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Shaping the Future of Sustainable Water Solutions

for Growth in the Middle East & Africa



VEOLIA

Mohamed Askar

Middle East & Africa Commercial Director - VEOLIA

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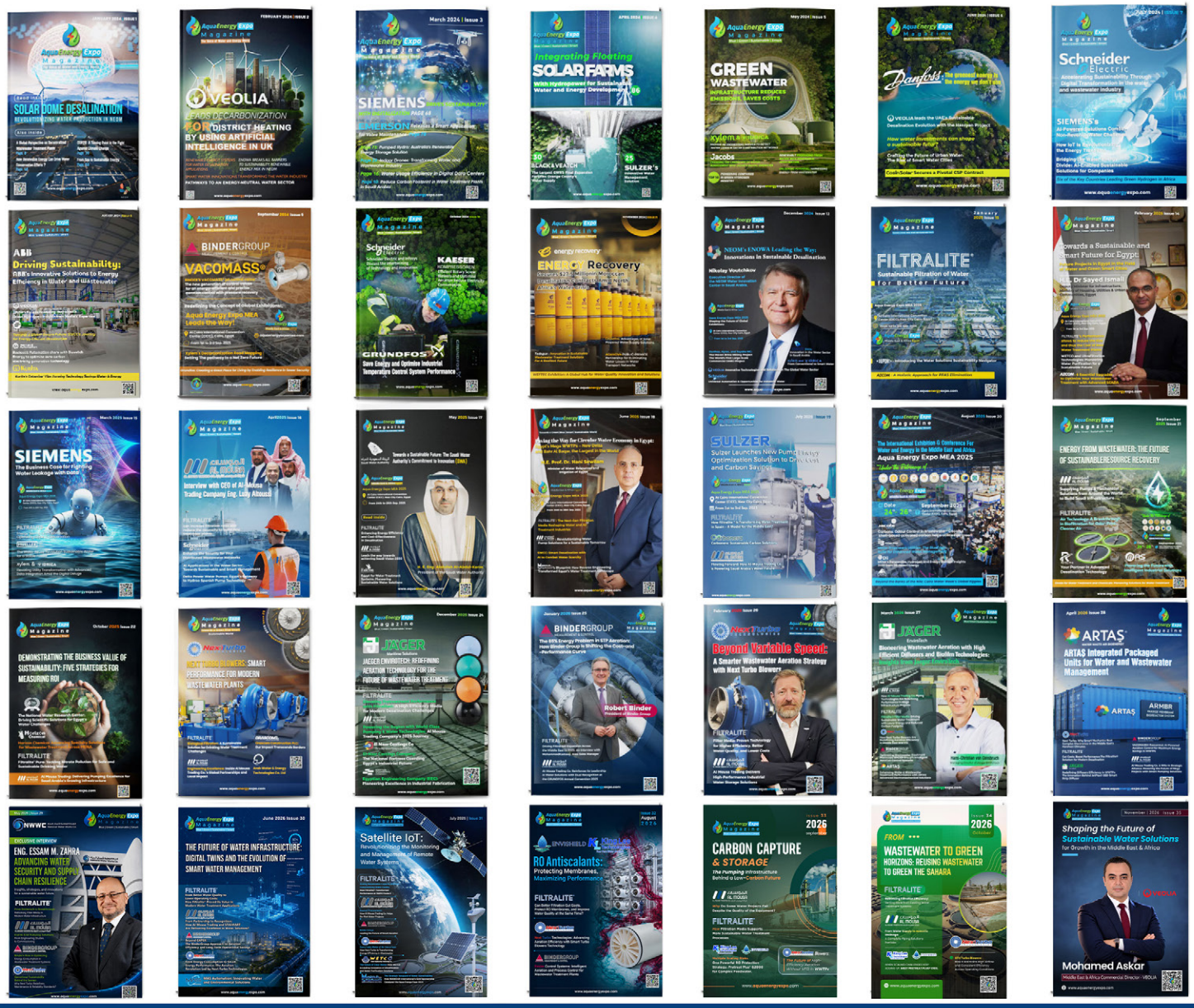

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Innovative Solutions to Achieve Sustainability in Water and Energy

From The Editor

The water industry is undergoing a profound transformation, driven by water scarcity, rising operational demands, and the need for sustainable resource management. As these challenges grow, the sector is moving toward smarter, more integrated, and value-driven solutions. This issue of Aqua Energy Expo explores the innovations and strategies shaping this transition.

Our exclusive interview with **Mohamed Askar**, Middle East & Africa Commercial Director at Veolia, explores the region's evolving water sector, highlighting long-term operational value, water reuse, advanced treatment, and digital optimization.

Addressing emerging contaminants, **Filtralite®** examines the role of filtration media in combined PFAS treatment approaches, emphasizing pretreatment and complementary technologies. Meanwhile, **Al Mousa Trading Co.** highlights how specialized showrooms enhance the water solutions buying experience through technical guidance, product accessibility, and customer support.

In wastewater treatment, **NextTurbo** explores the importance of blower control strategies, focusing on aeration demand, operational flexibility, and lifecycle costs. **King Lee Technologies**, alongside its regional partner **ENVISHIELD** in Saudi Arabia, highlights the importance of selecting appropriate antiscalants to address diverse scaling challenges in reverse osmosis systems.

As water infrastructure becomes increasingly digital, Securing Water Treatment Operations examines cybersecurity threats to SCADA systems and the measures needed to protect treatment facilities.

Complementing this, Beyond Monitoring: Turning Wastewater Data into Smarter Operations explores how integrated monitoring systems and operational data can support smarter decisions and improve network resilience.

Our industrial focus continues with Zero Liquid Discharge, examining its economic feasibility, resource recovery potential, and energy considerations. Wastewater Treatment in Industrial Processing further explores metal recovery, water reuse, and advanced treatment approaches.

Finally, Engineering the Water–Energy–Food Nexus highlights the interconnectedness of these essential resources and the importance of integrated planning, efficient technologies, and resilient infrastructure.

Together, these contributions reflect our commitment to sharing knowledge, encouraging innovation, and supporting a more sustainable future for the water and energy sectors.



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VEOLIA

Leading the Next Era of Sustainable Water Technologies and Enterprise Growth across the Middle East & Africa



Mohamed Askar

Middle East & Africa Commercial Director - VEOLIA

Mohamed Askar

VEOLIA

Middle East & Africa Commercial Director - VEOLIA

With more than two decades of experience in the global water industry, Mohamed Askar, Middle East & Africa Commercial Director at Veolia, brings a wealth of technical expertise and commercial leadership to the evolving challenges of water and wastewater management.

In this exclusive feature with AquaEnergy Expo, Askar shares his perspective on the transformation of the water sector across the Middle East and Africa, drawing on his extensive experience in municipal and industrial water treatment. He explores the role of advanced treatment technologies, high-recovery desalination, water reuse, and digital optimization in addressing growing water demands and advancing sustainable water management.

Beyond technology, he examines the strategic, technical, and commercial considerations that define successful water projects, highlighting the importance of innovation, operational excellence, and long-term value creation. He also shares his outlook on the opportunities shaping the future of the water industry and the role of integrated solutions in building a more resilient and sustainable water future.

Q1 You have worked across both municipal and industrial water treatment projects for more than two decades. From your experience, how have the priorities of water projects in the Middle East and Africa evolved—from simply meeting treatment requirements to achieving long-term operational and business value?

A1 The market has moved from buying treatment equipment to securing long term water resilience and business continuity. At Veolia our role is to convert water challenges into reliable, measurable outcomes through the right combination of technology, operations, digital capability, and local support.

Over the past two decades, I have seen clients place greater emphasis on what a water project delivers throughout its operating life. Meeting treatment requirements remains essential, but reliability, energy consumption, operating costs and the ability to accommodate future demand increasingly influence investment decisions. For industrial customers, water security is directly linked to production continuity. For municipalities, it supports reliable services and long-term development. At Veolia, our role is to translate these needs into treatment solutions that deliver the required water quality and availability at a sustainable lifecycle cost.

Q2 In complex water and wastewater projects, technical performance is only one part of the equation. What are the key factors you consider when determining whether a treatment solution is truly successful for the client—not only technically, but also operationally and financially?

A2 For me, success begins with a clear understanding of what the client needs to achieve, rather than selecting a technology at the outset. At Veolia, we provide tailored solutions designed to meet the specific technical, operational, and commercial requirements of each project.The selected solution must consistently deliver the required water quality, operate reliably under real operating conditions. This includes evaluating energy and chemical consumption, maintenance requirements, operational complexity, and overall operating expenditure.



A2 It is equally important in our region to assess whether the plant can be effectively operated and maintained by the local team. We also consider the real added value of the selected technology and its impact on both CAPEX and OPEX.Our broad portfolio of water and wastewater technologies allows us to compare different process options and select the combination best suited to the client's water quality requirements, operating conditions and financial constraints.

We are not limited to one specific solution; instead, we select the technology that is most efficient, economical, fit for purpose, and appropriate to the client's operating conditions. We also aim to minimize carbon emissions, footprint, and the overall environmental footprint.

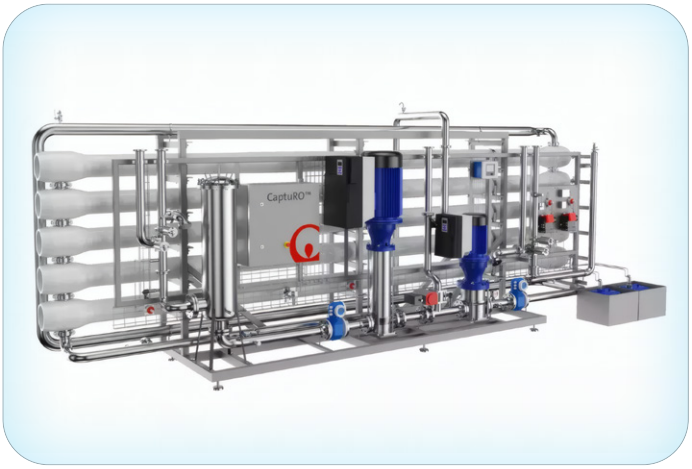
> "True success means delivering a solution that is technically compliant, operationally practical, financially justified, and resilient over time. The real measure of performance is not whether the plant operates on the day of commissioning, but whether it continues to create value throughout its entire operating life."



Q3 Water reuse is becoming increasingly important across the region. What do you see as the biggest barriers preventing industries and municipalities from moving from conventional wastewater treatment toward higher levels of water recovery and reuse?

A3 The first barrier is often uncertainty about how the recovered water will be used: who needs it, what quality they require and whether demand is consistent throughout the year. Clear regulatory requirements, confidence in water quality and the ability to operate the system reliably are equally important. Addressing these issues early is essential to building a viable reuse strategy.

At Veolia, we are addressing key reuse challenges through advanced high recovery solutions such as CaptuRO™. Deployed in suitable projects across the Middle East and Africa such as King Abdulaziz Park and Al-Urubah Park in Saudi Arabia, CaptuRO™ helps reduce reject-water volumes, minimize dependence on evaporation ponds, and address land or footprint constraints.



Depending on the wastewater characteristics and intended use, a reuse scheme may combine biological treatment, membrane separation and additional treatment or disinfection. The value comes from integrating the right processes into a reliable system, supported by appropriate monitoring and operating expertise. Hubgrade can help teams monitor performance and identify opportunities for optimization, depending on the scope of the installation and services deployed. Building confidence in water reuse also requires demonstrating that the recovered water can be produced consistently and reliably.

Water reuse is therefore not only an environmental initiative; it is a strategic opportunity to reduce dependence on natural resources, strengthen water security, and create long-term operational and financial value.

Q4 When evaluating technologies such as RO, UF, MBR, advanced treatment, or other water reuse solutions, how do you approach the trade-off between recovery rate, energy consumption, chemical requirements, concentrate management, and overall lifecycle cost?

A4 We start with the intended use of the recovered water and define the treatment required to achieve the appropriate quality. Ultrafiltration removes suspended particles and provides a barrier to many microorganisms, but does not remove dissolved salts. A membrane bioreactor combines biological wastewater treatment with membrane separation; further treatment may be required depending on the reuse application. Reverse osmosis is used where dissolved salts and other selected contaminants need to be reduced. These processes serve different functions and must be assessed as part of the complete treatment train.

However, every additional treatment barrier has operational and financial implications. Increasing recovery reduces concentrate volume but raises the concentration of retained substances, which can increase scaling risks and affect energy demand, chemical requirements and concentrate management.

