Investing in the Next Essential Utility: The Case for Decentralized Water Infrastructure

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Executive Summary (Contents at a Glance)

This white paper outlines the pressing global water crisis and highlights the opportunity to address it through decentralized water treatment and reuse systems. Key points include:

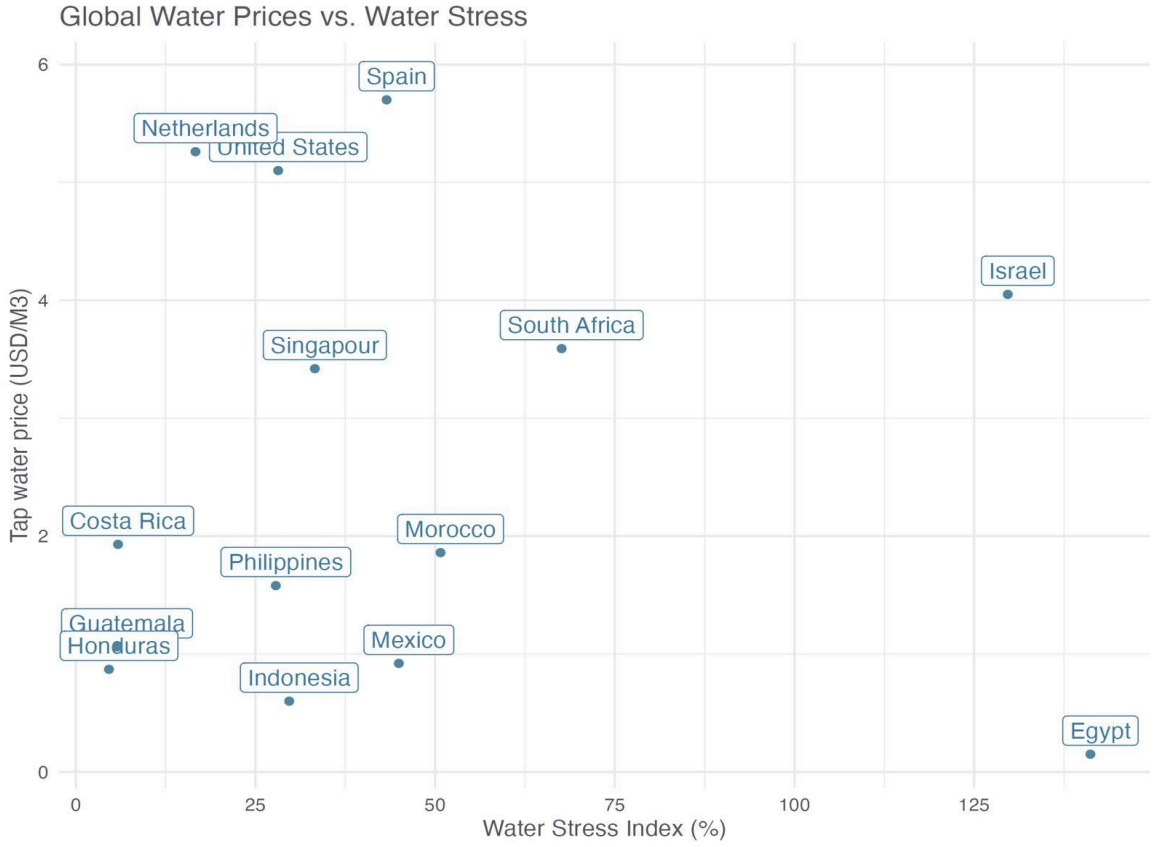
I. The Global Water Crisis: A Convergence of Risks Highlights global water stress, public health impacts, and climate-driven vulnerabilities due to untreated wastewater.
II. The U.S. Infrastructure Deficit and Global Imbalances Details the severe funding shortfall in U.S. water systems and its economic implications, both nationally and globally.
III. Why Decentralization Makes Sense Explains how modular, local water treatment systems provide flexible, efficient solutions compared to outdated centralized models.
IV. The Hydrous Model: Water as a Service (WaaS) Introduces Hydrous' infrastructure-as-a-service platform, emphasizing its capital efficiency, ESG benefits, and real-world success cases.
V. Market Entry: How to Invest in Water Outlines public and private avenues for water investment, comparing decentralized water to the solar energy boom.
VI. The Arbitrage Advantage Illustrates how regional price differences in water supply and disposal create high-margin opportunities for decentralized systems.
VII. Global and Corporate Tailwinds Reviews how regulation and corporate water stewardship are driving adoption of decentralized reuse solutions.
VIII. Returns and Resilience Summarizes strong financial performance metrics of water reuse assets, including short payback periods and high IRRs.
IX. From Scarcity to Security: The Role of Investors Calls for private capital to close the water infrastructure gap and scale decentralized systems globally.
X. Conclusion Reinforces the economic and environmental logic for investing in decentralized water reuse as a strategic infrastructure solution.

Introduction

The global water crisis is no longer a distant threat but a present reality. Driven by climate change, population growth, and urbanization, water demand is outpacing supply, and existing infrastructure is unable to keep up. This white paper explores why investment in water infrastructure, particularly decentralized water treatment and reuse, is a strategic, urgent, and profitable move for governments, industries, and private investors. While the global nature of the crisis is acknowledged, the United States is used throughout this report as a focal case study, given the scale of its infrastructure deficit, the maturity of its markets, and its relevance for guiding investment frameworks applicable in other geographies.

