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Arab Water World

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February 2017 / Vol. XL Issue 2



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Cover Photo Courtesy of SIDEM



Reuse of Treated Wastewater: Gaining Currency Worldwide



إعادة استعمال مياه الصرف الصحي المعالجة تلقى رواجًا في العالم

Growing water scarcity across the globe, coupled with the increase of effluents from urban areas, is expected to bolster the global wastewater-recycling and reuse market. Some of the beneficial usage of water recycling and reuse include commercial, residential, and municipal usage, agricultural uses and industrial uses. More importantly, if properly managed, wastewater can be used safely to support crop production — directly through irrigation or indirectly by recharging aquifers — but doing so requires diligent management of health risks through adequate treatment or appropriate use, according to **FAO**.

Marlos De Souza, Senior officer with FAO's Land and Water Division, says: "Although more detailed data on the practice is lacking, we can say that, globally, only a small proportion of treated wastewater is being used for agriculture, most of it municipal wastewater. But increasing numbers of countries — Egypt, Jordan, Mexico, Spain and the United States, for example — have been exploring the possibilities as they wrestle with mounting water scarcity." However, the most prominent barrier to the successful implementation of recycling water projects, specifically in the GCC region, has been the lack of technical and project management expertise in the government agencies, reveals **Frost & Sullivan**. Moving forward, the region should focus on improving wastewater management. "When safely used and managed to avoid health and environmental risks, wastewater can be converted from a burden to an asset," De Souza says.

The February 2017 issue of **Arab Water World (AWW)** magazine covers a number of interesting projects and topics. On page 07, the article sheds light on the industrial filtration market, which is expected to be worth USD30.78 billion by 2021. The article on page 11 provides a thorough discussion on energy-efficient aeration. Moreover, the article on page 15 focuses on the combination of distillation and membrane processes with power generation and the hybridization with renewable energy sources. Furthermore, the article on page 19 highlights efficient water treatment technologies. This issue is also abounded with a number of technical articles, country reports as well as news about latest innovations and market trends. Your comments and remarks are appreciated; please don't hesitate to contact us through our email content@cph.world

Fathi Chatila
Editor-in-Chief

وفقاً لمنظمة الأغذية والزراعة، من المتوقع أن تعزّز مسألة ندرة المياه في جميع أنحاء العالم، وزيادة المخلفات السائلة في المناطق الحضرية السوق العالمية لإعادة تدوير مياه الصرف الصحي وإعادة استخدامها. ويشمل بعض الاستخدام النافع لإعادة تدوير المياه وإعادة استعمالها مجالات متعدّدة مثل المجال التجاري، السكني، البلديات، الزراعي، والصناعي. والأهم من ذلك، يمكن اعتماد مياه الصرف الصحي بشكل آمن إذا تمت إدارتها بشكل صحيح، في دعم إنتاج المحاصيل بشكل مباشر عن طريق الري، أو بشكل غير مباشر عن طريق إعادة شحن المياه الجوفية. ولكن، يتطلب هذا الأمر الاضطلاع بالإدارة على نحو دؤوب للمخاطر الصحية من خلال توفير العلاج أو الاستخدام المناسب لها.

قال أحد كبار مسؤولي إدارة الأراضي والمياه لدى (الفاو) (مارلوس دي سوزا): "رغم الافتقار إلى بيانات تفصيلية حول هذه الممارسة، لكن يُمكننا القول إنه لا يتم استخدام إلا نسبة قليلة من مياه الصرف الصحي المعالجة في قطاع الزراعة على المستوى العالمي، فمعظمها مياه الصرف الصحي التابعة للبلدية. ولكن ثمة عدد متزايد من الدول، مثل مصر والأردن والمكسيك وإسبانيا والولايات المتحدة، تستكشف هذه الاحتمالات نظراً لأنها تعاني من ندرة المياه". وبحسب تقرير صادر عن شركة فروست أند سوليفان (Frost & Sullivan)، يتمثل الحاجز الأبرز للتنفيذ الناجح لمشاريع إعادة تدوير المياه في نقص الخبرة التقنية وخبرة إدارة المشاريع في الجهات الحكومية، وتحديدًا في منطقة دول مجلس التعاون الخليجي. لذا ينبغي أن تركز المنطقة على تحسين إدارة مياه الصرف الصحي. وقال دي سوزا "عندما تستخدم مياه الصرف الصحي وتدار بشكل آمن لتجنب المخاطر الصحية والبيئية، فإنه يمكن تحويلها من عبء إلى مصدر مفيد."

