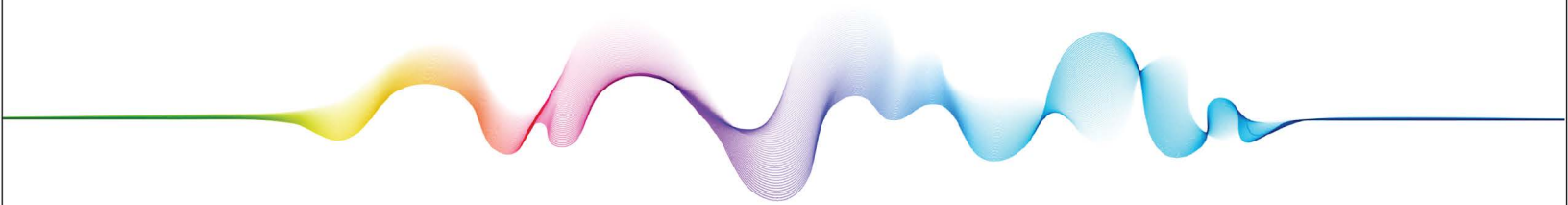


INSIGHT REPORT

AN OVERVIEW OF WATER MANAGEMENT



CLIMATE SCIENCE



TAG Insights Report: An Overview of Water Management

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Introduction

This TAG Insights Report on *Water Management* is intended to help companies, managers, practitioners, researchers, investors, and commercial vendors better understand current trends, issues, and market opportunities in this area. A list of representative commercial vendors working in various areas of water management is included. The five specific areas covered in this report include:

1. Water Purification and Filtration
2. Smart Irrigation and Agriculture
3. Industrial Water Recycling
4. Stormwater Management
5. Desalination Technologies

This report is intended for general and unrestricted use, but interested readers are encouraged to connect with the TAG research and advisory team for more information on the private [TAG Research as a Service \(RaaS\)](#) community that covers, discusses, and shares information on these topics in more depth and includes a wider range of startups, vendors, and companies.

TAG Climate Taxonomy

Our advisory work at TAG is guided by our TAG Climate Taxonomy which includes twenty different market categories, with one hundred associated subcategories – all developed consistent with our research into emerging and existing commercial offerings. Subscribers to

TAG Research as a Service (RaaS) have access to the more detailed specifics of the taxonomy and the full set of companies working in each area.

The taxonomy is intended to be interpreted as a market guide for commercial (and in some cases, open source) platform, tools, products, and services. The day-to-day tasks of any practitioners focused on sustainability will include many considerations such as dealing with regulators, addressing compliance issues, and keeping up with legislation that will not typically be represented in our taxonomy. We focus here on products and services.