I. The Global Water Crisis: A Convergence of Risks

Water scarcity affects every continent. According to the United Nations, 80% of wastewater is discharged into the environment untreated, and 44% of household wastewater is reused without being treated. As a result, 1.8 billion people are exposed to potentially harmful contaminants. Diseases like cholera, typhoid, and dysentery are closely tied to poor wastewater management (WHO, 2024; UN-Water, 2018).



Graph 1: Global Water Prices vs. Water Stress

This visualization illustrates a paradox: regions experiencing the greatest water stress often have the lowest water prices, disincentivizing investment and conservation. Sources: FAO (2025) and Global Comission on the Economics of Water (2023).

In parallel, 74% of natural disasters between 2001 and 2018 were water-related, including floods and droughts (UNICEF, 2024). Climate change is exacerbating these trends, placing

immense pressure on water systems and increasing the need for infrastructure capable of adapting quickly and effectively.

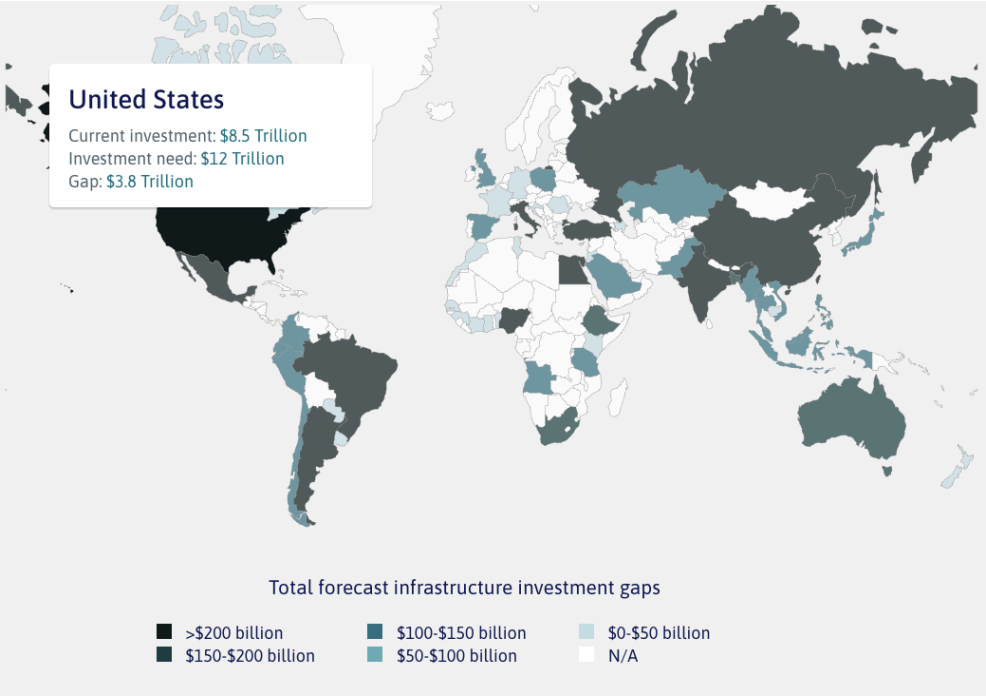
Water infrastructure is a core foundation of public health, economic productivity, and environmental stewardship. Without sufficient investment and innovation, communities risk being left vulnerable to shocks ranging from disease outbreaks to industrial disruption and agricultural failure.

These global challenges are mirrored—and magnified—at the national level. In countries like the United States, where aging infrastructure and fragmented regulation prevail, the disconnect between water stress and investment is especially acute. Understanding the U.S. infrastructure deficit offers a critical lens into the scale and urgency of the problem—and the opportunity.

II. The U.S. Infrastructure Deficit and Global Imbalances

Despite water's foundational role in economic productivity, infrastructure investment as a whole remains severely underfunded across sectors. The United States faces a historic shortfall in funding for critical infrastructure — from transportation and energy to broadband and water — threatening national competitiveness and resilience.

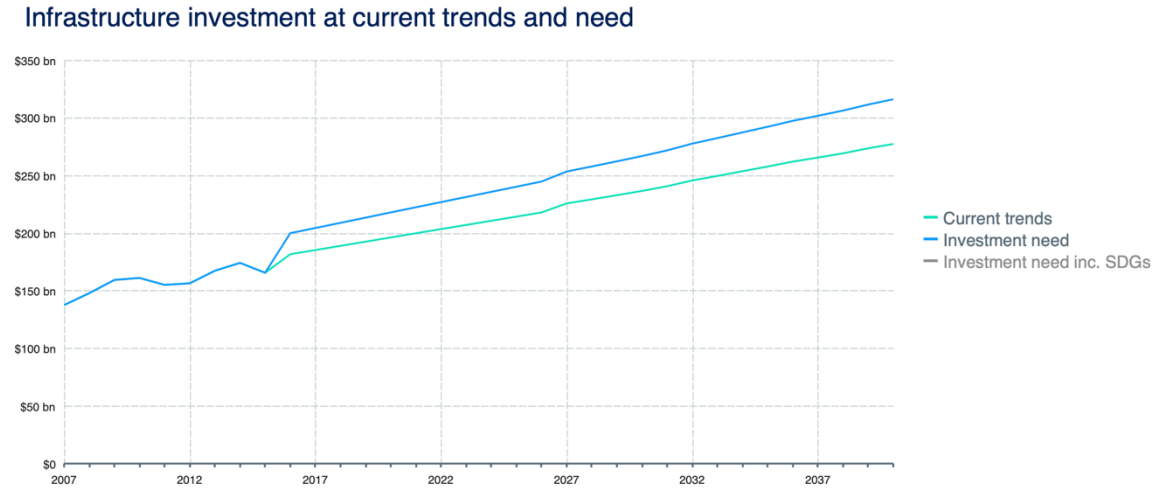
California has embraced water reuse as part of its long-term water security strategy. In response to sustained droughts and water scarcity, the state has launched initiatives such as Los Angeles' Operation NEXT and San Diego's Pure Water program, both aimed at treating and reusing municipal wastewater to meet a growing share of urban water demand. These examples underscore the potential of innovative reuse technologies when backed by local policy, funding, and public support.



