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Untapped Potential: An Assessment of Municipal and Industrial Water Efficiency Potential in the United States

Executive Summary

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ABOUT THE PACIFIC INSTITUTE

Founded in 1987, the Pacific Institute is a global water think tank that combines science-based thought leadership with active outreach to influence local, national, and international efforts in developing sustainable water policies. From working with Fortune 500 companies to frontline communities, our mission is to create and advance solutions to the world's most pressing water challenges. Since 2009, the Pacific Institute has also acted as co-secretariat for the CEO Water Mandate, a global commitment platform that mobilizes a critical mass of business leaders to address global water challenges through corporate water stewardship. For more information, visit pacinst.org.

ABOUT THE AUTHORS

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Bruk Berhanu is a Senior Research Specialist at the Pacific Institute. He works on national assessments of water efficiency and reuse feasibility and potential. Prior to joining the Pacific Institute, Bruk worked in the municipal water/wastewater utility industry where he supported long-range water and wastewater infrastructure planning, short- and long-range water demand forecasting, and water reuse feasibility assessments at multiple spatial scales. Bruk received a bachelor's degree in Civil and Environmental Engineering from the University of Pittsburgh, and a dual master's degree in Environmental and Water Resources Engineering and Public Affairs and a doctorate in Civil Engineering from the University of Texas at Austin.

Heather Cooley

Heather Cooley is the Chief Research and Program Officer at the Pacific Institute. She conducts and oversees research on an array of water issues, such as sustainable water use and management, the connections between water and energy, and the impacts of climate change on water resources. Prior to joining the Pacific Institute, she worked at Lawrence Berkeley National Laboratory studying climate and land-use change and carbon cycling. Heather received a bachelor's degree in Molecular Environmental Biology and a master's degree from the Energy and Resources Group at the University of California, Berkeley. She has served on the California Commercial, Industrial and Institutional Task Force, the California Urban Stakeholder Committee, and the California Urban Water Conservation Council's Board of Directors.

Jessica Dery

Jessica Dery is a Senior Research Associate at the Pacific Institute. Her work addresses impediments and incentives for the use of recycled water in agriculture by merging science, policy, and outreach to promote communication and trust. Jessica has worked on a variety of interdisciplinary projects related to water quality and water reuse including agriculture and food safety, water treatment technologies, power generation, and public perception. Her experience includes conducting synthesis research, co-developing outreach products, and working directly with agriculture communities, utilities, and regulatory agencies. She received a bachelor's degree in Microbiology from Arizona State University and a master's degree in Soil, Water, and Environmental Science from the University of Arizona.

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Sonali Abraham is a Senior Research Specialist at the Pacific Institute. She conducts qualitative and quantitative research into urban water use trends, the development of watershed-scale metrics, the role of multi-benefit projects in water and climate resilience, and associated policy solutions. Sonali received a bachelor's degree in Chemistry from St. Stephen's College in New Delhi, India, a master's degree in Environmental Engineering from Johns Hopkins University, and a doctorate in Environmental Science and Engineering from the University of California, Los Angeles.

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Shannon Spurlock is a Senior Engagement Specialist at the Pacific Institute. Focusing on public policy and practice uptake, she develops and implements strategies for advancing policies and practices on priority topics for the organization, with a focus on scaling the integration of approaches with multiple benefits into public policy and planning. Additionally, Shannon has extensive community-driven food systems experience and has led policy change at the local and state level. Shannon holds a bachelor's degree from the University of Colorado, Boulder, and a master's degree in Nonprofit Management from Regis University.

Peter Gleick

Peter Gleick is co-founder and Senior Fellow of the Pacific Institute working on issues of climate, water, security, and sustainability. He is a hydroclimatologist and a member of the U.S. National Academy of Sciences and a MacArthur Fellow. His work addresses the long-term sustainability of water resources, including developing the concepts of the soft path for water and peak water. He has worked extensively on the human right to water and the consequences of climate change for water resources. He currently focuses on water conflicts and strategies for moving from conflict to cooperation. He has a bachelor's degree in Engineering and Applied Sciences from Yale University and a master's degree and doctorate from the Energy and Resources Group at the University of California, Berkeley.

