of the water is required for safe reuse in industrial operations, where there are two major categories: non-potable reuse and potable reuse.

Water circularity should be implemented following the prioritized route of **reduce, reuse and reclaim** (J Rasmussen et al.). Starting with a reduction not only provides large water saving but can also be implemented with relatively low investment costs and change in treatment technology. Following the full route and combining 1) reduce, 2) reuse and 3) reclaim strategies is estimated to result in water saving potential of up to 75-90%. (J. Rasmussen et al.)

When calculating the water saving potential from combining all three strategies, it should be noted that the water saving potential for the reuse and reclaim strategy is lower compared to the water saving potential from implementing them separately. This is because the previous step(s) (i.e., reduce and/or reuse) have already reduced the total water volume and hence the water saving potential for reuse and reclaim is lower.

Estimating Water Savings Potential

Potential water savings in US light industries and the power sector are estimated utilizing a simplified water balance approach based on Bluefield Research's 2025 estimated data on total water withdrawals data across selected light industries and power generation.

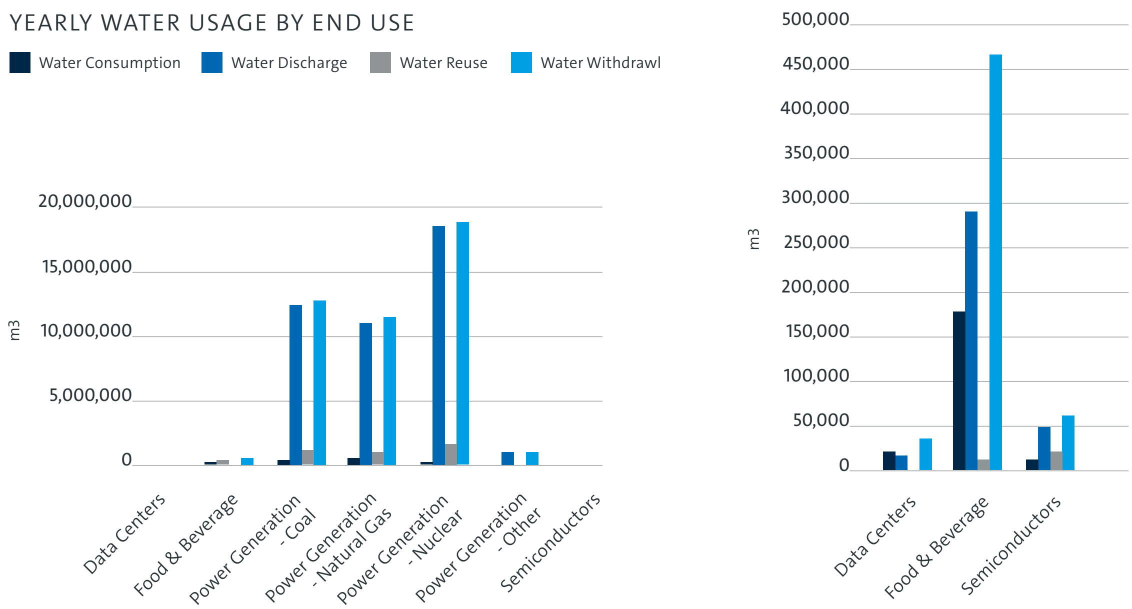
Water Balance Approach

Improving water efficiency requires a thorough analysis of the onsite water balance. Installing water meters helps map water use across processes and identify the processes. Water balance that accounts for inputs, usage and outputs is presented below. The actual water balance depends on the industry. Consumption depends on process and cooling needs. The current reuse fraction also varies across industries. The water balance presumes that there is no product uptake, and the water used for evaporative cooling is part of the consumption.

Figure 5: The water balance approach. Consumption plus discharge minus reuse equals the water use. The water balance is then used for the process balance utilizing assumption of the water usage for the different processes: boiler water, cooling water, process water and other purposes.

