

THE FUTURE OF WATER INFRASTRUCTURE: DIGITAL TWINS AND THE EVOLUTION OF SMART WATER MANAGEMENT



REAL-TIME MONITORING
 FLOW RATE
 25,650 m³/h

ASSET HEALTH
 92%
 OPTIMAL
 All Systems Normal

PREDICTIVE MAINTENANCE
 NEXT MAINTENANCE
 In 18 Days
 PUMP STATION #3
 Probability of Failure
 8%

AI INSIGHTS
 Optimization Opportunity
 Detected
 Potential Water Savings
 12.4%

FILTRALITE®
 From Better Water Quality to
 Lower Operating Costs:
 How Filtralite® Proved Its Value in
 Modern Water Treatment Applications



From Partnership to Recognition:
 How Al-Mousa Trading and STALWART
 Are Delivering Excellence in Water Solutions?



Beyond CAPEX:
 The BinderGroup Approach to Aeration
 Efficiency and Long-Term Operational Savings



From Energy Consumption to Smart
 Energy Performance: The Aeration
 Revolution Led by Next Turbo Technologies



**MAS Automation: Innovating Water
 and Environmental Solutions**

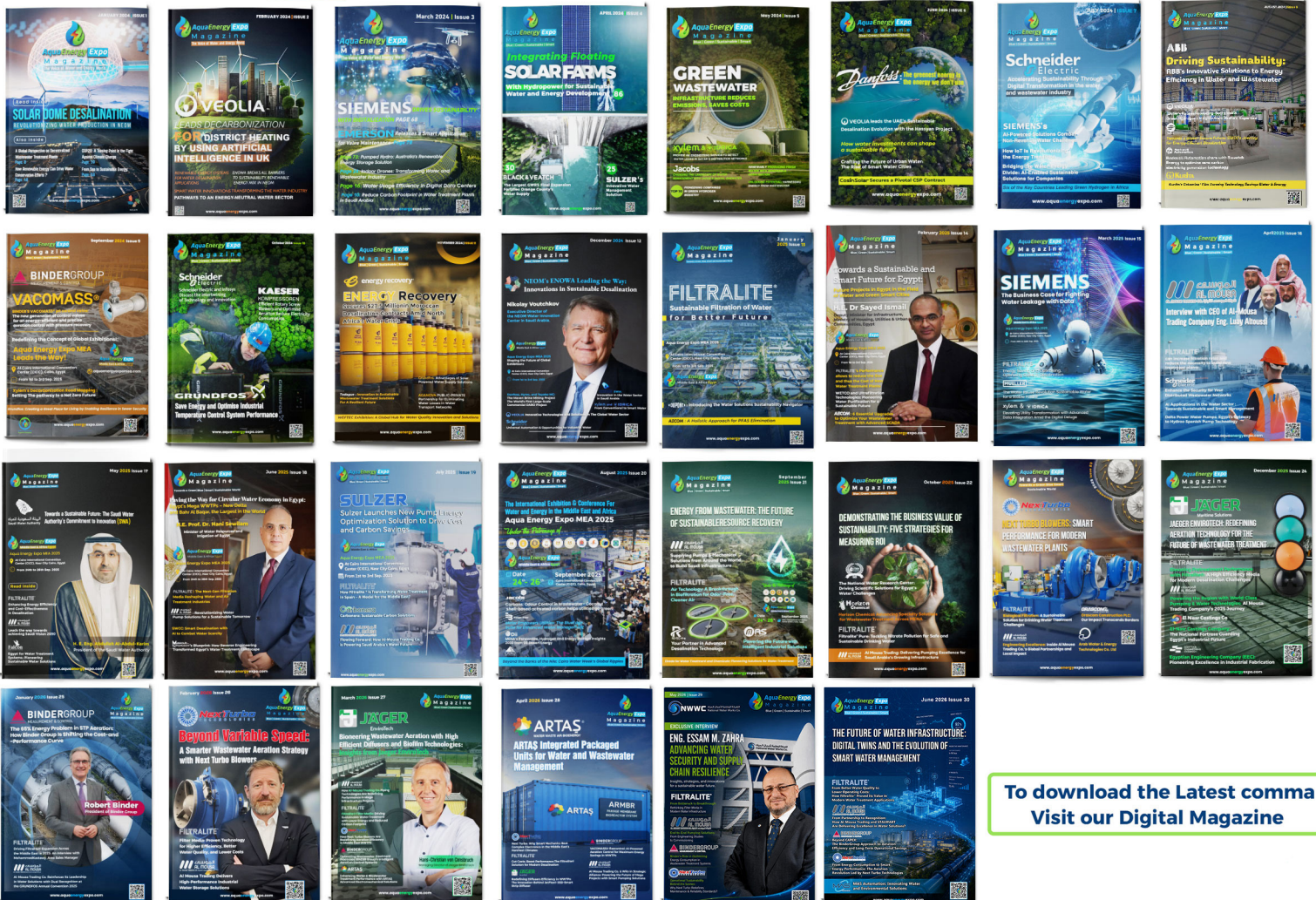




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From The Editor

Today, the global water sector stands on the precipice of a profound technological paradigm shift. Driven by the compounding pressures of climate variability, resource scarcity, and rapidly aging infrastructure, we are witnessing a quiet revolution, one where data is becoming the central currency and machine intelligence is the ultimate tool for systemic resilience.

Artificial Intelligence (AI) and Digital Twins are no longer speculative, futuristic concepts; they have emerged as the active, urgent nervous system of modern fluid infrastructure. This issue dives deep into how AI-powered data analytics and predictive maintenance are transforming operations from reactive fixes into proactive, autonomous management. We look at how these applications manifest globally, from intelligent leak detection networks in China to advanced aeration systems pioneered by BinderGroup's VACOMASS® and Next Turbo Technologies. By matching oxygen delivery precisely to microbial demand, these smart engineering solutions optimize airflow distribution and tackle the wastewater sector's largest energy consumers.

This digital transformation demands a holistic view of sustainability. As we harness the power of AI, we must also confront its hidden footprints—notably, the massive water-based cooling demands of next-generation data centers running intense AI workloads. True innovation

requires balancing high-tech progress with responsible governance and strict environmental stewardship.

Fortunately, the path forward is illuminated by strategic collaborations and cutting-edge hardware. We highlight the impactful partnership between Al-Mousa Trading and STALWART, alongside the resource-saving breakthroughs of Filtralite® filtration media in wastewater treatment and MAS Automation's EAGLE VIEW platform. These advancements prove that when engineering excellence meets digital intelligence, we can significantly reduce lifecycle costs, lower operating expenses, and secure water quality.

The future of water management belongs to adaptive, resilient, and interconnected ecosystems. By embracing these intelligent technologies responsibly, the water sector is uniquely positioned to safeguard our world's most precious liquid resource for generations to come.



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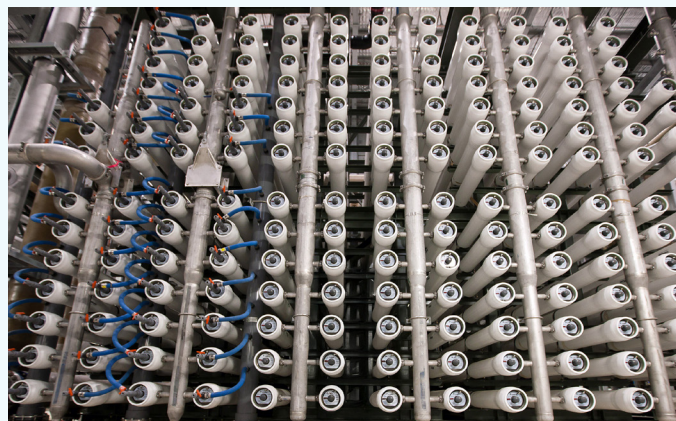


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The Future of Water Infrastructure: Digital Twins and the Evolution of Smart Water Management

The global water sector is standing on the precipice of a profound technological paradigm shift. For decades, water utilities operated through reactive, human-centric methodologies, relying heavily on physical inspections and historical heuristics. However, an era of unprecedented environmental and operational volatility, characterized by acute climate variability, rapidly aging infrastructure, workforce transitions, and tightening regulatory frameworks, demands a fundamental transformation. At the center of this modern revolution is the “Digital Twin” (DT). A digital twin is a dynamic, virtual representation of a physical water network that integrates real-time operational data with advanced predictive models. Far more than static engineering drawings or isolated databases, digital twins serve as intelligent decision-making ecosystems.

They bridge the gap between physical infrastructure and computational intelligence, allowing utilities to visualize, simulate, and optimize network behavior with unprecedented accuracy. This article explores how digital twins are driving the digital transformation of water management, shifting the industry from reactive maintenance to fully autonomous operations.

The Roots of Digital Transformation

Digital transformation in the water sector is often viewed as a modern phenomenon, yet its conceptual lineage spans millennia. The historical shift of core decision-making steps, encompassing problem definition, observation, modeling, analysis, decision, action, and evaluation, began when humans first sought to quantify water resources.

Early technological interventions can be traced back to ancient civilizations, where tools like the Nilometer in Ancient Egypt were utilized to observe and record river levels to predict seasonal flooding and optimize agricultural planning.

Over thousands of years, these primitive external tools gradually evolved into advanced mechanical and digital instruments. The true momentum of this transformation, however, accelerated exponentially with the advent of modern digital computers. By translating physical phenomena into computational logic, the water sector initiated a long-term migration of cognitive and analytical tasks away from sole human reliance and toward advanced, machine-driven computational architectures.

Shifting Cognitive Steps to Machines

In the contemporary water management landscape, computers have already been successfully entrusted with several critical phases of the traditional decision-making lifecycle. Specifically, the steps of observation, modeling, and analysis have largely transitioned to automated software systems. Advanced sensors, telemetry, and Supervisory Control and Data Acquisition (SCADA) networks autonomously handle the continuous observation of hydraulic pressures, water quality parameters, and volumetric flow rates across expansive distribution grids.

Concurrently, Geographic Information Systems (GIS) and hydraulic simulation software manage the complex tasks of asset modeling and structural analysis. These digital systems process millions of data points rapidly, uncovering hidden operational anomalies and bottlenecks that would be impossible for human operators to discern manually. By offloading these data-intensive analytical tasks to computers, utilities have drastically reduced human error while establishing a highly standardized, empirical foundation for daily operational oversight.

Defining the Modern Digital Twin

At its core, a modern water distribution digital twin is a unified decision-making platform that seamlessly harmonizes disparate data silos into a singular, cohesive virtual environment. A functional digital twin requires the integration of three foundational elements: asset data, real-time data, and predictive models.

Asset data, typically derived from GIS databases, provides the static structural framework, mapping out pipe diameters, material compositions, elevations, and geographic coordinates.