A4 These trade-offs must be assessed during design, even for a well-designed plant. For this reason, we evaluate the big picture and go in detail for the complete treatment train, including pretreatment, biological treatment, membrane selection, cleaning strategy, final disinfection, and the required level of automation and monitoring. Concentrate management is another critical part of the design. At Veolia we assess whether the reject stream can be discharged, blended, further concentrated, recovered, or treated through evaporation and crystallization, depending on its composition, local regulations, available infrastructure, and overall cost.

The correct approach is to evaluate the entire system and understand how each additional percentage of recovery affects energy consumption, chemical use, membrane life, operational complexity, and concentrate management.

MABR, UF, MBR, and other advanced processes each have an important role, depending on the feedwater characteristics, required final water quality, and intended reuse application. Ultimately, the objective is to optimize the complete solution not one individual parameter and achieve the best balance between performance, reliability, environmental impact, and lifecycle cost.



Q5 Large-scale water projects often involve multiple stakeholders with different priorities—owners, consultants, contractors, operators, and technology providers. In your experience, what are the most common points of disconnect between these stakeholders, and how can they be addressed early in the project?

A5 The most common disconnect is that each stakeholder defines project success differently. The owner may focus on water quality, budget, and long term asset value; the consultant on compliance and design standards; the contractor on schedule and construction cost; the operator on reliability and maintainability; and the technology provider on process performance and design conditions.

These differences are manageable, but they must be identified and aligned early. If they are not, the project may meet its contractual specifications but still be difficult to operate, expensive to maintain, or unable to deliver the expected business value. This is particularly important in the Middle East and Africa, where projects may involve international consultants, local contractors, government entities, financiers, technology providers, and operators with different levels of experience and different contractual responsibilities. Challenges related to local content, logistics, importation, climate, feedwater variability, utilities, and operator capability can also create gaps between the design assumptions and actual operating conditions.



These gaps can be addressed by involving the operator early, agreeing on a shared design basis and clearly defining the interfaces between all parties. Feedwater conditions, utility requirements, performance guarantees and responsibilities for residuals management should be documented before equipment is ordered.

A5 Commissioning, acceptance testing, training and handover requirements should also be agreed at this stage. This helps ensure that individual equipment packages work together as a reliable and operable plant.

Q6 Having worked across project execution, techno-commercial activities, and business development, what technical or project-related factors do you believe have the greatest impact on the commercial success of a water treatment project?

A6 The commercial success of a water treatment project depends on much more than winning the contract or meeting the required treatment performance. It is determined by whether the project is based on realistic technical assumptions, whether risks are properly understood and allocated, and whether the plant can be delivered, commissioned, and operated at the expected cost and performance over its full lifecycle.

In my experience, the most important factors are the quality of the basis of design, technology selection, constructability, interface management, performance guarantees, execution planning, and long term operational support.

I can illustrate this through several successful municipal and industrial projects:

Lucid Automotive faced water scarcity, complex wastewater streams and strict sustainability requirements. Veolia implemented a Hubgrade-enabled dual-treatment and water-reuse solution.

> “The project saves 379,000 m^3 of water annually, reduces carbon emissions and optimizes chemical and power consumption, supporting Lucid Motors’ sustainability goals.”

Green Riyadh projects, CaptuRO™ high-recovery technology is used to increase water recovery, reduce reject-water volumes, and address challenges related to concentrate management and limited available space.

A6

> The project is designed to maximize the reuse of TSE water up to 4.6 million cubic meters of water annually in the minimum possible footprint compared to conventional schemes which also reduces the reject volume more than 70%.

These projects demonstrate that commercial success is achieved by selecting the right technology for the application and integrating it with sound design, operational expertise, and a clear focus on water efficiency, reliability, and lifecycle value.



Q7

Across the Middle East and Africa, water challenges and market maturity vary significantly from one country to another. How do you adapt a water treatment strategy or business approach to the specific needs, regulations, economics, and infrastructure realities of each market?

A7

Our approach is not to sell a predetermined technology or contract model. It is to combine Veolia's global technology portfolio and experience with local market knowledge, practical execution capability, and long-term support. The most successful solution is one that is technically robust, commercially bankable, compliant with local requirements, and realistic for the people and infrastructure that will operate it.

You cannot apply the same approach across the entire region and expect the same results. The first step is to understand the country and project environment. This includes water availability, climate, feedwater quality, discharge regulations, energy cost and reliability, land availability, existing infrastructure, local-content requirements, import restrictions, currency exposure, financing conditions, and the availability of qualified operators and maintenance providers.

A7

For example, a large Gulf desalination or reuse project may be driven by water security, energy optimization, performance guarantees, local content, and long-term availability. In parts of Africa, the priorities may be more focused on affordability, phased investment, financing structure, power reliability, simplified operation, and access to spare parts and technical support. Even within the same country, the strategy may differ between a major municipal programme, a remote mining site, an industrial facility, and a small community.

Q8

Many organizations are under increasing pressure to reduce water consumption while controlling CAPEX and OPEX. Where do you see the greatest opportunities for water treatment companies to create measurable value beyond simply supplying treatment equipment or systems?

A8

The greatest opportunity is to help customers manage water more efficiently across their entire operation, rather than treating each facility as an isolated project. At Veolia, our solutions focus on three main pillars, decarbonization, de-pollution & regeneration of resources, while optimizing the overall use of water, energy, chemicals, and other resource streams.

This enables customers to secure a continuous and reliable supply of water that consistently meets the quality required for their specific applications.

Our support may include comprehensive water audits, process optimization, wastewater recovery, 360 million m3 of water that has been treated and reused in the region, and improvements in energy and chemical efficiency.



A8 Digital monitoring and performance-optimization tools can further identify inefficiencies at an early stage, allowing corrective action before they develop into costly operational problems.

It's about making sure our economies can continue to grow in a more volatile world, preserving health and ultimately keeping household bills under control, because the cost of inaction is far greater than the cost of acting early.

Q9 From a business-growth perspective, what changes are you seeing in the way clients evaluate water treatment solutions today? Are decisions becoming more focused on technology, total cost of ownership, sustainability targets, reliability, or a combination of these factors?

A9 It is a combination of all these factors, but I see greater attention being paid to the total cost of ownership and the risks associated with long term operation. Clients are increasingly evaluating water-treatment solutions through a combination of technical performance, total cost of ownership, sustainability, reliability, and commercial risk. Technology remains important, but it is no longer assessed in isolation. The key question is whether the proposed solution can deliver the required water quality consistently, at a predictable lifecycle cost, while supporting the client's operational and environmental objectives.



A9 In the past, many projects were evaluated primarily on compliance, capacity, and initial capital expenditure. Today, clients are looking more closely at energy consumption, chemical use, maintenance requirements, plant availability, water recovery, concentrate management, carbon emissions, and the ability to adapt to future regulatory or production requirements.

This is particularly important in the Middle East and Africa, where water scarcity, high salinity, energy costs, extreme temperatures, and varying infrastructure conditions can have a major impact on long-term performance. For industrial customers, water security is also directly linked to production continuity. A treatment plant that meets its design specification but causes frequent shutdowns does not provide real business value.



Q10 Looking ahead, which technologies or approaches do you believe will have the greatest impact on industrial water reuse and sustainable water management in the Middle East and Africa over the next five to ten years?

A10 Over the next five to ten years, I expect three approaches to have a particularly strong impact. The first is fit-for-purpose reuse: reducing avoidable demand and treating recovered water to the quality required for each application.The second is higher recovery combined with a clear strategy for concentrate management.

High-recovery membrane processes can help where water availability or discharge constraints justify them, but their value must be assessed alongside energy use, chemical requirements and operating costs.

The third is digital optimization, combining reliable monitoring, data analysis and operational expertise to help teams maintain performance and respond earlier to changes. Resource recovery and zero liquid discharge will also be relevant in selected applications, provided their costs, energy requirements and residuals management are justified. Across the Middle East and Africa, adoption will depend on local water pressures, regulation, infrastructure, financing and operating capabilities.

Q11 Finally, based on your experience leading water projects and business growth across the region, what advice would you give to water professionals who want to successfully bridge the gap between technical expertise, client requirements, and business value?

A11 My advice is to understand the client's pain and step-in his position to clearly understand the requirements and how to achieve the client's expectations with the most optimum and efficient treatment scheme.

Understanding operation challenges and the impact of water shortage or quality deficiency would also help in understanding the criticality of the solution provided and start addressing the value added by the solution provided at the end. Then explain the available options clearly, including the assumptions, costs and trade-offs. Be transparent about what is proven and what still needs testing. Finally, stay involved through commissioning and the early operating period: that is where design assumptions meet reality, and where lasting trust is built by delivering the agreed results.

> "The best professionals are those who can turn a technical solution into a clear business outcome, explain the trade-offs honestly, and build trust through realistic commitments. In this industry, long-term relationships are built by delivering what you promise and continuing to create value after the project is completed."



FILTRALITE®



PFAS in Water Treatment:

How Filtralite® Supports a Combined Treatment Approach

Per- & polyfluoroalkyl substances (PFAS) are persistent contaminants that present a complex challenge for water treatment facilities. Addressing them requires treatment processes tailored to the characteristics of the contaminants and the quality requirements of the treated water. A combined treatment approach allows each process to serve a specific purpose. Effective pretreatment can play an important role by supporting particle removal before subsequent treatment stages.

Why One Treatment Process Is Not Enough

PFAS can be present in different forms, affecting how they can be removed:

- **Particle-associated PFAS:** Can be captured when the particles carrying them are removed through filtration.
- **Dissolved PFAS:** Require specialised treatmenttechnologies designed to address dissolved compounds.

Understanding this distinction helps water utilities select appropriate treatment processes rather than relying on conventional filtration alone.

Filtralite®: Supporting the Pretreatment Stage

Geir Norden, Research & Development Expert at Filtralite, explains that Filtralite® can contribute to a combined PFAS treatment strategy when used as part of the pretreatment stage. Its lightweight expanded-clay filter media has a highly porous structure and can be used in granular filtration or biofiltration to help capture PFAS associated with particles, supporting subsequent treatment processes.



Geir Norden
Research & Development Expert at Filtralite

Filtralite® therefore has a supporting role within a broader treatment system; it is not a standalone solution for dissolved PFAS, which require specialised treatment technologies.

Designing an Integrated PFAS Treatment System

Selecting an appropriate treatment sequence involves three key considerations:

- **Source-water characteristics:** Identify the contaminants present & their relevant properties.
- **Treatment requirements:** Match filtration and specialised technologies to their intended functions.
- **Residual management:** Plan for the safe handling of PFAS-containing materials captured during treatment.

Capturing PFAS does not destroy them. PFAS retained in filter media or treatment residuals may require further treatment and appropriate management to prevent their release back into the environment.

Considering these factors together helps water utilities develop treatment systems suited to their specific water quality objectives. A comprehensive strategy must address both contaminant removal from water and the subsequent management of PFAS-containing residuals.



Integrating Filtralite® into a Combined Treatment Strategy

By giving filtration a defined role within a combined treatment system, water utilities can make better use of Filtralite®'s capabilities as part of a broader approach to PFAS management.

Conclusion

Effective PFAS management depends on selecting complementary treatment processes and planning for the responsible handling of captured contaminants. Filtralite® can support pretreatment within this broader approach, while dissolved PFAS require specialised treatment & PFAS-containing residuals need appropriate management.

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FILTRALITE®

HOW FILTRALITE® SUPPORTS PFAS TREATMENT



FILTRALITE® FILTER MEDIA

Porous expanded clay filter media.

- Captures particle-associated PFAS
- Supports downstream treatment
- Complements combined treatment approaches

Dissolved PFAS require specialised treatment.

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Beyond the Purchase: How Specialized Showrooms Transform the Water Solutions Buying Experience

Choosing a household water pump, swimming pool equipment, or a water purification system depends on each customer's needs and conditions of use. Although the buying journey may begin with an online search or price comparison, selecting the right solution often requires a clearer understanding of the problem, operating requirements, and after-sales support. Specialized showrooms help bridge this gap by bringing products, technical guidance, and direct communication together in one place.

Al Mousa Trading Co.'s Showroom in Al Rawdah, Riyadh

Al Mousa Trading Co. opened its showroom on October 20, 2026, in Al Rawdah District, on Khalid Bin Al Waleed Street in Riyadh.

The showroom brings water and swimming pool solutions closer to customers by offering:

- Household water pumps.
- Swimming pool supplies and equipment.
- Reverse osmosis (RO) water purification systems.
- Maintenance services and technical support.



Meeting Diverse Needs with the Right Water Solutions

Customers have different needs, levels of technical knowledge, and priorities. Homeowners may need to address low water pressure or choose a suitable water purification system. Technicians may focus on product specifications and compatibility with existing equipment, while contractors and facility owners may prioritize application requirements, installation considerations, and continuity of service.