Water Usage Overview

The data estimation is done using Bluefield Research specifically for the purpose of this white paper. The selected industrial sectors are the following: data centers, food and beverage, power production and semiconductors manufacturing. Some of the key assumptions in the water estimation include industry-specific splits for process usage. The reuse fraction is estimated by using published cases except in the food and beverage sector, where it is independently estimated. The water usage is depicted in the figures below.



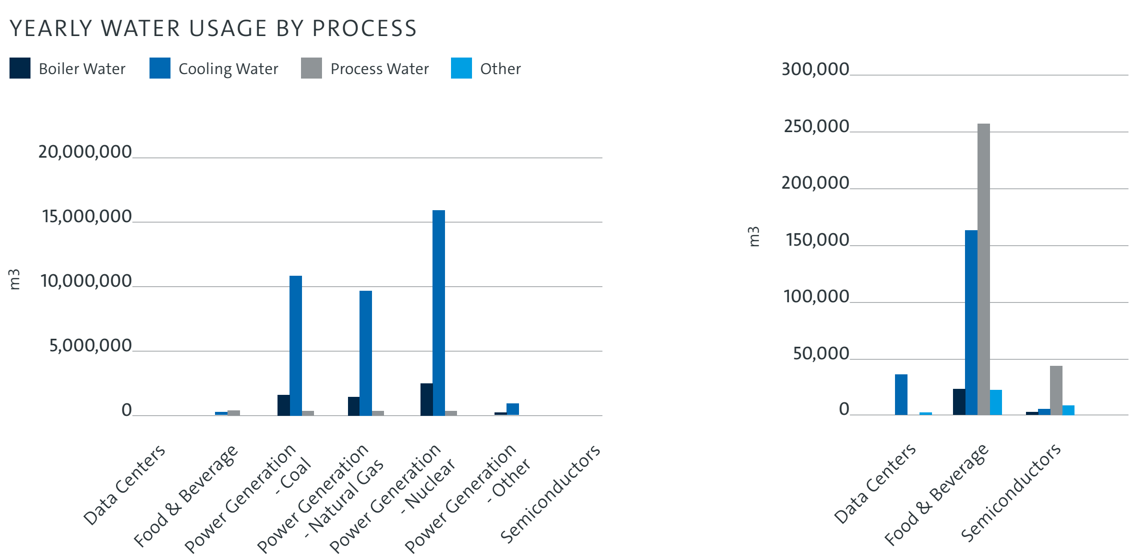


Figure 6, 7, 8 and 9: Overview of total water withdrawal (water consumption - water discharge + water reuse) from 2025 in US, and water usage by process (cooling water, boiler feedwater, process water uses and other uses). It's noted that the semiconductor sector already is utilizing water reuse at a large scale – based on published cases from the industry. Also, it is noted that both data centers and power production have relatively high levels of water discharge given that the primary process use of water is cooling. Because water use is significantly higher in Power Generation, the figures are shown both with and without this industrial segment (Bluefield Research).

Water Savings Potential

Starting with reduction not only provides large water savings but can also be implemented with relatively low investment costs and changes in treatment technology (J. Rasmussen et al.). Following the full route and combining 1: reduce, 2: reuse and 3: reclaim strategies is estimated to result in water saving potential of 75% (but can often be more). When calculating the water saving potential from combining all three strategies, it should be noted that the water saving potential for the reuse and reclaim strategy is lower compared to the water saving potential from implementing them separately. This is because the previous step(s) (i.e., reduce and/or reuse) have already reduced the total water volume and hence the water saving potential for reuse and reclaim is lower. The steps toward an increased water efficiency have different potential for different industries due to the applications and technology used. Also, the water quality 'fit for purpose' is different based on the use case of the water. The potential in the reduce and reuse steps varies due to the difference in water process complexity and maturity of the organizational focus. The range typically varies from 20-40% of the water intake at the start (J. Rasmussen et al). This range is implemented in the estimation of the water saving potential. The reclaim step, which is typically the most expensive step, varies depending on the water matrix and the local regulation. Typically, this ranges from 50-75% of the remaining wastewater (maybe even less for power generation depending on technology).