TAG Climate Taxonomy V2.0 – 1Q2024

1 Renewable Energy 1.1 Solar and Wind Power Generation 1.2 Fission and Fusion 1.3 Hydropower Innovations 1.4 Geothermal Energy Technologies 1.5 Bioenergy and Biomass Systems	6 Water Management 6.1 Water Purification and Filtration 6.2 Smart Irrigation and Agriculture 6.3 Industrial Water Recycling 6.4 Stormwater Management 6.4 Desalination Technologies	11 Climate Data Analytics 11.1 Climate Modeling and Prediction 11.2 Weather Forecasting Technologies 11.3 Environmental Monitoring Services 11.4 Climate Risk Assessment Service 11.5 Carbon Footprint Assessment Tools	16 Eco-Friendly Consumer Products 16.1 Sustainable Fashion and Textiles 16.2 Eco-Friendly Personal Care Products 16.3 Biodegradable Packaging 16.4 Energy-Efficient Appliances 16.5 Sustainable Electronics
2 Energy Efficiency 2.1 Building Energy Management 2.2 Smart Grid and Energy Storage 2.3 LED Lights/Energy-Efficient Appliances 2.4 Industrial Process Optimization 2.5 HVAC and Cooling Solutions	7 Sustainable Agriculture 7.1 Precision Farming Technology 7.2 Organic Farming Solutions 7.3 Soil Health and Nutrient Management 7.4 Vertical Farming and Aquaponics 7.5 Crop Monitoring and AgTech	12 Sustainable Food and Beverage 12.1 Plant-Based and Lab Grown Meat 12.2 Sustainable Seafood Production 12.3 Food Waste Reduction Technologies 12.4 Eco-Friendly Food Packaging 12.5 Sustainable Ingredients and Oils	17 Clean Air and Pollution Control 17.1 Air Quality Monitoring Services 17.2 Air Purification Technologies 17.3 Pollution Source Tracking 17.4 Emission Control Systems 17.5 Indoor Air Quality Solutions
3 Sustainable Transportation 3.1 EV Charging Infrastructure 3.2 Sustainable Urban Mobility Solutions 3.3 Fleet Electrification Services 3.4 Alternative Fuel Technologies 3.5 EV Battery Recycling and Repurposing	8 Circular Economy 8.1 Recycling and Waste Management 8.2 Product Lifecycle Assessment 8.3 Sustainable Packaging Solutions 8.4 Reusable and Repairable Products 8.5 Upcycling and Repurposing Services	13 Eco-Tourism and Recreation 13.1 Eco-Friendly Accommodations 13.2 Sustainable Travel Booking Platforms 13.3 Adventure Tourism/Conservation Focus 13.4 Wildlife Monitoring/Conservation Tours 13.5 Eco-Friendly Outdoor Gear	18 Climate Education and Services 18.1 Climate Change Education workshops 18.2 Sustainability Training 18.3 Climate Industry Advisory 18.4 Climate Intelligence Software 18.5 Climate Insurance
4 Carbon Capture and Utilization (CCU) 4.1 Direct Air Capture incl. Point Source 4.2 Carbon Removal and Sequestration 4.3 Carbon Mineralization 4.4 Enhanced Oil Recovery (EOR) 4.5 Soil-Based Sequestration	9 Carbon Market and Trading Platforms 9.1 Emission Reduction Verification Services 9.2 Carbon Offset Project Development 9.3 Carbon Credit Exchange Program 9.4 Blockchain-Based Carbon Trading 9.5 Carbon Taxation Solutions	14 Green Energy Storage 14.1 Advanced Battery Technologies 14.2 Advanced Fuel Cells 14.3 Energy Storage for Electric Vehicles 14.4 Grid-Scale Energy Storage Solutions 14.5 Hydrogen Energy Storage	19 Sustainable Supply Chain 19.1 Sustainable Sourcing/Procurement 19.2 Supply Chain Transparency 19.3 Ethical Labor Practices 19.4 Circular Supply Chain Solutions 19.5 Eco-Friendly Transport in Supply Chain
5 Green Building and Infrastructure 5.1 Sustainable Architecture and Design 5.2 Green Building Materials and Concrete 5.3 Zero-Emission Construction Equipment 5.4 Green Roofing and Insulation 5.5 Sustainable Urban Planning	10 Sustainable Finance and Investment 10.1 Green Bonds and Sustainable invest. 10.2 ESG Analysis 10.3 Impact Investment Platforms 10.4 Carbon Disclosure and Reporting Tools 10.5 Sustainable Investment Advisory	15 Biodiversity and Conservation 15.1 Wildlife Habitat Restoration 15.2 Conservation Tech for Monitoring 15.3 Anti-Poaching Solutions 15.4 Sustainable Forestry Practices 15.5 Marine Conservation Initiatives	20 Green Technology Integration 20.1 IoT for Sustainability 20.2 Autonomous Electric Vehicles 20.3 Blockchain/Transparent Supply Chain 20.4 3D Printing for Sustainable Manufact. 20.5 Space Tech for Climate Monitoring

Figure 1. TAG Climate Taxonomy

Overview of Water Management

The following emerging global commercial opportunities for water management are covered in this report, including the listing of several viable commercial entities providing solutions on the market today:

- Water purification and filtration technologies contribute to sustainable water management by ensuring access to clean water resources, mitigating the impact of pollution on aquatic ecosystems, and reducing the strain on freshwater sources amidst changing climate conditions.
- Smart irrigation and agriculture practices enable precise water usage tailored to crop needs, minimizing wastage, preserving soil health, and enhancing resilience to climate variability, thus promoting sustainable agriculture and water management.

