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KL **King Lee**
Technologies
Your Pure Water Partners

RO Antiscalants: Protecting Membranes, Maximizing Performance

FILTRALITE®

Can Better Filtration Cut Costs,
Protect RO Membranes, and Improve
Water Quality at the Same Time?



Next Turbo Technologies: Advancing
Aeration Efficiency with Smart Turbo
Blowers Technology



BINDERGROUP
MEASUREMENT & CONTROL

Binder Control Systems: Intelligent
Aeration and Process Control for
Wastewater Treatment Plants





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Innovative Solutions to Achieve Sustainability in Water and Energy

From The Editor

Water is no longer simply a resource to be treated and supplied; it is becoming a central element in how we think about energy efficiency, resilience, sustainability, and technological progress. In this issue, we explore how innovation across the water sector is helping utilities and industries respond to increasingly complex operational and environmental challenges.

Our coverage begins with King Lee Technologies and Envishield, highlighting the importance of advanced RO antiscalants in protecting membranes, improving recovery, and reducing operating costs. We also examine Filtralite® filtration technology and its successful application at the SULB Bahrain RO Plant, owned by SULB Company and operated by Veolia, demonstrating how improved pretreatment can strengthen membrane performance and operational efficiency.

In wastewater treatment, Next Turbo Technologies presents a smarter approach to aeration through high-efficiency turbo blowers designed around reliability, flexible airflow control, and long-term serviceability. Complementing this, Binder Control Systems demonstrates how VACOMASS® and Aqualogic® can combine precise aeration control, automation, and intelligent process optimization to reduce energy consumption while maintaining treatment performance.

We also turn our attention to Techno Install, whose broad portfolio spans chlorine gas injection systems, electromechanical works, water and wastewater infrastructure, and desalination projects across Egypt and beyond. Meanwhile, Midwater illustrates the value of vertical systems integration through advanced filtration, automation, specialty chemicals, MBBR technologies, and turnkey water treatment solutions. Its partnerships with Jkmatic, Kurita Europe GmbH, and Esli-PWG further demonstrate how strategic collaboration can accelerate innovation and strengthen regional water resilience.

Finally, this issue looks beyond individual technologies toward the wider water-energy nexus, where AI, Digital Twins, IIoT, predictive analytics, and intelligent automation are reshaping infrastructure management.

Together, these stories reinforce one message: the future of water depends on smarter engineering, stronger partnerships, and technologies that deliver efficiency, reliability, and sustainability.



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King Lee/Envishield RO Antiscalants: Protecting Membranes, Maximizing Performance

In Reverse Osmosis (RO) systems, reliable and efficient operation depends not only on membrane quality but also on the right chemical treatment. RO antiscalants are essential specialty chemicals that protect membranes, prevent scale formation, maintain system efficiency, and reduce operating costs.

King Lee Technologies, one of the oldest membrane chemistry companies in the United States, has been developing advanced RO antiscalants since 1977.

With nearly five decades of expertise, the company delivers innovative solutions for modern water treatment challenges. In Saudi Arabia, King Lee products are exclusively distributed by Envishield, combining global technology with local technical support.

Why Are RO Antiscalants Essential?

Scaling is one of the leading causes of performance deterioration in Reverse Osmosis systems. During the RO process, dissolved minerals become increasingly concentrated and can eventually crystallize, forming deposits on membrane surfaces. These deposits restrict water flow, reduce membrane efficiency, and increase the energy required to maintain system operation.

Without effective scale control, RO systems may experience:

- Reduced permeate flow.
- Increased differential pressure.
- Higher energy consumption.
- Lower water recovery.
- More frequent chemical cleaning.
- Shortened membrane lifespan.
- Higher operating and maintenance costs.

Because scaling develops gradually, its impact often becomes noticeable only after significant performance losses have already occurred.

How Do RO Antiscalants Work?

RO antiscalants provide a proactive solution by preventing mineral scale from forming before it can accumulate on membrane surfaces. They interfere with crystal growth and keep dissolved minerals dispersed within the water, minimizing their ability to precipitate and adhere to the membranes.

This preventive approach helps maintain stable membrane performance, reduce downtime, improve operational reliability, and support continuous, efficient water production.



Why Choose King Lee/Envishield RO Antiscalants?

With nearly five decades of experience in membrane chemistry, King Lee Technologies has developed a comprehensive portfolio of RO antiscalants designed to meet a wide range of feed water characteristics and operating conditions. Rather than offering a single solution for every application, King Lee classifies its products into three specialized categories:

• Classics:

Broad-spectrum antiscalants designed for reliable scale control across standard RO applications.

• Targeted:

Specialized formulations developed for challenging feed waters and specific scaling or fouling conditions.

• Synergy:

Advanced formulations combining broad-spectrum protection with targeted performance to address multiple scaling challenges simultaneously. This diversified product range enables operators to select the most suitable treatment solution for their specific application, resulting in greater operational efficiency & long-term membrane protection.

ANTISCALANTS & ANTIFOULANTS

PRODUCTS			EFFECTIVELY CONTROLS										
NSF/ANSI 60 Certified & RO/NF Membrane Compatible			CaCO ₃	CaSO ₄	BaSO ₄ SrSO ₄	Ca ₃ (PO ₄) ₂	Fe/Mn	Al	SiO ₂	Acid Elimination	Silt/Colloids	Organics/Bio	Sulfur
CLASSICS	Tried and true broad-spectrum line of antiscalants fully capable for the majority of water applications.	Pretreat Plus® Y2K	○ ■	○	○	○	○ ■	○	○ ■	○ ■			
		Pretreat Plus® 0100	○ ■	○	○	○	○ ■	○	○	○			
		Pretreat Plus® Select	○	○	○	○	○	○	○	○			
TARGETED	Targeted line of antiscalants & antifoulants meant for particularly difficult and unique applications.	Pretreat Plus® Gypsum*	○	○ ■	○ ■	○	○		○				
		Nutreat™ 1700	○ ■	○	○				○	○ ■			
		Protec™ RO							○ ■		○ ■	○ ■	
		Protec™ RO C									○ ■	○ ■	○
SYNERGY	Synergistic blends combine the ability to target specific scale and foulants while having broad-spectrum control.	Pretreat Plus® S1000	○ ■	○	○	○ ■	○ ■	○ ■	○ ■	○	○	○	
		Pretreat Plus® G2000	○ ■	○ ■	○ ■	○	○ ■	○	○	○			
		Pretreat Plus® G5000	○	○ ■	○ ■	○	○	○					

*Concentrated ○ = Effectively Controls ■ = Specifically Formulated For



How King Lee/ Envishield Selects the Right Antiscalant

Choosing the correct antiscalant is essential for achieving optimum RO system performance. Rather than offering a one-size-fits-all solution, King Lee Technologies uses its proprietary HydraCalc® software to evaluate feed water chemistry and operating conditions before recommending the most suitable antiscalant.

HydraCalc® analyzes key parameters such as water composition, scaling potential, recovery rate, and system operating conditions to predict scale formation & identify the optimal treatment program. This scientific approach enables accurate product selection, helping customers maximize membrane performance, increase water recovery, reduce chemical consumption, minimize cleaning frequency, extend membrane life, and lower overall operating costs.

What You Gain with King Lee/Envishield RO Antiscalants?

Selecting the appropriate King Lee/Envishield RO Antiscalant offers several operational advantages, including:

- Broad-spectrum scale control.

- Higher membrane performance.
- Increased water recovery.
- Extended membrane life.
- Reduced cleaning frequency.
- Lower operating costs.
- Improved energy efficiency.
- Accurate product selection using HydraCalc®.
- Reliable long-term RO system performance.

Conclusion

Efficient RO operation begins with effective membrane protection. Selecting the right antiscalant is more than simply choosing a specialty chemical—it is a strategic decision that directly impacts system performance, operational efficiency, maintenance requirements, and long-term operating costs. Backed by nearly five decades of innovation in membrane chemistry, King Lee Technologies provides advanced RO antiscalant solutions designed to protect membranes and maximize productivity. Through its exclusive partnership with Envishield in Saudi Arabia, customers benefit from globally recognized technology, scientifically guided product selection, and local technical support, ensuring reliable and sustainable RO performance across a wide range of water treatment applications.

HYDRACALC | Project Information | FeedWater Input | Chemical Projection Output | Project Database | **King Lee Technologies**

Results

CHEMICAL DOSING *

Pretreat Plus® 0100 @ 1.12 mg/L

Select Product

Adjust Recovery

77.0%

WARNING The adjusted feed reflects an auto-balance of cations/anions.

USAGE SUMMARY

Chemical	Pretreat Plus® 0100
Chemical Dosage	1.12 mg/L
Injection Rate	3.88 mL/min
Daily	5.92 kg/day 5.59 L/day
Monthly	177.69 kg/mo 167.6 L/mo
Annually	2132.23 kg/yr 2011.54 L/yr

US Units | **Save Project** | **Save As PDF**

% SCALING POTENTIAL

UNTREATED SCALING POTENTIAL		
Calcium Carbonate	LSI	2.4
	S&DSI	1.91



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Protect Every Membrane. Maximize Every Drop.



King Lee/Envishield RO Antiscalants combine advanced membrane chemistry with scientific water analysis to support reliable and efficient RO operation.



**Advanced
Scale Control**



**HydraCalc®-Based
Product Selection**



**Optimized RO
Performance**



**Lower
Operating Costs**



**Longer
Membrane Life**



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FILTRALITE®

Can Better Filtration Cut Costs, Protect RO Membranes, and Improve Water Quality at the Same Time?

In modern water treatment, achieving consistently high-quality water requires more than advanced membranes or sophisticated process controls. Effective filtration is the foundation of reliable treatment performance, playing a critical role in reducing fouling potential, protecting downstream equipment, improving operational stability, and lowering lifecycle costs.

Selecting the right filter media can significantly influence plant efficiency, water quality, and the long-term performance of Reverse Osmosis (RO) systems. Advanced filtration solutions such as Filtralite® are designed to optimize pretreatment, enabling treatment facilities to achieve better operational and economic outcomes without major infrastructure changes.

One Filtration Technology, Multiple Water Treatment Solutions

Manufactured from lightweight expanded clay, Filtralite® features a highly porous structure that combines excellent solids retention with outstanding hydraulic performance.

Compared with conventional filter media, it offers:

- Higher filtration efficiency
- Longer filtration cycles
- Reduced backwash frequency
- Lower water and energy consumption
- Reduced operating and maintenance costs

To address different treatment requirements, the Filtralite® portfolio includes specialized products:

- **Filtralite® PURE:** Optimized for drinking water treatment and desalination pretreatment, providing superior filtration while protecting downstream RO membranes.
- **Filtralite® CLEAN:** Engineered for municipal and industrial wastewater treatment, improving solids removal and biological process stability.
- **Filtralite® AIR:** Designed for air filtration and odor control, extending advanced filtration technology beyond water treatment applications.

This versatile product range enables utilities to select the most appropriate media for their specific operational needs while maximizing filtration performance and sustainability.

Success Story: Filtralite® Improves RO Pretreatment at the SULB Bahrain Plant



A compelling example of Filtralite®'s performance can be found at the SULB Bahrain Reverse Osmosis Plant, owned by SULB Company and operated by Veolia.

Producing approximately 4,500 m³/day of treated water, the facility operates under some of the Gulf region's most demanding seawater conditions, including:

- High salinity
- Seasonal algae blooms
- Fluctuating turbidity
- Elevated water temperatures

These conditions increased the fouling risk for the RO membranes, making efficient pretreatment essential for maintaining plant performance and controlling operating costs.

To improve filtration efficiency, the plant upgraded its dual-media filters by replacing conventional anthracite with Filtralite® NC 0.8–1.6, using a filter bed consisting of 0.6 m Filtralite® over 0.4 m sand.

The results demonstrated substantial improvements in water quality, membrane protection, and operational efficiency.

Cleaner Pretreatment Means Better RO Performance

▶ Lower SDI for Enhanced Membrane Protection

One of the most important indicators of pretreatment performance is the Silt Density Index (SDI), which measures the fouling potential of feed water entering RO membranes.

Following the upgrade:

- Anthracite: SDI = 4.7
- Filtralite®: SDI = 3.46

This significant reduction lowered the fouling potential of the feed water, helping extend membrane life, reduce cleaning frequency, and improve overall RO reliability.

▶ Superior Turbidity Removal

The upgraded filtration system also produced cleaner feed water.

Treated water turbidity improved from:

- 0.42 NTU with anthracite
- 0.31 NTU with Filtralite®

Lower turbidity improves downstream membrane performance while reducing the accumulation of suspended solids inside the RO system.

Operational Benefits Beyond Water Quality

The benefits of Filtralite® extended well beyond improved filtration performance.

The plant experienced:

- Enhanced protection of RO membranes
- Greater suspended solids retention
- Lower operating and maintenance costs
- Reduced media regeneration requirements
- Improved resistance to algae-related fouling
- Stable operation despite changing seawater conditions

Perhaps the most impressive result was the dramatic improvement in filtration cycle length.