Million m3 / Year										
High Estimate	Present Water Intake	Present Water Discharge	Potential Saving After the Reduce Actions	Potential Saving After the Reuse Actions	Water Saved According to DRIP Research (Reduce and Reuse actions)	% Water Saved After Reduce and Reuse Actions	Potential Saving After the Reclaim Actions	Water Saved Including on Site Reclaim	% Water Saved - After Adding Reclaimation	Corresponding No. of Olympic Swimming Pools
Data Centers	146	61	36	0	36	**25%**	34	71	**49%**	**28,302**
Food & Beverage	1,772	1,099	443	279	722	**41%**	409	1,131	**64%**	**452,556**
Power Generation - Coal	48,373	47,111	12,093	254	12,347	**26%**	26,309	38,656	**80%**	**15,472,670**
Power Generation - Natural Gas	43,312	41,627	10,828	227	11,056	**26%**	23,245	34,300	**79%**	**13,728,956**
Power Generation - Nuclear	71,254	70,341	17,813	374	18,187	**26%**	39,286	57,474	**81%**	**23,004,430**
Power Generation - Other	3,791	3,670	948	20	968	**26%**	2,050	3,017	**80%**	**1,207,683**
Semiconductors	234	187	58	53	111	**48%**	66	177	**76%**	**70,733**
Total Number of Olympic Swimming Pools										**54** million pools
Total Minus Nuclear and Coal, But Including Natural Gas										**14.3** million pools
Total w/o Power										**0.6** million pools

Saving 54 million Olympic sized swimming pools would be roughly equivalent to saving
the water of Lake Tahoe.

Million m3 / Year										
Low Estimate	Present Water Intake	Present Water Discharge	Potential Saving After the Reduce Actions	Potential Saving After the Reuse Actions	Water Saved According to DRIP Research (Reduce and Reuse actions)	% Water Saved After Reduce and Reuse Actions	Potential Saving After the Reclaim Actions	Water Saved Including on Site Reclaim	% Water Saved - After Adding Reclamation	Corresponding No. of Olympic Swimming Pools
Data Centers	145	61	15		15	**10%**	27	42	**29%**	**16,821**
Food & Beverage	1,772	1,099	266	192	458	**26%**	371	829	**47%**	**331,683**
Power Generation - Coal	48,373	47,111	4,8327	174	5,011	**10%**	12,668	17,679	**37%**	**7,076,242**
Power Generation - Natural Gas	43,312	41,627	4,331	156	4,487	**10%**	18,654	23,141	**53%**	**9,262,540**
Power Generation - Nuclear	71,254	70,341	7,125	257	7,382	**10%**	18,915	26,297	**37%**	**10,525,630**
Power Generation - Other	3,791	3,670	379	14	393	**10%**	987	1,380	**36%**	**552,209**
Semiconductors	234	187	23	41	64	**28%**	64	128	**55%**	**51,198**
Total Number of Olympic Swimming Pools										**27.8** million pools
Total Minus Nuclear and Coal, But Including Natural Gas										**9.7** million pools
Total w/o Power										**0.4** million pools

Figures 10 and 11: When applying the method in (J. Rasmussen et al.) we can estimate the potential water savings in the selected industry verticals. On top, the savings of the remaining effluent water have been calculated by applying 75% recovery in the final reclamation process water by on-site wastewater treatment (Carlsberg). It is seen that the potential for reduction and reuse in the data center and power production markets is comparatively low but still significant, because the water usage is primarily for cooling. If we add on-site recycling of the discharged water, the potential savings become relatively high. For the semiconductor vertical, there is relatively high potential for water savings. We know from cases that it is possible to make this happen as best practice within this sector reports up to 65-80% water reuse. The food and beverage sector has significant potential for saving water. Research shows that it is possible to obtain these savings.