يُغطي عدد شباط / فبراير ٢٠١٧ من مجلة عالم المياه العربي مواضيع مختلفة ومثيرة للإهتمام. فيلقي مقال الصفحة ٠٧ الضوء على سوق الترشيح الصناعي، ومن المتوقع أن تصل إلى ٣٠,٧٨ مليار دولار أمريكي بحلول العام ٢٠٢١، ويتناول مقال الصفحة ١١ موضوع التهوية الموفرة للطاقة. أمّا مقال الصفحة ١٥ فيركز على الجمع بين عمليات التقطير وتقنية الأغشية وبين عملية توليد الطاقة والتهجين من خلال مصادر الطاقة المتجددة. بينما يبرز مقال الصفحة ١٩ تقنيات المعالجة الفعالة للمياه. كما يزر هذا العدد مقالات تقنية وتقارير حول البلدان بالإضافة إلى آخر الأخبار حول أحدث ابتكارات سوق المياه واتجاهاتها. آراءكم وتعليقاتكم تهمّنا، فلا تترددوا بالتواصل معنا عبر البريد الإلكتروني content@cph.world

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Waste Water Re-Use

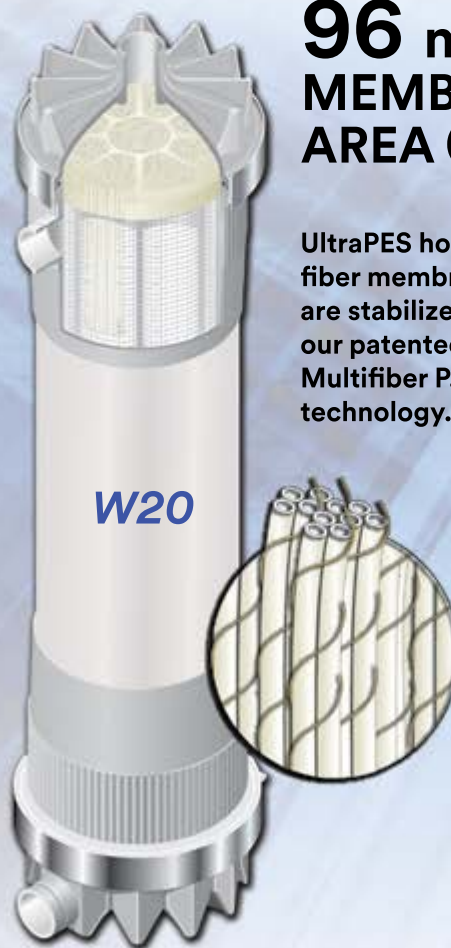


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Egypt

Siemens Overdelivers on Promise in Megaproject

In June 2015, **Siemens** was awarded its single biggest order ever for the expansion of the Egyptian power supply. Now, only 18 months after the signing of the contract, Siemens has set a new worldwide benchmark for the execution of fast-track power projects. Together with its local partners **Orascom Construction** and **Elsewedy Electric**, the company has made great progress in its effort to boost Egypt's power generation capacity by 45 percent, upon final completion of the three power plants. The first phase of the megaproject in Egypt has been finalized. The promised goal of bringing 4.4 gigawatts (GW) of new capacity to the grid has even been exceeded, and 4.8 gigawatts are already connected to the grid. The surplus capacity of 400 megawatts is sufficient to supply more than one million people in Egypt with electricity. After completion in May 2018, the three power stations will be the largest gas-fired, combined cycle power plants ever built and operated in the world.

existing power to the national grid: GE will set up the Samawa and Dhi Qar Power Plants, adding 1,500 megawatts (MW) to the grid. In the first phase of the project, GE will install four 9E gas turbines in simple cycle at each site by 2018. The second phase will entail the combined cycle conversion of the 9E units. GE is also supplying advanced heat recovery steam generators (HRSG) and steam turbine technology as well as serving as the engineering, procurement and construction (EPC) contractor for the projects.

in Jordan. With a storage capacity of 7.8 million cubic meters of water, the Kufranjah Dam aims to augment the country's irrigation and drinking water resources and further develop the fertile town of Ajloun. King *Abdullah II* of Jordan inaugurated the dam. Praising the historic brotherly ties between the UAE and Jordan, *Mohammed Saif Al Suwaidi*, Director General of ADFD, said: "For decades, our two nations have enjoyed strong bilateral ties fostered by the UAE's founding father late Sheikh *Zayed bin Sultan Al Nahyan*, and the late King *Hussein* of Jordan."