Graph 2: Total Infrastructure Investment Gaps. This chart shows the estimated U.S. infrastructure funding gap across key sectors over the next 20 years, with water systems representing a major share of unmet needs

Sources: Oxford Economics - Global Infrastructure Outlook. (2017)

The American Society of Civil Engineers (ASCE) estimates a $500 billion gap in water and wastewater infrastructure investment in the United States alone. Fully closing this gap could add $4.5 trillion to GDP, create 800,000 jobs, and boost average household income by $2,000 per year (ASCE, 2020).



Graph 3: Water Investment Gaps A shortfall in water and wastewater investment threatens long-term sustainability and economic competitiveness
Sources: Oxford Economics - Global Infrastructure Outlook. (2017)

Despite this urgency, less than 0.3% of U.S. water is recycled, according to The New York Times (Walsh, 2012). This underperformance not only exacerbates stress on dwindling freshwater supplies but also results in missed economic opportunities.
While California has made significant progress, national policy and market mechanisms remain underdeveloped. The challenge is not just technical—it is institutional, financial, and cultural.

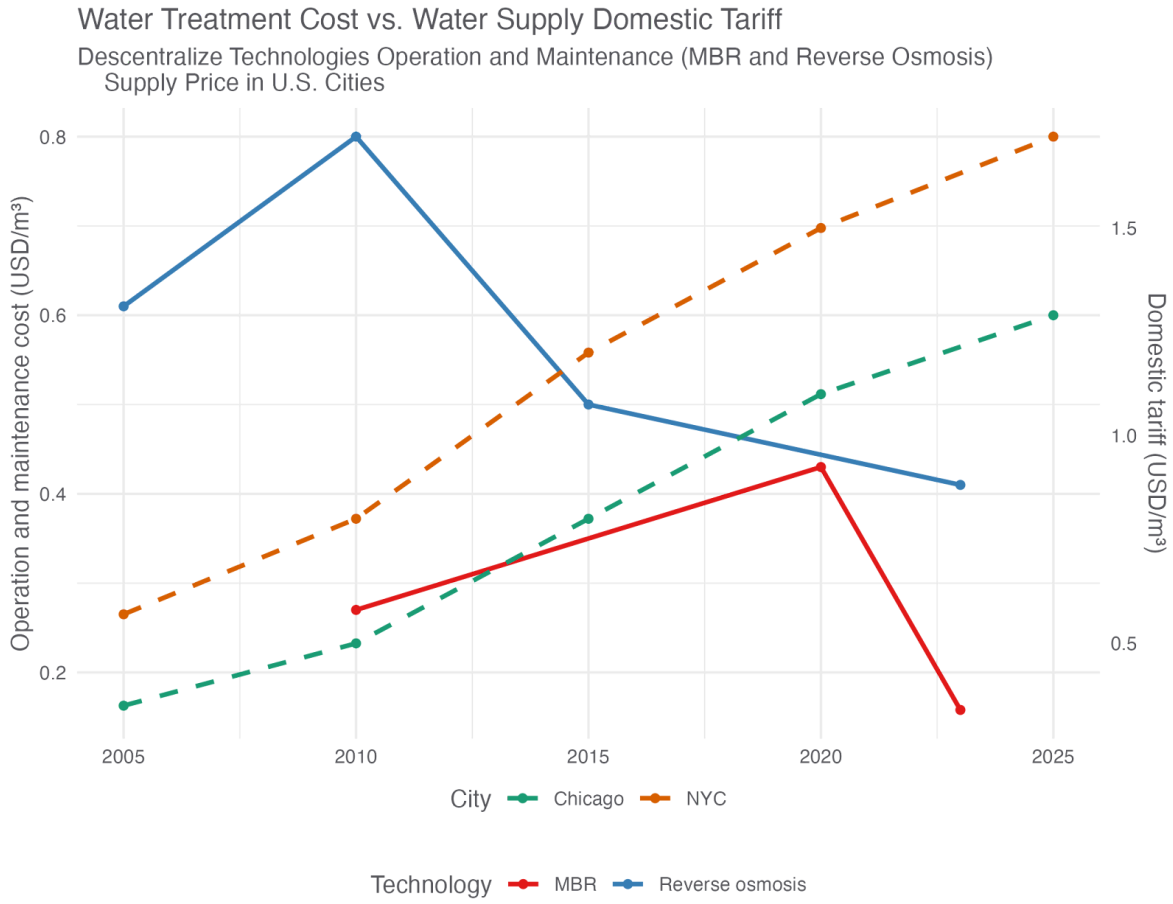
III. Why Decentralization Makes Sense

Traditional water systems were designed for centralized economies of scale—large treatment plants, long distribution networks, and significant upfront public capital. While effective in the past, these systems are inflexible, slow to adapt, and costly to maintain. In an era of climate volatility, population shifts, and rising energy prices, centralized infrastructure struggles to keep pace. It is vulnerable to single points of failure, requires massive investment to expand or upgrade, and often fails to serve rapidly growing or remote communities efficiently.
As economist Kate Raworth notes in *Doughnut Economics*, "We need economies that are distributive by design and regenerative by intention." This principle directly supports decentralized water systems: they distribute functionality closer to where it's needed and regenerate water resources at the local level, aligning economic development with ecological boundaries.

By contrast, decentralized water treatment offers a modern, adaptable alternative:

- Modular: Systems can be added or removed as needed.
- Localized: Treatment occurs near the point of generation and use.
- Flexible: Can be tailored to specific contaminants and reuse goals.
- Efficient: Minimizes the need for extensive infrastructure and pumping.

Decentralization supports the principles of the circular economy and resource optimization. Wastewater is no longer a burden—it becomes a local asset that is treated, repurposed, and reintegrated into the system, reducing both environmental impact and operating costs.



Graph 4: Technology Evolution – Costs of RO and MBR vs. Water Prices
This graph shows how the costs of advanced treatment technologies like reverse osmosis and membrane bioreactors have declined, enabling more cost-effective decentralized solutions. Sources: Worley Consulting, National Research Council (2006), Poole (2023), Verrecht et al. (2015), He et al. (2023), Cosín (2019), Arif et al. (2020), City of Houston (2009; 2020), Ketchum (2018), New York City Water Board (n.d.) and McGuinnes (2021)