By increasing attention and simpler operational measures,

water consumption can be reduced by

10-25%.

Case Studies

Various companies in the US have committed to sustainable water use and have achieved significant water savings and efficiencies in their processes. This has resulted in multiple benefits, including increased risk resilience, increased reliability, climate change resistance and sustainability, setting the stage for others in the US to follow their leadership. The following pages describe four such examples.

Enid RO Facility

Koch Enid Advanced Treatment Facility Expansion

Enid, Oklahoma

Black & Veatch provided engineering and design services to produce two different recycled water qualities for cooling tower makeup water and boiler feed water for a large fertilizer manufacturing plant. The scope included updated water balance for the plant, preliminary and final design, equipment installation and startup support for upgraded advanced water treatment facilities in conjunction with an ammonia system expansion. The advanced water treatment facility will treat 5.5 MGD (20.8 MLD) secondary effluent from City of Enid's municipal wastewater via ultrafiltration (UF) and reverse osmosis (RO). Approximately 1.4 MGD (5.3 MLD) of the RO effluent will be directed to an existing RO and mixed bed demineralizer system at the facility to produce demineralized water for boiler feed water. To meet discharge permit requirements, the RO reject will be treated in a solids contact unit for removal of phosphorus prior to discharge from the site. This project provided climate independent alternative supply source saving about 1.5 billion gallons of freshwater annually.

RARE RO Facility

East Bay Municipal Utilities District Richmond Advanced Recycled Expansion (RARE)

Richmond, California

Black & Veatch provided design, engineering, construction and permitting services for the expansion of the advanced water recycling facility to produce 3.5 MGD (13.2 MLD) of high-quality recycled water for low and high-pressure boiler feed applications.

The RARE project was developed to provide a reliable, climate proof and high-quality water supply for Chevron's refinery operations, such as producing steam to manufacture gasoline, jet fuel, diesel and lubricants, while also conserving potable water that is enough to serve 39,000 homes. To produce very high quality recycled water, Black & Veatch design included feed water chloramination, microfiltration, reverse osmosis and UV disinfection facilities, recycled water storage and pumping systems. The project, which was a public-private partnership with The East Bay Municipal Utility District (EBMUD), Chevron Richmond and the West County Wastewater District (WCWD) had a total capital cost of $55 million in 2010. Chevron is responsible for the capital, operations and maintenance costs, which means there is little or no impact on EBMUD's rates for its customers.

Pureflow, Inc., RO systems

Semiconductor Manufacturing Ultrapure Water Retrofit

Southeast US

A semiconductor manufacturer specializing in silicon carbide wafers aimed to improve sustainability at a facility in the Southeast. Faced with the industry's growing water demands and environmental pressures, the company prioritized water reuse as both a responsibility and strategic advantage. They partnered with Pureflow, Inc., to design and install a process water recovery and ultrapure water (UPW) filtration system tailored to the facility's retrofit constraints.

The system was engineered for high water recovery, energy efficiency and minimal maintenance. It enabled the manufacturer to meet its corporate goal of increasing water recycling by 25% by 2025 compared to a base year of 2019 — achieving this within the first year of operation. On average, the facility now recycles 180,000 gallons of water daily. Maintenance costs also declined due to system reliability and serviceability.

The intelligent chemical feed pumps and controls enable real-time performance monitoring and reduced maintenance frequency. This collaboration between the semiconductor manufacturer, Pureflow, and Grundfos demonstrates how existing water reuse technologies can drive sustainable innovation in water-intensive industries like semiconductor manufacturing.