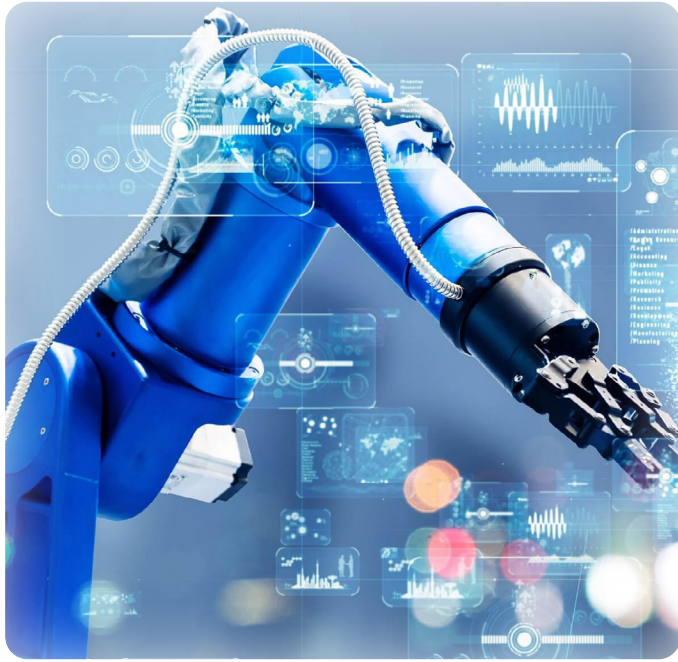
Real-time data feeds, sourced from SCADA systems and Internet of Things (IoT) sensors, inject live operational dynamics like current pressure levels, tank elevations, and valve positions into this structural framework. Finally, the predictive engine—which can utilize deterministic hydraulic models, statistical algorithms, machine learning, or advanced artificial intelligence—analyzes this aggregated data. This allows the digital twin to accurately simulate future network behaviors, test hypothetical operational scenarios, and deliver actionable insights.



Technological Drivers of the Digital Twin Evolution

The rapid acceleration and mainstream adoption of digital twins within the water industry are powered by the simultaneous convergence of three macroeconomic and technological forces. First, the industry has benefited from a significant drop in data acquisition and storage costs, making the deployment of widespread IoT sensor networks financially viable. Second, modern cloud computing has enabled easier data processing, integration, and cross-platform accessibility, breaking down traditional IT silos.

Finally, the exponential rise of artificial intelligence (AI) has provided the sophisticated computational cognitive power needed to interpret massive datasets. Together, these three converging forces are transforming the fundamental nature of engineering software. They are shifting applications from static, retrospective design toolkits into live, dynamic, and highly intelligent operational companions capable of managing complex water resources in real time.



Shifting from Reactive to Proactive

For over a century, water utility operations have been fundamentally reactive. Utilities typically responded to structural failures, pressure drops, or contamination events only after physical symptoms manifested within the network or when customers lodged formal complaints. Digital twins fundamentally invert this operational philosophy, serving as the technical backbone for an industry-wide migration from reactive operations to proactive, predictive management.

By continuously running real-time simulations and analyzing streaming sensor data, a digital twin can identify subtle hydraulic anomalies or localized structural stress points long before a catastrophic failure occurs. This predictive capability allows maintenance crews to intervene early, fixing weak points during scheduled hours rather than executing costly, disruptive emergency repairs. Ultimately, this paradigm shift minimizes service interruptions, preserves water quality, and drastically extends the operational lifespan of aging underground infrastructure assets.



Automating Routine Operational Decisions

In the near-term deployment phase, the primary value proposition of a digital twin centers on the automation of routine, repetitive operational decisions. Water networks require constant, minor adjustments to maintain equilibrium, such as optimizing pump scheduling to match diurnal demand patterns or managing automated valve operations for pressure zone isolation. Traditionally, these tasks demanded manual oversight from experienced control room operators.

A digital twin can automate these routine processes by utilizing real-time hydraulic data and predictive demand algorithms to execute optimal schedules autonomously. Crucially, during this evolutionary phase, human operators remain firmly in control, overseeing the digital twin's actions through a “human-in-the-loop” architecture. This operational approach ensures that safety protocols are strictly maintained while freeing human professionals to focus their attention on complex, high-priority systemic challenges.



Long-Term Planning and System Assessment

As organizational trust in digital twins matures and integrated artificial intelligence capabilities evolve, the utility of these platforms extends far beyond daily operational optimization. Modern digital twins are increasingly utilized to support long-term capital improvement planning, holistic system assessments, and adaptive operational evolution. Engineering teams can leverage the digital twin's verified hydraulic engine to run complex “what-if” planning scenarios spanning several decades into the future.

Planners can simulate the systemic impacts of aggressive urban population growth, prolonged climate-induced droughts, or the integration of new decentralized water treatment facilities. Because the digital twin accurately reflects the current, real-world state of the physical network, the resulting long-term asset allocations and infrastructural designs are highly optimized, mitigating the risks of over-engineering and capital expenditure waste.



The Democratization of Digital Water Technology to All Utilities

Historically, the deployment of advanced hydraulic modeling and real-time data integration platforms was restricted to the world's largest and most heavily funded metropolitan water utilities. These legacy software systems were often plagued by extreme cost barriers, restrictive proprietary architectures, and immense operational complexity that demanded highly specialized engineering expertise to maintain. The current wave of digital transformation, however, focuses heavily on the democratization of technology.

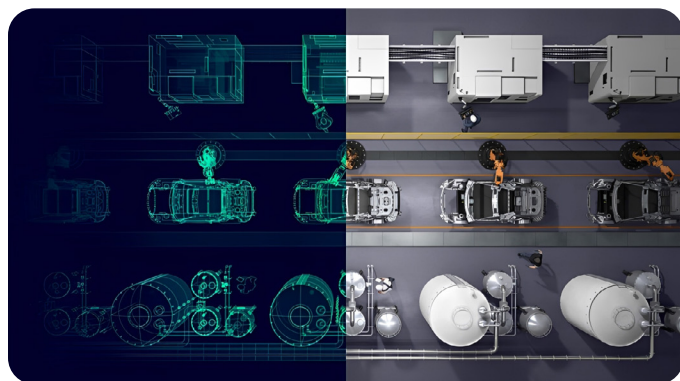
Modern cloud-native digital twin platforms are actively breaking down these traditional barriers. By offering open, intuitive user interfaces and seamless, turn-key integration with standard GIS and SCADA data streams, these platforms make digital twins accessible to utilities of all sizes.



This democratization ensures that small, rural, or underfunded water systems can leverage the predictive power of AI and digital twins to protect their communities.

The Ultimate Goal: Autonomous Operations

The evolutionary trajectory of digital twins leads to autonomous water network operations, which constitute the pinnacle of digital transformation. In this phase, core decision-making steps—decision, action, and evaluation—safely transfer from human operators to machine intelligence. Rather than simply recommending changes, the digital twin uses SCADA control loops to carry them out in the real world. It continuously assesses real-world hydraulic outputs and uses a feedback loop to improve future actions. While full autonomy necessitates organizational trust and strong AI safeguards, obtaining it allows water systems to self-heal and rearrange in real time in response to emergencies, bursts, or cyber threats.



Conclusion

The digital transformation of the water sector is critical to combating climate change, supply constraints, and aging infrastructure. Traditional human-centered management is no longer sufficient to ensure resilience. Digital twins are the ultimate evolution of water resource management, functioning as an intelligent central nervous system. By unifying asset registries, real-time data, and predictive AI, these platforms empower water systems to learn, reason, and act. By transitioning from old Nilometers to autonomous, self-healing networks, global utilities can protect our most valuable resource and provide a long-term, dependable water supply for future generations.

FILTRALITE®

**From Better Water Quality to Lower
Operating Costs:**

**How Filtralite® Proved Its Value in Modern
Water Treatment Applications**



In water and wastewater treatment, filtration media plays a critical role in achieving high water quality while optimizing operational efficiency. Filtralite® is one of the most advanced filtration media solutions available today. Manufactured from expanded clay through a high-temperature thermal process, Filtralite® features a unique porous structure, low density, and a large surface area that enhances solids removal and improves overall filtration performance.

The Filtralite® product family includes Filtralite® Pure for drinking water and desalination applications, Filtralite® Clean for wastewater and industrial water treatment, and Filtralite® Air for air treatment and odor control systems. These solutions have been successfully implemented in numerous projects worldwide, helping utilities improve filtration efficiency while reducing water and energy consumption associated with backwashing operations.



As part of the Long-term Operation and Maintenance Agreement – Package 01, Jeddah, a comparative performance study was conducted to evaluate Filtralite® against conventional anthracite filter media in a wastewater treatment plant. The objective was to assess filtration performance, treated water quality, and operational efficiency under real operating conditions.

During the first phase of testing, the plant operated at an actual production rate of 220,000 m³/day, compared to its design capacity of 250,000 m³/day, with 19 filters in service and an average flow of 11,579 m³/day per filter.

In the second phase, the operating load was increased by reducing the number of active filters to 16, while maintaining the same overall production rate. This increased the flow rate to 13,750 m³/day per filter and raised the filtration rate to 9.5 m/h, creating more demanding operating conditions for both media types.

Consistently Better Water Quality Under Varying Operating Conditions

The study demonstrated Filtralite®’s ability to maintain stable filtration performance while delivering lower turbidity levels compared to conventional anthracite media.

Throughout the testing period, Filtralite® achieved turbidity values as low as 0.42 NTU, while anthracite reached values of up to 1.53 NTU under similar operating conditions. Filtralite® consistently maintained stable effluent quality, reflecting its superior ability to capture suspended solids and support downstream treatment processes.

Case Study | Long Term Operation and Maintenance Agreement – Package 01, Jeddah

How Did Filtralite® Enhance Plant Performance and Deliver Measurable Operational Savings?

Key Results at a Glance

Key Indicator	Result
• Plant Design Capacity	250,000 m ³ /day
• Actual Production During Testing	220,000 m ³ /day
• Number of Filters in Normal Operation	19 Filters
• Number of Filters During High-Load Testing	16 Filters
• Flow Rate per Filter at High Load	13,750 m ³ /day
• Filtration Rate	9.5 m/h
• Reduction in Backwash Frequency	Up to 50%
• Reduction in Backwash Duration	Up to 50%
• Lowest Turbidity Achieved	0.42 NTU

Performance Comparison: Filtralite® vs. Anthracite

Performance Indicator

Anthracite

Filtralite®

Improvement

• Lowest Recorded Turbidity	0.75 NTU	0.42 NTU	Better Water Quality
• Highest Recorded Turbidity	1.53 NTU	0.79 NTU	Greater Stability
• Maximum Backwash Frequency	6 Times/Day	3 Times/Day	50% Reduction
• Maximum Backwash Duration	144 min/day	72 min/day	50% Reduction
• Backwash Frequency During Peak Operation	4 Times/Day	2 Times/Day	50% Reduction

Reduced Backwashing Means Lower Water and Energy Consumption

One of the most significant findings of the study was the reduction in backwash requirements when using Filtralite®. Under normal operating conditions, Filtralite® required fewer backwash cycles than anthracite. Daily backwash duration decreased from **81 minutes to 54 minutes**, while on certain days Filtralite® required only **27 minutes of backwashing**, compared to **54 minutes** for anthracite. These reductions translate directly into lower water consumption, reduced energy usage, and decreased operational stress on backwash systems and associated equipment.

The Real Advantage Becomes Clear at Higher Loading Rates

When the filtration system was challenged with higher hydraulic loading rates, Filtralite® continued to deliver stable performance while requiring significantly fewer backwash cycles.

On some testing days, anthracite filters required up to 6 backwash cycles per day, while Filtralite® required only 3 cycles. Similarly, total daily backwash duration decreased from 144 minutes to 72 minutes, representing an operational saving of up to 50%. These results demonstrate Filtralite®'s ability to retain solids more effectively, extend filter run times, and maintain performance under demanding operating conditions.

Operational Value Beyond Filtration

The benefits of Filtralite® extend beyond improved water quality. By reducing backwash frequency and duration, utilities can significantly decrease water & energy consumption while lowering maintenance requirements and improving long-term filter stability.