The filters operated two to three times longer between backwash cycles, while maintaining zero filter media loss, demonstrating exceptional durability and long-term operational stability.

Less frequent backwashing also reduced water consumption, energy demand, and operational interruptions, contributing to improved plant efficiency.

Why Water Utilities Choose Filtralite® PURE

Designed specifically for drinking water treatment and desalination pretreatment, Filtralite® PURE combines lightweight expanded clay technology with a highly porous internal structure that delivers exceptional filtration performance.

Its large specific surface area enables:

- Improved contaminant capture
- Better suspended solids retention
- Longer filter runs
- Reduced backwash frequency
- Lower operating costs
- Enhanced protection of downstream membrane systems

These advantages make Filtralite® PURE an effective pretreatment solution for utilities seeking higher performance and greater operational reliability.

Performance at a Glance

Parameter	Result
Plant Capacity	4,500 m ³ /day
Filter Bed Depth	1.0 m (0.6 m Filtralite® + 0.4 m Sand)
Filtration Media	Filtralite® NC 0.8–1.6 + Sand
SDI (Anthracite)	4.7
SDI (Filtralite®)	3.46
Turbidity (Anthracite)	0.42 NTU
Turbidity (Filtralite®)	0.31 NTU
Time Between Backwash	2–3× Longer
Filter Media Loss	0%

A Smarter Pretreatment Investment for Long-Term RO Performance

The experience at the SULB Bahrain RO Plant demonstrates that effective pretreatment can simultaneously improve water quality, protect RO membranes, and reduce operating costs.

By delivering lower SDI, improved turbidity removal, longer filtration cycles, and zero media loss, Filtralite® PURE proved that upgrading filter media is not simply a filtration improvement—it is a strategic investment in plant reliability, sustainability, and long-term operational efficiency.

As desalination facilities face increasing pressure to reduce energy consumption, extend membrane life, and optimize operating costs, advanced filter media continues to play an increasingly important role in achieving these goals. Choosing the right pretreatment solution today can deliver measurable technical, environmental, and economic benefits for years to come.



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Filtralite® Delivers Reliable Performance for Industrial RO Plants

Proven Results in Bahrain's Industrial Water Sector

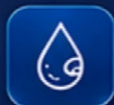
At an industrial RO plant in Bahrain, **Filtralite® PURE** demonstrated measurable improvements in pretreatment performance, helping optimize water quality while reducing operating costs.



KEY PERFORMANCE HIGHLIGHTS



Improved SDI
from **4.7** to **3.46**



Reduced Turbidity
from **0.42** NTU to **0.31** NTU



2-3× longer time
between backwashes



0% filter media loss

WHY FILTRALITE®?



More stable RO system performance



Lower energy and chemical consumption



Reduced membrane fouling



Lower operating costs



Reliable operation under
challenging water conditions



Filtralite® – Advanced filter media engineered for
higher efficiency, lower operating costs,
and **sustainable** water treatment.



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Next Turbo Technologies: Advancing Aeration Efficiency with Smart Turbo Blowers Technology

In modern wastewater treatment plants, aeration is one of the most energy-intensive processes, typically accounting for approximately 50–65% of the plant's total energy consumption, as energy costs continue to rise and industries place greater emphasis on sustainability and operational efficiency, the demand for reliable, high-efficiency aeration equipment has never been greater.

Next Turbo Technologies (NTT) is addressing this challenge through a new generation of integrally geared, single-stage centrifugal turbo blowers designed to deliver efficient, reliable, and flexible air supply for demanding aeration and oxidation applications.

Founded in 2014 by a team of industry veterans, Next Turbo Technologies has developed its expertise around the potential of integrally geared, single-stage turbo compressor technology.

Mechanical Simplicity for Long-Term Reliability

One of the key advantages of Next Turbo Technologies is its philosophy of prioritizing mechanical efficiency over complex electronic control. Unlike conventional high-speed turbo blowers that rely primarily on Variable Frequency Drives (VFDs) for capacity regulation, NTT's turbo blowers utilize the company's advanced 2-point

control system, combining Variable Diffuser Vanes (VDV) and Inlet Guide Vanes (IGV) to achieve a wide airflow regulation range while maintaining high efficiency, with no VFD required, simplifying the electrical system and enhancing long-term reliability.

Designed with robust mechanical components and industry-standard parts, Next Turbo blowers are engineered for a design lifetime exceeding 25 years. By focusing on durable gears, bearings, and serviceable components rather than electronics with shorter obsolescence cycles, NTT provides a long-term investment that minimizes lifecycle costs while ensuring reliable operation for decades.



Efficiency Where It Matters Most

For wastewater treatment facilities, energy efficiency is not simply a technical advantage; it is a major component of the plant's operating cost and environmental footprint. Aeration systems often operate continuously, making even small improvements in energy performance potentially significant over the lifetime of the equipment.

Next Turbo blowers place airflow and pressure control at the center of compressor efficiency. Its technology is designed to maintain high efficiency over a wide turndown range, offering airflow regulation from approximately 40% up to 100% of design capacity.



Customized Performance for Every Application

Another important feature of Next Turbo blowers' approach is the customization of the blowers' aerodynamic components. The impeller and its blade geometry can be individually calculated according to the specific requirements of each project.

Factors such as ambient temperature, humidity, barometric pressure, required airflow, and discharge pressure are considered when defining the compressor configuration. The impeller geometry is also matched with the diffuser vane design to achieve efficient compression under the actual operating conditions of the installation.

This project-specific approach allows the equipment to be selected and configured according to the real requirements of the site rather than relying solely on a standard, one-size-fits-all solution.

Designed for Easier Maintenance

A reliable machine is not only one that operates efficiently; it is also one that can be maintained effectively throughout its service life.

Next Turbo blowers emphasize serviceability as part of the equipment design. Many maintenance activities can be performed on-site by trained plant personnel, while local service centers and partners can provide additional support when required.

The company also offers services covering installation, commissioning, staff training, remote monitoring, and preventive maintenance. This creates a broader support framework that extends beyond the initial equipment supply and helps operators maintain the performance and health of their turbo blowers over time.

For plant owners, easier access to maintenance and service can contribute to reduced downtime, better equipment availability, and improved lifecycle management.



A Smarter Approach to Sustainable Aeration

As wastewater treatment plants move toward greater digitalization & sustainability, the role of intelligent aeration technology is becoming increasingly important. The objective is no longer simply to provide air; it is to deliver the right amount of air, at the right pressure, at the right time, while minimizing energy consumption and maintaining process stability.

Next Turbo blowers combine mechanical engineering, aerodynamic optimization, intelligent control, and serviceability to create turbo compressor solutions aligned with these modern requirements.

The company's technology portfolio is designed around one central principle: maximizing efficiency without compromising reliability. In an industry where energy efficiency, operational reliability, and lifecycle performance increasingly define successful projects, the next generation of turbo blowers technology is not simply about producing more air. It is about delivering smarter air, more efficiently, and with greater control.



SMART TURBO BLOWERS FOR EFFICIENT AERATION

NexTurbo TECHNOLOGIES (NTT)

delivers high-efficiency turbo blowers for reliable aeration.

Advanced VDV + IGV control

eliminates the need for a VFD while maintaining high efficiency.

Durable mechanical design

ensures a service life of over 25 years.

Custom-engineered solutions

provide 40–100% airflow control and long-term operational reliability.



Smart Sustainability
— for Water & Energy —

is the official representative of

NexTurbo TECHNOLOGIES in Egypt.

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BINDERGROUP
MEASUREMENT & CONTROL



Binder Control Systems: Intelligent Aeration and Process Control for Wastewater Treatment Plants

As wastewater treatment plants face increasing energy costs, stricter environmental regulations, and fluctuating process loads, efficient process control has become more important than ever. Since aeration is typically the largest energy consumer in a biological treatment plant, optimizing air distribution is essential for reducing operating costs while maintaining high treatment performance. The Binder Control System combines the precision of VACOMASS® with the intelligent process optimization capabilities of Aqualogic® to create a complete solution for modern wastewater treatment plants. By integrating advanced airflow measurement, intelligent control valves, process automation, and adaptive software, the system delivers reliable, energy-efficient operation under changing process conditions.

VACOMASS® – Precision Aeration Control

VACOMASS® is Binder's modular aeration control system designed to supply the exact amount of air required in each aeration zone. Instead of operating with fixed airflow rates, the system continuously measures airflow and adjusts it according to the actual oxygen demand of the biological process.

This demand-driven approach prevents both under-aeration, which can reduce treatment efficiency, and over-aeration, which wastes energy. As a result, wastewater treatment plants benefit from improved process stability, lower blower power consumption, and reliable compliance with discharge regulations.



VACOMASS® Product Portfolio

The VACOMASS® system consists of several integrated components that work together to provide accurate and efficient aeration control.

VACOMASS® Flow Meters

Thermal mass flow meters provide continuous and highly accurate airflow measurement without creating additional pressure loss. They deliver reliable data for real-time process control and are suitable for both new installations and retrofit projects.



VACOMASS Control Valves

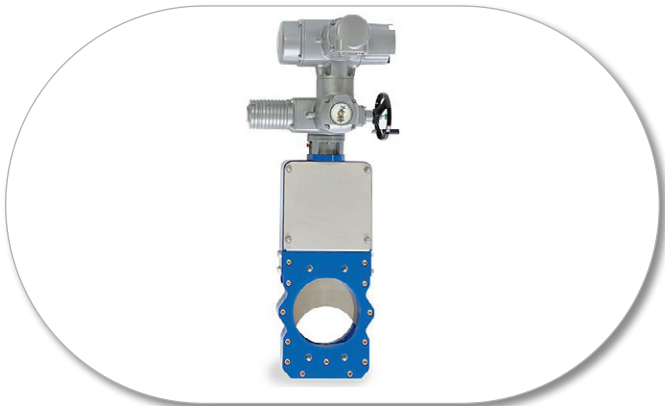
• Jet Control Valve

Binder's most advanced valve technology, designed with an aerodynamic profile to minimize pressure loss while providing highly accurate, linear airflow control. Its excellent pressure recovery contributes to significant energy savings.



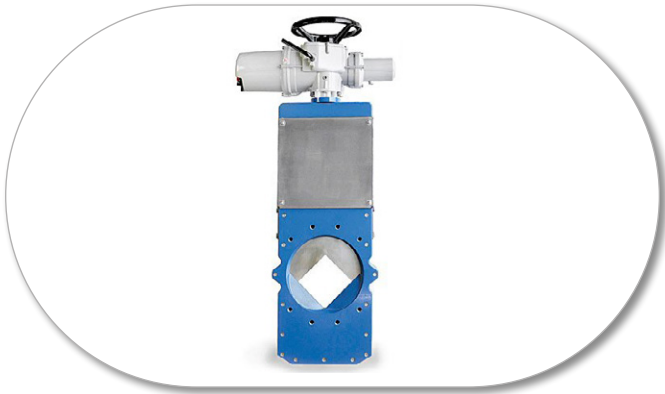
• Square Diaphragm Control Valve

A proven solution offering stable proportional control, gas-tight shut-off, and reliable long-term performance for standard aeration applications.



• Elliptic Diaphragm Control Valve

Designed for high airflow applications, this valve combines low pressure loss with reduced noise levels and improved diffuser cleaning performance, helping extend diffuser service life.



VACOMASS® Actuators

VACOMASS® actuators are available in Electric or pneumatic version to ensure precise valve positioning and stable airflow control. Their high positioning accuracy allows rapid response to changing biological process demands.



VACOMASS® FlexControl Platform

VACOMASS® FlexControl is a PLC-based modular automation platform that integrates:

- airflow control
- blower control
- sensor monitoring
- system visualization into one flexible automation platform.

The open architecture allows easy integration with existing SCADA systems and future expansion without replacing the existing system.



Intelligent Process Optimization with Aqualogic®

Aqualogic® enhances the Binder Control System by adding intelligent process control based on proven fuzzy logic technology. Instead of relying on fixed operating parameters, the software continuously evaluates process

conditions such as:

- dissolved oxygen.
- ammonia concentration.
- hydraulic loading.
- biological activity.



Using this information, Aqualogic® automatically adjusts aeration and process control strategies in real time, ensuring stable biological treatment while minimizing unnecessary energy consumption. Following its integration into the Binder Group, Aqualogic® now complements the VACOMASS® platform to provide a comprehensive solution that combines intelligent software with precise field instrumentation.

Artificial Intelligence for Future-Ready Operation

Binder continues to enhance its control technologies by integrating Artificial Intelligence into both VACOMASS® and Aqualogic®.

AI-supported algorithms can:

- analyze historical and real-time operating data.
- optimize airflow distribution.
- improve blower operation.
- support accurate chemical dosing.

This predictive approach enables wastewater treatment plants to operate more efficiently while reducing operating costs, lowering CO₂ emissions, and increasing overall process reliability.