Among the decentralized approaches emerging worldwide, several platforms have innovated on both the technological and financial models for deployment. One such example is Hydrous, which brings modular treatment technology and infrastructure-as-a-service financing into alignment. Its model, detailed below, demonstrates how decentralized systems can become bankable, investable, and highly scalable.

IV. The Hydrous Model: Water as a Service (WaaS)

Hydrous offers a decentralized, asset-light solution to water infrastructure through its Water as a Service (WaaS) model. Instead of requiring clients to invest in capital-intensive equipment, Hydrous finances, deploys, and operates modular water treatment units, charging only for the

volume or quality of water treated and reused. This shifts the capital and technical burden away from users and enables faster, more cost-effective deployment.

This model is particularly well-suited for:

- **Industrial facilities** in remote or water-stressed areas, such as oil & gas, mining, or automotive plants, where water recycling reduces logistics and supply risk.
- **Commercial users** like hotels, resorts, and shopping centers that generate large wastewater volumes but lack access to municipal reuse systems.
- **Food and beverage operations**, where clean-in-place (CIP) and sanitation processes demand large volumes of water, and wastewater carries high organic loads.
- **Real estate developers and industrial parks**, which often face delays and rising costs due to overburdened public infrastructure.
- **Municipal governments and utilities** seeking cost-effective alternatives to expand treatment capacity or reduce reliance on overextended centralized networks.

The approach comes with multiple benefits:

- **No CapEx for end users**: Removes a major barrier for adoption.
- **Risk transfer**: Operational and technical risk is assumed by Hydrous.
- **Scalable economics**: Investors benefit from asset-backed cash flows.
- **Circular impact**: Clients reduce their water footprint and improve ESG metrics.

Case studies demonstrate the versatility of the model:

- **Oil & Gas:** Treatment units reduced sludge by up to 90%, removed residual oil, and outperformed traditional DAF systems—cutting operational costs and increasing water reuse.
- **Food & Beverage:** Mobile WWTP effluent is reused for vehicle washouts and irrigation, ensuring compliance and lowering municipal water dependency.
- **Hospitality:** On-site electrochlorination replaced hazardous chemicals, improving safety, automation, and regulatory compliance for large-scale resort operations.
- **Paints & Coatings:** Sludge was dewatered on-site, reducing hauling and disposal costs by 70% and enabling safer, more efficient waste management.

V. Market Entry: How to Invest in Water

Water infrastructure is historically underrepresented in investment portfolios. Yet it offers inflation-resilient, essential-service characteristics similar to energy or transportation. Options include:

- **Public Equities**: Shares in large water companies like Veolia, Xylem, and American Water Works.
- **ETFs**: Basket funds like Invesco's CGW offer diversified exposure.
- **Private Equity**: Direct investment in operators like Gradiant, Fluence Corporation, Skion Water, with stable long-term contracts.