- Industrial water recycling systems facilitate the reuse of water in manufacturing processes, reducing demand on freshwater sources, minimizing pollution discharge, and fostering efficient resource utilization in industries, crucial for sustainable water management amidst climate challenges.
- Stormwater management strategies involve capturing, treating, and reusing stormwater, reducing flooding risks, preventing pollution runoff, replenishing groundwater reserves, and enhancing urban resilience to climate-induced extreme weather events, thus contributing to sustainable water management.
- Desalination technologies provide an alternative water source by converting seawater or brackish water into potable water, diversifying water supply options, reducing pressure on freshwater reserves, and enhancing water security in regions vulnerable to climate-induced water scarcity, thereby contributing to sustainable water management efforts.

Focus Area: Water Purification and Filtration

Water purification and filtration technologies play a crucial role in advancing water management toward sustainability and reducing emissions. These technologies ensure that water from various sources, including natural bodies of water and wastewater, can be treated to meet quality standards for consumption, industrial use, and environmental protection.

One key aspect of advancing water purification and filtration is the development of more efficient and environmentally friendly methods. Traditional purification methods often involve the use of chemicals or energy-intensive processes, which can contribute to pollution and carbon emissions. Advancements in membrane filtration, such as reverse osmosis and nanofiltration, offer more sustainable alternatives by requiring less energy and reducing the need for chemical additives.

Furthermore, research in materials science has led to the discovery of novel materials with superior filtration properties, enhancing the removal of contaminants from water while minimizing energy consumption. These advancements contribute to a more sustainable water treatment process with reduced environmental impact.

In addition to technological innovation, the integration of decentralized water purification systems can also enhance sustainability. By treating water closer to the point of use, decentralized systems reduce the energy and resources required for transporting water over long distances. This approach not only improves efficiency but also enhances resilience to disruptions in centralized water infrastructure.

Overall, advancements in water purification and filtration technologies are essential for promoting sustainable water management practices. By reducing energy consumption, minimizing chemical usage, and improving water quality, these innovations contribute to a more environmentally friendly and emissions-free future.

Focus Area: Smart Irrigation and Agriculture

Smart irrigation and agriculture technologies are revolutionizing the way water is used in farming, contributing to sustainable water management and emission reduction efforts. These technologies leverage data, automation, and precision techniques to optimize water usage, enhance crop yields, and minimize environmental impact.

Central to advancing smart irrigation and agriculture is the integration of sensors, IoT (Internet of Things) devices, and data analytics platforms. These technologies enable farmers to monitor soil moisture levels, weather conditions, and crop health in real time, allowing for precise irrigation scheduling and efficient water allocation. By delivering the right amount of water to crops precisely when needed, smart irrigation systems minimize water waste and reduce the energy required for pumping and distribution.

Moreover, precision agriculture techniques, such as drip irrigation and soil moisture sensors, help farmers optimize fertilizer and pesticide application, further minimizing runoff and water pollution. This targeted approach not only conserves water but also promotes soil health and biodiversity, contributing to sustainable agricultural practices.

Another key aspect of smart irrigation and agriculture is the use of climate forecasting models and predictive analytics to anticipate water availability and plan cultivation accordingly. By adapting cropping patterns and irrigation schedules to changing climate conditions, farmers can mitigate the impacts of water scarcity and climate variability on crop production.