Key Benefits

The Binder Control System provides numerous advantages for wastewater treatment plants, including:

- Lower energy consumption
- Optimized aeration efficiency
- Stable biological treatment performance
- Improved compliance with environmental regulations
- Reduced operating and maintenance costs
- Extended equipment lifetime
- Flexible integration with existing automation systems
- Easy modernization of existing facilities

Conclusion

The Binder Control System combines precise airflow measurement, advanced valve technology, intelligent automation, and adaptive process control into one integrated platform.

By bringing together the strengths of VACOMASS® and Aqualogic®, Binder delivers a complete solution that helps wastewater treatment plants achieve greater efficiency, improved operational reliability, & long-term sustainability.

With intelligent aeration control at its core, the Binder Control System enables operators to reduce energy consumption, optimize biological treatment, and confidently meet the challenges of modern wastewater management.

BINDER Control Systems

Intelligent Aeration and Process Control
for Wastewater Treatment Plants



VACOMASS®



AQUALOGIC®

KEY BENEFITS

- **50%**
Lower Energy Consumption
- **Optimized**
Aeration Efficiency
- **Stable Biological**
Treatment Performance
- **Reduced Operating**
& Maintenance Costs



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67K+

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17K+

WhatsApp
Subscribers



40K+

LinkedIn
Subscribers



195+

Countries



900+

Jobs Offers



16

Employees



18.9M+

Products
View



1235 +

Companies



16600+

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13K+

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Techno Install: Engineering Reliable Solutions for the Future of Water Treatment

Techno Install systems & equipment have been supplied & installed in all Egyptian governorates & TI have excellent reference with most of companies dealing in water treatment projects as TI maintains its good reputation & leadership in the market.

► Techno Install Activities

- Cylinders and injection systems for chlorine gas
- Industrial cranes
- Fiberglass tanks
- General contracting for construction, finishing and electromechanical works
- Water, wastewater and desalination plants

“ We were honored to participate in the first edition of the Aqua Energy Expo. This participation provided us with an excellent platform to showcase our role as a leading company in water treatment projects and the comprehensive services we offer in electromechanical and civil engineering, as well as advanced chlorine gas injection systems. We are proud of the positive impact we achieved, which reflects our unwavering commitment to providing reliable, innovative technical solutions that meet the evolving needs of the water sector and reinforces our position as a trusted partner in this vital industry. **”**

► The Most Important Projects :



Mansheya Water Treatment Station



Seyouf Water Treatment Station



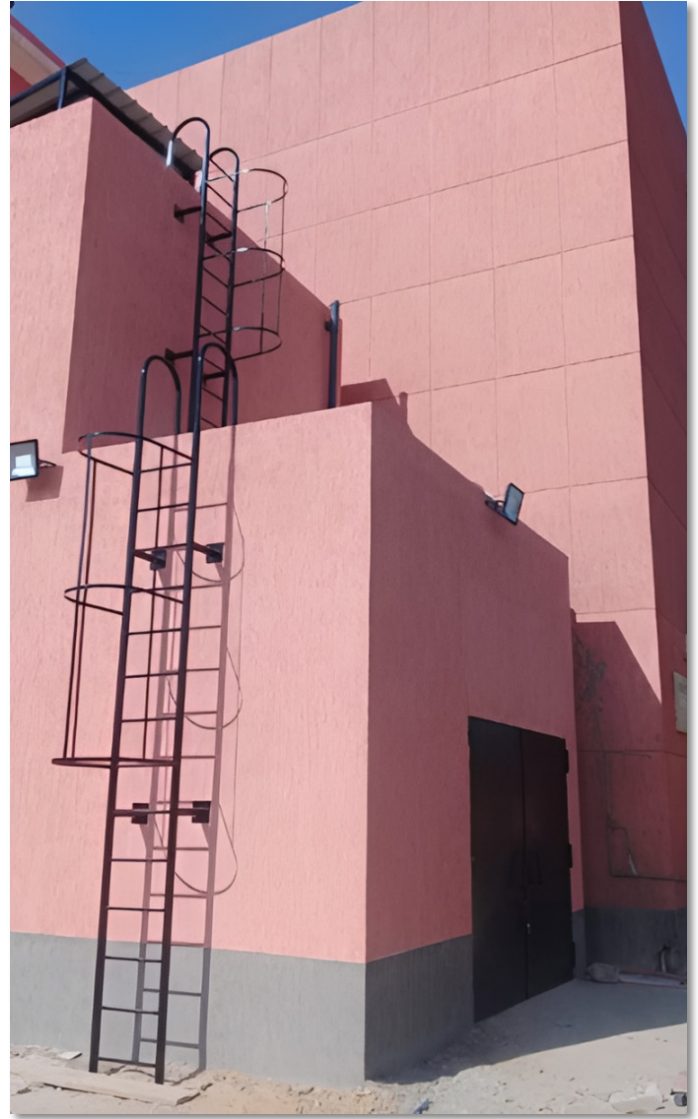
Sharki Water Treatment Station



Sharki Water Treatment Station



**Baten Water Treatment Station –
KSA**



El Amireya Water Treatment Station



El Fostat Water Treatment Station



**Hawamdeya Water Treatment
Station**



Supply & Installation of 12 metering pumps 3200 l/hr. to 4500 l/hr. for Giza WTC



Supply & Installation of 4 complete chlorine gas injection systems 200 kg/hr. in Embaba WTS for Giza WTC



East Antara Water Treatment Station



Mansheya Water Treatment Station

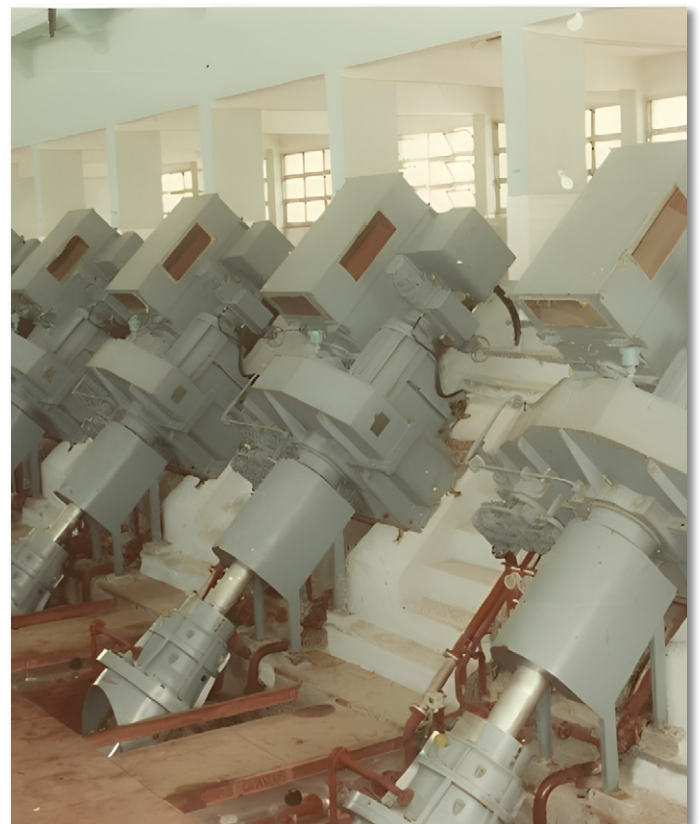


Badrasheen Water Treatment Station

**Ismailia Water Treatment Station
Badrasheen Water Treatment Station**



**East Antara Water Treatment Station
Geziret El Dahab Water Treatment Station**



**El Salam Canal Pumping Stations 1, 2
& 3 - Transformer Stations 1, 2**



Kohafa Water Treatment Plant



Petroleum Tanks for Agiba Company



Nubareya & Kafr El Dawar Water Treatment Plants



New Damietta Waste Water Treatment Plant

► Techno Install Products

- Evaporators
- Chlorine Cabinets with Flowmeter
- Vacuum Regulators
- Ejectors
- Gas Leak Detectors
- Mechanical & Electrical Pressure Reduce Valves
- Analyzer and Controller
- Automatic Switch Over
- Vacuum and Pressure Gauges
- Filters
- Expansion Cylinders



“ Building on the remarkable success of our inaugural Cooperation, we are thrilled and proud to announce our participation for the second consecutive year in the upcoming edition of Aqua Energy Expo, taking place from September 14 to 16, 2026, at the Cairo International Convention Centre. We invite all industry professionals, experts, and stakeholders to visit our booth to explore our latest innovations and sustainable solutions in water treatment and electromechanical technologies. Join us as we continue to build valuable partnerships and drive the future of the water and energy sector forward. ”

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midwater® Complete Water Solutions



Redefining Vertical Systems Integration: Midwater's Advanced Water Solutions Catalyze the MEA Sustainability Market

The Middle East and Africa (MEA) region is experiencing unprecedented water stress, turning the balance between high water recovery rates and low energy consumption into an industrial necessity. In large-scale municipal networks, heavy industrial manufacturing, and agricultural drainage frameworks, conventional treatment methodologies frequently struggle with high operational costs, power grid dependencies, and catastrophic equipment clogging. Headquartered in Cairo, Midwater has positioned itself as a leading vertical systems integrator in Egypt's water and wastewater sector to aggressively dismantle these limitations.

At the International Exhibition and Conference for Water and Energy (Aqua Energy Expo MEA 2025), Midwater's high-profile participation served as a major technical and strategic milestone. By showcasing its advanced engineering portfolio alongside its exclusive global partnerships—most notably with Jkmatic and Kurita Europe GmbH—Midwater demonstrated a tangible blueprint for regional resource resilience.



Company Background and Strategic Scope: Over a Decade of Vertical Integration

Established in 2012, Midwater has spent over a decade engineering sophisticated, sustainable, and technically advanced water treatment architectures. Operating as a comprehensive vertical systems integrator, the firm bridges the gap between primary equipment fabrication, complex automation design, and specialized technical consultancy.

This multifaceted operational model allows Midwater to serve both major engineering firms and end-user industrial customers with equal agility and precision. While Egypt remains the company's baseline testing ground and core market, Midwater has successfully extended its international footprint across the MENA region. The firm has successfully executed complex water and wastewater systems within highly challenging, infrastructure-limited environments in Iraq, Libya, and Yemen. By combining deep localized knowledge with robust international OEM partnerships, Midwater has proven that high-performance water treatment can be reliably deployed outside conventional municipal grids.



Filtration System at Iraq



Pre-treatment Filtration System for Foreign Company



Technical Breakdown: Midwater's Non-Conventional Engineering Portfolio

1- Premium Specialty Chemical Alliances



Filtration System at Iraq



Multivalve Components

AdvisorTMci

INTELLIGENT CHEMICAL DOSING

**Small Kurtia RO Chemical
Projection Program**

Recognizing that physical hardware requires precise chemical support to maintain long-term asset integrity, Midwater operates as the official representative of Kurita Europe GmbH in Egypt. Through this alliance, Midwater supplies premium specialty chemical formulations designed for:

- **Reverse Osmosis Systems:**
Antiscalants and biocides that prevent mineral scaling and bio-fouling on membrane surfaces.
- **Thermal Assets:**
Advanced anti-corrosive and stabilization treatments for cooling towers, industrial boilers, and chillers.



High Brackish Reverse Osmosis



Brackish Reverse Osmosis



Disc-Filters System

2- High-Flow Cartridge Filtration & Multi-Valve Configurations

Pre-treatment filtration systems are the front-line defense for sensitive downstream assets like reverse osmosis membranes. Traditional filtration configurations often suffer from rapid pressure drops, low fluid throughput, and excessive maintenance downtime. Midwater directly addresses these issues with two primary advancements:

- **HydroMid High-Flow Cartridge Filters:**

These robust microfiltration units are engineered to deliver exceptionally high throughput capacities with a low internal pressure drop. Their optimized service life extends operational windows, effectively mitigating plant downtime across reverse osmosis and softening arrays.

- **Jkmatic Multi-Valve Systems:**

Widely adopted across industrial sand, carbon, iron removal filtration and water Softening and deionization systems, these compact multi-valve systems replace messy, space-consuming traditional valve nests. This yields a highly scalable, cost-effective framework that streamlines backwashing and regeneration processes.



Omni-Filtration with Multivalve System



Duplex Water Softener with Multivalve System

3- Advanced Automatic Disc-Filters

For a reverse osmosis, agricultural irrigation & surface water reuse, dealing with heavy suspended solid loads is a constant challenge. Developed in tandem with Jkmatic, Midwater's Automatic Disc-Filters feature a specialized geometric design engineered to handle fluctuating, high-turbidity inputs. The automatic backwashing mechanism prevents the severe clogging issues common to surface, canal, and treated effluent water sources, requiring minimal manual maintenance.