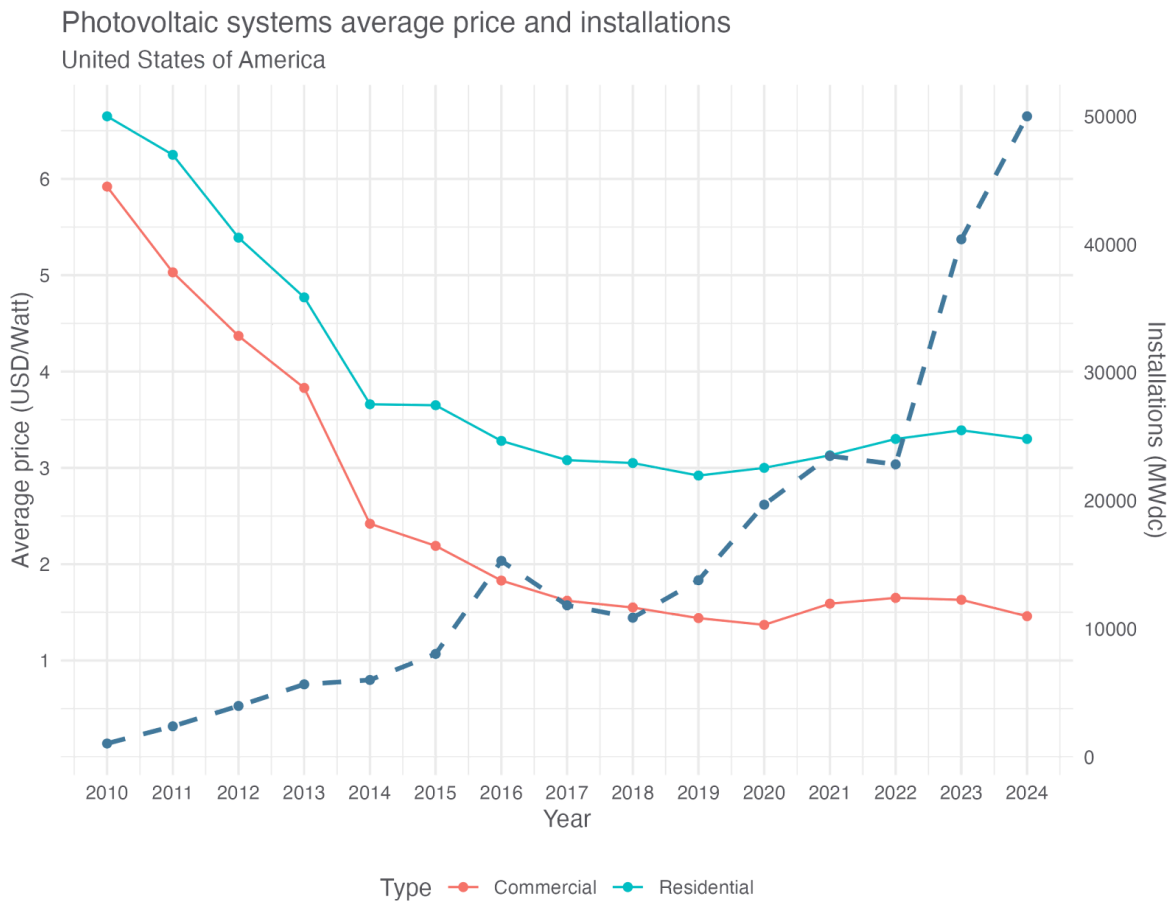
What once seemed unusual — investing in a mobile panel that converts sunlight into electricity — is now mainstream. These modular systems are financed, deployed, and monetized through long-term purchase agreements. Today, solar power is not just green; it is investable.

Water is now on the verge of the same transition.

Just as solar panels capture a raw feedstock (sunlight) to produce a saleable output (electricity), modular water treatment systems capture wastewater — a liability — and convert it into a valuable product: clean, usable water.

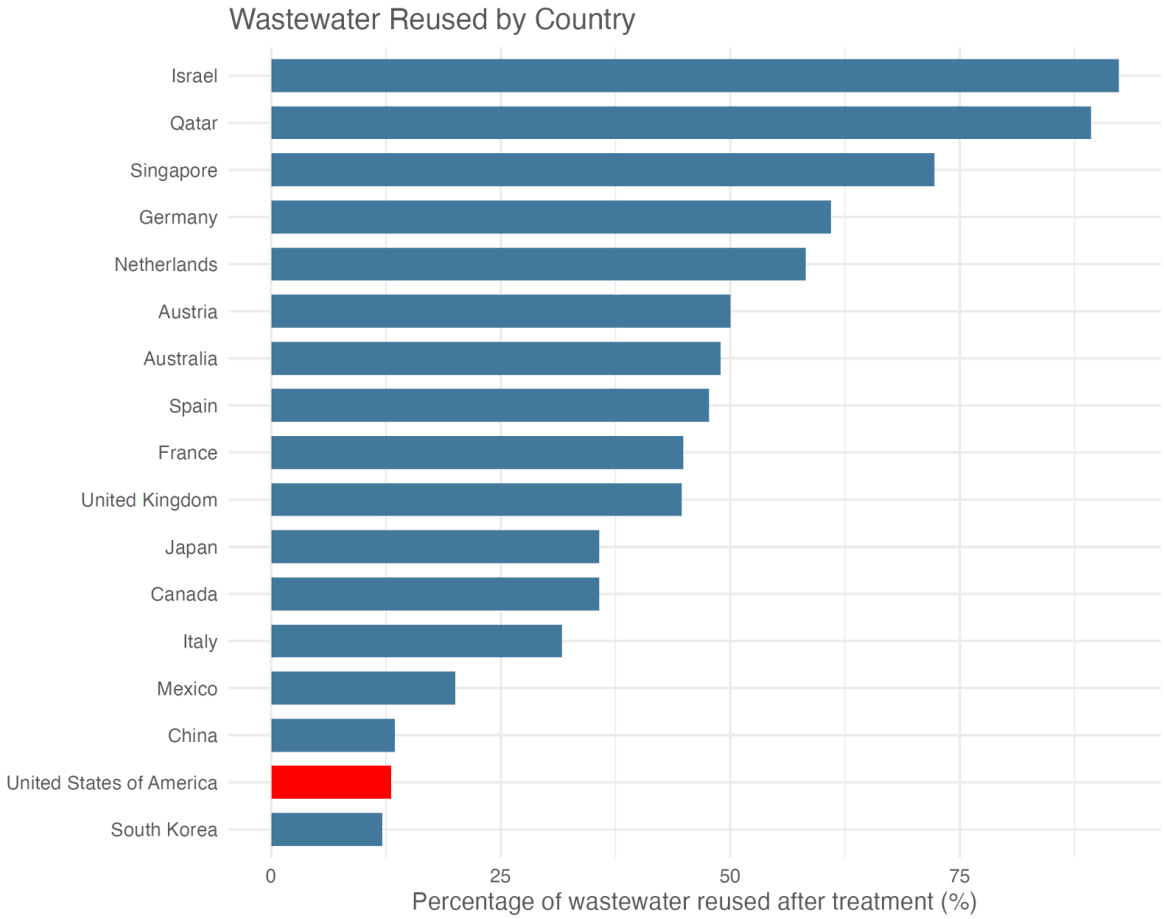
The story of solar, as shown in Graph 5, demonstrates that investors will back small, mobile, capital-efficient assets when the economics, regulation, and infrastructure needs align. Water is now at that inflection point.