This combination of operational efficiency and filtration performance makes Filtralite® an attractive solution for water and wastewater treatment facilities seeking to maximize performance while minimizing lifecycle costs.



Conclusion:

Investing in Efficiency & Sustainability

The results of the Long-term Operation and Maintenance Agreement – Package 01, Jeddah clearly demonstrate that Filtralite® is more than just a filtration media replacement. It is a strategic solution that enhances water quality, reduces resource consumption, and improves overall operational performance.

By delivering up to 50% reductions in backwash frequency and duration, while maintaining superior effluent quality under both normal and high-load conditions, Filtralite® provides a compelling pathway toward more efficient, sustainable, and cost-effective water treatment operations.

FROM BETTER WATER QUALITY TO LOWER OPERATING COSTS



Filtralite®
 Advanced filtration media based on thermally treated expanded clay for sustainable and efficient water treatment.

KEY RESULTS



50%

Reduction in Backwash Frequency



50%

Reduction in Backwash Duration



0.42 NTU

Lowest Turbidity Achieved



9.5 m/h

Stable Performance at Filtration Rate

KEY BENEFITS



Superior Water Quality



Up to 50% Less Backwashing



Reduced Water Consumption



Lower Energy Usage



Lower Operating Costs



Stable Performance Under High Loads



CASE STUDY

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**From Partnership to Recognition:
How **Al-Mousa Trading** and
STALWART Are Delivering
Excellence in Water Solutions?**

Al-Mousa Trading is a trusted provider of engineering and infrastructure solutions, known for delivering high-quality products and services across multiple sectors. STALWART, meanwhile, is recognized for its expertise in water storage, treatment, and filtration solutions, offering innovative technologies that support sustainable water management worldwide.

The partnership between Al-Mousa Trading and STALWART reflects a shared commitment to innovation, quality, and sustainability. Through this strategic collaboration, both companies combine their expertise to deliver advanced water storage, treatment, and filtration solutions that support infrastructure development, create long-term value for customers, and meet the evolving needs of the market.

A Partnership Built on Trust and Shared Vision

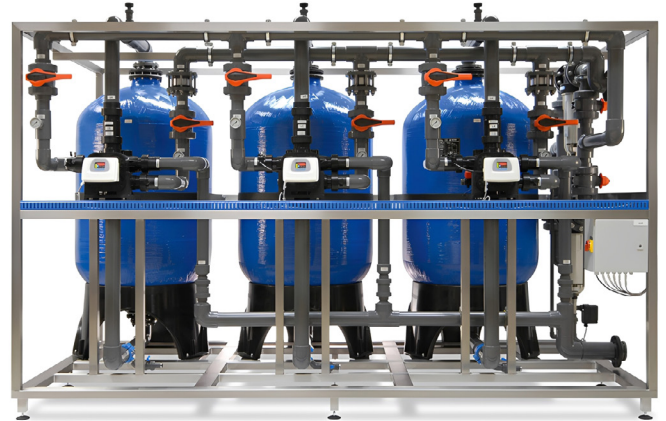
The strategic partnership between Al-Mousa Trading and STALWART represents a successful collaboration built on trust, innovation, and a shared vision for delivering sustainable and advanced water solutions. By combining Al-Mousa Trading’s expertise in engineering and infrastructure solutions with STALWART’s specialization in water storage, treatment, and filtration technologies, the two companies provide integrated solutions that support infrastructure development and meet evolving market needs. This synergy has enabled the delivery of innovative technologies, enhanced project efficiency, and greater value for customers through reliable, high-quality, and sustainable solutions.

Connecting Innovation to Customers: STALWART Products by Al-Mousa Trading

As part of this partnership, Al-Mousa Trading markets and supports a range of STALWART solutions designed to improve water quality, storage, treatment, and sustainability.

• Multi Media Filter

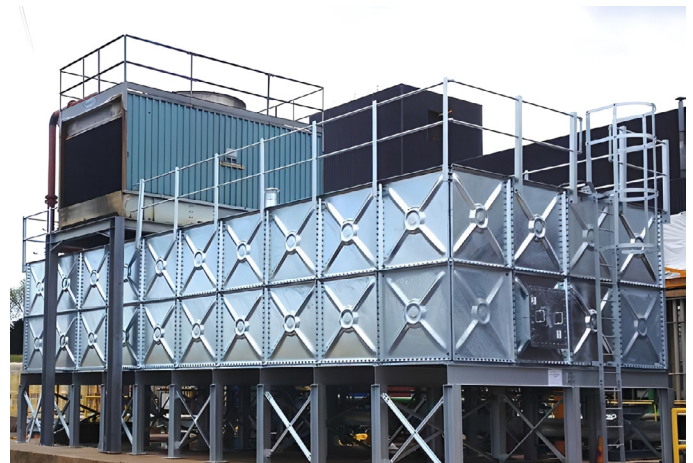
Designed to improve water quality and support sustainable resource management, these systems also include comprehensive rainwater harvesting solutions that help organizations conserve water, reduce waste, and achieve environmental sustainability goals while maintaining reliable access to clean water.



• Steel Sectional Tanks

STALWART’s Steel Sectional Tanks provide robust and dependable large-scale water storage solutions for a wide range of applications. With storage capacities reaching up to 1,300 cubic meters, these tanks have been successfully installed in water supply projects, food processing facilities, hotels, hospitals, railway systems, and utility networks worldwide.

Manufactured using proven engineering technologies and high-quality materials, these tanks offer exceptional structural strength, durability, and long-term performance, making them a trusted solution for demanding operational environments.



• GRP Sectional Tanks

For projects requiring flexibility and efficient space utilization, STALWART's GRP Sectional Tanks offer an ideal modular storage solution. Built using a panel-based design, these tanks can be assembled in virtually any required size, providing a customizable solution that adapts to project-specific requirements.

Available in both insulated and non-insulated configurations, GRP tanks can be installed at ground level, in basements, on rooftops, or inside buildings. Their corrosion resistance, lightweight construction, and ease of installation make them a preferred choice for modern water storage applications.



Recognizing a Successful Collaboration

The strength and success of this partnership were recently celebrated through a special appreciation award presented by STALWART to Al-Mousa Trading in recognition of the outstanding collaboration and strong business relationship achieved throughout 2025.

The award was presented by Moe Salman, Managing Director of STALWART, to Luay Altoussi, CEO of Al-Mousa Trading, reflecting the mutual trust, commitment, and shared vision that continue to drive the partnership forward.

This recognition highlights not only past achievements but also the confidence both organizations have in their future growth and continued success together.

Conclusion

As industries continue to seek smarter and more sustainable infrastructure solutions, the partnership between Al-Mousa Trading and STALWART remains focused on delivering innovation, reliability, and long-term value.

Together, the two companies are helping shape the future of water management through advanced technologies, engineering excellence, and a shared dedication to customer success. With a strong foundation already established, the partnership is well-positioned to achieve even greater milestones in the years ahead.



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DRIVING THE NEXT GENERATION OF WATER INFRASTRUCTURE

The strategic partnership between **Al-Mousa Trading** and **STALWART** continues to advance sustainable and innovative water infrastructure solutions across the region.



THROUGH THIS COLLABORATION, THEY DELIVER:



MULTI MEDIA FILTERS

Efficient filtration and rainwater harvesting solutions.



STEEL SECTIONAL TANKS

Durable, high-capacity water storage systems.



GRP SECTIONAL TANKS

Flexible, corrosion-resistant modular storage solutions.



Al-Mousa Trading was recently honored by **STALWART** with an **appreciation award** recognizing the success and achievements of their partnership throughout **2025**.



ENGINEERING BETTER WATER SOLUTIONS FOR A SUSTAINABLE FUTURE.



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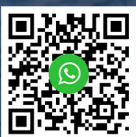


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BINDERGROUP

MEASUREMENT & CONTROL

**Beyond CAPEX: The BinderGroup
Approach to Aeration Efficiency and
Long-Term Operational Savings**

Aeration is the heart of biological wastewater treatment, providing the oxygen required by microorganisms to efficiently remove organic pollutants and nutrients. Despite its critical role in treatment performance, aeration remains the single largest energy consumer in most wastewater treatment plants (WWTPs), typically accounting for 50–70% of total plant electricity consumption. As energy costs continue to rise and environmental regulations become increasingly stringent, wastewater utilities are under growing pressure to improve operational efficiency while reducing carbon emissions. Consequently, optimizing aeration systems has become one of the most effective strategies for lowering operating expenses and improving overall plant sustainability.

While significant attention is often given to blower efficiency and diffuser performance, one critical component is frequently underestimated: the airflow control system. Recognizing the importance of precise airflow management, Binder-Group has developed specialized aeration control technologies designed specifically for wastewater treatment applications, helping utilities optimize airflow distribution, reduce pressure losses, and maximize energy efficiency.

The Direct Link Between Airflow Control & Biological Treatment Efficiency

Wastewater treatment plants rarely operate under constant conditions. Influent flow rates, pollutant concentrations, and nutrient loads fluctuate continuously throughout the day, causing oxygen demand within biological reactors to change accordingly.

To maintain stable treatment performance, airflow must be adjusted continuously to match these varying biological requirements. However, many conventional control valves were originally developed for water applications rather than air distribution systems. As a result, they often exhibit limited positioning accuracy, poor repeatability, and non-linear control behavior. These limitations can lead to unstable dissolved oxygen (DO) concentrations, inefficient biological treatment, and unnecessary energy consumption.

Precise airflow control provides several important operational benefits:

- Improved dissolved oxygen stability.
- Enhanced nitrification and denitrification performance.
- Better process reliability and regulatory compliance.
- Reduced blower workload.
- Lower overall energy consumption.

By supplying exactly the amount of oxygen required by the biological process, advanced aeration control systems help treatment plants maintain optimal performance while minimizing energy waste.

The Hidden Cost of Pressure Loss

When evaluating aeration equipment, many projects focus primarily on capital expenditure (CAPEX). However, the long-term operational impact of pressure losses is often far more significant than the initial purchase price.

According to Manuela Charatjan, Director Process Engineering at BinderGroup, evaluating aeration equipment solely on initial investment cost can be misleading, as pressure losses within the system often become a major contributor to long-term operating expenses.

Every additional millibar of pressure loss within an aeration system must be compensated for by the blower. Because blowers are among the most energy-intensive assets in a wastewater treatment plant, even relatively small pressure losses translate directly into higher electricity consumption.

Conventional control valves frequently operate with pressure drops ranging from 40 to 70 mbar during normal operating conditions. In contrast, advanced aeration-specific valve technologies can significantly reduce pressure losses. From an engineering perspective, reducing pressure loss by 50 mbar in a system operating at approximately 600 mbar discharge pressure can generate direct energy savings exceeding 8%, while total savings may reach 15% depending on plant operating conditions. These figures demonstrate that pressure loss is not simply a hydraulic parameter—it is a continuous operational cost that affects plant performance throughout its entire service life.

VACOMASS®: Turning Aeration Efficiency into Measurable Energy Savings



To address the growing demand for energy-efficient aeration systems, BinderGroup developed VACOMASS®, an advanced aeration control solution specifically engineered for wastewater treatment applications. The system combines precise airflow control, accurate flow measurement, and intelligent automation to ensure that each aeration zone receives exactly the amount of air required by the biological process.