Specialized showrooms allow customers to discuss these needs directly and help connect available products with their intended applications. For Al Mousa Trading Co., the showroom provides an additional channel to engage with individuals, technicians, and facility owners, bringing its products and expertise closer to everyday customer needs while complementing its work with companies, contractors, and projects.



Technical Guidance for Better Purchasing Decisions

Direct communication helps identify customer requirements before recommending a product. When selecting pumps, the intended application, required flow rate, and pressure are important factors in determining suitable options. For swimming pool equipment, the appropriate components depend on pool size and circulation and filtration requirements.

Selecting a water purification system also involves considering the water source, consumption patterns, and routine maintenance needs. At the showroom, customers can ask questions, view products, and discuss the differences between available options with the specialized team.

These conversations help clarify operating and maintenance requirements and establish realistic expectations regarding product performance and service, supporting more informed purchasing decisions.

Products and Technical Support Under One Roof

The Al Rawdah showroom brings together a range of products designed to meet the needs of homes, villas, and facilities. Having these product categories in one location enables customers to discuss related requirements, such as pumping and purifying water or equipping a swimming pool and maintaining its components.

Maintenance services and technical support extend the customer relationship beyond the initial purchase. Understanding maintenance requirements during the product selection stage helps customers prepare for ongoing use and provides them with a clear point of contact for questions or service needs.





Turning Customer Engagement into Long-Term Trust

Specialized showrooms can improve their understanding of evolving customer needs by following up on inquiries, maintenance requests, and feedback about product use. When managed effectively, this information can improve responsiveness and help align products and services with customers' actual requirements.

Al Mousa Trading Co.'s showroom in Al Rawdah reflects an approach that combines accessibility with direct customer engagement. Its value lies in helping customers access products, understand suitable options, & obtain maintenance services & technical support when needed. Together, these elements make specialized showrooms an important part of enhancing the water solutions buying experience & building long-term customer trust.

From Digital Research to Direct Customer Service

A customer's journey may begin with an online search, Google Maps, or product-related content before progressing to a showroom visit to view products and ask questions. Providing consistent information across these channels—particularly the location, opening hours, available product categories, and contact details—can make the buying journey easier.

Direct conversations with customers also reveal recurring questions and needs that may be difficult to express during online research. These insights can help improve digital content, explain product applications, and clarify service requirements, enabling customers to arrive better prepared and continue the discussion with a clearer understanding of their needs.

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A New Showroom

A New Experience In Water Solutions.

AL MOUSA TRADING CO. Opens Its New Showroom in Al Rawdah, Riyadh, Offering Water Pumps, Swimming Pool Equipment & RO Water Purification Systems.



info@almousatrade.com almousatrade.com +966 55 509 6549



Different Scaling Challenges?

Choose the Right Antiscalant for Your RO System

ENVISHIELD

King Lee Technologies
Your Pure Water Partners

In Reverse Osmosis (RO) systems, scale formation can affect operating conditions and increase the need for membrane cleaning. The challenge becomes more demanding when feedwater contains different scale-forming minerals, silica, or dissolved metals.

Choosing the right antiscalant is therefore an important part of RO pretreatment. Rather than focusing on one scaling factor, treatment selection should consider the overall feedwater composition and operating conditions.

The Ideal Choice for Broad-Spectrum Protection

Pretreat Plus® 0100 is a broad-spectrum antiscalant developed by King Lee Technologies for feedwaters with high levels of scale-forming minerals and metal oxides.

Its key capabilities include:

- Controlling Calcium Carbonate and Calcium Sulfate scales.
- Reducing the precipitation of Aluminum, Iron, and Heavy Metal salts.
- Controlling inorganic scale across a wide concentration range.

Its compatibility with RO, NF, and UF membranes from major manufacturers supports its use in different membrane-based water treatment applications.



When Feedwater Chemistry Demands More Specialized Control

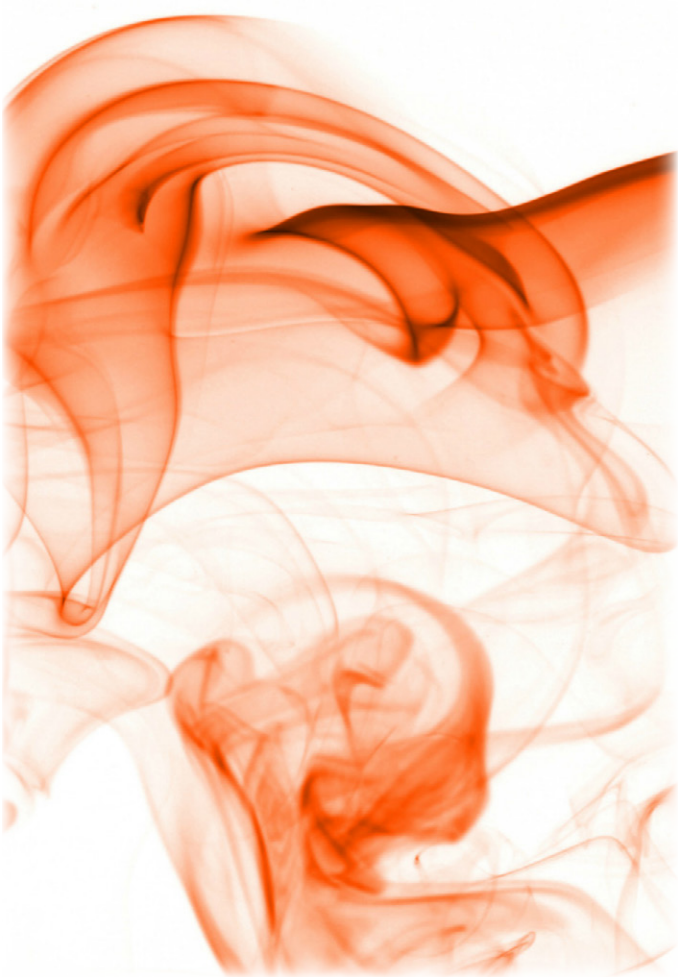
Some applications, particularly those involving industrial or mining water, present additional challenges due to sulfate scales, silica, carbonates, and dissolved metals.

Pretreat Plus® G2000 is a synergistic antiscalant specifically formulated for feedwaters requiring control of these combined scaling risks.

Its capabilities include:

- Controlling Calcium Sulfate, Barium Sulfate, and Strontium Sulfate scales.
- Inhibiting inorganic scale, including silica, across a wide concentration range.
- Controlling moderate levels of dissolved metals.
- Providing enhanced dispersing capabilities.

G2000 is particularly suited to applications where industrial or mining water treatment requires attention to multiple scaling contributors.



Beyond Product Selection: Getting the Dosage Right

Selecting an appropriate antiscalant is only one part of an effective scale-control strategy. Dosage should also reflect the actual feedwater chemistry and operating conditions.

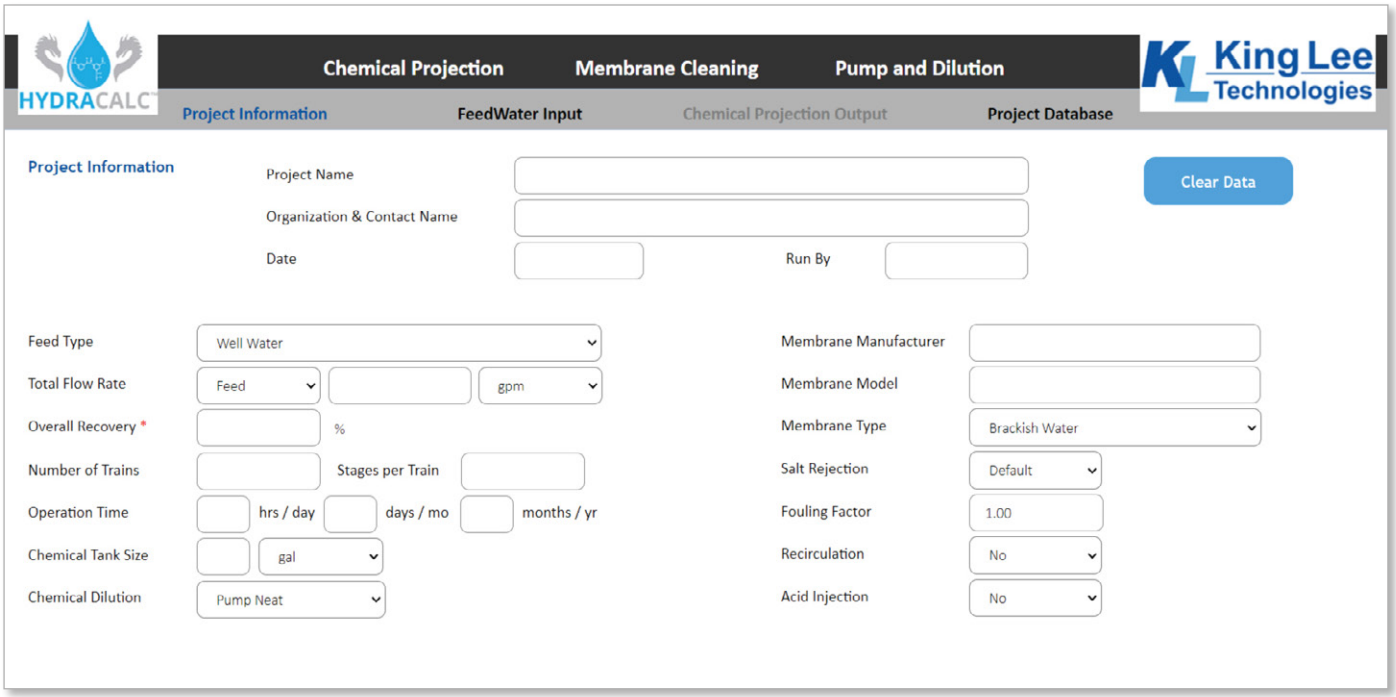
King Lee Technologies' HydraCalc® software supports antiscalant selection and dosage calculations using key parameters such as ion concentrations, pH, temperature, flow rates, and recovery rate. This data-based approach helps identify a suitable treatment strategy for the specific RO application.

A More Informed Approach to Membrane Protection

Pretreat Plus® 0100 and Pretreat Plus® G2000 address different scale-control requirements. The appropriate choice depends on the feedwater characteristics and the scaling risks identified in the system. By matching antiscalant selection to actual operating conditions, water treatment professionals can take a more informed approach to scale control and membrane protection.

King Lee Technologies specializes in advanced chemical solutions for water treatment, including antiscalants designed to address different scaling challenges in membrane-based systems. Through its product portfolio and technical resources, the company supports water treatment professionals in selecting suitable scale-control strategies for their applications.

King Lee Technologies' advanced antiscalant solutions, including Pretreat Plus® 0100 and Pretreat Plus® G2000, are available in Saudi Arabia through its exclusive agent, ENVISHIELD, providing access to these solutions for local water treatment applications.



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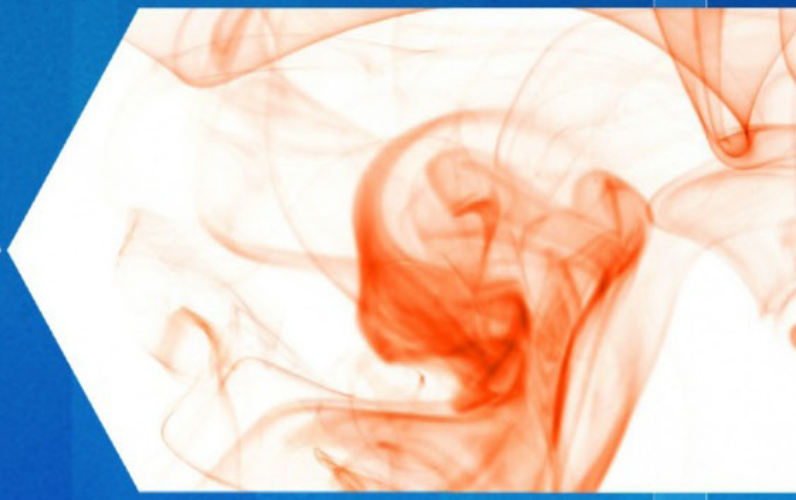
Different scaling **Challenges.**

One commitment to membrane protection.

The powerful antiscalant duo:

Pretreat Plus® 0100 | Pretreat Plus® G2000





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Why Is Control Strategy a Key Decision When Selecting a Turbo Blower for a WWTP?