Photo courtesy of Intel

Intel Corporation Returns 96% of Brine to Manufacturing and Recovers 98% of Water for Reuse Onsite

Chandler, Arizona

In the late 90s, Intel Corporation and the City of Chandler, AZ, constructed the Ocotillo Brine Reduction Facility (OBRF). Intel's investment in reuse systems has allowed it to scale up its operations in the desert Southwest, where water scarcity is a significant barrier to development, supporting about 9,000 jobs across Intel's Ocotillo and Chandler campuses. Since becoming operational, the recycling plant has saved more than 5 billion gallons of water. Intel treats city water to the ultra-pure standard needed for microchip fabrication, rejecting some water that does not meet the standard of purity, or brine, in the process. The OBRF purifies brine using several mechanisms, including reverse osmosis, and returns 96% of it to the facility for manufacturing use.

Intel has invested in the construction and operation of an innovative on-site industrial wastewater treatment facility in Chandler, Arizona, to enable the site to reclaim (treat and reuse) billions of gallons of water each year. The Water Treatment and Recovery (WATR) facility consists of complex treatment systems including biological nutrient removal (BNR), followed by membrane bioreactors (MBR) to treat the total nitrogen (TN) and chemical oxygen demand (COD) loads. The permeate is then sent to ion exchange (IX), reverse osmosis (RO) and thermal systems to treat the total dissolved solids (TDS). The WATR facility has approximately 9 million gallons per day (MGD) treatment capacity and is able to recover 98% of the influent wastewater to feed cooling towers, abatement systems and other facilities equipment. In 2024, the Ocotillo site in Chandler was able to conserve 3.3 Billion Gallons of water with much of that conservation through the OBRF and WATR reclaim facilities.

A Legislative Framework to Enable Increased Water Reuse

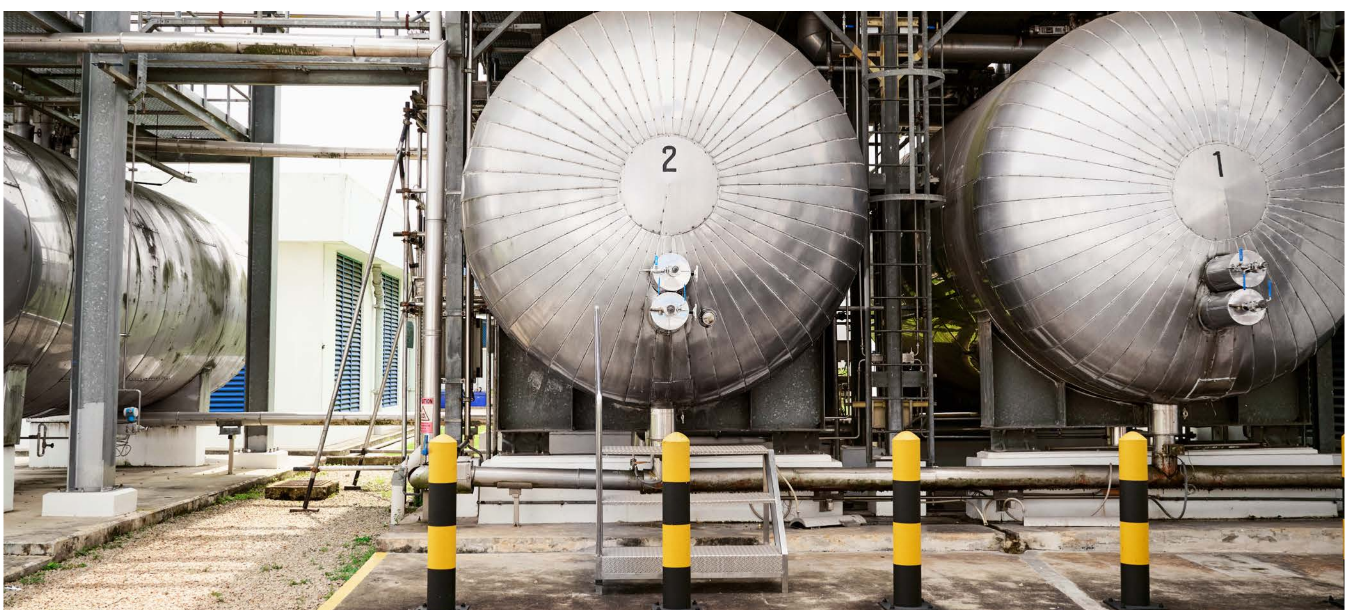
As we noted earlier, addressing the current water crisis — as well as the expected stress that increased demand will cause — requires coordinated efforts across sectors and government at the federal, state and local level. Throughout this paper, we have explored research, data, technology and best practices that support the positive, beneficial and impactful role water reuse has on industrial operations. Through adoption of sustainable practices and innovative technologies — and smart, forward-looking policies — industries, legislators, policy makers and communities can work together to secure long-term water future for the US