At the core of this technology is the VACOMASS® Jet Control Valve, which has been specifically designed to deliver highly accurate airflow regulation while maintaining extremely low-pressure losses. Unlike many conventional valve designs, the Jet Control Valve enables stable airflow distribution across varying operating conditions without creating significant resistance within the system.

Key operational advantages include:

- Highly precise airflow control.
- Extremely low-pressure losses.
- Improved dissolved oxygen stability.
- Optimized blower performance.
- Reduced energy consumption.
- Lower Total Life Cycle Cost (TLCC).

By continuously balancing airflow according to actual process requirements, VACOMASS® helps operators maximize treatment efficiency while minimizing unnecessary energy consumption. As wastewater facilities increasingly adopt smart operational strategies, technologies such as VACOMASS® are becoming essential tools for achieving both sustainability and cost-saving objectives.

Looking Beyond CAPEX: Understanding Total Life Cycle Cost



The true value of airflow control technologies becomes even more apparent when evaluating Total Life Cycle Cost (TLCC) rather than focusing solely on acquisition costs. A lower-priced valve may appear attractive during procurement; however, the associated energy consumption can dramatically increase operating expenses over the lifespan of the plant.

Lifecycle analyses have shown that a wastewater treatment facility operating with an average air-flow of 10,000 Nm³/h can incur energy costs exceeding €1.2 million over a 20-year period when using high-pressure-loss control valves.

In contrast, low-pressure-loss technologies can generate substantial energy savings, often exceeding the original investment cost many times over.

This reality has led utilities and engineering consultants to shift their focus from purchase price alone to a broader evaluation of energy consumption, maintenance requirements, reliability, and long-term return on investment.

Ultimately, sustainable infrastructure is defined not by the lowest initial cost, but by the lowest lifetime cost of ownership.

Smart Aeration Control: The Future of Energy-Efficient Wastewater Treatment



Modern wastewater treatment plants are increasingly adopting intelligent control strategies based on real-time process data. One of the most effective approaches is Ammonia-Based Aeration Control (ABAC), which continuously adjusts air-flow according to actual ammonia concentrations within the biological process.

Instead of operating at fixed dissolved oxygen setpoints, ABAC systems supply oxygen only when and where it is needed. This approach improves process efficiency while significantly reducing energy consumption.

Operational results have demonstrated that advanced aeration control strategies can achieve energy savings of up to 30% while maintaining treatment performance and compliance with discharge standards.

However, the success of these systems depends heavily on the precision and repeatability of air-flow control devices. Even the most sophisticated automation platform cannot achieve optimal performance without accurate airflow regulation. This is why technologies such as VACOMASS® play a critical role in enabling the next generation of Smart Wastewater Treatment Plants.

Conclusion

As wastewater utilities continue to pursue greater efficiency, sustainability, and operational resilience, optimizing aeration systems has become a strategic priority. Because aeration accounts for the largest share of plant energy consumption, even modest improvements in airflow management can generate substantial financial and environmental benefits.

Through decades of experience and installations across numerous wastewater treatment facilities worldwide, BinderGroup has demonstrated how precise airflow control can transform aeration systems from major energy consumers into significant opportunities for operational savings. Technologies such as the VACOMASS® Jet Control Valve provide a practical example of how engineering innovation can combine process stability, energy efficiency, and long-term economic value.

The industry is therefore moving beyond a simple CAPEX-focused approach toward a broader evaluation of long-term performance. In this new reality, the most important question is no longer, “How much does the valve cost?” but rather, “How much energy will it save over the next twenty years?” The answer to that question ultimately determines the true value of any aeration system investment.

BEYOND CAPEX

The BinderGroup Approach to Aeration Efficiency and Long-Term Savings

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From Energy Consumption to Smart Energy Performance: The Aeration Revolution Led by **Next Turbo** Technologies

Across the global water sector, wastewater utilities are entering a decisive transformation phase. Rising electricity prices, decarbonization targets, and stricter discharge regulations are forcing operators to rethink one critical process: aeration.

Today, aeration systems typically account for 50–65% of total energy consumption in activated sludge wastewater treatment plants. Even marginal efficiency improvements, therefore, translate directly into significant operational savings and carbon reduction.

Against this backdrop, high-efficiency turbo blower technology has emerged as one of the most impactful innovations in modern wastewater treatment — and companies such as Next Turbo Technologies are helping redefine

how process air is delivered inside biological treatment systems.

The Energy Challenge in Modern Wastewater Plants

Traditional positive displacement or multistage centrifugal blowers were designed for robustness rather than adaptability. However, biological treatment processes rarely operate under constant conditions. Influent load, temperature, and oxygen demand fluctuate continuously. According to recent water industry analyses, modern turbo blowers can reduce aeration energy consumption by 20–40% compared with conventional blower technologies, primarily due to high-speed dynamic compression and precise airflow modulation.

The implication is profound:

- Lower operating expenditure
- Reduced greenhouse gas emissions
- Improved biological process stability
- Extended equipment lifetime

Energy optimization is no longer a secondary upgrade — it is becoming a core design philosophy.

Next Turbo Technologies: Engineering Efficiency into Airflow

Founded by turbomachinery specialists with decades of blower experience, Next Turbo Technologies focuses on integrally geared, single-stage centrifugal turboblowers engineered specifically for demanding industrial and wastewater applications.

The company's flagship GTB Series turbo blower introduces a highly integrated architecture designed to minimize mechanical losses while maximizing process responsiveness.



Key engineering features include:

- Integrally geared single-stage compression
- Hybrid ceramic or hydrodynamic bearing systems
- Variable diffuser vanes and inlet guide vane control
- PLC-based intelligent optimization
- Customized impeller geometry for site conditions
- Plug-and-Play packaged installations

Unlike traditional blower concepts, airflow performance is dynamically optimized rather than mechanically fixed.

As described on the company's official technology overview:

Efficiency is preserved or lost in the control philosophy — intelligent optimization ensures stable performance across varying operating conditions.

Intelligent Control: Where Energy Savings Are Truly Achieved

While hardware efficiency is essential, modern wastewater performance increasingly depends on control strategy. Next Turbo's two-point control concept enables wide operational flexibility, maintaining stable pressure while allowing flow regulation from approximately 100% down to 40% capacity without efficiency collapse.

This capability directly addresses one of the largest historical inefficiencies in aeration systems: over-aeration. Over-supplying oxygen not only wastes energy but can disrupt biological nutrient removal. Intelligent airflow control aligns oxygen delivery precisely with microbial demand, stabilizing treatment performance.

Operational advantages include:

- Reduced dissolved oxygen oscillation
- Improved nitrification stability
- Lower blower cycling stress
- Decreased maintenance frequency

The result is a transition from mechanical aeration to process-driven aeration.

Design Philosophy: Maintainability as a Performance Metric

A defining element of Next Turbo Technologies' approach is the rejection of "black-box" equipment design.

Their turboblowers are engineered so that:

- Most maintenance tasks can be performed by plant personnel after training
- Remaining component lifetime can be estimated predictively
- Standard IEC motors, PLCs, and bearings are used instead of proprietary systems



This open architecture significantly reduces lifecycle risk — a growing concern for utilities operating assets over 20–30-year horizons.

According to company information, the machines are manufactured in Northern Italy using highly specialized machining partners, reinforcing reliability and precision manufacturing standards.

Why Turbo Blowers Are Becoming the New Aeration Standard

The wastewater sector is shifting toward what many engineers now call Energy-Positive Treatment Plants — facilities capable of minimizing energy consumption while recovering resources.

Turbo blower technology supports this transition through:

Operational Benefits

- Wide turndown ratios
- Low vibration and noise
- Reduced footprint

Process Benefits

- Stable biological treatment
- Responsive oxygen control
- Adaptation to load fluctuations

Sustainability Benefits

- Reduced CO₂ emissions
- Lower lifecycle costs
- Future-ready digital integration

As utilities face growing regulatory pressure & operational uncertainty, equipment flexibility is becoming as important as efficiency itself.

The Future of Wastewater Aeration

Wastewater treatment is evolving from infrastructure management into intelligent resource management. Air — once considered a simple utility — is now recognized as the most critical controllable parameter in biological treatment. Companies like Next Turbo Technologies demonstrate how advanced turbomachinery, digital control philosophy, and maintainability-focused engineering can converge to redefine plant performance.

The next generation of wastewater facilities will not simply treat water; they will optimize energy, stabilize biology, and operate as adaptive systems. And at the center of that transformation lies a deceptively simple concept:

Deliver exactly the air the biology needs — no more, no less.



NextTurbo
TECHNOLOGIES



Smart Sustainability
— for Water & Energy —

From Energy Consumption to Smart Energy Performance



The Aeration Revolution
Led by **NextTurbo** Technologies

WHY TURBO BLOWERS?



ENERGY EFFICIENCY

High-efficiency turbomachinery design



WIDE TURNDOWN RANGE

Flow regulation from 100% down to 40%



LOWER EMISSIONS

Reduced CO₂ emissions



KEY HIGHLIGHTS



INTELLIGENT AIRFLOW CONTROL



STABLE BIOLOGICAL TREATMENT



LOWER OPEX & MAINTENANCE



FUTURE-READY SOLUTION



EASY MAINTENANCE

THIS ARTICLE IS ABOUT:

- ✓ Energy-efficient aeration solutions
- ✓ Wide turndown & high efficiency
- ✓ Intelligent control for aeration
- ✓ Stable biological performance
- ✓ Lower OPEX & maintenance
- ✓ Sustainable & future-ready



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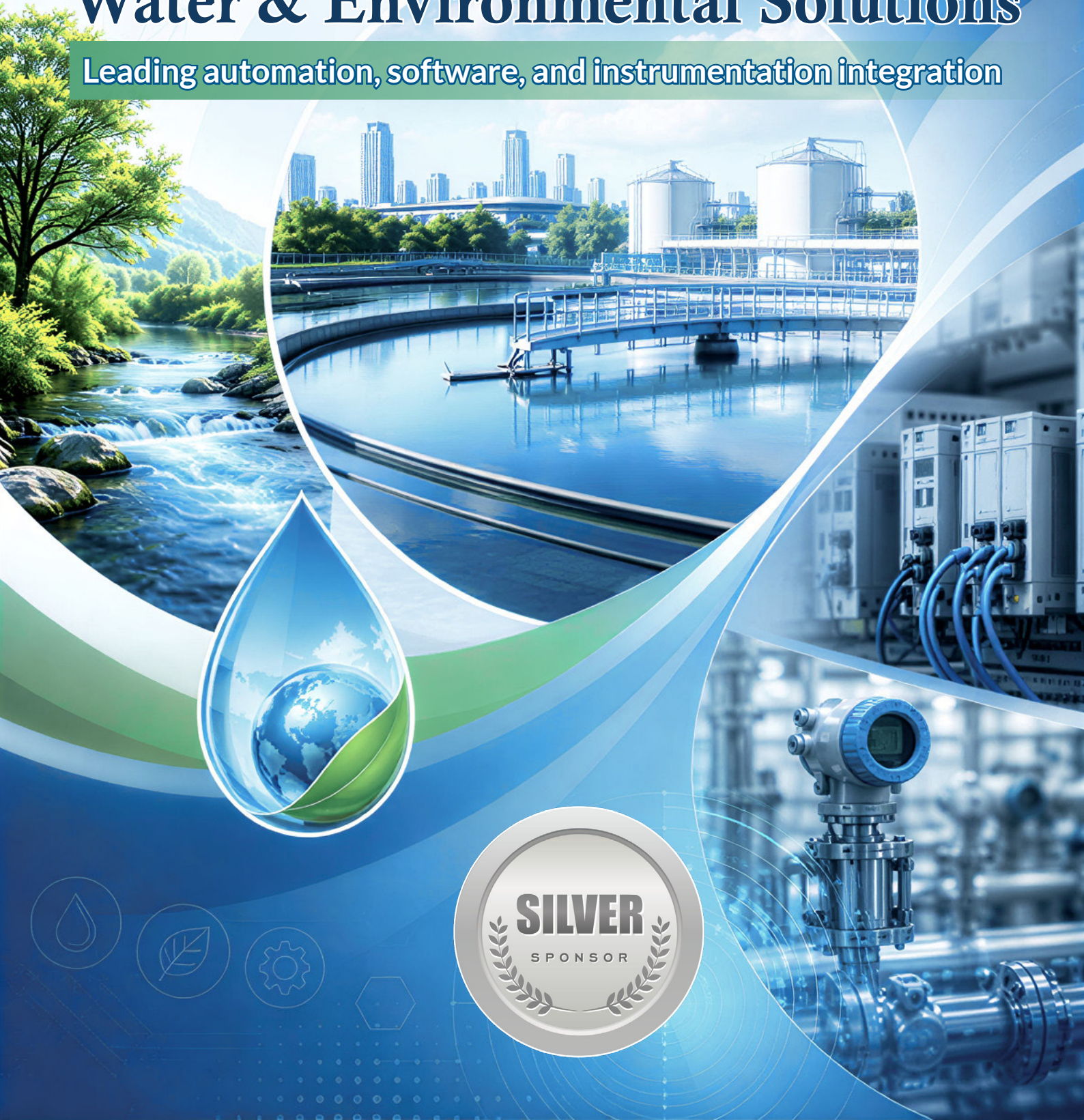
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MAS Automation: Innovating Water & Environmental Solutions