Aeration is one of the most important processes in wastewater treatment plants (WWTPs). It supplies the oxygen needed by microorganisms to break down organic pollutants. Continuous air delivery makes blower performance important to plant energy consumption.

Selecting a blower should therefore involve more than comparing rated capacity or peak efficiency. The control strategy also matters: it determines how the blower responds when the plant's air demand changes and how it operates away from its design point.

The Reality of Changing Air Demand

A WWTP does not necessarily require the same airflow throughout the day or across all operating conditions. The demand for oxygen can vary with the treatment load and process requirements. A blower selected only around a fixed design condition may therefore need to operate under conditions that differ from its original selection point.

The question is how effectively the system regulates airflow across the required range while maintaining suitable pressure and efficiency.

VFD Speed Control: Is It Always the Right Choice?

Variable Frequency Drives (VFDs) regulate blower output by changing motor speed. Although this approach is used in many blower applications, it is not the only way to control airflow in centrifugal turbo blowers.

In centrifugal machines, airflow is related to rotational speed, while the pressure developed varies approximately with the square of speed. Therefore, reducing speed to regulate airflow can affect the pressure available and the machine's operating conditions. The required turndown range and efficiency across the operating range must both be considered when selecting a control strategy.

For this reason, Next Turbo's integrally geared blowers use a different approach:



Dual Point Control, combining Inlet Guide Vanes (IGV) and Variable Diffuser Vanes (VDV), rather than relying on a conventional VFD for airflow regulation. This approach allows airflow to be adjusted through aerodynamic control while the blower operates at constant speed.

Variable Vane Control

Variable diffuser vanes (VDV) regulate airflow by adjusting the diffuser geometry rather than relying only on a reduction in rotational speed. This allows airflow to be controlled while the blower speed remains constant. In suitable configurations, the regulation range can extend from 40% to 100% airflow.

Airflow regulation can therefore come from aerodynamic control, not only motor-speed changes. Suitability depends on the required range, pressure conditions, and blower configuration.

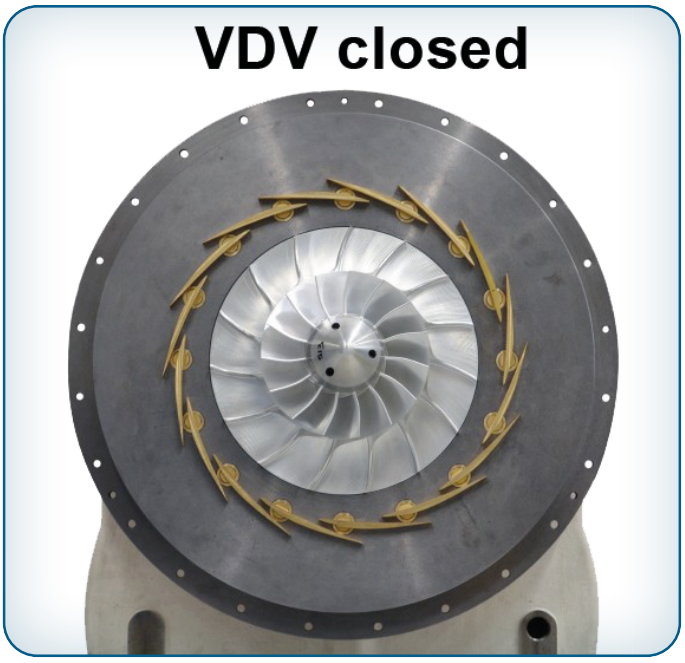
Dual Point Control: IGV and VDV

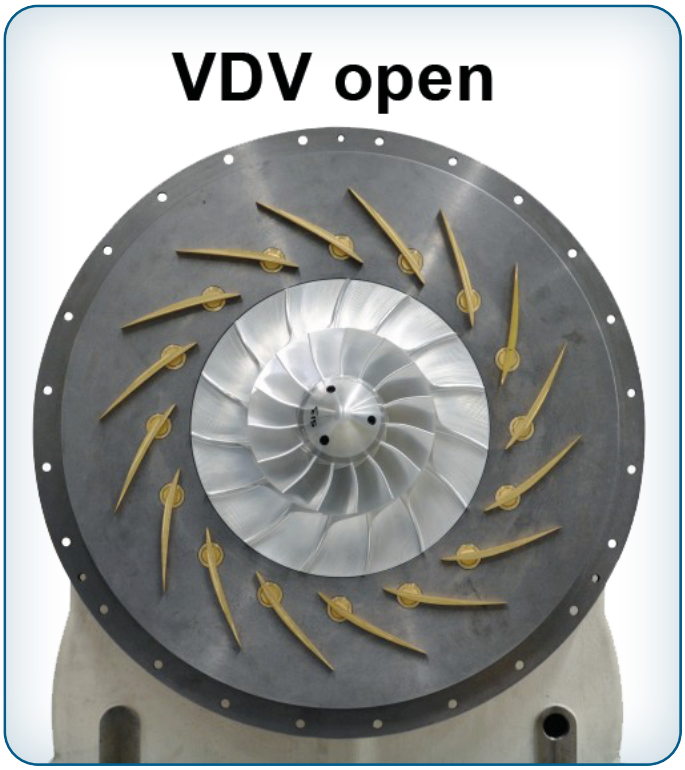
Dual point control combines modulating inlet guide vanes (IGV) with variable diffuser vanes (VDV). The inlet guide vanes influence the airflow entering the compression stage, while the diffuser vanes regulate the flow downstream.

Together, these control points provide another way to adapt blower operation as process conditions change.

This arrangement can help optimize operation in response to fluctuations in suction-air temperature, barometric pressure, and system pressure. For WWTP aeration, where airflow demand and operating conditions may vary, dual point control is a strong option to evaluate.

The choice should reflect the plant's process requirements and operating profile. The airflow regulation range is also important. A range of 40–100% provides a different operating envelope from one that is limited to 75–100%. The blower should cover the plant's real demand range.





Lifecycle Cost, Not Just Purchase Price

The control strategy can affect how a blower operates throughout its years of service. When comparing options, engineers should consider the expected operating profile, energy consumption across the required operating range, maintenance requirements, and the consequences of operating outside the preferred performance range. These factors should be included in the lifecycle cost assessment alongside the purchase price.

Another important factor is equipment lifespan. With a suitable design, turbo blowers can have a service life exceeding 25 years, making expected operating life an important consideration when evaluating total cost over the long term.

A single efficiency figure is not enough to determine lifecycle cost for every project. A sound comparison requires the plant's airflow and pressure requirements, operating hours, expected load variations, and performance data for the specific equipment under consideration.



Conclusion

Selecting a turbo blower for a wastewater treatment plant involves more than choosing the required capacity. The control strategy plays an important role in determining how the blower responds to changing air demand and should therefore be evaluated against the plant's actual operating conditions.

While VFD speed control is used in many blower applications, Next Turbo's integrally geared blowers use Dual Point Control, combining Inlet Guide Vanes (IGV) and Variable Diffuser Vanes (VDV), rather than relying on a conventional VFD for airflow regulation. This approach allows airflow to be regulated while the blower operates at constant speed.

The right selection should consider the required airflow range, operating conditions, energy efficiency, and expected service life. With a service life that can exceed 25 years with a suitable design, turbo blowers should be assessed based on their long-term performance and lifecycle cost, not just their initial purchase price.

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Why Next Turbo Blowers Stand Out

- ***VFD-Free*** Airflow Control.
- ***Dual Point*** Control (IGV + VDV).
- Wide Airflow Regulation: ***40–100%.***
- ***High Efficiency*** Across Operating Conditions.
- Long Service Life: ***25+ Years.***



Smart Sustainability for Water & Energy is *the official representative of* ***Next Turbo Technologies*** *in Egypt.*

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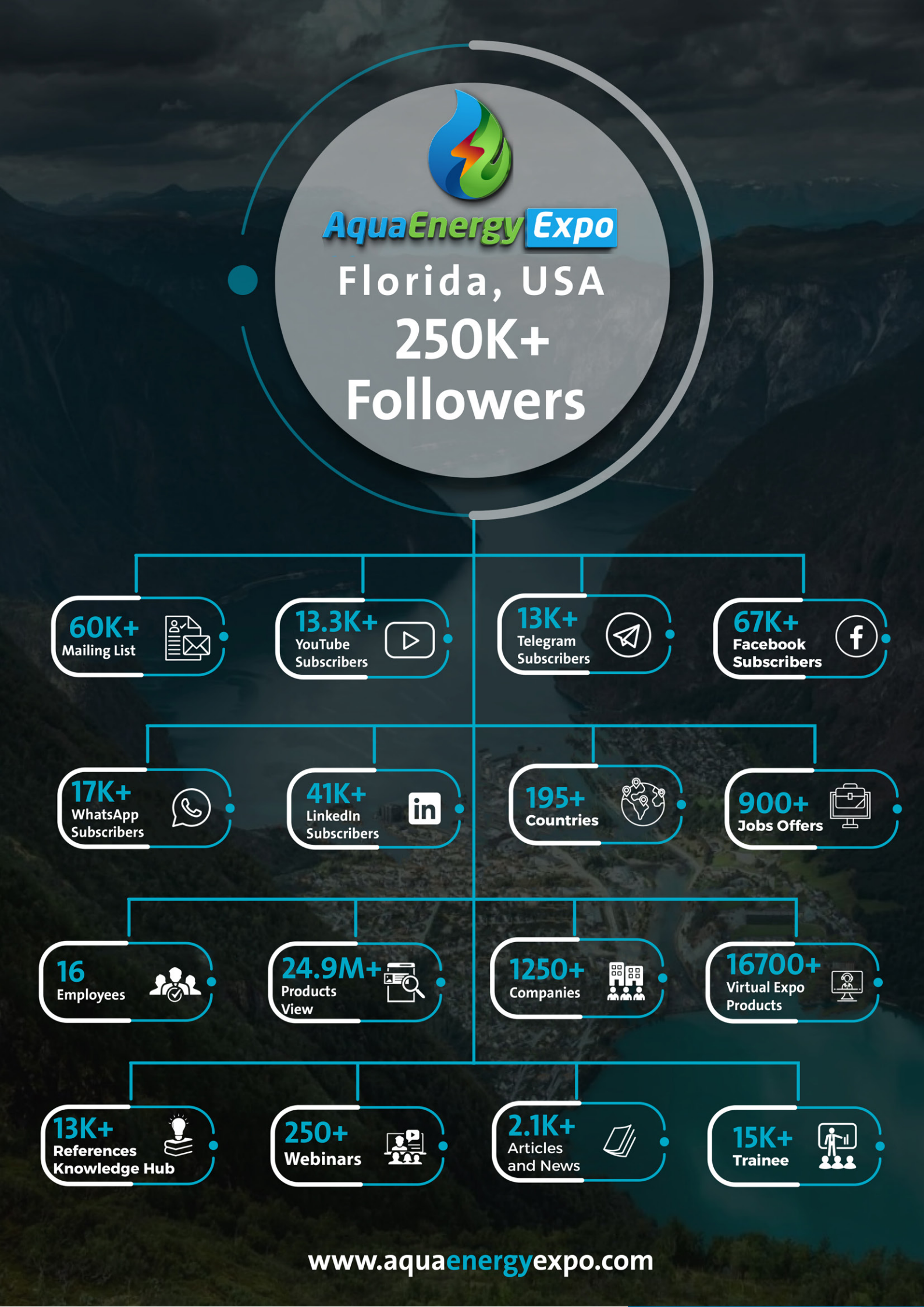
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Securing Water Treatment Operations:
Protecting SCADA Systems from Cyber Threats

Modern water and wastewater treatment facilities increasingly depend on interconnected digital technologies to maintain efficient and continuous operations. From controlling pumps and valves to monitoring water quality, regulating chemical dosing, and managing aeration, Supervisory Control and Data Acquisition (SCADA) systems play a central role in treatment plant operations.

However, greater automation and remote connectivity also increase exposure to cybersecurity threats. Unlike conventional cyberattacks that primarily target digital information, attacks on Operational Technology (OT) can directly affect physical equipment and treatment processes.

Unauthorized access to control systems may disrupt operations, compromise treatment efficiency, interrupt water supply, and create potential risks to public health and the environment. Cybersecurity is therefore not just an IT concern; it is an essential part of operational reliability and critical infrastructure protection.

When Cyber Threats Become Operational Risks

SCADA systems connect operators with critical plant assets, including pumps, control valves, chemical dosing equipment, sensors, and blowers. If compromised, attackers may manipulate operating parameters, interfere with alarms, or disrupt communication between control systems and field equipment. **Potential consequences include:**

- **Incorrect Chemical Dosing:** Changes to dosing settings may affect treatment efficiency and water quality.
- **Equipment Disruptions:** Unexpected pump shutdowns or altered flow rates can affect hydraulic performance.
- **Aeration Problems:** Changes to blower operation may reduce dissolved oxygen levels and biological treatment efficiency.
- **Manipulated Sensor Readings:** Inaccurate measurements may mislead operators and delay corrective actions.