Jkmatic Multivalve Products



Jkmatic Disc-Filter Units

4- Anti-Clogging Patented MBBR Carrier Technology

Moving Bed Biofilm Reactors (MBBR) are highly valued for their space-saving footprints in decentralized facilities. However, traditional plastic media can suffer from severe biological fouling and physical clogging, which quickly degrades microbial performance. Midwater introduced a smart, patented MBBR carrier technology explicitly engineered to eliminate media clogging. This carrier maintains a stable biological surface area and uniform fluid circulation, making it an ideal choice for compact municipal plants in residential compounds and isolated industrial zones.



MBBR Sewage Treatment Plant



Smart Patent MBBR Carriers

5- Non-Electrical Smart Control Valve Systems

In remote, energy-sensitive, or off-grid environments, electrical power dependencies present a major operational risk for water treatment plants. To combat this vulnerability, Midwater pioneered the introduction of non-electrical control valve systems in the Egyptian market through an exclusive strategic partnership with Jkmatic.

- **Mechanics & Efficiency:**

These smart control valves operate entirely without electricity, utilizing the hydraulic pressure of the fluid stream itself to actuate internal mechanisms.

- **Operational Value:**

By removing electrical components, industrial operators drastically minimize continuous energy consumption, eliminate the risk of control-board failures due to power surges, and simplify the overall control system architecture.



Multivalve System for Filter



Non Electoral Control Valve



Non Electric Control Valve Filter

National and International Mega-Projects: Proven Field Impact

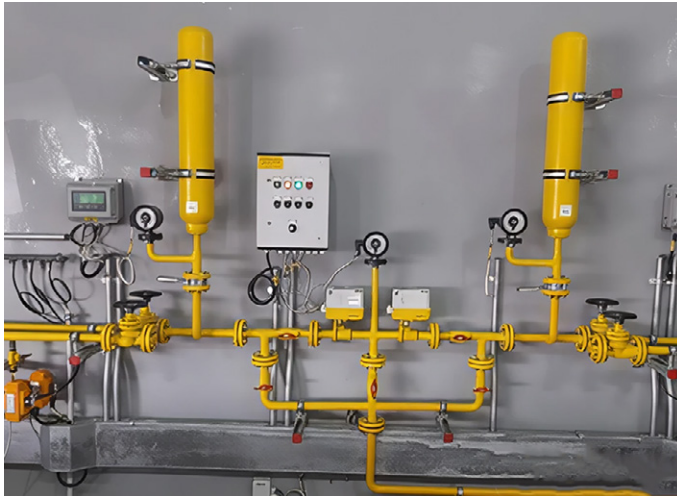
Midwater's engineering claims are backed by its participation in some of the largest infrastructure developments in the region:

• The Bahr El-Baqar Agricultural Drainage Mega-Project

Midwater played a vital role in the historic Bahr El-Baqar project, which processes a massive 5.6 million cubic meters of agricultural drainage water per day. The company installed, manufactured, and supplied localized Parts and critical structural materials for the largest gas chlorination plant in the world. This project stands as a major achievement in water conservation, reclaiming massive volumes of wastewater for safe agricultural reuse across Egypt.



Gas Chlorination at Bahr El Bakar Project



Gas Chlorination at Bahr El Bakar Project



JICA- ADW Control Treatment at Kafer El-Sheikh

• JICA-Funded Drainage Treatment (Kafr El-Sheikh)

In collaboration with the Japan International Cooperation Agency (JICA), Midwater executed comprehensive electromechanical works for five critical water treatment stations in Kafr El-Sheikh. Processing capacities ranging from 500 to 1,000 liters per second, these stations allow regional agricultural networks to safely utilize treated drainage water for smart irrigation, directly protecting local food security.



JICA- ADW Control Treatment at Kafer El-Sheikh

• Academic & Research Cooperations

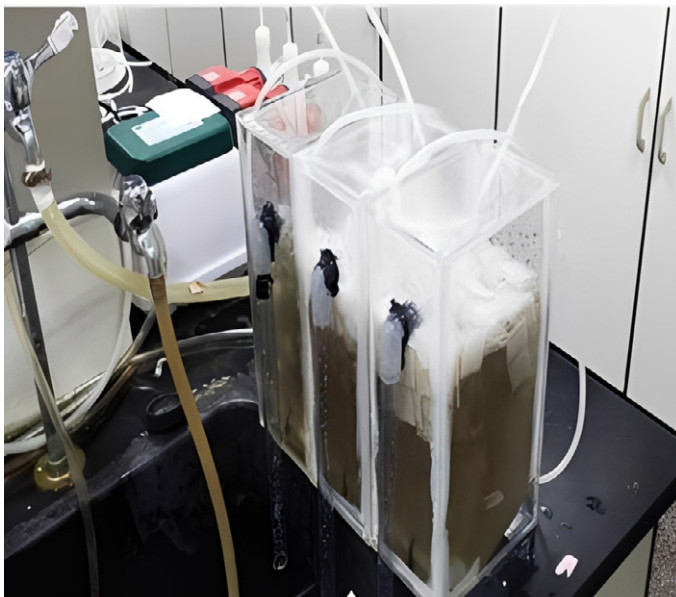
To bridge the gap between academic innovation and commercial field applications, Midwater actively collaborates with leading universities and research entities, including the Egyptian Research Center (ERC), the British University in Egypt (BUE), American University in Cairo AUC, Helwan University and the Egypt-Japan University of Science and Technology (EJUST). Midwater designs and delivers specialized, scaled Reverse Osmosis (RO) systems, Brackish Water Reverse Osmosis (BWRO) units, and Energy Recovery Equipment to help academic institutions pioneer next-generation water conservation models.



BWRO for EJUST University



Small RO for UN- BUE University



MBBR Pilot Unit for Research

Elevating the Aqua Energy Expo MEA 2025

The participation of Midwater at the Aqua Energy Expo MEA 2025 injected clear commercial, technical, and strategic value into the conference. Led by Technical and Marketing Director Essam Tantawy and Managing Director Yasser Nagah, the Midwater delegation used the platform to re-engineer how the region approaches utility-scale water challenges.



Shifting the Narrative Toward Smart Autonomy

A major theme at the expo was finding ways to optimize aging public water grids. Midwater shifted this conversation by showcasing ready-to-deploy, smart autonomous hardware.

By demonstrating heavy filtration units—such as the Aqualine Centrifugal Separators, UV disinfection units, and Jkmatic non-electrical systems—Midwater proved to municipal engineers that plants can achieve exceptional recovery rates without demanding extensive infrastructure overhauls or massive power allocations.

Facilitating B2B Alliances and Regional Growth

By showcasing working, containerized BWRO drinking water units and advanced deaerator systems for commercial bottling, Midwater directly connected with private sector utilities, agricultural cooperatives, and industrial manufacturers attending the expo.

The firm's capability to deliver custom OEM system components, automated dosing skids, and complete turnkey units allowed it to build strong partnerships with regional engineering firms. This helped transform the expo from a simple equipment exhibition into an active hub for cross-border industrial investment.



Technology and Operational Value Matrix

Core Technology Line	Strategic Implementation	Tangible Operational Value
Jkmatic Non-Electrical Valves	Energy-independent valve control utilized in remote and energy-sensitive zones.	Completely removes electrical power grid dependencies, lowering operational risks and utility costs.
HydroMid Cartridge Filtration	High-performance microfiltration arrays implemented as RO pre-treatment.	Delivers superior fluid throughput, experiences low internal pressure drops, and minimizes plant downtime.
Patented MBBR Carriers	Anti-clogging biological media deployed in compact or decentralized facilities.	Prevents biological fouling and clogging, ensuring highly stable microbial treatment performance.
Kurita Specialty Chemicals	Targeted chemical projection programs for RO, cooling towers, and boilers.	Prevents membrane scaling and biological fouling while maximizing long-term asset longevity.
Large-Scale Gas Chlorination	Utility-scale disinfection systems implemented in mega-scale drainage projects.	Delivers reliable, world-scale microbial control for agricultural drainage reuse at a massive scale.
Aqualine Systems UV (Esli-PWG Partnership)	Ultra Violet Disinfection System Targeting harmful microorganisms (bacteria, viruses, molds, and protozoa) with exposing the it to electromagnetic radiation in the UV-C spectrum	Achieves up to 99.99% pathogen destruction in seconds without Leaving toxic disinfection byproducts, chemical residues, or undesirable tastes and odors in air or water.
Aqualine Centrifugal Separators (Esli-PWG Partnership)	Effective solid separation for industrial wastewater. rely on centrifugal force and gravity to drive particle separation.	Acts as a heavy pre-filter to prevent severe abrasive wear on pumps, heat exchangers, spray nozzles, and RO membranes.



Aqualine Centrifugal Separator



Containerizing BWRO for Drinking



Aqualine Ultraviolet Unit



Deionized Unit with Multivalve



Deionized Unit with Multivalve



Conclusion

Midwater's presence at the Aqua Energy Expo MEA 2025 clearly demonstrated that solving complex regional water scarcity requires a commitment to smart, energy-efficient innovation. By successfully merging advanced physical filtration systems, energy-independent automation, and premium specialty chemical support into a unified vertical framework, the company has set a clear benchmark for the modern water sector. As industrial expansion and changing climates continue to strain limited resources across Egypt and the broader MENA region, Midwater's proven vertical integration model provides a vital, scalable framework for nations seeking true self-reliance in sustainable water infrastructure.

midwater®
Complete Water Solutions

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WEBINARS

Meet our Experts at Aqua Energy Expo Weekly Webinars



Lecturer/ Omar Selim

"Sustainable Smart Cities"



Friday, August 7th



8:00 to 10:00 PM
(KSA & Cairo Time)



Eng. Ahmed Khairy

"Water - Energy - Sustainability Nexus"



Friday, August 14th



8:00 to 10:00 PM
(KSA & Cairo Time)



Rami Shalabi
(Operation Manager)



Tom Stocker
(Senior Project Scientist)



Carlos Gutierrez
(Senior Technical Engineer)

"How to advance your RO operations through superior chemicals formulations
from King Lee Technologies / US - Envishield"



Friday, August 28th



8:00 to 10:00 PM
(KSA & Cairo Time)



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WATER NEWS BRIEF

August| 2026

www.aquaenergyexpo.com

Veolia Strengthens Its Leadership in Latin America with a Landmark Water Contract in Colombia

Veolia is embarking on a significant initiative to modernize water and sanitation infrastructure in Cúcuta, Colombia, benefiting 866,000 residents. Starting in July 2026, this long-term project aims to enhance service resilience and environmental security, generating around €100 million annually over 20 years.

The plan addresses water challenges from urbanization and climate change by reducing water losses from 42% to below 30% and upgrading treatment facilities and distribution networks. Veolia, with 30 years of experience in Colombia, emphasizes innovative solutions for reliable water access while supporting sustainability and community needs amid urban growth.



ACCIONA Completes the Refurbishment and Extension of the Tróia WWTP (Portugal)



ACCIONA has completed the renovation and expansion of the Tróia wastewater treatment plant (WWTP) in Grândola, Portugal, for TROIARESORT. This project includes civil engineering works and technological upgrades, with ACCIONA managing the facility's operation for six months. The enhancements increase the plant's wastewater treatment capacity for a population equivalent to 16,500 residents, using membrane bioreactor (MBR) technology to produce treated water for irrigation.

This upgrade supports sustainable water resource management and addresses local water scarcity, promoting the development of Portugal's Tróia peninsula as a key tourist destination while reinforcing ACCIONA's commitment to innovative, circular solutions.

DuPont™ FilmTec™ Fortilife™ XC220 Element Named a Sustainability Product of the Year for Advancing Industrial Water Circularity

DuPont's DuPont™ FilmTec™ Fortilife™ XC220 element has been awarded the Sustainability Product of the Year by the Business Intelligence Group for its contributions to industrial water reuse and sustainable practices in Zero Liquid Discharge (ZLD) and Minimal Liquid Discharge (MLD) operations.

This high-pressure reverse osmosis solution enables industrial operators to optimize water recovery and achieve brine concentrations of up to 220 g/L NaCl, reducing reliance on energy-intensive thermal processes. Launched in April 2026, the element enhances water circularity and operational efficiency across various sectors, addressing challenges like water scarcity and stringent discharge regulations while supporting DuPont's commitment to innovative water management solutions.

2026 WINNER!

DuPont™ FilmTec™
Fortilife™ XC220 Elements



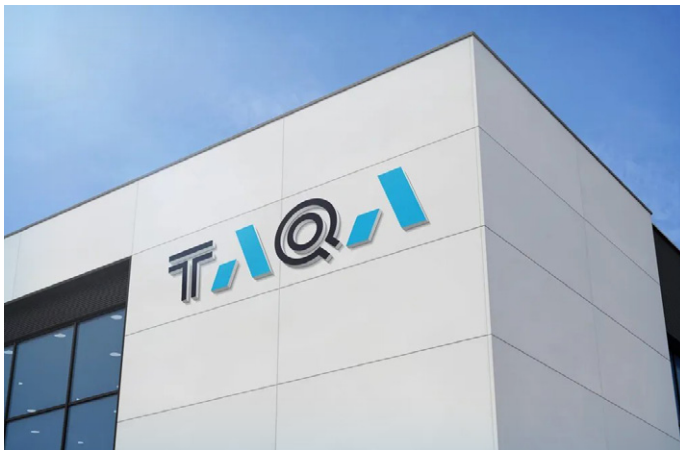
Aquatech Acquires Metichem, Expanding Comprehensive Lifecycle Water Services Capabilities Across MENA and Southeast Asia

Aquatech has successfully acquired Metito Chemical Solutions, now rebranded as Metichem, enhancing its capabilities in water treatment technologies and specialized chemicals. This integration combines Aquatech's global project experience with Metichem's local expertise, enabling comprehensive water lifecycle solutions across the Middle East, North Africa, and Southeast Asia.