Leading automation, software, and instrumentation integration



MAS Automation delivers advanced solutions for water and environmental management—combining software, instrumentation, and automation. We build sustainable, future-ready systems for governments, utilities, and industries.

Our mission is clear – to drive the digital transformation of industries by providing smart, flexible, and scalable automation solutions that help organizations stay competitive in an ever-changing market. We extend our heartfelt gratitude to our partners and clients, whose confidence and collaboration have been the cornerstone of our growth and success. Together, we look forward to shaping the future of industrial automation.



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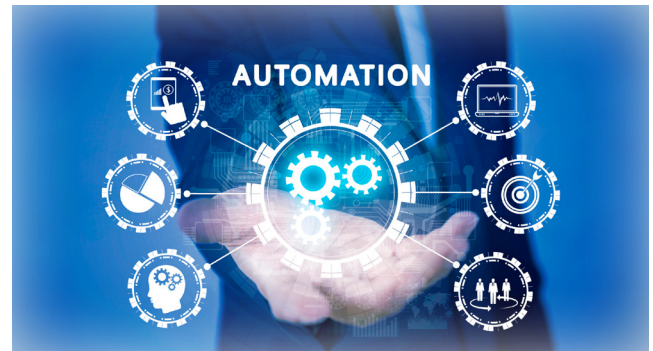
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- Trusted By

- Holding Company for Water & Wastewater
- Ministry of Environment
- Ministry of Health



MAS Automation Commitment

Driving sustainability through intelligent, integrated technologies.

Mas Automation continues to be a trusted partner for businesses seeking reliable, future-ready industrial solutions. Our strength lies not only in our technical know-how but in our ability to adapt and innovate. As industries evolve, so do we—pioneering the shift from traditional systems to smart, integrated, and data-driven ecosystems.



OZONMAS is a specialized division of MAS Automation, dedicated to the research, design, and manufacturing of professional ozone systems.



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OZONMAS ozonated water generators are engineered to deliver safe, highly effective disinfection without the use of any chemicals.

Our technology dissolves ozone gas directly into water, producing ozonated water with powerful antimicrobial action capable of eliminating bacteria, viruses, and fungi within seconds.

These systems are widely used for washing vegetables and fruits, sanitizing surfaces and equipment in factories, and supporting hygiene processes in agricultural and industrial facilities.

OZONMAS devices are built for reliability, energy efficiency, and ease of operation—making them the ideal choice for organizations seeking higher purity standards and sustainable environmental performance.



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Dr. El-Sawy Mabrouk El-Sawy

“From Analysis to Decision: How to Choose the Right Treatment Technology for Industrial Wastewater?”



Friday, June 5th



8:00 to 10:00 PM
(Saudi Arabia Time)



Eng. Salah Ghorab

“Facility Management”



Friday, June 19th



8:00 to 10:00 PM
(Saudi Arabia Time)



Eng. Mohamed Kastawy

“FILTRALITE® – Advanced Filtration Media Solutions for Modern Water Treatment?”



Saturday, June 20th



8:00 to 10:00 PM
(Saudi Arabia Time)



Dr. Iman Fouad

“Water Footprint in the Era of Digital Transformation: Towards Smart and Innovative Management of Sustainable Water Resources”



Saturday, June 27th



8:00 to 10:00 PM
(Saudi Arabia Time)





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WATER NEWS BRIEF

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Flocean and WaterConnect Partner to Advance Groundbreaking Subsea Desalination Project in the Maldives

Flocean has partnered with WaterConnect to advance an innovative subsea desalination project in the Maldives. This groundbreaking initiative aims to provide sustainable freshwater solutions by utilizing advanced desalination technology underwater. The collaboration focuses on addressing the Maldives' critical water scarcity issues, particularly in remote islands where freshwater resources are limited. By harnessing renewable energy and cutting-edge technology, the project seeks to enhance water accessibility and promote environmental sustainability. Both companies are committed to improving the quality of life for local communities while contributing to the Maldives' climate resilience and sustainable development goals.



Ecolab Delivers Strong Performance and Impact



Ecolab has reported strong performance and significant impact in its latest financial results. The company highlights its commitment to sustainability and innovation, demonstrating growth across various sectors, including water, hygiene, and energy solutions. Ecolab's initiatives have led to enhanced operational efficiencies for its clients, resulting in reduced water usage and improved environmental outcomes. The report emphasizes the importance of collaboration with customers to achieve sustainable practices and drive positive change. Ecolab remains focused on delivering value while addressing global challenges, reinforcing its role as a leader in providing essential services that promote resource conservation and environmental stewardship.

Wipe Out – 15.5 million Wet Wipe Users Flush Them Down the Toilet Causing Millions of Pounds of Damage

Thames Water has launched a campaign to address the issue of wet wipes being improperly flushed down toilets, urging the 15.5 million users to reconsider their habits. The company highlights that flushing wet wipes leads to significant blockages in sewage systems, causing costly repairs and environmental damage. The campaign aims to raise awareness about the impact of wet wipes on plumbing and wastewater treatment. Thames Water encourages consumers to dispose of wet wipes in the bin rather than the toilet, promoting better waste management practices and protecting the environment. The initiative emphasizes the importance of responsible disposal for sustainable water systems.



Kurita Signs Joint R&D Agreement with Tokyo Fire Department under Public Offering Project for R&D of Lithium-Ion Battery Compatible Fire Extinguishing Chemicals and Equipment

Kurita Water Industries has announced its participation in the 2026 Water Expo, showcasing its innovative water treatment solutions. The company aims to highlight its commitment to sustainability and advanced technologies that address global water challenges. At the expo, Kurita will present its latest products and services designed to enhance water efficiency and quality across various industries. The event provides an opportunity for Kurita to engage with industry professionals, share insights, and explore collaborations that promote sustainable water management practices. This participation underscores Kurita's dedication to contributing to a more sustainable future through effective water treatment solutions.



SUEZ Expands UK Operations with £396 million Milton Keynes City Council Contract Win, and Two New Facilities Under Construction, to Support the Development of the Circular Economy



Suez has expanded its contract with Milton Keynes City in the UK to enhance its circular economy initiatives. The renewed agreement focuses on improving waste management & recycling services, aiming to reduce landfill waste and promote sustainable practices within the community. Suez will implement innovative solutions to increase recycling rates and support local businesses in adopting circular economy principles. This expansion reflects Suez's commitment to environmental sustainability & its role in helping cities transition towards more resource-efficient systems. The partnership is expected to create a positive impact on the local environment & contribute to the region's sustainability goals.

DuPont is Part of a Desalination Consortium Named as a Semifinalist in the XPRIZE Water Scarcity Competition

DuPont is part of a consortium that has been named a semifinalist in the XPRIZE Water Scarcity competition. This initiative aims to develop innovative solutions for addressing global water scarcity through advanced desalination technologies. The consortium's project focuses on creating sustainable and cost-effective methods to convert seawater into freshwater, enhancing water accessibility in regions facing severe water shortages. DuPont's expertise in materials science and water treatment is integral to the consortium's efforts. The recognition as a semifinalist underscores the commitment to tackling water challenges and contributing to sustainable water management practices worldwide.



Global Water Events

Indo Water 2026 Expo & Forum

Date: From 11 to 13 August 2026

Location: JIExpo Kemayoran, Jakarta, Indonesia

Join at Indo Water 2026 Expo & Forum, the Indonesia's No. 1 International Water and Wastewater Technology Event. Through exhibitions, conferences, seminars, and workshops, connect industry leaders, innovators, and professionals to showcase the latest technologies & solutions in water resource management, sewerage, industrial wastewater, purification, and irrigation.

Website: indowater.com



Aquatech Mexico

Date: From 1 to 3 September 2026

Location: Centro Banamex ,Av. del Conscripto 311, Mexico City

On 1st to 3rd September 2026, Aquatech Mexico will take place. You're invited to join other professionals, experts and investors interested in doing business in the water technology industries in the Americas. Join 3 action-packed days that provide the ideal platform to make profitable business relationships, exchange ideas and learn all about opportunities in this specific region for the water technology.

Website: aquatechtrade.com/mexico



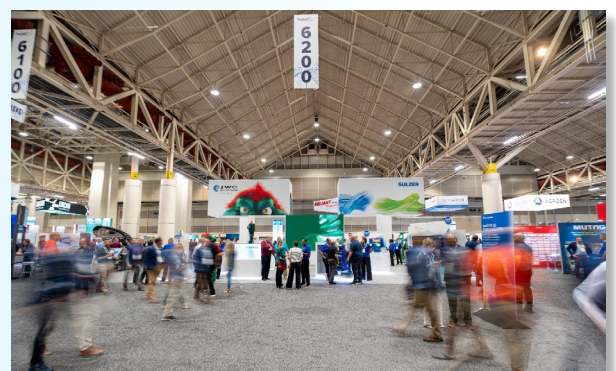
WEFTEC 2026

Date: From 28 to 30 September 2026

Location: New Orleans, La. USA

Solving water challenges takes more than great ideas, it takes connection, collaboration, and action. At WEFTEC 2026, you'll find all three through cutting edge solutions, hands on learning experiences, and a global network of water professionals.

Website: www.weftec.org



FiltXPO 2026

Date: 28 & 29 October 2026

Location: Minneapolis , Minnesota

Grow your business by connecting with decision-makers across diverse industries who are actively sourcing advanced

filtration and separation solutions. Engage with 1,200+ filtration professionals from around the world. Expand your North American market reach. Generate leads across high impact sectors, including: Water and Wastewater Treatment, Power Generation, Oil & Gas.