- **Operational Downtime:** System disruptions can increase maintenance costs and interrupt essential services.

Since treatment processes are interconnected, a disruption in one critical operation may affect several treatment stages.

How Cyberattacks Affect Water and Wastewater Treatment

» Drinking Water Treatment: Protecting Water Quality

Drinking water facilities rely on automated systems to regulate chemical dosing, filtration, and disinfection. Unauthorized changes to dosing parameters or manipulated measurements of chlorine residual, turbidity, and pH could interfere with treatment conditions and compromise monitoring reliability. Protecting control commands and sensor data is therefore essential to maintaining consistent treatment performance and public health protection.

» Wastewater Treatment: Maintaining Process Stability

Wastewater facilities depend on coordinated operation of pumps, wet wells, valves, and blowers to maintain hydraulic balance and biological treatment efficiency. Unauthorized interference may disrupt flow management, affect tank levels, or alter aeration conditions. Changes in blower performance can affect dissolved oxygen concentrations and reduce the efficiency of biological treatment processes. Protecting both automated controls and operational data is essential to maintaining process stability.



Oldsmar, Florida: A Real Cybersecurity Incident

A cyberattack targeted a drinking water treatment plant in Oldsmar, Florida, demonstrating the potential physical consequences of SCADA vulnerabilities.

Key Incident Details:

- **Unauthorized Access:** An attacker remotely accessed the plant's SCADA system.
- **Chemical Dosing Manipulation:** The sodium hydroxide setting was changed from approximately 100 ppm to 11,100 ppm.
- **Incident Detection:** A plant operator noticed the unusual change and immediately restored the original setting before it could affect the treatment process.
- **Security Weaknesses:** A joint advisory from CISA, the FBI, and other federal agencies identified issues including inadequate password protection and an outdated operating system.

The incident highlighted how compromised control systems can threaten treatment safety and operational reliability.

Where Are SCADA Systems Most Vulnerable?

Three areas deserve particular attention:

1. Remote Access & Network Connections

Remote monitoring improves operational flexibility, especially across pumping stations and distributed facilities. However, poorly secured connections and weak authentication can create entry points for unauthorized users.

2. Sensor Data and Process Monitoring

Measurements of flow, pressure, tank levels, turbidity, pH, and dissolved oxygen support essential operational decisions. Manipulated readings can mislead operators and result in inappropriate corrective actions.

3. Legacy Operational Technology

Older controllers, outdated software, and equipment with limited security capabilities can increase vulnerability. Shared credentials, insufficient network segmentation, and unmonitored remote access further increase these risks.

Upgrading legacy systems requires careful planning to improve security without disrupting essential treatment operations.

Strengthening SCADA Security: Essential Measures for Water Utilities

Protecting water infrastructure requires a coordinated strategy combining technical safeguards, operational procedures, and personnel awareness.

Key measures include:

- **Access Control and Authentication:** Replace default and shared passwords, assign individual accounts, and implement multifactor authentication for remote access wherever supported.
- **Network Segmentation:** Separate OT networks from corporate IT networks and restrict communication to authorized systems.
- **Continuous Monitoring:** Identify unusual changes in chemical dosing, pump operation, sensor readings, and controller commands.



- **Secure Backups:** Maintain protected and regularly tested backups of SCADA configurations and Programmable Logic Controller (PLC) logic.
- **Controlled Software Updates:** Apply security patches through planned procedures that consider equipment compatibility and operational continuity.
- **Incident Response Planning:** Establish clear response procedures, train operators, and prepare safe manual operating alternatives when automated controls become unavailable.

These measures align with cybersecurity principles promoted by organizations such as CISA and the U.S. Environmental Protection Agency (EPA).

Effective protection also requires identifying critical assets, assessing operational risks, and coordinating cybersecurity responsibilities between IT specialists, OT engineers, and plant operators.

Beyond Cybersecurity: Protecting Operational Efficiency

Cybersecurity is an essential investment in treatment infrastructure and business continuity.

A compromised control system can cause production interruptions, equipment damage, additional maintenance, increased energy consumption, and costly recovery procedures.

Integrating cybersecurity into plant management helps utilities strengthen process monitoring, improve system resilience, reduce operational risks, and maintain reliable treatment performance.

Cybersecurity Is the Foundation of Reliable Water Infrastructure

As water and wastewater facilities increasingly adopt automation, remote monitoring, and interconnected control technologies, protecting digital infrastructure becomes essential.

Securing SCADA systems means safeguarding the equipment, processes, and operational decisions that keep treatment facilities running.

Ultimately, reliable water treatment depends not only on advanced technologies and efficient equipment, but also on the ability to protect these systems against threats that could compromise their performance.



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WEBINARS



Prof. Dr. Walid Tawfik Younes

Professor of Laser Physics and Head of Department of Laser Applications in Metrology, Photochemistry and Agriculture at National Institute of Laser Enhanced Sciences, Cairo University.

Webinar Title: "Advanced Laser Applications in Environmental Monitoring"

Date: Thursday, Novamber 5
Time: 7:00-9:00 PM Egypt time | 8:00-10:00 PM Saudi Arabia time



Prof. Dr. Wael AbdelMoez

Professor of Chemical Engineering, Co-Founder, and CEO of Smart Drop Company.

Webinar Title: "Water under Near-Critical Conditions and Its Applications in Municipal and Industrial Wastewater Treatment"

Date: Friday, November 6
Time: 7:00-9:00 PM Egypt time
8:00-10:00 PM Saudi Arabia time.



Eng. Rabab Elgharieb

Water O&M General Manager

Webinar Title: "Fundamentals of Drinking Water Treatment and Plant Operation"

Date:Saturday, November 7
Time: 7:00-9:00 PM Egypt time
8:00-10:00 PM Saudi Arabia



Mrs. Yasmin Samir

Media Office Member, Ministry of Water Resources and Irrigation.

Webinar Title: "On the Right Track: A Journey Towards Water Awareness and the Rational Use of Water"

Date: Friday, November 13
Time: 7:00-9:00 PM Egypt time
8:00-10:00 PM Saudi Arabia .



Eng. Mohammed Kastawy

Filtralite's MENA Region Sales Manager.

Webinar Title: " Optimizing Seawater Desalination Through Advanced Filtration Solutions"

Date: Saturday, 14 November
Time: 7:00-9:00 PM Egypt time
8:00-10:00 PM Saudi Arabia time



Dr. Eman Mohamed Mostafa

Associate Professor at the Petroleum Research Institute and Faculty Member at Cairo University's Faculty of Graduate Studies for Nanotechnology.

Webinar Title: "Solar Energy in Egypt: Innovation, Energy Storage Challenges, and Sustainable Industrial Development"

Date: Friday, November 27th
Time: 7:00-9:00 PM Egypt time
8:00-10:00 PM Saudi Arabia.



Dr. Rehan Mohamed

Development Manager at Biondex.

Webinar Title: "Innovative Water Recycling and Approaches"

Date: Saturday, November 28th
Time: 7:00-9:00 PM Egypt time
8:00-10:00 PM Saudi Arabia time

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Beyond Monitoring: Turning Wastewater Data into Smarter Operations

Digitalisation is changing how cities manage wastewater networks. By connecting monitoring systems, sensors, weather data, and hydraulic models, utilities can move beyond simply collecting information to making faster, better-informed operational decisions.

The real opportunity lies in turning fragmented data into actionable intelligence that improves efficiency, strengthens network resilience, and supports environmental protection.

The Challenge: Too Much Data, Not Enough Insight

Urban wastewater networks generate continuous data through SCADA systems, sensors, Geographic Information Systems (GIS), maintenance platforms, and weather monitoring tools.

However, when these systems operate independently, operators may struggle to understand the full picture. A rising water level, a pump malfunction, and heavy rainfall may be closely connected, yet their relationship can remain unclear when the information is scattered.

> The challenge is not collecting more data. It is connecting the right information to understand what is happening and determine what action is needed.

From Monitoring to Operational Intelligence

Traditional monitoring systems generate alerts when measurements exceed predefined limits. But an alert does not always explain the cause, severity, or potential consequences of an incident.



By integrating sensor readings with rainfall data, pump status, flow measurements, and historical records, utilities can gain a clearer understanding of developing risks.

This connected view helps operators distinguish between isolated events and wider network problems, prioritise interventions, and respond before minor issues escalate.

Connecting the Systems Behind Urban Wastewater Networks

Effective digitalisation does not mean replacing every existing system. It means enabling current technologies to work together.

Integrating SCADA, GIS, IoT sensors, hydraulic models, and maintenance records creates a more complete operational picture.

This allows teams to connect real-time network conditions with asset locations, equipment history, and previous incidents—supporting faster fault identification and more informed maintenance decisions.

The value comes from making existing information more useful, not simply adding another dashboard.

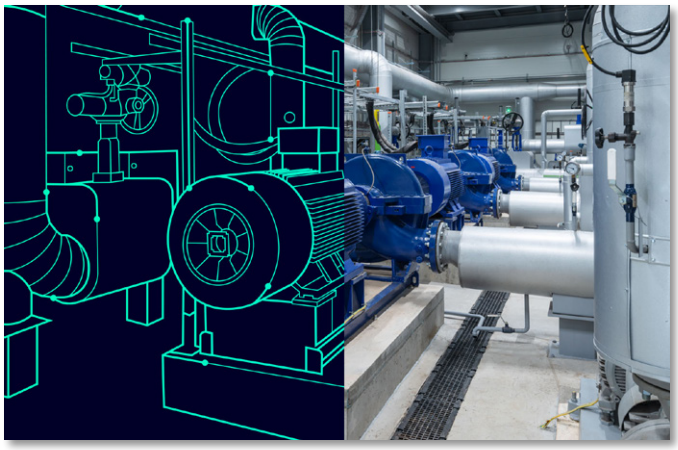


Predicting Problems Before They Escalate

Hydraulic models help utilities understand water movement and assess how networks may respond to rainfall and changing flow conditions. Artificial intelligence and machine learning can complement these models by identifying unusual patterns and supporting forecasts.

Digital twins can also simulate different operating scenarios, helping engineers evaluate potential risks and possible responses.

However, reliable predictions depend on accurate data, appropriate model calibration, and continuous validation. These technologies support engineering expertise; they do not replace it.



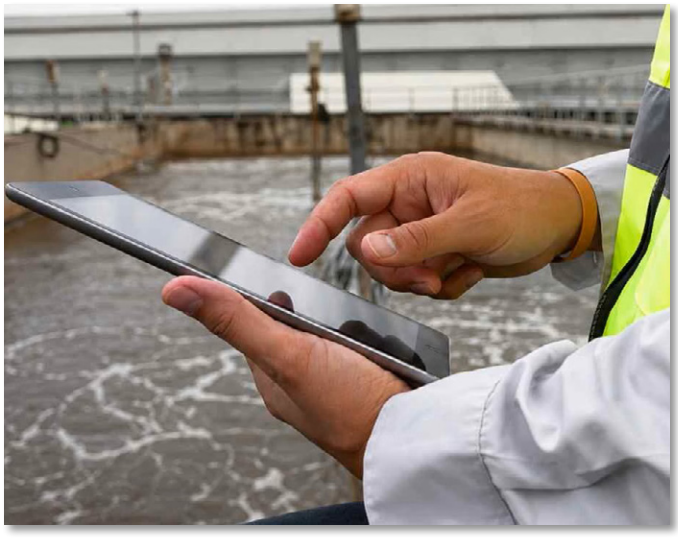
Better Data, Better Environmental Management

Managing wastewater overflow requires more than recording that an incident occurred. Utilities need reliable information about its location, duration, potential discharge volume, and possible causes.

Connecting rainfall measurements, water levels, flow rates, and operational records can improve incident analysis and environmental reporting.

Where direct flow measurements are unavailable, estimated discharge volumes may be useful, provided that the assumptions and limitations are clearly documented.

Reliable digital records help utilities identify recurring problems, improve accountability, and develop more effective measures to reduce abnormal discharges.



Case Study: ADASA and EPSAR in Spain

ADASA's StormGuard platform demonstrates how digital integration can improve wastewater monitoring and operational management. In collaboration with the Valencian Agency for Wastewater and Water Treatment (EPSAR), a digitalisation programme in Spain brought monitoring data together within a unified Internet of Things (IoT) environment.