The collaboration offers an expanded portfolio of treatment technologies, operations, maintenance services, and digital solutions to improve efficiency and sustainability. Celebrated by over 300 employees just before the acquisition's finalization, this milestone aligns with Aquatech's 45th anniversary. Both companies will maintain existing contracts and customer relationships, emphasizing their commitment to client service and collaboration.



TAQA Group Successfully Issues USD 750 Million Blue Bond



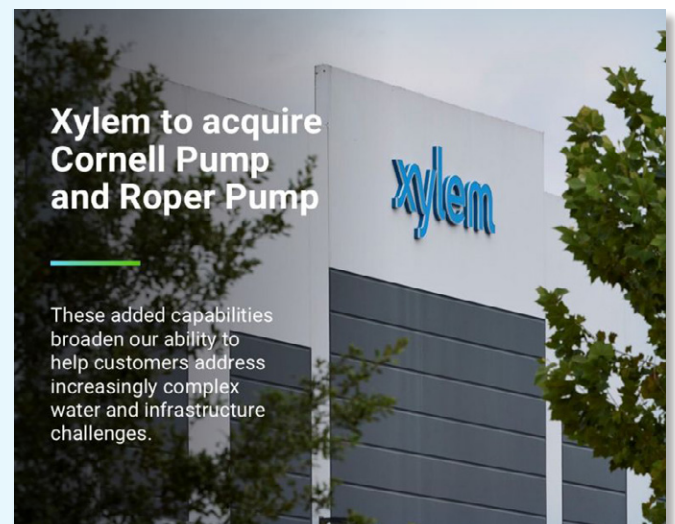
Abu Dhabi National Energy Company PJSC (TAQA) has successfully issued a USD 750 million Blue Bond, the largest ever by an integrated power and water utility, to finance sustainable water and wastewater management projects. The five-year bond, placed privately with Standard Chartered Bank, features a coupon rate of 5.125% and is listed on the London Stock Exchange.

This marks TAQA's first Blue Bond issuance under its revised Green and Blue Finance Framework, which aims to address water scarcity challenges. With a total of USD 2.6 billion in Green and Blue labeled bonds issued since 2023, TAQA is committed to sustainable solutions for water security and energy transition.

Xylem to Acquire Cornell Pump and Roper Pump

Xylem Inc. has agreed to acquire the Cornell Pump and Roper Pump businesses from Indicor for \$1.46 billion, enhancing its capabilities in critical industrial applications. This acquisition aligns with Xylem's strategy to engage in high-growth sectors benefiting from infrastructure investments and rising resource demands. CEO Matthew Pine emphasized that the deal strengthens Xylem's presence in industrial markets where water is crucial for operational success.

The Cornell and Roper Pump businesses provide advanced pumping technologies for challenging fluids, addressing needs in sectors such as construction, mining, food and beverage, and municipal services, thereby promoting reliability and process efficiency within Xylem's Water Infrastructure segment.



Global Water Events

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



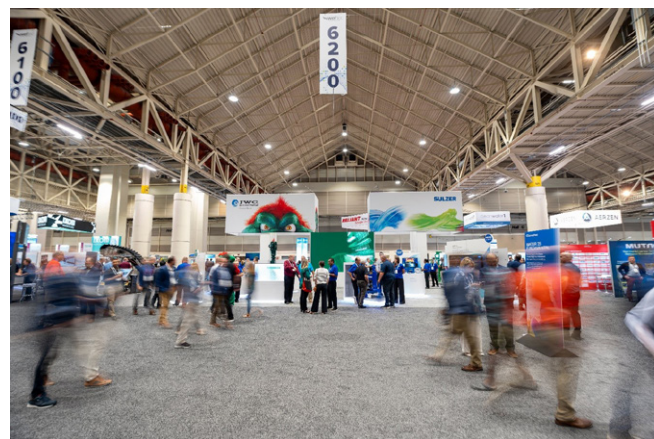
WEFTEC 2026

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



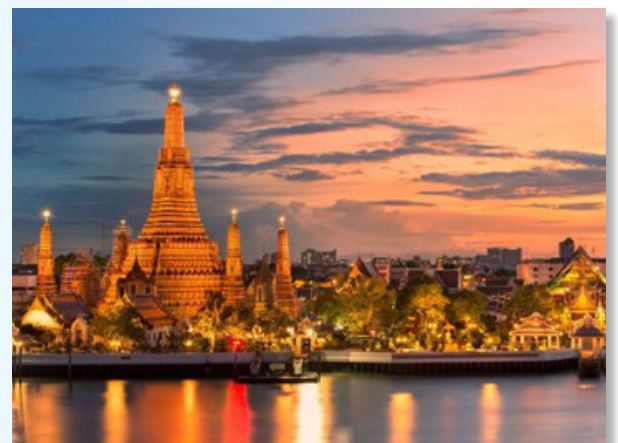
Aquatech Asia

Date: From 25 to 27 November 2026

Location: Bangkok

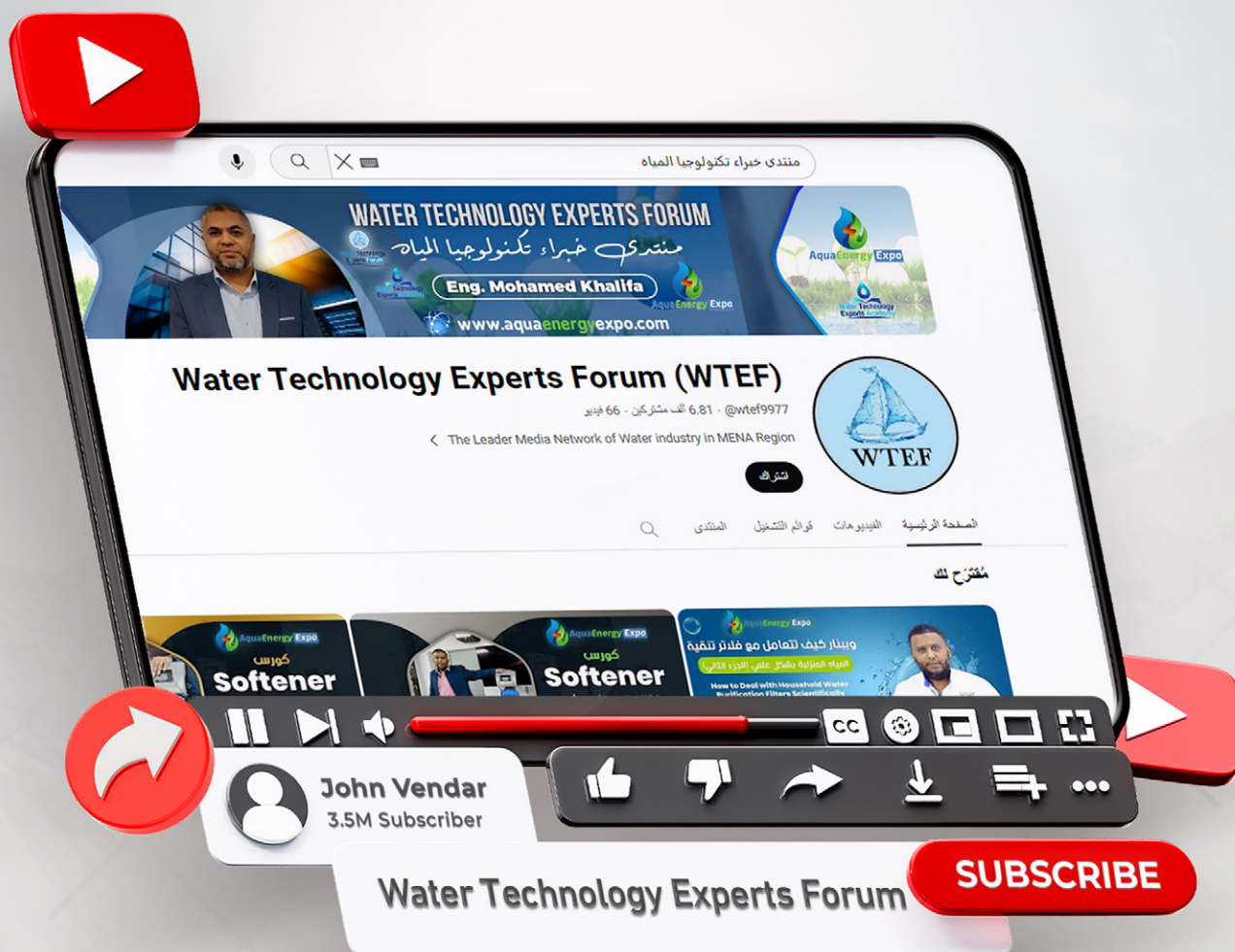
The most recent addition to the well-known Aquatech portfolio is Aquatech Asia, which will be present at flagship trade shows in China, Mexico, and Amsterdam. Southeast Asian water experts, innovators, and decision-makers will come together at Aquatech Asia.

Website: aquatechtrade.com/asia



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AquaEnergy Expo

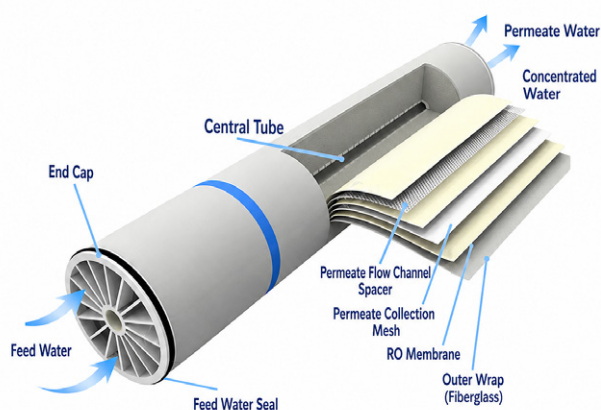
Designing High-Performance Reverse Osmosis Systems: Key Principles for Reliable, Efficient, and Sustainable Water Desalination

Reverse osmosis (RO) is one of the most widely used membrane separation technologies for producing high-purity water in municipal, industrial, commercial, drinking water, and wastewater treatment applications. Although RO systems use common components such as membrane elements, pressure vessels, pumps, and instrumentation, reliable performance depends on much more than selecting membranes and establishing a recovery target. Effective RO design requires careful consideration of feedwater quality, system capacity, pre-treatment, membrane selection, scaling, fouling, hydraulics, energy consumption, monitoring, and maintenance. These factors are closely connected, and decisions made during the design stage can significantly influence membrane performance, system reliability, and lifecycle costs. A balanced design is therefore essential for achieving consistent and long-term RO performance.

Understanding Feedwater Quality

A comprehensive analysis of the water source is one of the first steps in RO system design. Understanding contaminants, salinity, suspended solids, and microbiological content helps engineers select appropriate membranes, pre-treatment processes, and operating conditions.

Feedwater quality may also vary over time, making it important to consider potential changes in both water quality and flow.

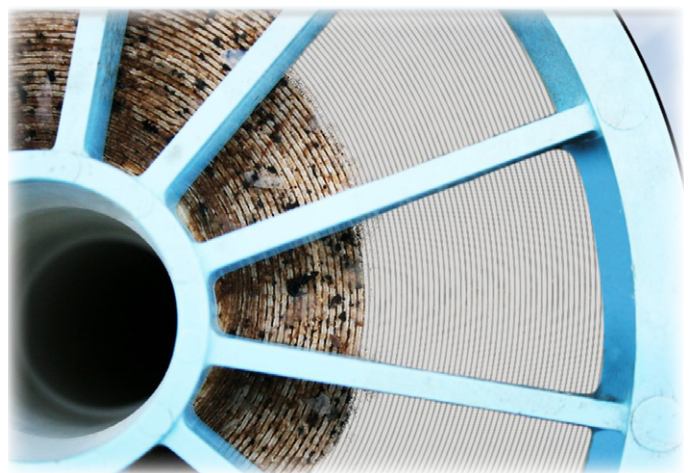


The system capacity should be based on water demand, required flow rates, peak usage, and potential future requirements. Designing around actual and expected feedwater conditions provides greater adaptability and helps reduce operational challenges.

Membrane Selection and System Capacity

Membrane selection is a critical aspect of RO design because different membranes have varying resistance to fouling, scaling, and chemical degradation. The selected membrane should be compatible with the feedwater composition while providing an appropriate balance between permeability and durability.