Website: filtxpo.com



Aquatech China

Date: From 28 to 30 October 2026

Location: China

China is making monumental investments in this sector, recognizing the critical need to address water shortages in its cities. With a mandate for cities to reclaim 25% of used water, the commitment is clear. This drive is further evidenced by the planned construction of 100 new sewage treatment plants.

Website: aquatechtrade.com/shanghai



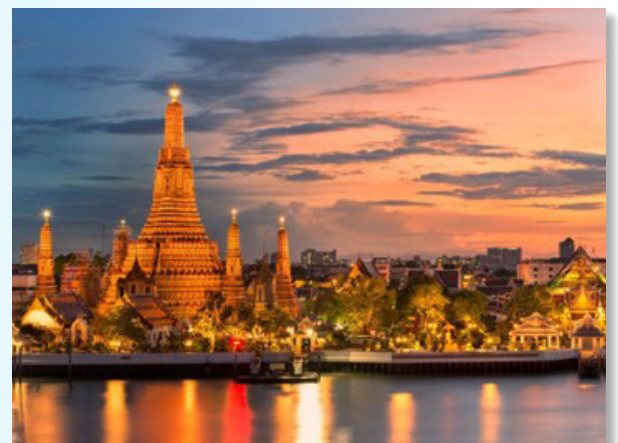
Aquatech Asia

Date: From 25 to 27 November 2026

Location: Bangkok

The most recent addition to the well-known Aquatech portfolio is Aquatech Asia, which will be present at flagship trade shows in China, Mexico, and Amsterdam. Southeast Asian water experts, innovators, and decision-makers will come together at Aquatech Asia.

Website: aquatechtrade.com/asia





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How Artificial Intelligence Is Reshaping the Future of Water Management in China

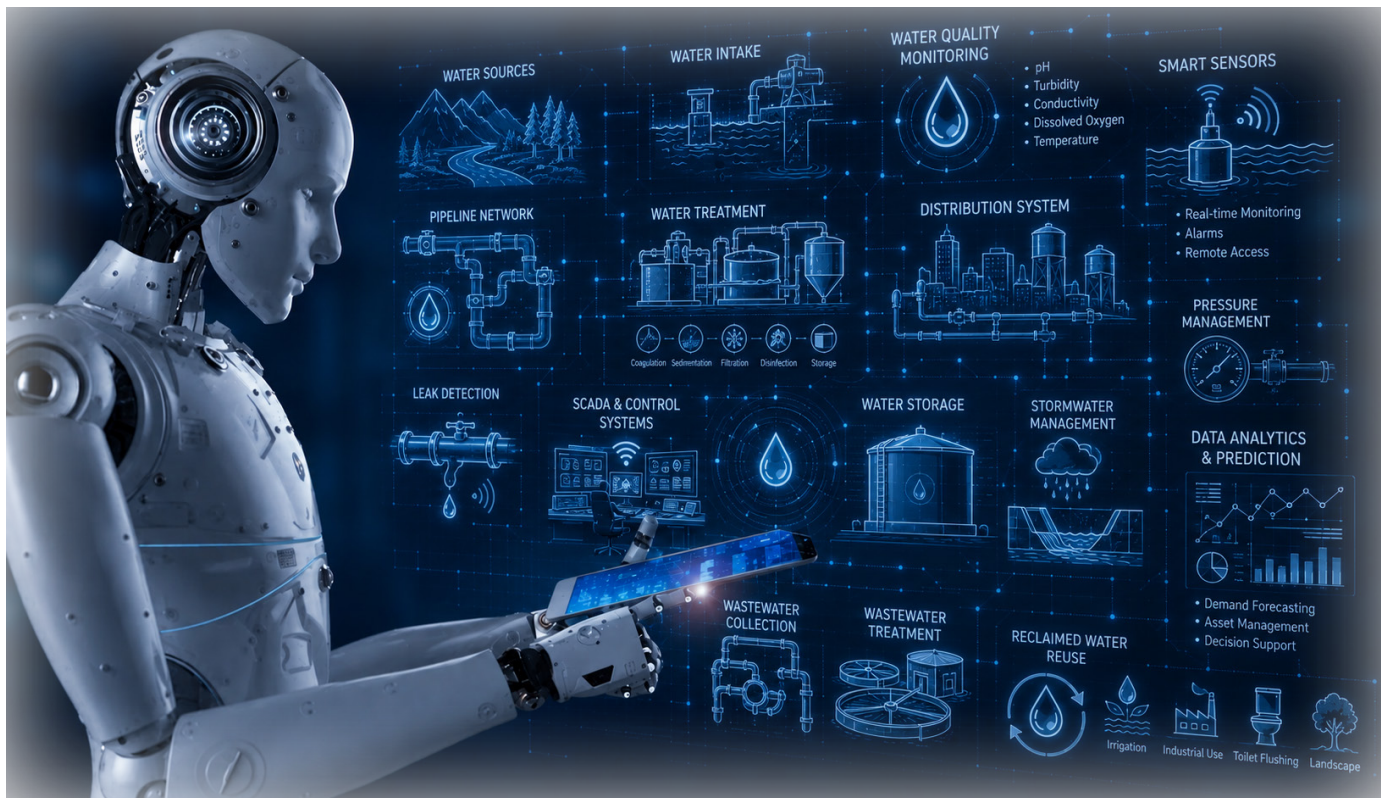
The water sector is entering a new era driven by digital innovation and artificial intelligence (AI). Around the world, utilities are seeking smarter ways to manage resources, improve operational efficiency, and address growing challenges such as water scarcity, aging infrastructure, and increasing service demands. China has emerged as one of the leading countries in the implementation of digital water technologies, combining advanced data analytics, intelligent monitoring systems, and AI-powered decision-making tools. These developments are transforming the way water utilities operate and maintain their networks. The Chinese experience offers valuable insights for utilities worldwide seeking to accelerate their digital transformation journey.

The Rise of Digital Water in China

China's rapid urbanization and industrial growth have created significant pressure on water resources and infrastructure. To address these challenges, utilities have increasingly adopted digital water strategies that integrate sensors, cloud platforms, and artificial intelligence into daily operations.

Digital water systems collect vast amounts of information from treatment plants, distribution networks, pumping stations, and customer connections. AI technologies analyze these data streams in real time, enabling utilities to detect anomalies, optimize performance, and make informed decisions. This shift from traditional management methods to data-driven operations represents a major step toward more resilient and sustainable water services.





AI-Powered Data Analytics and Decision Support

One of the most important applications of artificial intelligence in the water sector is advanced data analytics. Water utilities generate enormous amounts of operational data every day, but extracting actionable insights from it can be challenging. AI algorithms can process large datasets rapidly and identify patterns that would otherwise remain hidden. In China, digital water platforms are increasingly using machine learning models to support operational planning, performance assessment, and strategic decision-making. By transforming raw data into valuable intelligence, AI helps utility managers improve resource allocation, reduce operational uncertainty, and respond more effectively to changing conditions across their networks.

Predictive Maintenance and Asset Management

Aging infrastructure remains a major concern for water utilities worldwide. Unexpected equipment failures can lead to service interruptions, increased maintenance costs and water losses. AI is helping Chinese utilities move from reactive maintenance to predictive maintenance. By continuously monitoring equipment performance and operational

parameters, AI systems can identify early warning signs of potential failures. Utilities can then schedule maintenance activities before breakdowns occur. This proactive approach improves asset reliability, extends equipment lifespan, and reduces operational risks. Predictive maintenance also allows utilities to optimize maintenance budgets while ensuring uninterrupted service delivery to customers.

Intelligent Leak Detection and Network Monitoring

Water losses caused by leaks and pipe failures represent a significant challenge for utilities. Traditional leak detection methods often require extensive field inspections and may not identify problems quickly enough. AI-enabled monitoring systems offer a more efficient solution. By analyzing pressure data, flow measurements, and network behavior patterns, AI can detect abnormalities that indicate potential leaks.

In China, utilities are increasingly deploying intelligent monitoring platforms that provide real-time alerts and precise leak localization. These technologies reduce non-revenue water, improve network efficiency, and minimize water wastage. Enhanced visibility across distribution systems enables faster response times and more effective infrastructure management.

Optimizing Treatment Plant Operations

Water and wastewater treatment facilities involve complex processes that require careful control and continuous optimization. AI technologies are helping operators improve treatment efficiency while reducing energy consumption and operating costs. Intelligent systems can analyze process data, predict performance trends, and recommend operational adjustments. In Chinese treatment plants, AI applications are being used to optimize chemical dosing, improve filtration performance, and enhance biological treatment processes. By supporting operators with real-time insights, AI contributes to more stable plant performance and improved water quality outcomes. These benefits are particularly valuable as utilities strive to meet increasingly stringent environmental standards.



Enhancing Water Security and Emergency Response

Climate variability, extreme weather events, and infrastructure vulnerabilities are increasing the importance of water security. Artificial intelligence provides powerful tools for risk assessment and emergency preparedness. By integrating information from multiple sources, including weather forecasts, operational systems, and historical records, AI can help utilities anticipate potential disruptions and develop effective response strategies. Chinese digital water initiatives increasingly incorporate predictive models that support contingency planning and crisis management. During emergencies, AI-powered systems can provide rapid analysis and decision support, enabling utilities to respond more efficiently and maintain essential services under challenging conditions.



Strategic Insights for the Global Water Sector

China's experience demonstrates that successful digital transformation requires more than technology adoption alone. Strong leadership, clear strategic objectives, and organizational readiness are equally important. Utilities must invest in data governance, workforce development, and cross-functional collaboration to fully realize the benefits of AI. The Chinese digital water journey highlights the importance of integrating technological innovation with operational expertise and long-term planning. For water utilities worldwide, these lessons provide a valuable roadmap for implementing AI solutions that deliver measurable improvements in efficiency, sustainability, and service quality while supporting future growth and resilience.

Conclusion

Artificial intelligence is rapidly becoming a cornerstone of the modern water sector. China's advancements in digital water technologies illustrate how AI can transform utility operations, improve asset management, reduce water losses, optimize treatment processes, and strengthen emergency preparedness.

As water challenges become increasingly complex, data-driven decision-making will play a critical role in ensuring sustainable and reliable services. While each utility faces unique circumstances, the strategic lessons emerging from China's experience offer valuable guidance for organizations embarking on their own digital transformation journeys. The future of water management will be shaped by intelligent technologies, and AI is positioned to become one of the most influential tools in achieving operational excellence and long-term sustainability.

The Hidden Water Footprint of Artificial Intelligence:

Managing Cooling Demands in Next-Generation Data Centers



The rapid advancement of artificial intelligence (AI) has accelerated the expansion of data center infrastructure worldwide. The computational requirements of AI applications, particularly large-scale machine learning and generative AI models, have significantly increased power densities within data centers, creating unprecedented cooling demands. As a result, water has become a critical resource for maintaining operational reliability and thermal efficiency.

While water-based cooling systems offer substantial thermodynamic advantages over conventional air-cooling methods, their growing adoption raises concerns regarding water consumption, wastewater management, and long-term sustainability. Consequently, understanding the relationship between AI-driven digital infrastructure and water resource management has become essential for balancing technological growth with environmental stewardship.

Growth of AI Data Center Capacity

The development of AI technologies has fundamentally altered the scale of data center infrastructure. Historically, conventional data centers operated at relatively modest capacities, with average facility sizes measured in tens of megawatts.