Policy engagement at both the federal and state levels is important for developing impactful strategies that will help scale up the use of recycled water by industry. We can do this at the federal level through federal legislation and Executive Branch actions such as rulemaking, program implementation and administrative initiatives. We can also do this through state-level legislating and regulatory development.

Water and energy are interdependent. As the US advances innovation, AI and data center development, increasing water reuse adoption becomes an important consideration for long-term sustainability.

Federal programs are shaped by Congress through two main types of legislation: authorizing legislation, which originates with various authorizing committees and establishes policies and programs; and appropriations legislation, which provides annual funding for federal programs.

For example, legislation can authorize and fund federal loan and grant programs that support the development of municipal recycled water supplies. These supplies can then be used by industrial operations, reducing reliance on freshwater supplies that may already be under stress. States can take similar approaches that encourage industrial operations to consider long-term water demand before construction even begins.



Congress

Congress plays a key role in ensuring that funding and resources are available to develop new and improve existing solutions for increasing the use of recycled water in industrial operations. Examples of potential actions include:

- Extending the funding and authorizations under the Infrastructure Investment and Jobs Act (IIJA), which is set to expire in September 2026.
- Increasing annual appropriations for key water reuse grant programs.
- Establishing a federal investment tax credit to support industrial adoption of recycled water.
- Holding hearings to raise awareness and highlight the importance of water reuse for industrial purposes.

Federal Agencies

Federal agencies and departments can play a role in advancing industrial water reuse by identifying it as an eligible activity within relevant federal programs, where practicable. Coordinated efforts may be supported through the Federal Interagency Working Group on Water Reuse.

- The Environmental Protection Agency (EPA) can highlight and support water reuse as a tool for advancing the Agency's "five pillars," in particular Pillar 1: Clean Air, Land, and Water for Every American; Pillar 2: Restore American Energy Dominance; Pillar 3: Permitting Reform, Cooperative Federalism, and Cross-Agency Partnership; and Pillar 4: Make the United States the Artificial Intelligence Capital of the World.
- The EPA may continue to facilitate and grow the National Water Reuse Action Plan, including efforts to increase the number of actions focused on scaling up the use of recycled water in industrial applications.

White House

An annual recognition program could spotlight companies that demonstrate leadership in industrial water reuse. For example, the "Industrial Water Reuse Champions Award" currently being offered by WateReuse Association in partnership with the US Chamber of Commerce and other organizations highlights best-in-class examples of innovation and impact in this space.

State Level

While congressional action can influence policy across all states, navigating the legislative process can be complex, regardless of a proposal's importance or urgency. Therefore, states are also important for helping advance industrial water reuse by developing, supporting and funding or incentivizing programs within their borders. Many states are already facing stressed water supplies and increasing demand, positioning them to leverage water reuse strategies.

- Tax incentives can be enacted to encourage the use of recycled water by industrial operations.
- States can collaborate with partners, practitioners and experts to develop and formalize industrial water reuse standards and regulations where gaps exist. In some cases, this may involve passing state-level legislation.
- Integrating industrial water reuse into state water resource management plans and economic development strategies can help align long-term sustainability goals.