As capital flowed into solar, scale increased and costs dropped — making it one of the most successful decentralized infrastructure stories of the last two decades.



Graph 5: Installed MW vs. Cost of Solar Installations
This graph illustrates how capital inflows and scale reduced solar costs dramatically—a similar transition is poised to occur in water. Sources: Solar Energy Industries Association (2025).

While countries like Israel and Singapore have made water recycling central to national strategy, the United States significantly lags behind other developed nations. Unlocking reuse at scale is a public health, economic, and investment imperative.



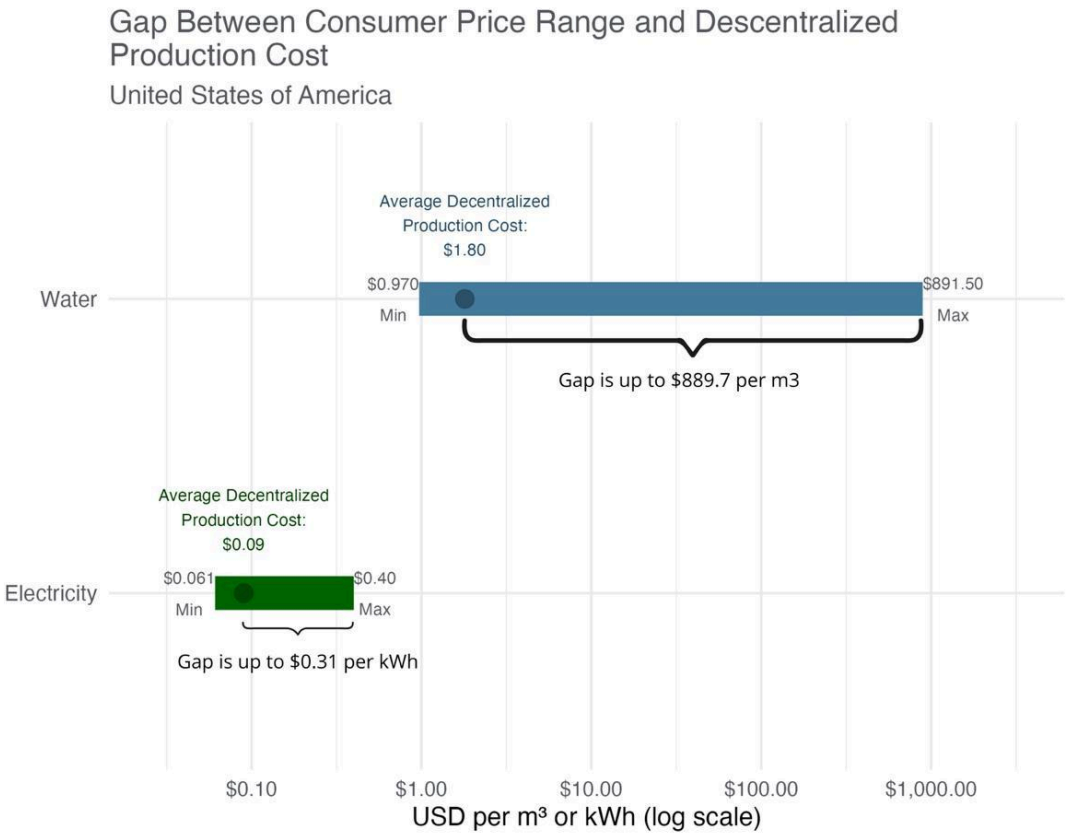
Graph 6: Wastewater Reuse by Country

Comparison by nation shows immense variability. Israel reuses over 85% of its water; the U.S. is below 10%, and Mexico lower still. The gap represents opportunity. Sources: Yale Center for Environmental Law & Policy (2024) & Jones et al. (2020).

This gap is not just a statistic — it's a map of opportunity. Wastewater reuse is essential to address water scarcity, reduce environmental impact, and cut costs for industry and municipalities alike.