However, the increasing computational intensity of AI workloads has led to the emergence of significantly larger facilities, with planned capacities ranging from hundreds of megawatts to several gigawatts. This expansion reflects the substantial processing requirements associated with AI model training and inference. As AI adoption continues to grow across industries, data centers are expected to become increasingly important consumers of energy and water. Consequently, infrastructure planning must address not only electrical requirements but also sustainable water management strategies.



Thermal Management Requirements in AI Computing

One of the primary drivers of increased water demand in AI data centers is the dramatic rise in processor power consumption. Traditional central processing units (CPUs) typically operate within a power range of approximately 150–200 watts. In contrast, modern graphics processing units (GPUs) designed for AI applications may consume more than 1,200 watts per device. The resulting increase in rack power density generates heat loads that exceed the practical limits of conventional air-cooling systems. Under these conditions, liquid cooling technologies provide a more effective solution for heat removal. Direct-to-chip cooling and immersion cooling systems have therefore gained considerable attention as methods capable of supporting the thermal requirements of high-density AI computing environments.



Thermodynamic Benefits of Water-Based Cooling

Water possesses several physical properties that make it particularly suitable for thermal management applications. Compared with air, water exhibits significantly higher heat capacity, density, and thermal conductivity. These characteristics enable water to absorb and transport substantially larger quantities of heat while requiring lower volumetric flow rates. The superior heat transfer performance of water allows cooling systems to maintain stable operating temperatures even under extreme computational loads. As AI processors continue to evolve toward higher power densities, the thermodynamic advantages of water are expected to reinforce its role as the dominant cooling medium within next-generation data centers.



Balancing Water Consumption and Energy Efficiency

The selection of a cooling strategy often involves balancing competing objectives related to water and energy use. Mechanical cooling systems can reduce direct water consumption; however, they generally require higher electricity inputs. Conversely, evaporative cooling systems improve energy efficiency by utilizing the latent heat of water evaporation but increase overall water demand. This relationship highlights the importance of evaluating both Water Usage Effectiveness (WUE) and Power Usage Effectiveness (PUE) when assessing data center sustainability. Optimizing one parameter may negatively affect the other, making integrated resource management essential for achieving long-term environmental performance.

Water Demand and Regional Resource Implications

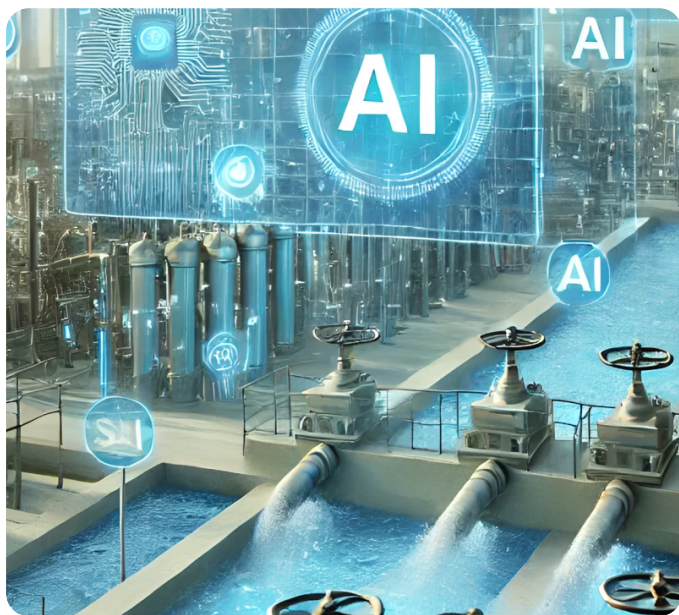
As AI infrastructure expands, water demand is becoming an increasingly significant consideration for local communities and water utilities. Large-scale facilities may require thousands of cubic meters of water per day to support cooling operations. In regions already experiencing water stress, such demand can intensify competition for available resources. The challenge is particularly relevant in areas where population growth, industrial development, and climate variability are placing additional pressure on water supplies. Consequently, data center operators must evaluate local hydrological conditions and incorporate water resource considerations into site selection and facility design processes.

Alternative Water Sources for Cooling Applications

To reduce dependence on potable water supplies, many facilities are exploring the use of alternative water sources. Treated municipal wastewater, brackish groundwater, and industrial reuse streams represent potential options for cooling operations. The utilization of these sources can help preserve drinking water resources while supporting industrial water requirements. However, alternative water supplies frequently contain elevated concentrations of dissolved solids, hardness constituents, and biological contaminants. Effective pretreatment technologies are therefore required to ensure compatibility with cooling systems and to maintain operational reliability.

Concentrate Management & Water Recovery

A significant challenge associated with cooling tower operation is the generation of concentrated waste streams. As water evaporates, dissolved contaminants accumulate within the recirculating system, eventually requiring removal through blowdown processes. The disposal and treatment of these concentrated streams can represent a substantial operational and environmental burden. To address this issue, facilities are increasingly adopting advanced water recovery technologies aimed at maximizing reuse and minimizing wastewater generation. Higher recovery rates not only reduce freshwater demand but also decrease disposal requirements and associated costs.



Advanced Treatment Technologies

Recent developments in membrane-based treatment technologies have expanded opportunities for water recovery in industrial cooling applications. Reverse osmosis systems, enhanced fouling control mechanisms, and integrated crystallization processes are enabling facilities to achieve increasingly high recovery efficiencies. These technologies support the treatment of impaired water sources and the reduction of blowdown volumes, contributing to improved resource utilization. In addition, advanced treatment systems provide a pathway toward near-zero liquid discharge strategies that can further enhance water sustainability within large-scale AI infrastructure.



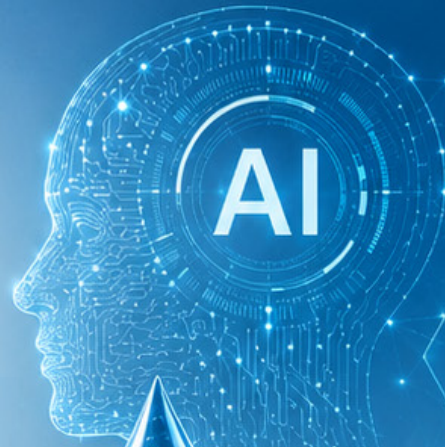
Conclusion

The expansion of AI data centers has established water management as a critical component of digital infrastructure sustainability. Increasing computational densities have intensified cooling requirements, reinforcing the importance of water-based thermal management systems. At the same time, concerns regarding water consumption, wastewater generation, and local resource availability necessitate the implementation of comprehensive water management strategies.

Future progress will depend on the integration of efficient cooling technologies, alternative water sources, advanced treatment systems, and high-recovery processes. Through these approaches, AI data centers can improve operational performance while reducing their impact on water resources, supporting a more sustainable balance between technological advancement and environmental responsibility.

Artificial Intelligence:

The Driving Force Behind Enhanced Water Resources Management in a Changing World



MONITOR



ANALYZE



PREDICT



OPTIMIZE



SUSTAIN



Artificial Intelligence (AI) is rapidly emerging as one of the most influential technologies shaping the future of water management. As water systems become increasingly complex and data-rich, utilities and water professionals are searching for smarter ways to transform information into actionable insights. AI offers a powerful opportunity to improve the way water resources are monitored, managed, and protected. By enhancing data analysis, supporting faster decision-making, and enabling more adaptive operational strategies, AI has the potential to strengthen both efficiency and resilience across the water sector. However, realizing these benefits requires careful consideration of governance, sustainability, and the broader implications of digital transformation.

The Growing Importance of Data in Water Management

Modern water systems generate vast quantities of information from monitoring networks, operational processes, and management activities. While access to data has increased significantly, transforming that data into meaningful knowledge remains a challenge. AI provides new capabilities for processing large volumes of information and identifying patterns that may otherwise remain hidden. By converting raw data into useful insights, AI enables water professionals to better understand system performance and emerging trends. This improved understanding supports more informed planning and operational decisions. As data continues to play a central role in water management, AI is becoming an increasingly valuable tool for helping organizations navigate complexity and respond more effectively to changing conditions.



Accelerating Decision-Making Processes

Timely decision-making is essential in a sector where operational conditions can change rapidly. Traditional analytical approaches often require significant time and resources to interpret data and develop responses. AI offers the potential to accelerate these processes by quickly analyzing information and presenting relevant insights. Faster access to knowledge can improve operational responsiveness and strategic planning. Instead of relying solely on retrospective analysis, organizations can use AI-driven insights to support more proactive management approaches. This ability to move from data collection to decision-making more efficiently is one of the key advantages driving interest in AI across the water sector.

Building Adaptive Water Systems

Water systems operate within dynamic environmental, economic, and social contexts. Climate variability, population growth, and changing resource demands all require flexible management approaches. AI can contribute to the development of adaptive systems capable of responding more effectively to evolving circumstances. Through continuous analysis of available information, AI can help organizations identify emerging challenges and opportunities. This capability supports operational flexibility and allows managers to adjust strategies when conditions change. As uncertainty becomes an increasingly significant factor in water management, adaptability is likely to become a defining characteristic of successful water systems.



Enhancing Efficiency Across Operations

Efficiency remains a critical objective for water utilities and resource managers. AI has the potential to improve operational performance by helping organizations make better use of available information and resources. Smarter data analysis can support more targeted actions, reducing inefficiencies and improving overall system performance. The value of AI lies not only in automation but also in its ability to support better-informed decisions. By helping managers understand complex situations more quickly, AI can contribute to improved operational outcomes and more effective resource allocation. These benefits position AI as an important component of future water management strategies.



Strengthening Resilience in a Changing World

Resilience refers to the ability of water systems to withstand disruptions, adapt to challenges, and continue delivering essential services. As water managers face increasing uncertainty, resilience has become a central priority. AI can support this objective by improving situational awareness and enabling faster responses to emerging issues. Access to timely and reliable information allows organizations to anticipate challenges and evaluate potential responses more effectively. In this way, AI contributes not only to operational efficiency but also to the long-term capacity of water systems to manage risks and adapt to future pressures. Building resilient systems requires both technological innovation and informed decision-making, areas where AI can play an important role.



Governance and Sustainability Considerations

While AI presents significant opportunities, its adoption also raises important questions. Effective data governance is essential to ensure that information is managed responsibly and used appropriately. Organizations must establish clear frameworks for data quality, accessibility, and accountability. In addition, the expansion of digital technologies requires consideration of their broader environmental implications. The infrastructure supporting AI relies on energy and digital resources that carry sustainability considerations of their own. As the water sector embraces digital transformation, balancing innovation with responsible governance and environmental stewardship will be critical to achieving long-term benefits.

Conclusion

Artificial Intelligence has the potential to become a transformative force within the water sector. From improving data analysis and accelerating decision-making to supporting adaptive, efficient, and resilient water systems, AI offers a wide range of opportunities for organizations seeking to enhance performance and sustainability. Yet technology alone is not enough. Successful implementation requires thoughtful governance, responsible data management, and a commitment to balancing innovation with environmental considerations. As digital transformation continues to reshape industries worldwide, the water sector has an opportunity to harness AI to strengthen resource management, improve service delivery, and contribute to a more sustainable & resilient future.

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Smart Desalination:
How Technology Is Changing
the Face of Global Water Security



Water scarcity has become one of the most pressing challenges of the twenty-first century. Rapid population growth, urbanization, industrial expansion, and climate change are placing unprecedented pressure on freshwater resources across the globe. As traditional water sources become increasingly unreliable, desalination has emerged as a strategic solution capable of providing a dependable supply of potable water. However, desalination is an energy-intensive process, making efficiency and sustainability critical factors in its long-term success. Today, advances in electrical engineering, digital technologies, and renewable energy integration are transforming desalination facilities into smarter and more efficient operations, helping countries address water shortages while minimizing environmental impact.