Overall, smart irrigation and agriculture technologies offer significant potential for advancing water management toward sustainability and reducing emissions in the agricultural sector. By improving water efficiency, minimizing environmental impact, and enhancing resilience to climate change, these innovations contribute to a more sustainable and environmentally friendly future.

Focus Area: Industrial Water Recycling

Industrial water recycling is a critical component of advancing water management toward sustainability and reducing emissions in industrial processes. As industries consume large volumes of water for various operations, recycling and reusing water not only conserve this precious resource but also minimize the environmental footprint associated with water extraction, treatment, and discharge.

Key to advancing industrial water recycling is the implementation of closed-loop systems and advanced treatment technologies. Closed-loop systems capture and treat wastewater generated from industrial processes, allowing it to be reused within the facility for purposes such as cooling, cleaning, and production. By minimizing the discharge of wastewater into the environment, these systems reduce the demand for freshwater resources and mitigate pollution risks.

Advanced treatment technologies, such as membrane filtration, electrocoagulation, and advanced oxidation processes, play a crucial role in ensuring the quality of recycled water

meets the required standards for industrial use. These technologies effectively remove contaminants, including heavy metals, organic compounds, and pathogens, from wastewater, rendering it suitable for reuse without compromising process efficiency or product quality.

Furthermore, the integration of process optimization and water management strategies enables industries to maximize water recycling rates and minimize operating costs. By identifying opportunities for water conservation, implementing water-efficient technologies, and optimizing production processes, industries can enhance resource efficiency and sustainability while reducing emissions associated with water consumption and treatment.

Overall, industrial water recycling holds great potential for advancing water management toward sustainability and promoting emissions-free industrial practices. By closing the loop on water use, minimizing freshwater consumption, and reducing pollution, these initiatives contribute to a more environmentally friendly and resource-efficient industrial sector.

Focus Area: Stormwater Management

Stormwater management plays a crucial role in advancing water management toward sustainability by mitigating the impacts of urbanization, reducing flood risks, and protecting water quality. As urban areas continue to expand, the management of stormwater becomes increasingly important to ensure the resilience of communities and ecosystems in the face of climate change and environmental degradation.

One key aspect of advancing stormwater management is the implementation of green infrastructure solutions. Green infrastructure, such as permeable pavements, green roofs, and rain gardens, mimic natural hydrological processes to absorb, filter, and infiltrate stormwater runoff. By reducing the volume and velocity of runoff, green infrastructure helps mitigate flood risks, alleviate pressure on traditional drainage systems, and recharge groundwater resources.

Furthermore, the integration of nature-based solutions, such as constructed wetlands and riparian buffers, enhances stormwater management by restoring natural waterways and ecosystems. These natural habitats not only provide valuable wildlife habitat and recreational opportunities but also improve water quality through biological filtration and nutrient uptake, reducing the need for costly and energy-intensive treatment infrastructure.

In addition to green infrastructure and nature-based solutions, stormwater management strategies also include the implementation of decentralized retention and detention practices. These practices, such as rainwater harvesting and detention basins, capture and temporarily store stormwater, allowing for gradual release and infiltration into the ground. By reducing peak flows and preventing erosion, decentralized stormwater management techniques protect water resources and infrastructure while promoting sustainable land use practices.

Overall, stormwater management initiatives contribute to advancing water management toward sustainability by enhancing flood resilience, protecting water quality, and promoting the wise use of natural resources. By integrating green infrastructure, nature-based solutions, and

decentralized practices, communities can build more resilient and sustainable urban environments while reducing emissions associated with conventional stormwater management approaches.

Focus Area: Desalination Technologies

Desalination technologies offer a promising solution for addressing water scarcity and advancing water management toward sustainability, particularly in regions facing freshwater shortages due to population growth, climate change, and industrial development. Desalination processes remove salt and impurities from seawater or brackish groundwater, producing freshwater suitable for various uses, including drinking, irrigation, and industrial applications.