- **A Unified View of Wastewater Networks**

The programme integrates data from monitoring equipment and connected systems, helping utilities build a more consistent view of water quality and overflow events.

- **Key Figures at a Glance**

1,850 Water quality and overflow monitoring points integrated into the IoT environment. 10 months Reported implementation period for integrating the monitoring points. 467 Treatment plant outlets included in the programme's monitoring scope. 142 Overflow monitoring points across sewer networks included in the programme.



- **Expanding Monitoring Capabilities**

The programme also includes 359 overflow monitoring points at treatment plants and 12 points associated with urban water reuse. Further plans include monitoring the inlets of 243 wastewater treatment plants with flow rates exceeding 150 m^3/day.

- **What Makes This Approach Valuable?**

The project connects data from existing and new equipment, incorporates secure communication channels, and supports local data storage during communication interruptions.

Beyond the number of connected points, its value lies in establishing a more consistent foundation for tracking water quality, flow rates, and overflow events. Some monitoring activities remain part of the programme's planned scope.

The key takeaway: Digital transformation becomes more practical when utilities connect existing data sources, improve network visibility, and build their capabilities around real operational needs.



Cybersecurity and Data Quality: Essential Foundations

Connecting more systems also increases the importance of cybersecurity and data reliability.

Utilities need clear access controls, secure communications, reliable sensor maintenance, and procedures for identifying missing or inaccurate measurements.

Digital platforms should also make alerts understandable, allowing operators to see why a warning has been generated and which information supports it.

Without reliable data and appropriate security measures, even advanced digital tools may produce misleading results or introduce operational risks.

How Utilities Can Start Their Digital Transformation

Digital transformation does not have to begin with a large, network-wide investment. A practical starting point is to focus on one measurable operational challenge.

Utilities can:

- **Identify a priority:** Such as recurring pump failures, high energy consumption, or overflow risks.
- **Assess available data:** Identify existing systems, data gaps, and reliability issues.
- **Connect relevant sources:** Integrate only the information needed to address the selected problem.
- **Measure results:** Compare operational performance before and after implementation.
- **Expand gradually:** Build on proven results while maintaining cybersecurity and staff training.

This approach connects digital investment to measurable operational value rather than technology adoption alone.

The Future of Wastewater Management Is Smarter Decision-Making

Urban wastewater networks face increasing pressure from ageing infrastructure, urban growth, extreme weather, and tighter environmental expectations. Collecting data is only the beginning. The real advantage comes when information is connected, interpreted, and translated into timely action. The future of wastewater management will not be defined by how much data utilities collect, but by how effectively they use it to make better decisions. Moving beyond monitoring towards operational intelligence can help utilities build wastewater networks that are more efficient, resilient, and prepared for future challenges.



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WATER NEWS BRIEF

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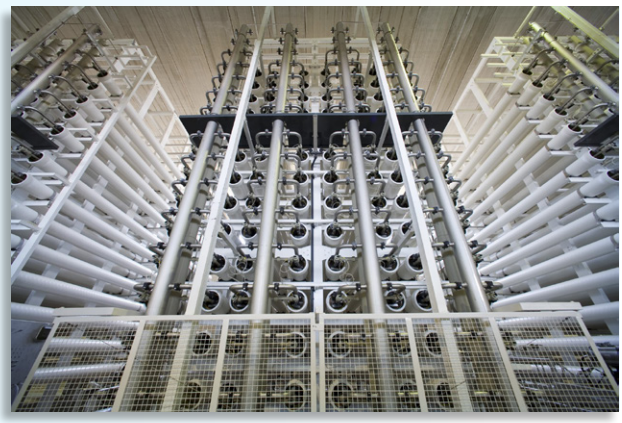
ACWA Power Signs $478 Million Water Purchase Agreement for Hassyan Desalination Project in Dubai



Acwa Power has signed a 30-year contract with the Dubai Electricity and Water Authority (DEWA) for a new seawater reverse osmosis (SWRO) desalination facility at the Hassyan Complex, valued at $478 million. Acwa holds a 40% stake in the project, which will produce approximately 272,000 m^3/day (60 MIGD) of desalinated water. This facility complements an initial phase being developed by Acwa, which has a capacity of 818,000 m^3/day. DEWA's first Independent Water Producer (IWP) project is nearing completion, with the first 60 MIGD block operational by early 2026, contributing to a total capacity of around 240 MIGD when combined with the new plant.

Tunisia Secures ¥9.6 Billion Japanese Loan to Complete Sfax Desalination Plant



On November 18, the Japan International Cooperation Agency (JICA) signed a loan agreement in Tunis for up to ¥9,559 million (approximately €54.4 million) to finalize the Sfax seawater desalination plant, crucial for Tunisia's second-largest city that relies on external sources for 80% of its water. The supplementary loan addresses funding shortfalls caused by inflation and exchange-rate fluctuations, enabling the completion of unfinished components. The plant, with a capacity of 100,000 m^3/day, aims to serve 650,000 residents and is expected to be operational by February 2029. JICA anticipates a supply-demand gap of 60,000 m^3/day by 2030.

DuPont Announces Collaboration with Microsoft and NobleAI to Accelerate R&D Innovation with AI



DuPont has partnered with Microsoft and NobleAI to expand access to advanced AI tools and resources, aiming to accelerate innovation and shorten customer solution cycles. This collaboration combines DuPont's expertise in advanced solutions with NobleAI's Science-Based AI modeling capabilities and Microsoft's Discovery platform for R&D. The initiative will enable DuPont's scientists and engineers to evaluate solutions quickly, guide experimentation, and streamline learning processes. DuPont's Chief Technology Officer, Marty DeGroot, emphasized the importance of these tools in solving complex problems efficiently. The collaboration aims to facilitate faster development and market readiness for innovative solutions across DuPont's portfolio.

Veolia Secures Design Contract for 410,000 m³/day Al Hamriyah Plant in Sharjah (UAE)

Veolia has secured a design contract for the Al Hamriyah desalination plant in Sharjah, UAE, which will produce 410,000 m³/day of drinking water for approximately 1.4 million people. This contract, alongside another for the 80,000 m³/day Al Asilah plant in Oman, totals nearly €200 million. At Al Hamriyah, Veolia will implement advanced pretreatment and remineralization technologies, aiming for an energy consumption of 2.75 kWh/m³, setting a new efficiency benchmark. The company plans to double its global desalination capacity by 2030, with the Middle East as a key market for growth, emphasizing the importance of desalination for regional water security.



Xylem Completes Acquisition of Cornell Pump and Roper Pump



Xylem Inc. has completed its acquisition of Cornell Pump and Roper Pump, enhancing its portfolio and targeting higher-growth markets. This move aligns with Xylem's strategy to focus on businesses with strong growth potential, as demonstrated by Cornell/Roper's historical growth rates exceeding Xylem's targets. The acquisition expands Xylem's capabilities in industrial sectors such as mining, power, and food and beverage, adding engineered technologies for complex applications like slurry transport and solids handling. Following the acquisition, these businesses will initially be reported under the Water Infrastructure segment, transitioning to the Flow Solutions segment in January 2027, which focuses on pumping and water distribution solutions.

Jordan Launches $6.7 Billion Aqaba–Amman Desalination and Water Conveyance Project

Jordan has officially launched the Aqaba-Amman Water Desalination and Conveyance Project, also known as the National Water Carrier, which aims to meet 40% of the country's domestic water needs by the end of 2030. The project, led by Meridiam, involves a total investment of approximately $6.7 billion, supported by $6.664 billion in financing from the Green Climate Fund (GCF). It will produce 300 million m³ of desalinated water annually, delivered via a 418 km pipeline to Amman. The project includes a 280 MW solar plant to supply energy, expected to cover 80% of the desalination facility's needs. It will create over 33,000 construction jobs and 2,600 operational jobs.





Global Water Events

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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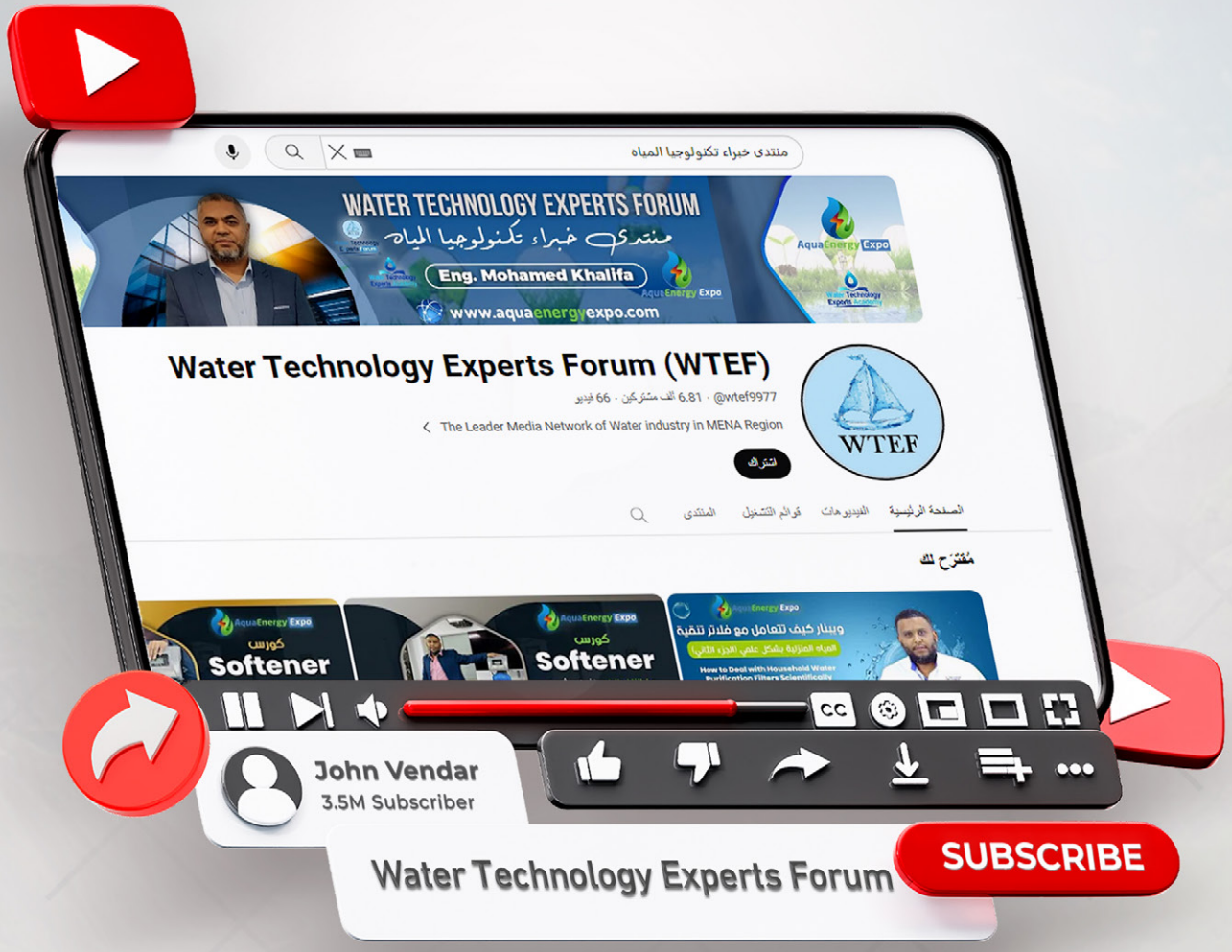

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Zero Liquid Discharge: Is Eliminating Industrial Wastewater Discharge Economically Viable?

Industrial wastewater is no longer just an environmental challenge; it represents an opportunity to recover valuable resources, reduce freshwater consumption, and improve operational efficiency. As water scarcity intensifies and environmental requirements become more demanding, industries are looking beyond conventional wastewater treatment.

Zero Liquid Discharge (ZLD) offers an advanced approach that aims to recover and reuse wastewater while eliminating routine liquid discharge from industrial facilities. By combining advanced treatment, membrane separation, evaporation, and crystallization, ZLD systems transform wastewater management into a resource recovery strategy.

The result is reduced dependence on freshwater supplies, lower liquid waste disposal requirements, and greater control over industrial water cycles. However, the real value of ZLD lies in more than its environmental benefits: Can it deliver measurable economic returns while supporting long-term industrial performance?

How Does Zero Liquid Discharge Technology Work?

ZLD systems integrate several treatment and separation processes to maximize water recovery and convert the remaining concentrated waste into solid residues.

Pretreatment: Protecting System Performance

The process begins with pretreatment to remove suspended solids, adjust pH, and reduce contaminants that may cause scaling, fouling, or corrosion.