VI. The Arbitrage Advantage

One of the most compelling investment features of decentralized water infrastructure is its powerful economic arbitrage opportunity. Unlike electricity markets—where regulatory frameworks and competition have narrowed pricing spreads—water markets remain inefficient, fragmented, and often heavily subsidized. This creates a unique opening: in many regions and use cases, the cost of producing recycled water on-site is significantly lower than the combined cost of purchasing fresh water and treating or disposing of wastewater.



Graph 7: Electricity and Water Prices vs. Decentralized On-Site Systems
This visual illustrates the significant margin between production cost and market prices, especially in industrial use cases. The water decentralized cost is for sanitary wastewater. Sources: U.S-Mexico Climate Change Agenda Working Group (2021), Iglesias et al., 2022, Bluefield Research (2025) and U.S. Energy Information Administration (2025).

As illustrated in Graph 7, the average cost of decentralized sanitary water treatment is around $1.80/m³, while industrial water users may pay up to $891.50/m³ when factoring in supply, disposal, and regulatory costs. This change delta of $889.7/m3 makes water recycling one of the most lucrative infrastructure investments available.

In contrast, the average cost to produce decentralized electricity via solar is approximately $0.09/kWh, while grid-supplied electricity can reach up to $4.00/kWh at the top end of the market—still a significant margin, but far narrower than in the water sector and already heavily capitalized by institutional investors.

What makes this moment particularly advantageous is timing. We are at the early stages of a transformation similar to what solar and wind energy experienced a decade ago. Investors entering now can benefit from:

- Undervalued markets with untapped high-yield project opportunities.
- Favorable regulation trends, such as tightening discharge norms and ESG pressures.
- Low competition relative to mature infrastructure sectors.
- Growing customer demand for water independence and resilience.

The decentralized model is also inherently scalable: mobile, modular units can be quickly deployed to serve high-value clients in regions where centralized infrastructure is overwhelmed, delayed, or economically infeasible.

For private capital, this convergence of low-cost production, high demand, and wide pricing spreads offers an unmatched opportunity to generate strong, recurring cash flows from infrastructure that is not only profitable but essential for long-term sustainability.

VII. Global and Corporate Tailwinds

The transition to decentralized systems is being accelerated by a combination of regulation, corporate leadership, and technological innovation.

Regulation

In the U.S., the EPA has launched initiatives to promote water reuse, while the State Revolving Fund offers low-interest financing for infrastructure upgrades. In parallel, Mexico's environmental laws are being tightened to require more effective wastewater treatment.

Corporate Commitments

Major firms are adopting water-positive goals:

- Microsoft aims to replenish more water than it consumes by 2030.
- Amazon and Intel are investing in closed-loop water systems.
- Coca-Cola has announced water neutrality across operations.

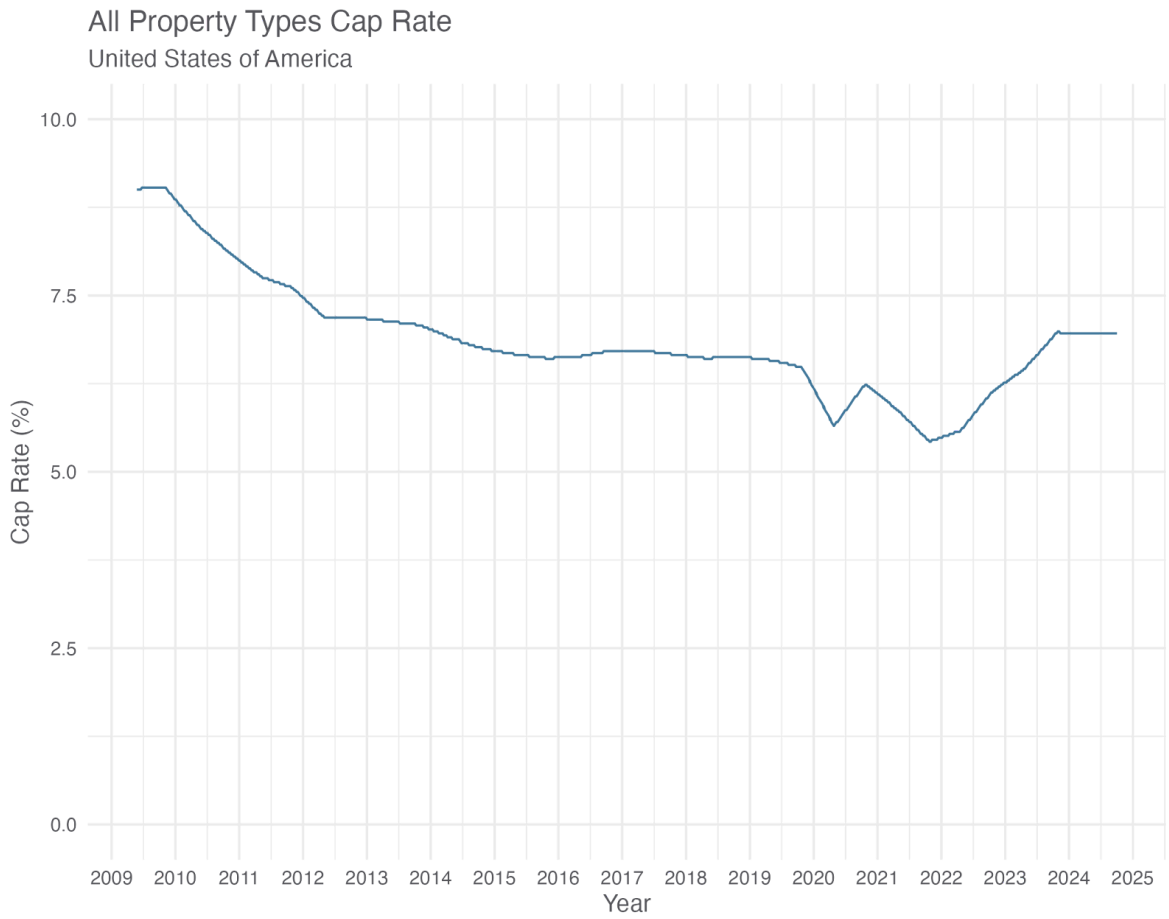
These actions not only reduce risk but enhance reputation and investor confidence.