One key advancement in desalination technologies is the development of more energy-efficient and environmentally friendly processes. Traditional desalination methods, such as thermal distillation and reverse osmosis, often require large amounts of energy, primarily derived from fossil fuels, leading to high operating costs and carbon emissions. However, advancements in membrane materials, system design, and renewable energy integration have significantly improved the energy efficiency of desalination plants, making them more economically viable and sustainable.

Furthermore, innovations in desalination pretreatment and post-treatment processes have enhanced water quality and minimized environmental impacts. Advanced pretreatment technologies, such as ultrafiltration and granular media filtration, remove particulates and organic matter from feedwater, reducing fouling and enhancing the efficiency of downstream desalination processes. Additionally, post-treatment techniques, including remineralization and disinfection, ensure the safety and palatability of desalinated water while minimizing chemical usage and environmental discharge.

Moreover, the integration of desalination with water reuse and resource recovery strategies enhances the sustainability of water management practices. By coupling desalination plants with wastewater treatment facilities or brine management technologies, communities can maximize water recycling rates, minimize environmental impacts, and recover valuable resources such as energy and nutrients from waste streams.

Overall, desalination technologies play a vital role in advancing water management toward sustainability by providing a reliable and drought-resistant water supply, reducing pressure on freshwater resources, and promoting emissions-free water treatment solutions. By leveraging technological innovations and integrating desalination with other water management strategies, communities can ensure water security and resilience in the face of growing water challenges and climate uncertainties.

Companies and Contributions

The companies listed below emerged as part of our research at TAG Climate. Our goal in listing these fine firms is to provide a starting point for buyers, advocates, stakeholders, and

researchers trying to make sense of the commercial landscape for water management as a means for driving toward a more sustainable energy future.

Water Purification and Filtration Vendors

1. [3M](#): Offers a wide range of water filtration and purification products for residential, commercial, and industrial use.
2. [Aqua-Aerobic Systems](#): Provides water and wastewater treatment solutions including filtration and purification systems.
3. [Eaton](#): Offers filtration and purification solutions for industrial and commercial applications.
4. [Evoqua Water Technologies](#): Provides water purification and filtration systems for various applications including municipal, industrial, and healthcare.
5. [Kemira](#): Provides chemical solutions for water treatment including purification and filtration.
6. [Mann+Hummel](#): Offers filtration solutions for water and air purification in various industries.
7. [Pall Corporation](#): Specializes in filtration, separation, and purification technologies for water and other fluids.
8. [Pentair](#): Offers a range of water purification and filtration products for residential, commercial, and industrial use.
9. [Suez](#): Provides water treatment solutions including purification and filtration systems for industrial and municipal clients.
10. [Veolia Water Technologies](#): Offers advanced water purification and filtration solutions for industrial and municipal clients.
11. [Xylem](#): Provides water technology solutions, including purification and filtration systems, for various industries and applications.

Smart Irrigation and Agriculture Vendors

1. [Antelco](#): Offers a wide range of irrigation products including drippers, sprayers, and valves for agriculture and landscaping.
2. [Hunter Industries](#): Offers irrigation products and solutions for residential, commercial, and agricultural use.
3. [Irritec](#): Provides irrigation products and solutions including drip and micro-irrigation systems for agriculture.
4. [Jain Irrigation Systems](#): Specializes in drip irrigation systems and solutions for agriculture and landscaping.
5. [Lindsay Corporation](#): Offers precision irrigation solutions and technology for sustainable agriculture.
6. [Nelson Irrigation Corporation](#): Specializes in irrigation products including sprinklers and pivot irrigation systems.
7. [Netafirm](#): Specializes in smart drip and micro-irrigation solutions for sustainable agriculture.