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Abbreviations

AWE – Alliance for Water Efficiency
AWWA – American Water Works Association
BGD – Billion Gallons Per Day
CBSA – Core Based Statistical Area
CII – Commercial, Industrial, and Institutional
ETAF – Evapotranspiration Adjustment Factor
GASB – Governmental Accounting Standards Board
GPCD – Gallons Per Capita Per Day
GPF – Gallons Per Flush
GPM - Gallons Per Minute
GWh – Gigawatt Hour
IAPMO – International Association of Plumbing and Mechanical Officials
ILI – Infrastructure Leakage Index
kWh – Kilowatt Hour
MAFY – Million Acre-Feet Per Year
MWD – Metropolitan Water District of Southern California
SAWS – San Antonio Water System
SNWA – Southern Nevada Water Authority
U.S. EPA – United States Environmental Protection Agency
USGS – United States Geological Survey
WE-STAND – Water Efficiency and Sanitation Standard

Executive Summary

Water is one of our most precious and vital natural resources and is fundamental for human and ecological health and economic prosperity. Yet, water scarcity is a growing risk for communities across the United States, due in part to natural hydrologic variability, population and economic growth, and the intensifying effects of climate change. The good news is that over the past several decades, communities across the United States have improved the efficiency of their water use, enabling growth and economic activity nationwide. Many communities have seen marked reductions in the amount of water used per person. For some, these reductions have been substantial enough that total water demand has peaked and declined even as the population and economy continue to grow. Even as traditional water sources are stressed, the opportunity to reduce demand through water efficiency remains both vast and largely untapped.

Water efficiency measures, by definition, reduce water demand without affecting the services and benefits water provides. These measures include a variety of technologies and practices, such as replacing old, inefficient toilets, showerheads, and clothes washers with high-efficiency models, as well as installing regionally appropriate landscapes, improving irrigation efficiency, and reducing leakage in the water delivery system. By reducing overall demand and doing more with less, water conservation and efficiency are critical tools for sustaining communities when water supplies are constrained and supporting long-term water resilience.

Water efficiency supports affordability by helping to mitigate rising water and wastewater bills, particularly for lower-income households.

Beyond water savings, water efficiency reduces energy use, lessens water and wastewater treatment costs, and can defer or eliminate the need for costly new infrastructure. Efficiency also supports affordability by helping to mitigate rising water and wastewater bills, particularly for lower-income households. Moreover, improving water efficiency can strengthen environmental resilience, protecting rivers, wetlands, and groundwater systems stressed by overuse. Despite these multiple benefits, water efficiency is often treated as optional rather than foundational in water supply planning. Efficiency efforts remain underfunded compared to new supply projects, and many water utilities rely on outdated water demand forecasts that underestimate ongoing improvements in per capita water demand. Without a shift in priorities, communities risk missing a major opportunity to build resilience at lower cost.

In this first-of-its-kind assessment, we quantify and describe the additional water efficiency opportunities in homes, businesses, institutions, and water distribution systems across the entire United States at the state and national scales. We find that efficiency improvements in these sectors can save 14.0 to 34.1 million acre-feet of water per year, or 12.5 to 30.1 billion gallons per day. These savings represent significant reductions from nationwide water demands, currently estimated at 57.2 million acre-feet per year, or 51.1 billion gallons per day. This means that even basic upgrades to meet current national standards could cut municipal and industrial water demand by one-quarter across the United States. The most ambitious efforts, based on technologies, strategies, and efficiency performance levels that exist today, could reduce municipal and industrial water demands by up to 60% in the most efficient scenario, equal to levels last seen in the 1960s.

Water efficiency gains are possible across all sectors. The residential sector, including both indoor and outdoor water use, offers the largest water savings, while reducing distribution system leakage presents a cost-effective opportunity that has historically been underrepresented in terms of funding and effort. Commercial, industrial, and institutional facilities also have substantial room for improvement through better benchmarking and targeted retrofits.

Efficiency potential exists in every state, and states with the largest efficiency potential tend to fall into two categories. The first category reflects states with the largest populations, where water savings are predominantly driven by the overall number of households, businesses, and water distribution systems affected by efficiency improvements. The second category is states with the highest current-day per capita demands and varying overall populations, where savings are driven by the outsized difference in per capita demands between the current-day estimates and efficiency scenario estimates.