Depending on wastewater characteristics,treatment may include chemical conditioning, filtration, and other separation processes. Effective pretreatment protects downstream equipment, improves membrane performance, and reduces maintenance requirements.

Membrane Treatment: Maximizing Water Recovery

Membrane technologies, particularly reverse osmosis (RO) and ultrafiltration (UF), play a major role in recovering reusable water.

As water passes through the membranes, dissolved salts and other contaminants become concentrated in the remaining stream. Once the concentrate reaches the operational limits of membrane treatment, additional processes are required to recover more water.



Evaporation: Reducing Concentrated Wastewater

Thermal technologies such as mechanical vapor compression (MVC) and multi-effect evaporation (MEE) remove additional water from concentrated brine. These processes significantly reduce the volume of liquid waste while producing water that can potentially be reused within industrial operations.

Crystallization: Achieving Zero Liquid Discharge

The final stage involves crystallization, where dissolved salts and other residual materials are separated as solids. Recovered water can be returned to industrial processes, while the resulting solids are collected for potential material recovery or regulated disposal. Through this integrated treatment sequence, ZLD minimizes liquid waste generation and supports a more efficient industrial water cycle. However, solid residues still require appropriate management.

The Economic Value of ZLD: Where Does the Return Come From?

Although ZLD requires significant investment, its economic value can extend beyond wastewater treatment. By recovering water and reducing waste disposal requirements, it can create several operational and financial benefits.

Reducing Freshwater Consumption

Recovered water can replace a portion of the freshwater required for industrial operations, including cooling, washing, and selected process applications, depending on its quality.

For facilities operating in water-stressed regions or facing high freshwater procurement costs, this can provide substantial long-term value.

Reducing Wastewater Disposal Costs

Industrial wastewater disposal can involve transportation, treatment fees, discharge charges, and regulatory compliance costs. By minimizing liquid discharge, ZLD can reduce dependence on external disposal services and provide greater control over wastewater management.

Improving Regulatory Compliance

Stricter environmental requirements are increasing the importance of effective industrial wastewater management. ZLD can help facilities address restrictions on liquid discharge, reduce the risk of non-compliance, and strengthen environmental performance, particularly where conventional discharge options are limited.



Supporting Resource Recovery

Depending on wastewater composition, ZLD systems may enable the recovery of salts and other materials with potential reuse or commercial value. Although not all recovered materials are economically marketable, suitable recovery strategies can reduce waste volumes and create additional resource utilization opportunities.

Where Can ZLD Make the Greatest Difference?

ZLD is particularly valuable in industries that generate high-salinity wastewater, operate in water-scarce regions, or face strict discharge requirements.

- **Power Generation:** Managing cooling tower blowdown and concentrated wastewater streams.
- **Chemical & Petrochemical Industries:** Treating complex effluents containing dissolved salts and process chemicals.
- **Textile Manufacturing:** Recovering water from dyeing and finishing operations.
- **Mining and Mineral Processing:** Recovering process water and managing saline wastewater.
- **Pharmaceutical Manufacturing:** Managing specialized wastewater streams with complex treatment requirements.
- **Electronics & Semiconductor Manufacturing:** Recovering process water and managing concentrated wastewater streams.

For these industries, ZLD can support water security, reduce disposal requirements, and improve control over industrial water resources.

Engineering Strategies That Improve ZLD Efficiency

The economic performance of ZLD depends heavily on system design, technology selection, and operating conditions. An optimized treatment configuration can improve recovery rates while controlling energy and maintenance costs.

Combining Membrane and Thermal Technologies

Integrating reverse osmosis with thermal concentration can reduce the volume of brine entering evaporation and crystallization units.

This approach helps limit thermal energy demand and improves the overall efficiency of the treatment process.

Considering Minimal Liquid Discharge (MLD)

Minimal Liquid Discharge (MLD) provides an alternative for facilities seeking high water recovery without eliminating liquid discharge completely.



By combining advanced membrane treatment and brine concentration, MLD can achieve substantial water recovery while avoiding some of the investment and energy requirements associated with final crystallization.

Where regulations permit controlled management of the remaining concentrate, MLD may offer a more cost-effective solution.



Integrating Energy-Efficient Operations

Thermal energy recovery, vapor recompression, and heat integration can reduce the energy required for evaporation. Efficient equipment selection and optimized operating conditions are equally important for controlling long-term operating expenditure.

Applying Digital Monitoring and Process Control

Advanced monitoring systems and automated process control can track pressure, flow rates, conductivity, energy consumption, and water recovery performance.

These technologies help operators detect scaling and fouling, optimize treatment conditions, and improve system reliability while reducing avoidable maintenance costs.



Is ZLD the Right Investment for Every Industry?

Despite its advantages, ZLD is not automatically the most economical solution for every industrial facility. Its feasibility depends on several factors, including wastewater characteristics, treatment capacity, freshwater prices, energy costs, discharge regulations, and the potential value of recovered resources.

A comprehensive techno-economic assessment should compare capital expenditure (CAPEX), operating expenditure (OPEX), expected water recovery, energy consumption, and avoided disposal costs. For some facilities, complete ZLD may provide the strongest long-term solution. For others, MLD or advanced wastewater reuse systems may deliver a better balance between investment, performance, and operational requirements.

The key is selecting a treatment strategy that matches the facility's actual water management needs rather than adopting the most complex technology by default.

From Wastewater Management to Industrial Competitiveness

Zero Liquid Discharge represents a significant shift in industrial water management. It moves wastewater treatment beyond regulatory compliance toward water recovery, resource efficiency, and more sustainable operations. By integrating membrane technologies, thermal concentration, crystallization, energy optimization, and digital monitoring, industries can reduce freshwater dependence, minimize liquid waste, and improve control over their water resources.

Although investment and energy consumption remain important considerations, the long-term value of ZLD lies in its ability to turn wastewater management into an integral part of industrial efficiency and environmental performance.



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Wastewater in Industrial Processing:

Recovering Valuable Resources Beyond Extraction

Water plays an essential role in metal extraction and processing. It transports materials, supports chemical reactions, and separates valuable minerals from unwanted substances. Yet, once these processes are completed, water often becomes a complex waste stream containing dissolved metals, salts, acids, suspended solids, and residual processing chemicals.

Traditionally, wastewater treatment has been viewed as an environmental requirement at the end of production. Today, however, a different perspective is emerging: wastewater can represent an additional source of recoverable resources and an opportunity to reduce freshwater consumption.

This shift is increasingly important as mining and metal-processing operations face growing pressure from water scarcity, declining ore quality, and rising demand for critical minerals. Recovering both water and valuable materials from industrial streams can improve operational efficiency while reducing environmental pressures. But how can wastewater treatment move beyond disposal and become an integral part of the resource recovery process?

Wastewater as a Secondary Source of Valuable Metals

• Recovering What Remains in the Process

Industrial wastewater is not necessarily devoid of economic value. Depending on the original processing operations, it may contain residual concentrations of metals such as copper, nickel, cobalt, and zinc, which remain dissolved or suspended after the primary extraction stage.

Although these concentrations may be lower than those found in the original ore, recovering them can reduce valuable material losses during processing. This creates an opportunity to reconsider wastewater as a potential source of additional resources rather than simply a residual stream.

• Treatment Methods That Recover Metals

Several treatment approaches can support metal recovery from industrial wastewater. Chemical precipitation, for example, uses selected reagents to convert dissolved metals into solid compounds that can be separated from water.

Sulphide precipitation has been applied to recover metals such as copper and zinc, while ion

exchange offers another route by selectively capturing particular metal ions and allowing their recovery in a more concentrated form. These approaches demonstrate how wastewater treatment can support resource recovery while reducing material losses within the production cycle.

• From Wastewater Treatment to Resource Recovery

The practical value of these approaches has been demonstrated in mining operations where wastewater treatment has been combined with metal recovery.

In one documented copper-mining case, treatment of acidic drainage enabled copper recovery, while a separate ion-exchange process recovered nickel and cobalt from a low-grade solution. The treated water could then be reused on site or safely discharged.

Such examples highlight how a single wastewater stream can support both resource recovery and water management, transforming treatment from a disposal-focused process into an opportunity for more efficient resource utilization.



Recovering Water: Closing the Industrial Loop

- Reducing Dependence on Freshwater

Recovering metals is only part of the opportunity. The water remaining after treatment can represent an equally important resource, particularly in regions where freshwater supplies are limited or industrial demand is high. Water recovery systems remove suspended matter, dissolved salts, and other contaminants to produce water suitable for reuse in selected process applications. By returning treated water to industrial operations, facilities can reduce freshwater dependence and improve water management efficiency.

- Combining Treatment Processes

Depending on wastewater composition, treatment may involve filtration, chemical conditioning, membrane separation, ion exchange, or combinations of these methods. Rather than relying on a single treatment stage, integrated systems address different contaminants progressively.

A mining operation in the Middle East provides an example of this approach. Its industrial wastewater contained elevated concentrations of heavy metals, including antimony and arsenic, requiring preliminary treatment before further desalination.

By combining conventional treatment stages with advanced separation processes, the facility aimed to achieve water recovery exceeding 90%, while operating under strict conditions that allowed no liquid effluent to leave the site. This illustrates how integrated treatment systems can support high water recovery while addressing the challenges associated with complex industrial wastewater.

- Why Recovery Rates Vary

Although high-recovery treatment systems demonstrate significant potential, achievable recovery rates depend on feedwater composition, salinity, scaling potential, treatment design, and the intended reuse application.

The objective is not simply to maximize recovered water, but to produce water of appropriate quality without creating a more difficult residual stream. Balancing recovery performance with wastewater characteristics and reuse requirements is therefore essential.



Biological Treatment: Using Microorganisms to Address Cyanide

• Microorganisms as Treatment Agents

Among the challenges associated with metal recovery, cyanide-containing wastewater deserves particular attention. Cyanide is widely used in gold extraction because of its ability to dissolve gold from ore. However, residual cyanide and related compounds in process water and tailings require careful treatment before reuse or discharge.

Biological treatment offers an alternative to relying exclusively on chemical oxidation. Certain microorganisms can transform cyanide and related compounds through metabolic processes, converting them into less harmful substances.

• Conditions for Effective Biodegradation

Effective biological cyanide treatment depends on selecting suitable microbial communities and maintaining conditions that support their activity, including appropriate pH, oxygen availability, and wastewater composition.

The approach has been commercially applied in gold-mining operations for decades. More recent research has also explored bacterial communities isolated from gold-mine tailings. In one laboratory investigation, a native bacterial consortium achieved up to 98% removal of free cyanide under controlled conditions using synthetic alkaline wastewater. However, this result should not be interpreted as a guaranteed performance level for full-scale operations, where variations in metal concentrations, salinity, and other contaminants can affect microbial activity.



• Exploring Enzyme-Based Solutions

Beyond whole-cell treatment, enzyme-based approaches are also being investigated. Enzymes such as nitrilases can participate in cyanide-degrading reactions, creating opportunities for more targeted biological treatment.

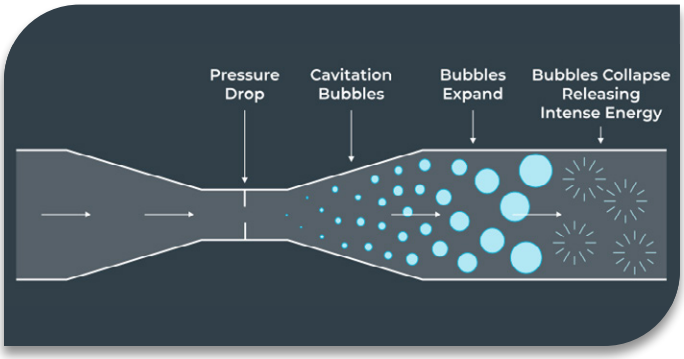
Their potential lies in supporting specific chemical transformations, although further development is needed to establish their performance under the variable conditions of industrial wastewater.

Hydrodynamic Cavitation: Intensifying Wastewater Treatment

- How the Process Works

Hydrodynamic cavitation occurs when water passes through a restricted flow area, creating pressure changes that lead to the formation and subsequent collapse of microscopic vapor bubbles.

This collapse releases localized energy and generates highly reactive conditions that can contribute to the breakdown of certain contaminants, offering a potential means of intensifying wastewater treatment.



- Applications in Industrial Effluents

Hydrodynamic cavitation can be used as a treatment step on its own or combined with oxidation processes to improve the removal of persistent pollutants. Its relevance to metal-processing wastewater has also been investigated directly.