In the US, water is inexpensive and typically viewed as a utility with reliable delivery. However, in an increasingly water-contained world, low pricing underscores the need for a strong framework that encourages the development and adoption of water reuse solutions.

Policy approaches that are scalable or adaptable to the diverse needs of individual states are critical to ensuring that the water needed to sustain communities and drive economic growth and innovation remains readily available.

CONCLUSION:

Looking to the Future of Industrial Water Reuse

Over the next several years, economic growth, the AI boom and onshoring of industries will present a unique set of opportunities and challenges for American society and industry. It will also put pressure on one of our most precious resources — water, a resource none of us can live without. Looking to the future, sectors including food, data centers, semiconductors and power will be even more essential to our daily lives, yet they will also add demand to an already constrained water supply. Addressing this challenge will be critical to positioning the United States for a strong, resilient future.

Accelerating the adoption of readily available technologies across industries and building a mix of pragmatic and innovative policy solutions at the federal and state level are key steps toward a more sustainable future for the US water supply.

> **It's astounding to look at the potential impact of saving between**
> **27.8 and 54 million**
> **Olympic-sized swimming pools of fresh water annually.**

Yet, that's not just a hopeful idea – it is the potential that lies before us in these sectors.

At the intersection of technology, legislation and private sector action, there is a real opportunity to build resilience and enable water security for communities, businesses and industries across the nation. These data and insights shared here underscore the importance of action and collaboration to build this future, starting today.

Boiler feedwater: Is the water used in boilers to produce steam. The water should be treated to remove impurities and salts to ensure correct operation.

Chemical status: Is based on the concentrations of priority substances relative to Environmental quality standards as established in the Environmental Quality Standards Directive 2008/105/EC.

Cooling water: Water used to lower the temperature of industrial processes. The cooling water is circulating in a cooling tower and is cooled by evaporation.

Decentralized water treatment: Reusing and treating smaller volumes of water locally, e.g., in a factory, contrary to treating large volumes of water from many industries at the municipality.

Ecological status: The cumulative impacts of different pressures, including pollution, habitat degradation and climate change, are incorporated into a combined evaluation.

Fit for purpose treatment: Water treated to meet the specific requirements of a process.

Alternative water sources: Alternative water streams such as repurposed treated wastewater. Not including groundwater, surface water and seawater.

Light industries: Data centers, food and beverage, pharmaceuticals, pulp and paper, semiconductors and other light industries. According to Bluewater Research, 2023.

Manufacturing industries: Manufacturing cooling, food and beverage, textiles, pulp and paper, chemicals, refined petroleum products, basic metals, motor vehicles transport equipment and other manufacturing, according to Eurostat (NACE Section C).

Non-potable water: Water with no intentional contact with humans, or products where the required quality is lower than drinking water standard (water used in cooling towers, closed loop recirculation, toilet flushing, vehicle washing, or other external uses). If the physical barrier is intact, less safety for this water is needed.

Potable water: Water with intentional or potential contact with humans or products where the required quality is drinking water standard or higher (ingredient, direct/indirect contact, cleaning processes).

Process water: Water used in an industrial and/or manufacturing process.

Reverse osmosis (RO): A water treatment process using a membrane to remove dissolved impurities such as salts from water. This is done by applying pressure to force only the water through the membrane leaving the contaminants behind.

Water balance: Identifying all the water related processes in a system and calculating total water use by covering water entering and leaving the system as well as water consumption.

Water circularity: Closed-loop systems where water is continuously recycled, treated and repurposed.

Water efficiency: Optimal water management that aims to sustain or increase intended benefits, while reducing water consumption and pollution (UNEP).

Water-energy nexus: Describes how water and energy are connected. Water is used in the energy industry, and the water system needs energy for treatment, pumping etc.

Water footprint: The volume of water used to produce a service or goods.