System capacity must also be carefully established. The RO plant should provide the required production capacity while accommodating variations in demand and feedwater conditions. Recovery is particularly important because higher recovery concentrates dissolved salts within the system and increases scaling potential. Therefore, recovery should be considered together with membrane characteristics, flux, staging and feedwater quality.



Pre-treatment and Fouling Control

Effective pre-treatment is essential for protecting Reverse Osmosis membranes from suspended solids, colloidal materials, organic matter, and other contaminants. Feedwater may contain bacteria, clay, colloidal silica, iron corrosion products, and organic materials represented by total organic carbon.

Pre-treatment options include conventional media filtration, microfiltration, ultrafiltration, activated carbon filtration, cartridge filtration, and chemical dosing such as antiscalants. A reliable 5-micron pre-filter can also remove larger particles before water enters the RO system.

Pre-treatment chemicals must be properly controlled. Excessive coagulation can increase solids loading on media filters or prematurely block cartridge filters, while residual coagulants and polymers may contribute to membrane fouling. Hydrophobic organic materials can also accumulate on membrane surfaces and accelerate fouling.

Using SDI to Evaluate Feedwater

The Silt Density Index (SDI) provides an indication of particulate matter in RO feedwater and its potential fouling tendency. The sources identify an SDI15 of 5 or less as a common guideline for minimizing fouling risk, while an SDI15 below 3 is preferred for more robust RO performance.

Media filtration, microfiltration, and ultrafiltration are identified as effective pre-treatment technologies for reducing SDI. Maintaining appropriate feedwater quality before water reaches the membranes is essential because particulate fouling can reduce performance and increase cleaning and maintenance requirements.



Scaling Control Through LSI and SDSI

Scaling occurs when sparingly soluble salts precipitate and accumulate within the RO system. Potential scale-forming compounds include calcium carbonate, barium sulfate, calcium sulfate, strontium sulfate, and calcium fluoride.

Calcium carbonate is one of the most common RO scaling concerns. The Langelier Saturation Index (LSI) can be used to evaluate calcium carbonate scaling tendency. For high-TDS water, including seawater and high-brackish water, the Stiff & Davis Stability Index (SDSI) provides a more appropriate indication because it accounts for ionic strength effects.

Several design parameters can be adjusted to control scaling. Acid addition can lower pH and reduce calcium carbonate scaling potential. Hydrochloric acid is often preferred when elevated calcium concentrations make calcium sulfate scaling a concern. Antiscalants can reduce the likelihood of scale formation, although they do not remove hardness or reduce calcium and magnesium concentrations.

Lower recovery, suitable staging, and lower design flux can also reduce salt concentration and scaling conditions at the membrane surface.

Concentration Polarization and the Beta Factor

Concentration polarization occurs when rejected salts and solutes accumulate near the membrane surface, creating a higher concentration at the membrane wall than in the bulk feedwater. Because membrane performance is influenced by surface conditions, this phenomenon can increase effective osmotic pressure, reduce permeate flux, and increase scaling and fouling.

Concentration polarization can be controlled through appropriate crossflow velocity, suitable array configuration, lower design flux, effective pre-treatment, and antiscalant use. Antiscalants do not reduce concentration polarization itself; instead, they help mitigate the scaling resulting from increased concentrations at the membrane surface.

The beta factor is another modeling parameter used in RO projections to represent the effect of concentration polarization on salt concentration at the membrane surface. It varies according to membrane stage and element position and increases as recovery increases within a stage. Engineers can use it when evaluating concentrations of sparingly soluble salts against their solubility limits.

Hydraulic Protection and Back-pressure

Hydraulic conditions must be carefully managed to protect membrane elements. High-pressure pumps can generate water hammer during startup and shutdown, creating sudden pressure changes that may damage membranes.

Variable frequency drives (VFDs), soft starters, and electrically controlled slow-opening valves at pump outlets can help reduce these effects. Proper pressure control is also necessary because RO membrane elements should not be exposed to backpressure.

The system should ensure that product-water pressure does not exceed feed or concentrate pressure. For composite membranes, the sources specify that static backpressure should remain below 5 psi. These hydraulic considerations should be incorporated into the design from the beginning.



Low-Pressure Flushing and Cleaning

Low-pressure flushing should be incorporated during RO startup and shutdown. The flushing water should meet RO feedwater requirements and should preferably be RO product water.

For continuously operating systems, periodic low-pressure flushing should also be scheduled.

The sources specify a flushing pressure of approximately 0.1–0.2 MPa, maximum flow rates of 200 L/min for 8-inch elements and 50 L/min for 4-inch elements, and a typical flushing period of 0.5–1.0 minutes.

The cleaning system should also allow individual RO stages to be cleaned separately. Cleaning should follow the normal operational flow direction, while reverse cleaning should be avoided because it can damage membrane elements.

Pressure Vessel Access and Instrumentation

Adequate space should be provided at both ends of RO pressure vessels to facilitate membrane installation and replacement. Considering maintenance access during the design stage can make future servicing more efficient and reduce operational difficulties.

Reliable instrumentation is equally important for monitoring system conditions. Common instruments include temperature gauges, pressure gauges, flow meters, pH meters, conductivity meters, and oxidation-reduction potential (ORP) meters.

These instruments provide information about water temperature, system pressure, flow rates, pH, water purity, and oxidation-reduction conditions. Together, they allow operators to monitor system performance and identify changes that may require corrective action.



Maintenance and Energy Efficiency

A robust maintenance and monitoring plan is essential for sustaining RO performance. Regular checks of membrane condition, system pressure, and water quality can help identify potential problems before they become more serious.

Proactive maintenance can reduce downtime and contribute to longer membrane service life.

Energy efficiency is another important design consideration because RO systems can be energy-intensive. Energy recovery devices such as isobaric pressure exchangers can increase capital costs while reducing energy consumption and operating expenses. Over the system's lifetime, these savings may justify the additional investment.

Cost analysis should therefore consider more than the initial investment. Energy consumption, operation, maintenance, and other lifecycle costs should be evaluated to determine the overall cost-effectiveness of the system.

Integrated RO System Design

The different elements of RO design are closely interconnected. Feedwater quality determines pre-treatment requirements and influences membrane selection. Recovery and staging affect salt concentration, while concentration polarization influences conditions at the membrane surface. These factors subsequently affect scaling, fouling, and membrane performance.

Hydraulic protection, flushing, cleaning, monitoring, and maintenance provide additional layers of membrane protection. Regulatory requirements must also be considered to ensure that the selected system meets the standards required for its intended drinking water or industrial application. An integrated design approach therefore allows engineers to balance technical performance, energy use, maintenance requirements, compliance, and lifecycle costs rather than optimizing individual components separately.



Conclusion

Reliable reverse osmosis system design requires a comprehensive understanding of water quality, system capacity, membrane selection, pre-treatment, recovery, scaling, fouling, hydraulics, energy consumption, and maintenance. No single design parameter can determine RO performance independently because the different elements of the system continuously influence one another. Effective pre-treatment protects membranes from particulate and organic fouling, while appropriate recovery, staging, flux, and antiscalant strategies help control scaling. Concentration polarization and beta-factor considerations provide further insight into conditions at the membrane surface, while hydraulic protection, flushing, cleaning, and instrumentation support reliable operation. By balancing these technical and operational requirements with energy efficiency, regulatory compliance, and lifecycle costs, engineers can develop RO systems capable of delivering consistent performance, improved reliability, and longer membrane service life across demanding water treatment applications.



Beyond the VFD: The Next Generation of Smart Pumping

When energy consumption is discussed in water, wastewater, and desalination facilities, attention often goes straight to pump efficiency. But there is another part of the equation that deserves just as much attention: how the pump actually operates during its working hours.

A pump can be highly efficient by design and still consume more energy than necessary if it operates at a constant speed when the system does not require that level of performance.

This matters particularly in the water sector, where pumps often run for long hours and flow and pressure requirements can change throughout the day depending on demand and network conditions. That is why controlling how a pump operates has become an important part of

improving plant efficiency, not simply an optional technology upgrade.

Where Do Energy Losses Begin?

A water facility may require a relatively low flow rate during a certain period, while the pump continues running at a higher speed because it has been set to operate at a fixed point. The water will still reach its destination, but the energy consumed may be higher than necessary. This is where speed control becomes important.

Instead of running the pump at maximum speed all the time, its speed can be adjusted to match actual demand. This principle is one of the reasons Variable Frequency Drives (VFDs) became widely adopted in pumping applications. But the technology is now moving another step forward.

From Separate VFDs to Integrated Systems

In a conventional setup, an electric motor is connected to a separate VFD, along with the control panels and electrical connections required to operate the system. This approach remains effective and is still widely used. However, it is not always the most practical solution, particularly when installation space is limited or when an existing facility needs to be upgraded without major changes to its infrastructure.

Integrated Motor-Drive Systems offer a simpler approach by combining the motor and drive into one integrated unit. For an operator, the difference may appear relatively small at first. In practice, however, it can be significant. Fewer external components, fewer connections, a smaller installation footprint, and more direct communication between the motor and drive can all contribute to a simpler system. In retrofit projects, these advantages can make installation and modernization considerably more flexible.



What Does This Mean for Plant Operating Costs?

For water facilities, the most important question is not how the system looks, but what happens after it is put into operation.

In a plant running around the clock, even small amounts of unnecessary energy consumption can become a high cost over the course of a year. That is why adjusting pump speed according to actual demand can make a noticeable difference, particularly in applications where flow or pressure requirements change frequently.

Operating at the appropriate speed may also reduce mechanical loads and vibration, creating better operating conditions for the equipment. For this reason, the discussion around integrated systems should not focus on energy efficiency alone.

There are also maintenance costs, equipment life, reliability, and downtime to consider. Together, these factors determine the real cost of operating a water facility.



Not Every Operating Hour Is the Same

It is easy to think of a pump as a machine that operates under the same conditions all day. In reality, water demand changes. Pressure changes. Flow rates change. Operating conditions can vary from one part of the day to another and from one season to the next. Running a pump at a fixed speed in a system that is constantly changing is therefore not always the most efficient approach.

Modern systems can respond to these changes by adjusting motor speed according to actual operating data. The goal is not to run the pump at the lowest possible speed.

The goal is to run it at the right speed for the conditions at hand. That distinction matters. True efficiency is not about reducing performance. It is about delivering the required performance while using only the energy that is actually needed.

The Technology Operators May Not See, But That Makes a Difference

Much of the progress in pump control has taken place inside the electronic components that end users may never see.

Technologies such as IGBTs have helped advance variable-speed motor control, while Wide Bandgap (WBG) technologies, including silicon carbide (SiC), are opening the way for more compact and efficient designs. But for the water sector, the name of the technology is not the most important point. The practical question is:

» What does it deliver to the facility?

If a technology can reduce energy losses, improve control, reduce equipment size, and increase reliability, its value will ultimately be seen in day-to-day operation—not simply in a technical data-sheet.

The Next Step: A Pump That Can Communicate with the Plant

This is where the evolution of pumping systems becomes particularly interesting. With sensors and digital connectivity, pumps and their surrounding systems can provide continuous information about pressure, flow, temperature, energy consumption, and operating conditions. This data gives operators a clearer picture of what is happening inside the system.

If performance begins to change unexpectedly, the change can potentially be identified earlier rather than waiting for the pump to stop and the problem to become obvious. This is one of the key ideas behind Smart Pumping. The pump is no longer simply a machine that moves water. It becomes a continuous source of operational information that can support maintenance, system optimization, and better decision-making.



Can Data Help Prevent Failures?

No system can eliminate every possible failure. However, continuous monitoring can make it possible to respond more proactively. When operating data is collected over time, gradual changes that may not be obvious during routine operation can become easier to identify.

An unusual increase in temperature, a change in pressure, higher energy consumption, or a shift in pump behavior may indicate that further inspection is needed.

This moves maintenance away from simply reacting after a failure and toward monitoring equipment condition and taking action at the right time. For large facilities, this can have a direct impact on operational continuity and maintenance costs.



Why Does This Matter So Much to the Water Sector?

Because pumps in water facilities are not machines that run for a few hours and then sit idle. In water treatment, desalination, and wastewater plants, pumps may operate continuously, handle significant volumes of water, and account for a considerable share of energy consumption.

As a result, even relatively small improvements in operating efficiency can become valuable when repeated every day over many years. At the same time, water utilities are under growing pressure to reduce energy consumption, improve reliability, and maintain uninterrupted service. This makes smart control and energy management part of a broader operational strategy—not simply an equipment upgrade.

Do You Need a New Pump or a Smarter Way to Operate It?

This is a question worth asking before making a new investment. In some cases, the equipment itself may be the problem, and replacement may be the right solution.

In other cases, the pump may already be suitable, but the way it is operated may not match the actual requirements of the system. In such situations, improving the control system could have a greater impact than simply installing a larger pump.