In a study involving effluent from a polymetallic processing facility, controlled hydrodynamic cavitation achieved an average reduction of 73.6% in measured metal concentrations and 52.1% in suspended solids under the reported operating conditions. Sulphate reduction, however, was much more limited, highlighting that the process does not remove all contaminant groups equally.

- A Complementary Treatment Option

These findings suggest that hydrodynamic cavitation may serve as a useful treatment or pretreatment stage in selected industrial applications.

Nevertheless, its effectiveness depends on operating pressure, treatment duration, wastewater characteristics, and the contaminants present. It should therefore be considered as part of a broader treatment strategy rather than a universal replacement for established separation and treatment processes.

Designing Treatment Around the Wastewater

• Why One Solution Is Not Enough

Industrial wastewater streams vary significantly according to the metals being processed, chemicals used, operating conditions, and the stage at which water is collected. Consequently, a treatment process that performs well for one stream may be unsuitable for another.

Understanding these variations is essential for selecting effective treatment methods and avoiding the limitations of applying a single solution to different wastewater characteristics.



• Building Integrated Treatment Trains

Effective resource recovery increasingly depends on combining treatment methods according to the specific characteristics of each wastewater stream. A treatment sequence may begin with suspended solids removal, followed by metal recovery, biological treatment of selected contaminants, or advanced oxidation where persistent organic compounds are present. Membrane separation or other polishing stages can then help produce water suitable for reuse. By integrating these processes, industrial facilities can address multiple objectives within the same operation: recovering valuable metals, reducing contaminant loads, and returning treated water to appropriate industrial applications. The key is selecting each treatment stage according to the problem it is intended to solve, rather than applying multiple technologies without considering their compatibility.

Measuring Success Beyond Metal Production

• A Broader Definition of Resource Efficiency

The future of metal recovery will depend not only on how efficiently valuable materials are extracted, but also on how responsibly water and residual materials are managed.

Wastewater treatment can become part of the production strategy itself, helping reduce freshwater withdrawals, recover metals that would otherwise be lost, and limit the environmental risks associated with industrial effluents.

• Turning Waste into Another Opportunity

Achieving this requires a broader definition of resource efficiency. The quantity of metal recovered remains important, but it should be considered alongside the volume of water reused, the reduction of hazardous contaminants, and the amount of residual waste requiring further management.

By integrating water treatment and resource recovery into the metal-processing cycle, industrial facilities can move away from the traditional view of wastewater as an unavoidable by-product. What was once considered the end of a production process may instead become the starting point for another recovery opportunity, turning waste streams into valuable resources while supporting a more circular and water-conscious industrial future.





Engineering the Water–Energy–Food Nexus: Integrated Systems, Resource Efficiency, and Sustainable Infrastructure

Water, energy, and food systems are closely interconnected. Water is essential for agricultural production, industrial processes, and energy generation, while energy is required for water abstraction, treatment, pumping, and distribution. Food production depends on both resources through irrigation, processing, and storage. This interdependence creates engineering challenges because decisions in one sector directly affect the performance and resource requirements of the others.



Expanding irrigation, for example, increases water demand and pumping energy, while desalination improves water availability but adds to electricity consumption. The Water–Energy–Food (WEF) Nexus provides an integrated approach to managing these relationships through coordinated planning, infrastructure optimization, and resource efficiency.

Engineering Challenges Across the Three Sectors

- **Water Infrastructure and Energy Consumption**

Water and wastewater facilities require significant energy for pumping, treatment, desalination, and distribution. In pumping systems, energy consumption depends on flow rate, total dynamic head, pump efficiency, and operating conditions. Poor hydraulic design and operation away from the Best Efficiency Point (BEP) can increase electricity demand. Seawater reverse osmosis (SWRO) desalination also requires substantial energy.

Specific Energy Consumption (SEC), measured in kWh/m^3, is a key indicator for evaluating desalination energy performance. Improving efficiency requires optimized hydraulic networks, variable frequency drives (VFDs), appropriate pump selection, and energy recovery systems.

• Energy Production and Water Requirements

Conventional thermal power plants depend on water for cooling and steam generation. Their water requirements vary according to generation technology and cooling configuration.

Renewable energy technologies, particularly solar photovoltaic and wind power, generally require less operational water than conventional thermal generation. However, water may still be needed for equipment cleaning, manufacturing, and maintenance.

Therefore, energy infrastructure planning should consider both electricity generation efficiency and water requirements.



• Agricultural Water & Energy Efficiency

Agriculture accounts for approximately 70% of global freshwater withdrawals, making irrigation efficiency a central concern within the WEF Nexus. Water pumping, conveyance, and pressurization contribute to agricultural energy demand. Drip irrigation, precision scheduling, soil-moisture monitoring, and efficient pumping can improve resource utilization.

However, field-level irrigation efficiency does not automatically translate into basin-wide water savings. Effective assessment must consider water withdrawals, evapotranspiration, return flows, and actual consumption.

Integrated Strategies for Resource Optimization

• Smart Monitoring and Digital Technologies

SCADA systems, IoT sensors, artificial intelligence (AI), and digital twins can improve operational control across water, energy, and agricultural infrastructure.

Key applications include:

- Monitoring flow, pressure, water quality, and energy consumption.
- Detecting leakage and abnormal operating conditions.
- Optimizing pump operation and maintenance schedules.
- Improving irrigation decisions using soil and weather data.

These technologies support data-driven decisions, reduce operational inefficiencies, and improve infrastructure reliability.

• Wastewater Reuse and Resource Recovery

Treated wastewater can supplement freshwater supplies for irrigation, industrial applications, and other non-potable uses, subject to appropriate treatment standards.

Technologies such as membrane bioreactors (MBR), ultrafiltration (UF), and reverse osmosis (RO) can provide different treatment levels according to reuse requirements.

Wastewater facilities can also recover energy through anaerobic digestion, which converts organic matter into biogas for heat and electricity generation. Nutrient recovery offers additional opportunities to support agricultural applications and circular resource management.



- **Renewable Energy Integration**

Solar photovoltaic and wind systems can supply electricity for water pumping, treatment, and desalination facilities.

However, renewable-powered water infrastructure requires careful consideration of energy intermittency, storage capacity, and operational continuity. Hybrid systems combining renewable generation, grid electricity, and energy storage can improve reliability while reducing dependence on conventional energy sources.

- **Improving Infrastructure Performance**

Resource optimization requires evaluating the entire system rather than individual equipment alone. Important performance indicators include:

- Specific Energy Consumption (SEC) in water treatment and desalination.
- Pump efficiency and operation relative to the BEP.
- Non-Revenue Water (NRW) in distribution networks.
- Water recovery rates in treatment processes.
- Irrigation water productivity in agricultural systems.

Pressure management, leakage detection, hydraulic optimization, and efficient equipment operation can reduce unnecessary water and energy consumption.

Integrated Planning and Infrastructure Resilience

Managing the WEF Nexus requires coordination between water utilities, energy providers, agricultural authorities, and environmental institutions. Infrastructure planning should consider future water and energy demand, climate conditions, operating costs, and the availability of natural resources.

Climate change further complicates resource management through changing rainfall patterns, rising temperatures, increased evaporation, and more frequent extreme weather events. Resilient infrastructure must therefore be designed to maintain performance under changing environmental and operational conditions.



Engineering a More Sustainable Resource Future

The Water–Energy–Food Nexus demonstrates that water, energy, and food security cannot be addressed independently. Efficient pumping, advanced treatment, wastewater reuse, renewable energy, precision irrigation, and digital monitoring offer practical engineering solutions. Their effectiveness, however, depends on integrating these technologies into coordinated resource management strategies. The priority is to develop infrastructure that improves water and energy efficiency while supporting sustainable agricultural production. This integrated approach is essential for building more reliable, resource-efficient, and resilient systems.



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ENERGY NEWS BRIEF

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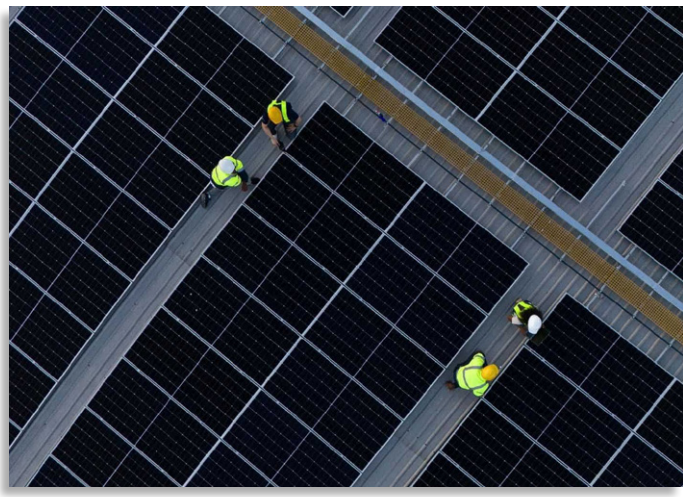
Shell Delivers First Gas from the Rosmari-Marjoram Development in Malaysia

Sarawak Shell Berhad (SSB), a subsidiary of Shell plc, has commenced production at the Rosmari and Marjoram gas fields, located 220 kilometers off Sarawak, Malaysia. This development is part of Shell's strategy to enhance production growth into the 2030s. Gas from these fields will be transported to a new onshore processing plant in Bintulu, which will supply the PETRONAS LNG Complex. The offshore platform is powered by solar energy, with diesel generators as backup, while the onshore facility operates on hydropower and renewable energy certificates. SSB holds a 71% stake in the project, reflecting its strong partnership with PETRONAS.



SunPower Expands in Texas with SOLRITE Virtual Power Plant Partnership



SunPower Inc. has announced its expansion in Texas by acquiring project assets from Houston-based Greenlight Solar and forming a strategic partnership with Fort Worth financier SOLRITE Energy. This move aims to enhance SunPower's residential solar and storage offerings and accelerate its Virtual Power Plant (VPP) business, allowing residential and commercial batteries to sell power. The acquisition brings experienced local talent and operational capabilities to support growth in Texas, a major U.S. solar market. CEO T. J. Rodgers emphasized the importance of this expansion for tapping into Texas's solar potential, while SOLRITE will provide project funding and innovative VPP solutions to increase customer engagement.

Envision Green Ammonia Successfully Fuels the World's First VLAC

Envision has achieved a significant milestone in maritime decarbonization by supplying certified green ammonia for the bunkering of the Terra Clove, the world's first Very Large Ammonia Carrier (VLAC) with dual-fuel ammonia propulsion. This event follows Envision's inaugural commercial green ammonia shipment in February 2026, marking the first complete delivery chain from renewable hydrogen synthesis to maritime logistics. The green ammonia is produced at Envision's Chifeng facility in Inner Mongolia, which has an annual capacity of 320,000 tons. This development confirms the viability of green ammonia as a scalable marine fuel, furthering Envision's leadership in green hydrogen and ammonia solutions.



PIF and Aramco Close HUMAIN Transaction to Accelerate HUMAIN's Global Growth

The Public Investment Fund (PIF) and Aramco have finalized a transaction in which Aramco acquires a 49% stake in HUMAIN, with PIF retaining 51%. This partnership aims to accelerate HUMAIN's growth and enhance its AI capabilities globally by integrating AI assets and talent from both organizations. The collaboration will develop a comprehensive AI ecosystem, including data centers and advanced applications, supporting both public and private sectors in deploying AI at scale. The deal involves approximately SAR 9.9 billion ($2.6 billion) in cash contributions from Aramco and aligns with Saudi Arabia's strategy to foster innovation and strengthen its position in the global AI market.



Iberdrola Launches a Programme to Renew and Upgrade 1,300km of Electricity Transmission Lines in New York State



Iberdrola, through its subsidiary Avangrid, will renew over 230 electricity transmission lines spanning 1,300 kilometers in New York State, with work expected to continue until 2031. This initiative aims to enhance the reliability and resilience of the electricity grid against extreme weather and growing demand, ensuring a secure power supply for homes and businesses while supporting regional economic development. Additionally, Iberdrola plans to invest over €8.5 billion in U.S. electricity distribution networks by 2028. The company, with a regulated asset base of nearly €16 billion in the U.S., aims to expand its presence in the electricity networks sector, targeting a total of €30 billion by 2031.

Saudi Arabia Overtakes UAE as India's Second Oil Supplier; Russia Retains Lead

India's oil imports from Saudi Arabia surpassed those from the United Arab Emirates (UAE) for the first time since the Iran war disrupted regional supplies. Saudi imports reached an eight-month high of approximately 790,000 barrels per day (bpd), while UAE imports fell to a seven-month low of 612,000 bpd. Russia remained India's top supplier, with imports rising to 1.85 million bpd, accounting for about a third of total purchases.





Global Energy Events

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