Water risk: The potential impacts of water-related issues; including physical (e.g., having too little or too much water), regulatory (e.g., changing or ineffective regulations) and reputational (stakeholder perceptions).

Water scarcity: Describes a problem with water availability, meaning high water consumption compared to water resources available, focusing only on the volume of water.

Water stress: Describes the problem of water availability, water quality and water accessibility, meaning both volume, purity and water access are considered.

WWTP: Abbreviation for wastewater treatment plant.

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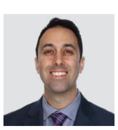
Ufuk Erdal, PhD, PE: Dr. Erdal is serving as the Water Reuse Global Practice and Solutions Director at Black & Veatch with more than 30 years of diverse experience. He led or was directly involved in industrial reuse projects in the United States, Australia, Argentina, Brazil, Taiwan and the UAE offering innovative, sustainable and cost-effective water management solutions for data center cooling, process water for pharmaceuticals, food and beverage and chip manufacturing.

Zeynep Erdal, PhD, PE: Dr. Zeynep Erdal is Black & Veatch's Integrated Solutions and Capabilities Director, overseeing development of sustainable approaches through thoughtful integration of traditional approaches with system scale and data insights based solutions. In her more than 25 year career, she has worked on some of the largest infrastructure renewal planning and implementation programs, driving water resiliency at regional scale. She is a Board Director for Water Research Foundation (WRF) and WateReuse CA, and serves on a number of Technical Practice committees and industry Water Council groups.



Greg Fogel: Mr. Fogel joined the WateReuse Association in January 2019. As Director of Government Affairs and Policy, Greg leads the Association's federal policy work, including its legislative and regulatory advocacy program. Before joining WateReuse, Greg worked for a decade on agriculture policy issues, including issues related to conservation, water quality and water quantity. Greg is a native of California, completed his undergraduate degree at the University of California, Berkeley, and holds a Master of Science degree and a Master of Public Policy degree from the University of Michigan, Ann Arbor.

Chris Hogan: Mr. Hogan is the Director of US Public Affairs & External Relations at Grundfos. He brings more than 25 years of experience in communications, public affairs and media relations, with deep expertise in issues management, advocacy and sustainability. Prior to Grundfos, Chris held senior roles at Burson and several industry associations, representing sectors ranging from energy and agriculture to consumer goods and finance. He holds degrees from Northeastern University and the University of Maryland Global Campus, along with nonprofit management credentials from the US Chamber of Commerce Foundation.

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Courtney Tripp: Ms. Tripp is a results-focused strategy, sustainability leader with 20 years of experience igniting the growth of purpose-driven companies and nonprofits, including five years in the water solutions industry. She is also a Certified Water Efficiency Professional. Courtney is passionate about the importance of increasing sustainability to address the world's water and climate challenges through innovations in industry and manufacturing. She holds a master's degree from the University of Central Missouri and bachelor's degree from the University of Missouri.

Grundfos

Grundfos pioneers solutions to the world's water and climate challenges and improves the quality of life for people. As a leading global pump and water solutions company, we promise to respect, protect, and advance the flow of water by providing energy and water-efficient solutions and systems for a wide range of applications for water utilities, industries, and buildings. For more information, please visit: www. grundfos.us

Black & Veatch

Black & Veatch is a 100-percent employee-owned global engineering, procurement, consulting and construction company with a more than 100-year track record of innovation in sustainable infrastructure. Since 1915, we have helped our clients improve the lives of people around the world by addressing the resilience and reliability of our most important infrastructure assets.

WateReuse

The WateReuse Association is the nation's only trade association solely dedicated to advancing laws, policy, funding and public acceptance of recycled water. WateReuse represents a coalition of utilities that recycle water, businesses that support the development of recycled water projects and consumers of recycled water. We envision a nation in which every community uses water recycling to safeguard public health and achieve environmental and economic resilience. Learn more and get involved: www.watereuse.org