The Growing Importance of Desalination

Desalination has evolved from a niche technology into a cornerstone of water security strategies worldwide. Countries facing chronic water shortages are increasingly investing in large-scale desalination facilities to supplement natural freshwater supplies.

Coastal regions, arid climates, and rapidly growing urban centers particularly benefit from this technology, which converts seawater into high-quality drinking water.

The increasing adoption of reverse osmosis systems has significantly improved desalination efficiency compared to earlier thermal technologies. Nevertheless, energy consumption remains one of the highest operational costs. As global demand for desalinated water continues to rise, operators and governments are focusing on methods to reduce power requirements while maintaining reliable production. This shift has placed energy efficiency at the center of modern desalination planning, design, and operation.

Electrical Infrastructure as the Foundation of Efficient Plants

The performance of a desalination facility depends heavily on the quality and reliability of its electrical infrastructure. High-pressure pumps, intake systems, pretreatment units, and distribution networks require sophisticated electrical systems capable of operating continuously under demanding conditions.

Motors, drives, transformers, switchgear, and control systems must work together seamlessly to ensure operational stability. Modern electrical solutions enable facilities to optimize equipment performance while minimizing energy losses. Advanced motor technologies, coupled with intelligent power management systems, improve efficiency across the entire treatment process. By carefully integrating electrical components from the design stage, plant operators can reduce operational costs, increase reliability, and extend equipment lifespan. These improvements contribute significantly to the overall sustainability of desalination projects.

Variable Speed Drives and Smart Energy Management

One of the most significant advances in desalination efficiency has been the widespread adoption of variable speed drives (VSDs). These systems allow operators to precisely control motor speed according to actual process demands rather than operating at fixed output levels. As a result, pumps and other equipment consume only the energy necessary to meet production requirements.

Smart energy management systems further enhance efficiency by continuously monitoring plant performance and adjusting operating parameters in real time. Through advanced analytics and automation, operators can identify inefficiencies, reduce unnecessary energy consumption, and optimize process performance. The combination of intelligent drives and digital control technologies helps facilities achieve substantial energy savings while maintaining consistent water production and operational reliability.



Integrating Renewable Energy into Desalination Operations

As countries pursue ambitious sustainability goals, the integration of renewable energy into desalination facilities has become increasingly important. Solar and wind power offer significant opportunities to reduce dependence on conventional electricity sources and lower greenhouse gas emissions associated with water production.

Modern desalination plants are being designed with the flexibility to accommodate variable renewable energy inputs while maintaining stable operation. Advanced electrical systems help manage fluctuations in power generation and ensure continuous process performance. In regions with abundant solar resources, renewable-powered desalination is becoming an attractive solution for expanding water supplies sustainably. This approach not only supports environmental objectives but also improves long-term energy security and resilience against rising electricity costs.



Digitalization & Predictive Maintenance

Digital transformation is reshaping the water industry, and desalination facilities are among the primary beneficiaries of this technological evolution. Modern plants are increasingly equipped with sensors, monitoring platforms, and industrial communication networks that provide continuous visibility into equipment performance.

Predictive maintenance systems analyze operational data to detect potential issues before failures occur. Instead of relying solely on scheduled maintenance, operators can make informed decisions based on actual equipment conditions. This proactive approach reduces unplanned downtime, lowers maintenance costs, and improves asset utilization.

Digital technologies also support remote monitoring capabilities, enabling experts to assess plant performance and troubleshoot issues without being physically present on site. These capabilities contribute significantly to operational efficiency and reliability.

Lessons from Large-Scale Global Projects

Around the world, large desalination facilities demonstrate how advanced electrical technologies contribute to efficient and reliable water production. Major projects in the Middle East, North Africa, Latin America, and other water-stressed regions have adopted integrated electrical systems to support high-capacity operations.

These facilities often produce hundreds of thousands of cubic meters of potable water per day while maintaining strict efficiency targets. Their success highlights the importance of combining robust electrical infrastructure with intelligent control systems and energy optimization strategies. Experience gained from these projects continues to influence industry best practices, providing valuable insights for future developments. As global demand for desalinated water grows, lessons learned from existing facilities will play a critical role in shaping the next generation of water infrastructure.

Sustainability Through High-Efficiency Equipment

Equipment efficiency has become a major focus area for plant designers and operators seeking to reduce both operational costs and environmental impact. High-efficiency motors, advanced pump technologies, and optimized control systems are helping facilities achieve substantial reductions in energy consumption. Even small efficiency improvements can generate significant savings over the lifetime of a large desalination plant. Reduced energy demand translates directly into lower operating expenses and decreased carbon emissions. Manufacturers continue to develop innovative technologies that improve performance while meeting increasingly stringent sustainability requirements. By investing in efficient equipment and adopting energy-conscious operating strategies, desalination facilities can support long-term water security objectives while minimizing their environmental footprint.

The Future of Water and Energy Integration

The future of desalination will be defined by the increasingly close relationship between water production and energy management. Emerging technologies such as artificial intelligence, advanced analytics, digital twins, and smart grid integration are expected to further improve efficiency and operational flexibility. Future desalination facilities will likely function as interconnected systems capable of dynamically responding to changes in water demand, energy availability, and environmental conditions. Enhanced automation will support faster decision-making, while improved renewable energy integration will help reduce dependence on fossil fuels. As innovation continues, the boundaries between water infrastructure and energy infrastructure will become increasingly interconnected, creating new opportunities for sustainable resource management.



Conclusion

Desalination is playing an increasingly vital role in addressing global water scarcity, but its long-term success depends on achieving greater energy efficiency and sustainability. Advances in electrical engineering, digital technologies, automation, and renewable energy integration are transforming desalination facilities into smarter and more resilient operations. From high-efficiency motors and intelligent drives to predictive maintenance and renewable-powered systems, modern solutions are helping reduce costs, improve reliability, and minimize environmental impact. As water demand continues to rise worldwide, the integration of advanced energy and electrical technologies will remain essential for ensuring sustainable access to clean water and supporting future generations in an increasingly water-constrained world.

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LONGi's Multiple Achievements Authoritatively Included in the Release of Martin Green's 68th Edition Solar Cell Efficiency Tables

LONGi announced that several of its technological achievements have been officially recognized in the 68th edition of the Solar Cell Efficiency Tables, compiled by Professor Martin Green's team and widely regarded as the global benchmark for verified photovoltaic efficiency records. The company set a new world record for monocrystalline silicon solar cell efficiency at 28.13%, while its silicon-perovskite tandem solar cell achieved an efficiency of 35.2%. In addition, LONGi's crystalline silicon module reached a record efficiency of 26.4%, the highest reported for this technology. These milestones highlight LONGi's leadership in photovoltaic innovation and its commitment to accelerating the global transition toward clean and sustainable energy.



Iberdrola Drives Forward Energy Storage with Spain's Largest Battery Project



Iberdrola has inaugurated Spain's largest battery energy storage project at the Campo Arañuelo solar complex in Cáceres, reinforcing its commitment to accelerating the energy transition. The facility features two lithium iron phosphate (LFP) battery systems with a combined capacity of 58 MW and 120 MWh, enabling excess solar energy to be stored and dispatched during periods of peak demand. Integrated with the Campo Arañuelo I and II photovoltaic plants, the project will enhance grid flexibility and support the growing electrification of the economy. With nearly 200 MW of battery storage already in operation across Spain, Iberdrola continues to strengthen its leadership in renewable energy integration and system resilience.

Water and Energy Will Decide Whether Europe Can Scale AI, Says New Grundfos Report

The article discusses the critical role of water and energy in determining Europe's ability to scale artificial intelligence (AI). Experts emphasize that sustainable access to these resources is essential for AI development and deployment. The increasing demand for AI technologies necessitates a focus on efficient resource management, as both water and energy are vital for powering data centers and cooling systems. The intersection of these elements could either propel or hinder Europe's technological advancements, highlighting the need for strategic investments and innovations in resource sustainability to support the AI sector's growth.



Cobalt Power Systems Completes 1.2 MW Commercial Solar & Storage Project for Santa Clara University

Cobalt Power Systems has successfully completed a 1.2 MW commercial solar storage project. This initiative aims to enhance energy efficiency and sustainability for businesses by integrating solar power with advanced storage solutions. The project will allow companies to utilize renewable energy more effectively, reducing reliance on traditional power sources and lowering energy costs. Cobalt's innovative approach aligns with the growing demand for clean energy solutions in the commercial sector, contributing to a greener future. This milestone reflects the company's commitment to advancing solar technology and supporting businesses in their transition to renewable energy.



France: TotalEnergies Files for Authorization of Its Giant Centre Manche Énergies Offshore Wind Project



TotalEnergies has filed for authorization to develop its ambitious Centre Manche offshore wind project in France. This initiative aims to harness the region's wind resources to generate renewable energy, significantly contributing to France's energy transition goals. The project is expected to provide substantial power to the grid, supporting the country's commitment to reducing carbon emissions and increasing reliance on sustainable energy sources. TotalEnergies emphasizes the importance of this project for both local economies and the environment, aiming to create jobs and promote technological innovation in the renewable energy sector. The authorization process marks a significant step towards realizing this large-scale project.

Vestas Adds New Orders in Germany and the United Kingdom

Vestas has announced new orders as part of its Q2 order intake, including a 50 MW project in Germany for Raiffeisen Windpark Saterland GmbH, featuring seven V162-7.2 MW turbines with a 20-year AOM 5000 service agreement. Delivery is set to begin in Q2 2027, with commissioning starting in Q2 2028. Additionally, a 45 MW project in the United Kingdom, involving ten V136-4.5 MW turbines, is also planned, with delivery expected in Q1 2027 and commissioning in Q4 2027. These projects highlight Vestas' commitment to expanding renewable energy solutions in Europe.



Global Energy Events

Intersolar Europe

Date: From 23 to 25 June 2026

Location: At Messe München

As the world's leading exhibition for the solar industry, Intersolar Europe demonstrates the enormous vitality of the solar market. For more than 30 years, it has been providing a networking opportunity for the key players from manufacturers, suppliers and distributors to installers, service providers, project developers, planners and start-ups all under the motto "Connecting Solar Business".

Website: intersolar.de



International Energy Storage & Battery Conference & Exhibition

Date: From 9 to 11 October 2026

Location: Shanghai World Expo Exhibition and Convention Center

Council (Preparatory), New Energy Industry Association for Asia and the Pacific, European Association of Energy Storage Trade, China Electric Power Construction Association, Shanghai Federation of Industrial Economics, Shanghai New Energy Industry Association, and the SNEC PV, Storage & Hydrogen Energy Alliance, the SNEC ES+ 13th (2026) International Energy Storage & Battery Conference & Exhibition (abbreviated as "2026 SNEC ES+ Exhibition") will be grandly held.

Website: energystorageexpo.org



Battery Asset Management Summit Europe 2026

Date: 2 & 3 December 2026

Location: Hotel nhow Roma, Italy

Europe saw unprecedented growth in energy storage last year, with a record-breaking 12GW installed, and Battery Energy Storage Systems (BESS) continued to dominate this expansion. What continued to set this summit apart was the strength of its community. Through technical workshops & structured networking, stakeholders came together not only to learn but also to work through the real operational challenges shaping Europe's storage landscape.

Website: batteryeurope.solarenergyevents.com





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