This study also highlights case examples that demonstrate innovative and forward-looking approaches to advancing water efficiency beyond the strategies represented by the efficiency scenarios analyzed. These include strategies such as designing homes with right-sized plumbing and compact hot-water systems to minimize waste; promoting the WaterSense® Labeled Homes program that combines multiple efficiency measures; and proactively managing leaks across water distribution systems. These examples illustrate how communities can build upon the foundational efficiency strategies quantified in this analysis to achieve even greater water savings, operational benefits, and customer satisfaction. They serve as real-world models that can guide water utilities, policymakers, and planners in enhancing and expanding their own water efficiency programs to support long-term water resilience.

Water efficiency is a proven strategy for augmenting and diversifying water supplies, while simultaneously supporting a vibrant economy, reducing water and wastewater utility costs, adapting to and mitigating climate change, supporting water affordability, and maintaining healthy freshwater ecosystems for current and future generations. Communities, water utilities, and policymakers can and should elevate water efficiency as a central element of water management. This includes investing in efficiency programs and incentives; modernizing demand forecasting methods; strengthening regulations for fixtures, landscapes, and buildings; expanding education and outreach; and integrating efficiency savings into infrastructure and financial planning. Here, we offer recommendations to help realize the untapped potential of water efficiency through changes in policies, programs, and investments.

Expand funding and financing opportunities for water efficiency programs. Water efficiency improvements are typically the cheapest, fastest way to meet water needs. Yet, investments in water efficiency are often far less than investments in developing new water supplies, such as recycled water and desalination. Depending on the relevant local and state statutes, some water utilities can leverage capital budgets to finance more extensive efficiency program investments. Accelerating water efficiency improvements will require new funding and financing strategies and policy changes to reduce or remove these obstacles.

Increase financial and non-financial water efficiency incentives for customers. Incentives are effective strategies for promoting the adoption of water-efficient technologies, practices, and behaviors. These incentives can take many forms. For example, the WaterSense program is a powerful public-private partnership that provides a simple way for customers to identify high-performing water-efficient products and services while driving innovation in American manufacturing. Likewise, financial incentives, such as tax credits, discounts, and rebates, can motivate customers to purchase efficient products and support new business opportunities.

Provide water efficiency incentives to retailers, installers, and manufacturers. While most water efficiency incentives target individual customers, they can also be designed to incentivize, for example, retailers, installers, and manufacturers. These upstream and midstream incentives are more commonly employed by the energy sector but could also be used to advance water efficiency.

Update standards and codes. Standards and codes have been cost-effective strategies for saving both water and energy and lowering utility bills for households and businesses. The Energy Policy Acts of 1992 and 2005 established maximum water use rates for a variety of plumbing products and appliances sold in the United States. Accelerating efficiency improvements requires broad adoption of these standards and codes, and further revisions as new devices are developed and proven in the field, to reflect the most up-to-date technologies and practices.

Reduce water distribution system leakage. Leaks in the water supply and distribution system result in a loss of both water and revenue. Reliable data on system leakage are limited because adequate monitoring systems and requirements are not in place and available data are often not reported and/or used. However, available data suggest that significant opportunities to reduce system leakage exist across the country. Capturing these savings requires monitoring and reporting, as well as the adoption of performance standards, as has been done in only a minority of states.

Adopt universal metering and conservation-oriented water and sewer rates. Water and sewer rates play an essential role in communicating the value of water and promoting the wise use of water resources. Universal metering supports accurate monitoring of water use for efficiency performance benchmarking and goal-setting, and well-designed rate structures support multiple objectives, including the financial viability of the water utility, efficient allocation of water, water affordability, and environmental sustainability.

Expand data collection and monitoring. Limited data and information are available for water use at the end-use level (i.e., fixtures and appliances). In the commercial, industrial and institutional sector, data for subsector (i.e., industry type) rates and drivers of water use are even less common. Consistently reported data collected at regular time intervals under a standardized framework and customer categories are needed to inform decisions about water efficiency opportunities and challenges, as well as projections of water demand, water availability, and investment needs.

Fill critical research gaps. There remain outstanding research questions that must be addressed for effective implementation of water efficiency measures. Agencies across all levels of government, academics, water utilities, and community-based organizations have a role to play in filling these gaps.

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