UPSTREAM STRATEGIES: Future Water Research & Innovation Solutions

# ECONOMIC

# Financial Sustainability

**In the next 10 to 20 years, disruptive challenges like financial sustainability may continue to impact the ability of water utilities to meet their committed levels of service for their ever-changing service areas. How can utilities provide capital-intensive and critical services in the face of increased costs, limited resources, and economic uncertainty?**

## CRITICAL FUTURE DISRUPTORS

For the purposes of this effort, a disruptor is defined as something that interrupts an event, activity, or process by causing a disturbance, problem, or opportunity. Disruptors can arise as barriers to normal operations or may present opportunities to do things differently/innovate.

The following items were chosen by a diverse group of water leaders and experts as the most significant future disruptors that water utilities must anticipate and plan for.

### TECHNOLOGY
Various technological advances (e.g., machine learning, artificial intelligence) will impact utilities' financial bottom line. Some technologies might lower costs in the long run but require significant up-front costs. Increased investment in renewables could drive energy costs down.

### CLIMATE CHANGE
Utilities can count on unpredictable weather patterns, leading to an increased frequency of natural disasters (e.g., drought, flooding, wildfires). Water scarcity in many areas could increase.

### REGULATORY
Regulations will continue to change and become more stringent, and utilities will have to juggle competing regulatory objectives (e.g., greenhouse gas emission limits, zero discharge requirements, emerging contaminants, etc.). The federal government may take a larger role in water management and financial requirements.

### CHANGING CUSTOMER BASE
Demographic changes will affect utilities across the board. Many communities might experience diminished trust in water agencies, shifts in the way the public values water, and other disruptive changes.

### WATER USE CHANGES
Changes in water use patterns are likely to occur because of population changes, increased water efficiency, prolonged droughts, and in some cases, permanent loss of water supplies.

### DECENTRALIZATION

There will likely be an increased drive to decentralize water infrastructure. Many areas may choose to implement non-sewered sanitation solutions, point-of-use water treatment approaches, and closed-loop systems.


## RESEARCH OPPORTUNITIES

Based on these critical future disruptors, experts prioritized the following targeted research areas:

### WORKFORCE

Research is needed on creative ways to recruit the next generation of the water workforce. Utilities should raise awareness of the vast range of roles now available in the water sector, so that they can attract not just those with water and wastewater backgrounds, but those with sustainability and financial expertise.

### SMART WATER TECHNOLOGY

Research is needed to standardize and make smart technology (e.g., real-time automated monitoring, sensors, and modular treatment systems) more accessible to utilities. Machine learning should be further investigated to inform the next generation of process design and control.

### ASSET MANAGEMENT

Research is needed on programs allowing shared use of private land for stormwater management and more concentrated development to avoid sprawl. Research should also focus on asset management approaches emphasizing consolidation and right-sizing—so that water utilities build only what they need.

### INNOVATIVE FINANCING

Research is needed to help utilities identify strategies to reduce their reliance on federal and state funds, and on practical implementation of innovative financing approaches like performance and green bonds. Research is needed to identify alternative revenue sources to support water affordability programs.

### POLICY, ADVOCACY, AND COLLABORATION

Research is needed to on how community values might evolve as climate change and water scarcity advance. Additional research is needed to identify strategies to enhance public recognition of the value of water services, e.g., incorporating recovered wastewater nutrients into fertilizers, raising awareness about the financial and environmental benefits of water and wastewater services, the need to build producer responsibility to reduce pollutants from source water, strategies to promote watershed-based governance, and more.

### NATURE-BASED SOLUTIONS

Research is needed on better ways to value our natural assets. Natural systems can also be our guide when it comes to exploring innovative technical solutions—research on biomimicry will be necessary.

### WATER CONSERVATION AND REUSE

Research is needed to better understand water use in various customer categories. Reuse research should investigate separate streams in buildings for black water, gray water, etc., and how to drive wide-scale adoption of building-level decentralized wastewater treatment and reuse.

### PRICING

Research is needed on how funds from increased taxes on vehicles, chemicals, etc. could be directed to utilities and other institutions that must deal with environmental impacts. Utilities should also explore new revenue streams and reimagine water pricing (e.g., time-of-day billing).