For some projects, the best approach may be a combination of:

» **An efficient motor + the right control system + continuous performance monitoring.**

The investment then becomes focused on the result the facility needs to achieve—not simply on the equipment itself.



From Energy Savings to Better Asset Management

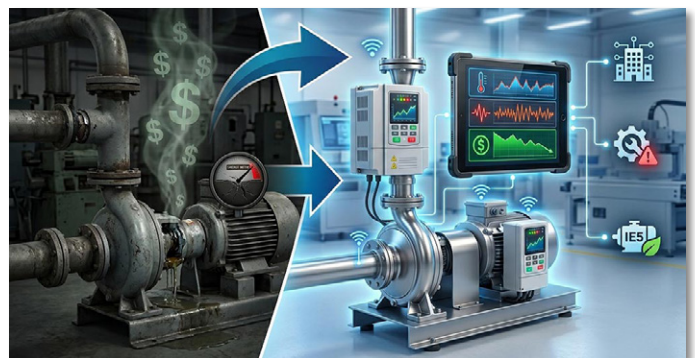
Integrated systems should not be viewed as a technology operating in isolation. Their real value becomes clearer when they are part of a wider strategy for managing energy, assets, and operational data. As equipment becomes more connected, operators gain a better understanding of what is happening within the system. Performance can be compared, sources of energy waste can be identified, and maintenance priorities can be established more effectively.

This fits naturally with the wider digital transformation taking place across the water sector, where data is gradually becoming an essential tool for managing modern facilities.

What Comes Next?

It is difficult to predict exactly what pumping systems will look like over the next decade, but the direction is becoming increasingly clear. Motors are becoming more efficient. Drives are becoming smaller and more capable. Sensors are becoming more common. And operational data is becoming an increasingly important part of day-to-day plant management.

As artificial intelligence and data analytics continue to develop, this information can be used more effectively to improve performance, identify potential problems, and support operational decisions. This means the concept of the smart pump will extend far beyond motor speed. It will be about the ability of the entire system to understand operating conditions and respond to them intelligently.



In the End, Efficiency Starts with How We Operate the Pump

Not every facility needs the latest technology available, and there is no single solution that fits every pumping system. But one principle deserves attention in every project: Choosing an efficient pump is important. Making sure it operates the right way is just as important.

This is where integrated systems and intelligent control can make a real difference. They provide an opportunity to improve energy use, reduce equipment stress, simplify maintenance, make better use of operational data, and support more informed decisions. For the water sector, which is constantly looking for ways to deliver better services at lower cost, this shift can be one practical step toward more efficient and reliable facilities. The future is not about running pumps at maximum capacity. It is about running them at the capacity the system actually needs.

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The Intelligent Nexus: Where Water, Energy, and Digital Innovation Converge

Water and energy are deeply interconnected foundations of sustainable development. Water treatment, distribution, and reuse require significant energy, while energy production depends heavily on water resources. With climate change, population growth, and rising demand placing increasing pressure on both sectors, smarter and more efficient management has become essential.

Digital technologies including Artificial Intelligence (AI), Digital Twins, IIoT, predictive analytics, and intelligent automation are transforming how water and energy systems are managed. By turning real-time data into actionable insights, these technologies help optimize operations, reduce energy consumption and water losses, strengthen resilience, and build more sustainable infrastructure for the future.

The Water-Energy Nexus: Driving Smarter, More Sustainable Infrastructure

Water and energy are deeply interconnected. Producing, treating, transporting, and recycling water requires significant amounts of electricity, while generating electricity depends heavily on water resources. Because of this close relationship, improving efficiency in one sector directly benefits the other.

Across the world, utilities are facing increasing pressure from population growth, industrial development, stricter environmental regulations, and aging infrastructure. As demand for both water and energy continues to rise, organizations must find smarter ways to optimize operations without compromising service quality.

Managing water and energy as interconnected systems rather than separate sectors enables better planning, lower operating costs, and more sustainable resource management. This integrated approach has become essential for achieving long-term resilience.

Climate Change Is Accelerating the Need for Smarter Infrastructure

Climate change is transforming the way water utilities operate. Extended droughts, unpredictable rainfall, flooding, and rising temperatures are creating new operational challenges that existing infrastructure was not originally designed to withstand.

At the same time, many treatment plants, pumping stations, and distribution networks have been operating for decades and require continuous maintenance to remain reliable. Unexpected equipment failures, water losses, and energy inefficiencies can significantly increase operational costs while affecting service continuity.



Building new infrastructure alone is not enough. Utilities must also become more intelligent in how they manage existing assets. Digital technologies provide the visibility needed to monitor system performance continuously and respond proactively before small issues develop into costly failures.

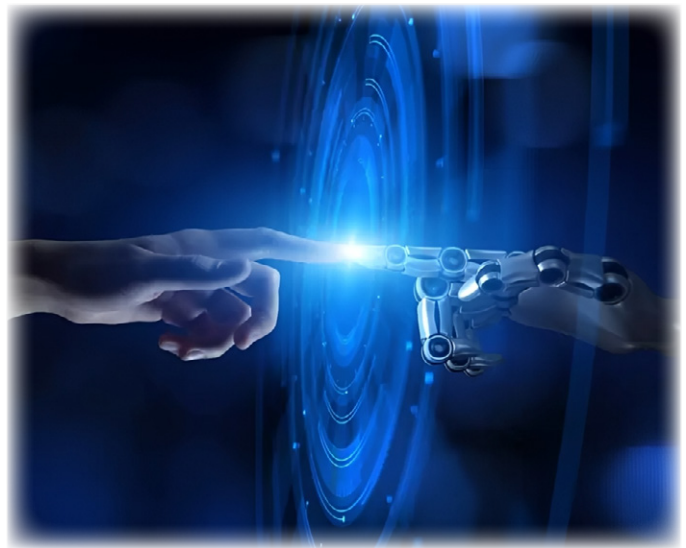
Digital Transformation: A New Era for Water Utilities

The digital transformation of the water sector extends far beyond simply replacing paper records with electronic systems. It represents a fundamental shift toward data-driven decision-making,

where real-time information supports every operational activity. Modern utilities are deploying connected sensors, cloud platforms, and advanced software capable of collecting information from thousands of assets simultaneously.

Operators can now monitor treatment processes, pumping systems, storage facilities, distribution networks, and energy consumption through centralized digital dashboards.

This level of visibility allows organizations to detect inefficiencies, optimize operations, and improve overall system performance while enhancing customer service and operational reliability.



Artificial Intelligence Is Driving Smarter Decisions

Artificial Intelligence has become one of the most influential technologies shaping the future of water management. AI systems can process massive amounts of operational data far more quickly than traditional analytical methods. By evaluating historical records together with real-time information, AI identifies patterns that may indicate equipment deterioration, operational inefficiencies, or potential system failures.

These intelligent systems support engineers by providing recommendations for improving operations, optimizing pump schedules, reducing energy consumption, and enhancing water quality management. Rather than replacing experienced professionals, AI enhances human expertise by providing accurate, data-driven insights that enable faster and more informed decision-making.

Predictive Maintenance Reduces Risk and Cost

Historically, maintenance activities were often performed after equipment failures occurred or according to fixed maintenance schedules. Both approaches can lead to unnecessary costs, unexpected downtime, and inefficient use of maintenance resources.

Predictive maintenance offers a more effective alternative. Using data collected from sensors installed on pumps, motors, valves, and other critical assets, predictive analytics can identify early signs of wear long before equipment fails.

Maintenance teams can then prioritize interventions based on actual equipment condition rather than routine schedules. This approach minimizes operational disruptions, extends equipment lifespan, improves worker safety, and significantly reduces maintenance costs. Most importantly, predictive maintenance helps ensure uninterrupted water services for communities and industries.



Digital Twins Are Revolutionizing Infrastructure Management

One of the most exciting developments in digital transformation is the adoption of Digital Twin technology. A Digital Twin is a virtual representation of a physical asset or an entire water system that continuously updates using real-time operational data.

Engineers can simulate different operational scenarios, evaluate equipment performance, predict failures, and optimize processes within a virtual environment before implementing changes in the real world.



This capability allows utilities to make better-informed decisions while reducing operational risks and improving investment planning. Digital Twins also support long-term infrastructure development by helping organizations evaluate future demand, climate impacts, and expansion strategies more accurately.

Connected Infrastructure Through Industrial Internet of Things (IIoT)

The Industrial Internet of Things (IIoT) has become the foundation of modern smart utilities. Thousands of connected devices continuously monitor essential operating parameters,

including:

- Water quality
- Pressure
- Energy consumption
- Equipment vibration
- Network performance
- Flow rates
- Pump efficiency
- Reservoir levels
- Chemical dosing

Real-time monitoring enables operators to identify abnormal conditions immediately and respond before service quality is affected.

The result is a more reliable, efficient, and resilient water infrastructure capable of adapting to changing operating conditions.

Data Is Becoming the Most Valuable Utility Asset

Utilities generate enormous volumes of operational data every day. However, data only creates value when it is transformed into meaningful insights.

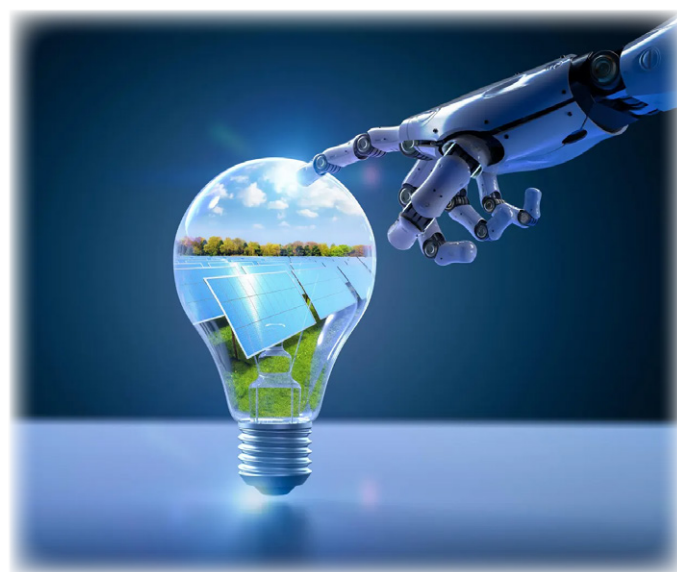
Modern digital platforms integrate information from multiple sources into unified dashboards that provide a comprehensive overview of system performance. Decision-makers can monitor energy usage, water quality, maintenance activities, asset conditions, operational efficiency, and environmental performance from a single interface.

This integrated approach enables faster decisions, more accurate forecasting, better resource allocation, and continuous operational improvement. Organizations that successfully leverage data gain a significant competitive advantage while improving sustainability and customer satisfaction.

Improving Energy Efficiency Through Intelligent Operations

Energy is one of the largest operating expenses for most water utilities. Digital technologies enable organizations to optimize pump operations, improve treatment processes, reduce unnecessary equipment operation, and minimize energy waste without affecting service quality.

Intelligent control systems automatically adjust operating conditions based on real-time demand, weather forecasts, reservoir levels, and network conditions. These improvements reduce electricity consumption, lower greenhouse gas emissions, decrease operating costs, and support corporate sustainability objectives. The result is a smarter balance between operational performance and environmental responsibility.



Building Long-Term Resilience

Technology alone cannot create resilient utilities. Successful digital transformation also depends on skilled employees, effective leadership, continuous training, and organizational readiness for change. Many utilities are experiencing workforce transitions as experienced professionals retire and new generations enter the industry.

Digital platforms help preserve institutional knowledge by documenting operational procedures, automating routine tasks, and supporting less-experienced employees with intelligent decision-support tools. By combining technology with human expertise, organizations can maintain operational excellence while preparing for future challenges.



Collaboration Is Essential for Sustainable Progress

Addressing the water-energy nexus requires collaboration across governments, technology providers, utilities, researchers, and private industry. No single organization can solve today's complex sustainability challenges alone.

Partnerships encourage innovation, accelerate technology adoption, improve knowledge sharing, and create integrated solutions that benefit both water and energy sectors. As digital ecosystems continue to evolve, collaboration will remain one of the most important drivers of sustainable infrastructure development.

The Road Ahead

The future of water management will be defined by intelligent infrastructure rather than infrastructure alone. Artificial Intelligence, Digital Twins, predictive analytics, cloud computing, and connected assets are rapidly becoming essential components of modern utility management. These technologies empower organizations to anticipate problems before they occur, optimize resource utilization, strengthen operational resilience, and deliver higher-quality services with greater efficiency.

Digital innovation is no longer a vision for the future—it is becoming the new operational standard. Organizations that embrace this transformation today will be better positioned to meet growing demand, adapt to climate uncertainty, reduce operational costs, and achieve ambitious sustainability goals.

By integrating digital intelligence into every stage of the water cycle, the global water sector can build a future where water and energy are managed more efficiently, more responsibly, and more sustainably than ever before.