VIII. Returns and Resilience

Water is an uncorrelated asset class with downside protection. Decentralized installations have shown:

- **Payback periods under 24 months**
- **Internal rates of return above 30%**
- **2.8x to 4x cash-on-cash returns over contract life**

These figures rival and often exceed returns from real estate or renewable energy.



Graph 8: Real Estate Cap Rates.. *Sources: CBRE (2025)*

IX. From Scarcity to Security: The Role of Investors

Solving the water crisis will require trillions in investment over the coming decades. Decentralized systems, with their lower barriers to entry and faster deployment, are a powerful tool in this transition.

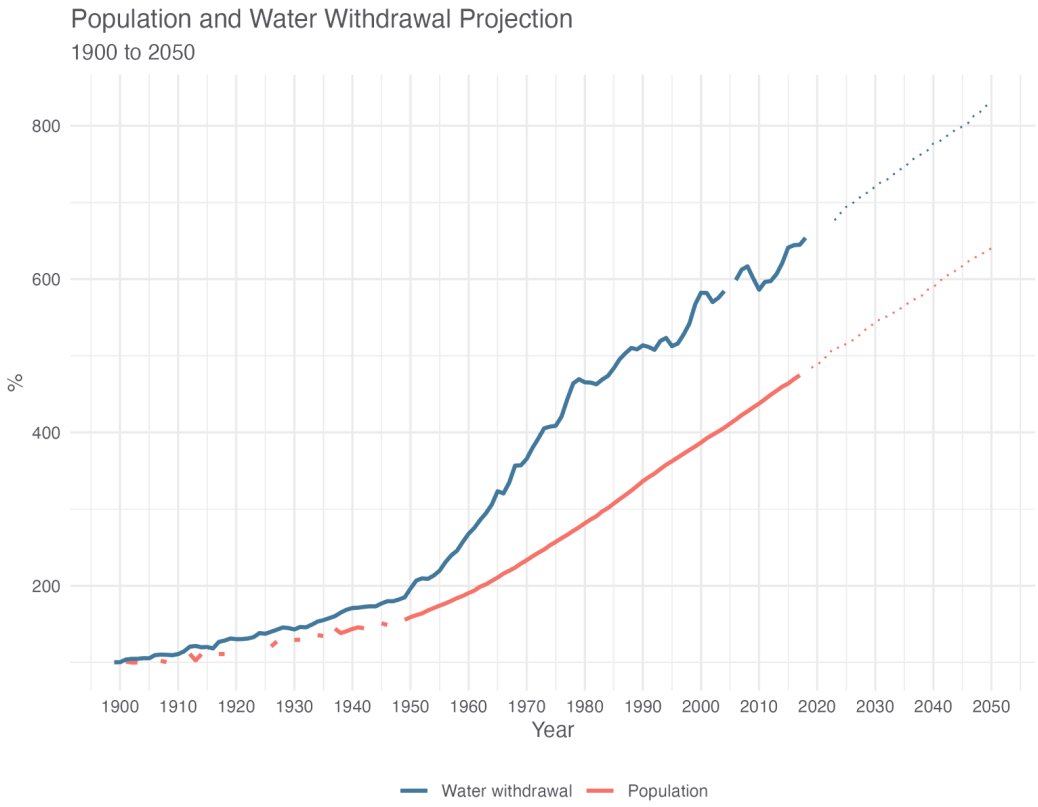
By supporting platforms like Hydrous, investors can:

- Unlock recurring revenue from critical infrastructure.
- Hedge against inflation and climate volatility.
- Deliver measurable social and environmental returns.

X. Conclusion

The global water challenge is urgent, but solvable. The tools exist. The technology is proven. What remains is capital, coordination, and conviction.

For investors seeking sustainable impact, long-term cash flow, and alignment with megatrends, decentralized water infrastructure offers one of the clearest opportunities of the 21st century**.**



Graph 8: Future Projections – Population Growth vs. Water Demand
This projection shows a sharp divergence population and water withdrawal growing rates. Sources: Boretti and Rosa (2019).

As shown in Graph 8, water demand is rising sharply—outpacing both population growth and the availability of reliable freshwater supplies. This growing imbalance is exacerbated by climate change, urbanization, and failing infrastructure. Inaction will only deepen the crisis.

It is therefore essential to act now and adopt scalable, proven strategies like decentralized water recycling. These systems can be deployed quickly, tailored locally, and financed flexibly—delivering both environmental resilience and economic returns.

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