8. [Rain Bird](#): Provides smart irrigation systems and solutions for residential and commercial landscapes.
9. [Rivulis](#): Provides drip and micro-irrigation solutions for agriculture, greenhouse, and landscape applications.
10. [T-L Irrigation](#): Offers center pivot and linear irrigation systems for agricultural applications.
11. [The Toro Company](#): Provides smart irrigation systems and equipment for efficient water management in landscaping and agriculture.
12. [Valmont Industries](#): Offers irrigation equipment and technology for precision agriculture and water management.

Industrial Water Recycling Vendors

1. [Aquatech](#): Specializes in industrial water treatment and recycling solutions for various industries.
2. [Biwater](#): Offers water and wastewater treatment solutions including recycling and reuse technologies for industrial and municipal clients.
3. [NalcoWater](#): An Ecolab company that offers water management solutions, including recycling and reuse, for industrial clients.
4. [H2O Innovation](#): Specializes in membrane filtration and water treatment solutions for industrial and municipal clients.
5. [Huber Technology](#): Provides water and wastewater treatment solutions including recycling systems for industrial applications.
6. [OriginClear](#): Provides water treatment solutions including recycling and reuse systems for industrial, municipal, and agricultural applications.
7. [Aria Filtra](#): Offers water treatment solutions including recycling and reuse systems for industrial clients.
8. [Samco Technologies](#): Specializes in water treatment systems including recycling and reuse solutions for industrial clients.
9. [Siemens Water Solutions](#): Provides water recycling and reclamation solutions for industrial processes.
10. [Suez Water Technologies & Solutions](#): Provides water treatment solutions including recycling and reuse technologies for industrial applications.

Stormwater Management Vendors

1. [ACO](#): Offers stormwater management products including surface drainage and infiltration systems.
2. [Armtec](#): Offers stormwater management solutions including detention, filtration, and erosion control systems.
3. [Contech Engineered Solutions](#): Offers stormwater management solutions including detention and infiltration systems.
4. [CULTEC](#): Manufactures plastic stormwater management chambers including underground detention and infiltration systems.

5. [Hydro International](#): Specializes in stormwater management solutions including filtration and separation systems.
6. [Hynds Pipe Systems](#): Provides stormwater management products including pipes, chambers, and detention systems.
7. [Imbrium Systems](#): Offers stormwater treatment and management solutions including filtration and sediment control.
8. [Oldcastle Infrastructure](#): Offers stormwater management products including detention and treatment systems.
9. [StormTrap](#): Provides stormwater management solutions with underground detention and infiltration systems.
10. [Stormwater360](#): Offers sustainable stormwater management solutions including filtration and detention systems.

Desalination Technologies Vendors

1. [Acciona Agua](#): Specializes in desalination technology and plants using reverse osmosis and membrane distillation.
2. [Bechtel](#): Offers engineering and construction services for desalination plants and water infrastructure projects.
3. [Cadagua](#): Provides desalination technology and plants for water treatment and reuse projects.
4. [Enpure](#): Provides desalination and water treatment solutions including reverse osmosis and filtration systems.
5. [Doosan Heavy Industries & Construction](#): Offers desalination plants and solutions using multi-stage flash distillation and reverse osmosis.
6. [Energy Recovery](#): Offers energy recovery solutions for desalination plants to increase efficiency.
7. [GS Inima](#): Provides desalination and water treatment solutions for municipal and industrial clients.
8. [IDE Technologies](#): Specializes in desalination solutions including reverse osmosis and thermal desalination technologies.
9. [SUEZ Water Technologies & Solutions](#): Offers desalination solutions including reverse osmosis and electrodialysis reversal.
10. [Toray Industries](#): Provides membrane technologies for desalination including reverse osmosis membranes.

About TAG

TAG is a trusted next generation research and advisory company that utilizes an AI-powered SaaS platform to deliver on-demand insights, guidance, and recommendations in cybersecurity, artificial intelligence, and sustainability to enterprise teams, government agencies, and commercial vendors.

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