Conclusion

The water-energy nexus is becoming a critical priority for building sustainable and resilient infrastructure. Digital technologies such as AI, predictive analytics, Digital Twins, and IIoT are helping utilities improve efficiency, reduce resource consumption, anticipate risks, and strengthen reliability. The future will depend not only on building more infrastructure but also on smarter management of water and energy to create more efficient, resilient, and sustainable systems.





Sustaining Water and Energy: System Dynamics, Industrial Efficiency, and Integrated Management

Every time you illuminate a room or pour yourself a glass of water, you engage with one of the planet's most crucial yet least comprehended relationships: the water-energy nexus. The process of generating electricity consumes significant quantities of water, while the cleaning, treatment, and distribution of water are heavily reliant on energy. Despite this, these two sectors are often operated separately, overlooking their profound interconnections.

Currently, this fragile relationship is under immense pressure. Factors such as global population growth, economic development, rapid urbanization, and advanced infrastructure like data centers are dramatically increasing resource demands. Concurrently, climate change is altering hydrological patterns through more frequent droughts and rising temperatures. It is vital to understand and manage this nexus using an integrated approach to ensure a sustainable and dependable future.

Water for Energy, Energy for Water

• Water for Energy Production

Water is essential for nearly every type of energy supply. Thermoelectric power plants, powered by coal, natural gas, or nuclear sources, depend significantly on water for their cooling processes. Hydropower relies directly on flowing water to rotate turbines and produce electricity. Moreover, substantial amounts of water are necessary for the extraction, processing, and transportation of fuel in the oil, coal, and gas industries.

On average, the global energy sector withdraws approximately 0.6 billion cubic meters (bcm) of freshwater for each exajoule (EJ) of energy demand. The energy sector's heavy reliance on water creates significant environmental and operational challenges. Thermal power plants can cause thermal pollution by releasing heated cooling water,

reducing dissolved oxygen and harming aquatic life. During droughts and heatwaves, warmer water sources lower cooling efficiency, forcing plants to reduce electricity generation. Low-carbon energy options also present water-related concerns: biofuels increase water demand, hydraulic fracturing risks groundwater contamination, and hydropower reservoirs, while supporting flood and drought management, can alter groundwater, increase sedimentation, and disrupt ecosystems.



• Energy for Water Services

On the other hand, extracting, treating, and transporting water requires a significant amount of electricity. Utilities operate continuously to pump groundwater, purify municipal supplies, maintain pressure in distribution networks, and treat wastewater. As a result, water treatment facilities are among the largest consumers of electricity in many cities, leading to a continuous feedback loop where increased water demand elevates electricity consumption.

Advanced water processing considerably heightens energy needs. Electricity generally represents 25% to 40% of the operational costs for a typical water treatment facility, while nearly 50% of the expenses for desalination plants are attributed to energy. Additionally, industries such as semiconductors, pharmaceuticals, and food and beverage production require ultrapure water (UPW), which necessitates 4 to 18 times more energy to treat compared to standard drinking water.

Vulnerabilities and Unintended Trade-Offs

• Hydrological Droughts and Power Grid Reliability

When water becomes limited or excessively warm, energy production is directly impacted. Drought conditions lead to intense competition for stored water between hydropower turbines and municipal drinking supplies. A striking instance occurred in 2021 at California's Lake Oroville, where water levels fell so low that officials had to shut down the hydropower facility to conserve emergency drinking water. This situation compelled the state to depend on higher-emission natural gas plants, undermining its clean energy objectives.

Climate change significantly worsens hydrological variability. In nations like Sri Lanka, China, and South Africa, long-term hydropower investments must now consider the increased frequency and duration of droughts. Moreover, water scarcity necessitates a greater dependence on energy-intensive supply methods, such as long-distance water transport and desalination, which further constricts the resource cycle.



• Microclimatic Effects and High-Tech Demands

Addressing resource challenges in isolation often results in unintended effects. In Phoenix, homeowners who replaced their lawns with desert landscaping effectively saved water. However, this change led to an increase in electricity consumption because the removal of green grass raised local temperatures, prompting residents to use air conditioning more frequently. This trade-off demonstrates how efforts to conserve water can unintentionally boost energy usage.

The rapid advancement of technology presents similar issues. Data centers, particularly those expanding in Pennsylvania, require substantial amounts of electricity and significant water for cooling purposes. Even in areas that have historically had ample water supply, the swiftly growing demand from data centers, electric vehicles, and advanced infrastructure poses a threat to local water systems, as evidenced by the 2024 Mid-Atlantic drought.

The Industrial Sector: Efficiency and Synergies

• Industrial Resource Demands and Wastage

The industrial sector is crucial for resource sustainability. Worldwide, industry ranks as the second-largest user of freshwater after agriculture, accounting for nearly 20% of withdrawals, and is the largest consumer of energy, utilizing almost 40% of global energy. Despite this significant dependence, considerable inefficiencies are evident in industrial operations around the globe.

An analysis of U.S. manufacturing indicates that nearly 50% of the energy used on-site is wasted. Globally, approximately 30% of freshwater is lost due to leaks and inefficient practices, with supply system losses reaching as high as 60% in some countries. Furthermore, Thames Water in the UK discovered that over 25% of the water supplied to business customers is lost due to leaks on their premises, with certain industrial sectors experiencing losses of up to 50%.



• Integrated Efficiency Measures

Given the strong connection between energy and water, conserving one resource inherently leads to the conservation of the other. Implementing AI-driven energy management could decrease industrial energy consumption per unit of value added by 28% by 2035. This reduction in energy usage translates to withdrawing 17 bcm less freshwater each year—equivalent to the total municipal water consumption in Sub-Saharan Africa in 2020. Likewise, minimizing water waste lowers energy expenses associated with extraction, treatment, and pumping.

Conducting industrial water audits can yield water savings ranging from 10% to 50%, along with up to 20% reductions in energy and chemical costs. In U.S. manufacturing, investing in water efficiency is ten times more cost-effective than creating alternative water supplies and can lead to a 60% decrease in water usage. Industries can also recycle lower-quality process water or treated wastewater on-site to lessen their demand for freshwater.



Integrated Governance and Policy Frameworks

• Bridging Institutional Silos

Traditionally, energy planners and water managers have functioned independently. Energy planners concentrate on diversifying low-carbon supply without fully considering water constraints, while water managers prioritize meeting various user needs without factoring in energy requirements.

Additionally, as the energy sector shifts towards managing supply, the water sector increasingly emphasizes managing demand (“more crop per drop”). Coordination between these sectors is crucial for optimizing both investment and conservation efforts.

Economic distortions further hinder effective management. In regions like India, subsidized electricity makes pumping inexpensive, resulting in significant groundwater over-extraction for irrigation purposes. Similarly, subsidized water prices promote waste, increasing energy demand for water distribution. It is essential to align economic instruments and pricing frameworks to accurately reflect the true costs of resources.



• Policy Roadmap for Agencies

Energy ministries and water agencies can take specific policy actions to promote integrated efficiency:

Integrated Audits: Require combined energy and water audits, similar to those implemented for large consumers in India.

Data Benchmarking: Integrate water metrics into energy surveys. The U.S. Energy Information Administration (EIA) assesses water usage in more than 46,000 commercial buildings, while Singapore requires large businesses to report their water consumption.

Joint Programs: Create collaborative initiatives involving multiple agencies, such as the Central Asia water and energy program that has been active since 2009.

Rating and Recognition Schemes: Include water efficiency in energy rating systems like NABERS in Australia, training programs in Malta, and the U.S. Better Plants initiative.



Conclusion

The water-energy nexus is a crucial element of sustainable development. As climate variability, population growth, and advanced infrastructure increase the demand on global resources, managing energy and water independently is no longer feasible. Each kilowatt-hour has an associated water cost, and each gallon of clean water requires energy to process.

To create a resilient future, it is essential to engage in cross-sectoral planning, establish transparent regulatory frameworks, and implement integrated technology solutions. By harmonizing energy and water management across various industries and public policies, societies can ensure energy reliability, safeguard vital freshwater ecosystems, and promote sustainable economic growth.

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Navgrun Plans 1.2 GW TOPCon G12R Wafer and Cell Facility in India

Navgrun plans to establish a 1.2 GW annual manufacturing facility for TOPCon G12R solar wafers and cells in India, complementing its existing 700 MW TOPCon G12R module manufacturing capacity. The proposed expansion will integrate wafer, cell, and module production while supporting the company's portfolio of advanced solar modules and Building-Integrated Photovoltaic (BIPV) solutions. The project aims to strengthen domestic solar manufacturing, enhance supply chain resilience, and support India's renewable energy and local manufacturing goals. Focused on advanced TOPCon technology, operational efficiency, and sustainable growth, the expansion is expected to strengthen Navgrun's position across India's photovoltaic manufacturing value chain.



LONGi to Supply Hi-MO 9 Modules for 71 MWp Solar Projects in Italy



LONGi Solar Europe will supply its Hi-MO 9 photovoltaic modules for a 71 MWp utility-scale solar portfolio being developed by Innovo Renewables S.p.A. in Italy, marking the companies' first major utility-scale collaboration. Based on LONGi's HPBC 2.0 back-contact technology, the modules deliver efficiencies of up to 24.8% and power output of up to 670 W. The projects will use single-axis trackers alongside bifacial modules to maximize solar energy capture. Hi-MO 9 modules feature a $-0.26\%/^{\circ}\text{C}$ temperature coefficient, low degradation rates, and a 30-year linear power warranty, supporting long-term performance and reliability.

Envision Launches Renewable-Powered AI Campus in China with 2 GW+ Capacity

Envision has commissioned the Envision Galaxy Campus in Ulanqab, Inner Mongolia, a next-generation AI infrastructure project powered directly by renewable energy. The campus is designed to scale beyond 2 GW and includes a 120,000-square-metre AI supercomputing facility. Once fully operational, it is expected to deliver up to one million PFLOPS of computing power and support one million AI accelerators. Envision's proprietary AI Power System integrates renewable generation, dedicated transmission and large-scale energy storage to provide stable, low-cost green power for intensive computing workloads. The project is also the first flagship development under Mission Gobi, targeting 5 GW of green AI capacity globally by 2030.



Eswatini Launches 10 MW Solar Plant to Boost Energy Security

Eswatini has launched the 10 MW Nsoko Solar Power Plant, a 200 million Malangeni project developed by Innovent Eswatini to strengthen domestic renewable energy generation. Operating under a 25-year Power Purchase Agreement, the facility will supply electricity to the national grid and is expected to generate around 26 GWh of clean energy annually, meeting approximately 2% of national electricity demand. The project will also create around 80 temporary construction jobs and 10 permanent positions. The plant is part of Eswatini's strategy to reduce its heavy dependence on imported electricity, particularly from South Africa, while expanding utility-scale solar generation and advancing long-term energy security.



NTPC REL Floats O&M Tender for 62.5 MW Sadla-I Solar Capacity in Gujarat



NTPC Renewable Energy Limited (NTPC REL) has issued a tender for the operation and maintenance (O&M) of 62.5 MW of its Sadla-I Solar Plant in Gujarat, which has a total capacity of 70 MW. Issued on August 4, 2026, the tender covers a three-month O&M contract under a single-stage composite bidding process. The package is intended for Larsen & Toubro Limited, with no tender fee or bid security required. No pre-bid conference or reverse auction is planned. The tender forms part of NTPC REL's ongoing efforts to maintain the performance and operational reliability of its utility-scale solar assets.

Enphase Expands U.S. Manufacturing for Solar, Batteries and AI Power Systems

Enphase Energy is expanding its U.S. manufacturing operations across residential and commercial solar, battery energy storage, and power electronics for AI data centers. The company currently manufactures IQ Microinverters and IQ Batteries in South Carolina and Texas and plans to produce its upcoming IQ Solid-State Transformer (IQ SST) platform domestically. Designed for high-power AI infrastructure, the GaN-based system converts medium-voltage AC directly to 800 V DC, supporting efficient and reliable data center power delivery. Enphase said the expansion will strengthen domestic supply chains, support U.S. energy security, and help eligible clean energy projects meet domestic sourcing requirements and qualify for applicable incentives.



Global Energy Events

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



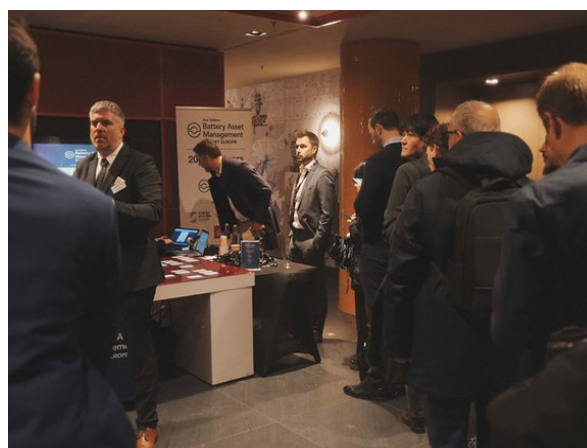
Battery Asset Management Summit Europe 2026

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.

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