Iraq

GE Secures New Orders

GE announced that it has secured more than USD1.4 billion in orders from Iraq's **Ministry of Electricity** to set up power plants as well as provide technology upgrades and maintenance services. The announcement further strengthens GE's collaborations in Iraq to support the country's power infrastructure and meet the growing need for electricity. GE signed agreements that will add over two gigawatts (GW) of power and secure the delivery of ~1.75 GW of



Jordan

Kufranjah Dam Project Unveiled

Abu Dhabi Fund for Development (ADFD) attended the official opening of the Kufranjah Dam – a development project funded by the UAE government and managed by ADFD in Jordan. Located north of Jordan's capital Amman, the newly completed USD28 million project is in line with the framework of the 2013 UAE government contribution of USD1.25 billion to the Gulf Development Fund, a five-year grant program of the GCC member countries to finance development projects



Qatar

Masdar Inks Deal with QEWC & Nebras

Masdar, Abu Dhabi's renewable energy company, has signed a Cooperation Agreement with **Qatar Electricity & Water Company (QEWC)** and **Nebras Power** at Abu Dhabi Sustainability Week to develop renewable and sustainable energy projects. The agreement aims to strengthen mutual cooperation between Masdar, QEWC and Nebras in the development of commercially viable renewable energy projects in the UAE, Qatar, and international markets. It will also promote

collaboration on research & development, education and raising awareness of the importance of sustainable development. *Mohamed Jameel Al Ramahi*, CEO of Masdar, said: "Our cooperation agreement with QEWC and Nebras Power provides a valuable opportunity for collaboration and knowledge sharing among regional partners who share common goals. This



Saudi Arabia

Saudi Power & Water Growth

ACWA Power, a developer, investor, and operator of a portfolio of power

energy-intensive industries. "Saudi Arabia is moving into renewable energy to inject greater longevity, affordability and accessibility into the power and water industries. This is an ambitious move, but the kingdom is ideally positioned to see this through," said Padmanathan. "Renewable energy can provide approximately 40 percent of electricity in Saudi Arabia, and there are fiscally sound ways to achieve this."



UAE

Developing Energy-Efficient Desalination Technologies

The **Masdar Institute of Science and Technology**, an independent, research-driven graduate-level university focused on advanced energy, and sustainable technologies, and the **Korea University** signed a research collaboration agreement to develop energy-efficient desalination technologies. The research project aims to confirm the viability of large-scale production of desalinated water from a plant fully powered by renewable energy. It also aims to demonstrate the potential of using promising innovative desalination technologies to reduce the energy footprint of desalination in the UAE. A consortium of South Korean companies will build a pilot desalination plant in Abu Dhabi to facilitate the research to be conducted by both universities. According to the agreement, a collaborative research program will evaluate the performance of the desalination pilot plant. Additionally, it will foster the collaboration with Korea University to develop, test and demonstrate novel pretreatment technologies with high potential for energy-efficient operation. The research program will comprise specific tasks for both Masdar Institute and Korea University. Masdar Institute will conduct chemical analysis of water streams to support the development of pre-treatment technology developed at Korea University. Masdar Institute will also support Korea University in their evaluation of the performance of the Korean pilot desalination plant installed in Abu Dhabi.

generation and desalinated water production plants, participated in the World Future Energy Summit (WFES) 2017. President & CEO *Paddy Padmanathan* and Managing Director *Thamer Al Sharhan* examined Saudi Arabia's power and water sectors — two segments headed for substantial growth in the coming years. Under the vision of King *Salman bin Abdulaziz Al Saud*, Saudi Arabia will invest heavily outside upstream oil and gas industries, increasing the competitiveness of the power and water industries and reducing energy usage across the country. The government is already getting ahead of its energy needs, with plans to integrate renewable energy into desalination projects and boost efficiencies in other

will lead to closer ties, investment and value creation, and ultimately support the wider deployment of renewable energy." QEWC is one of the largest electricity and water desalination companies in the Middle East and North Africa. Its production capacity is 11,098MW for electricity and 535.5 MIGD for desalinated water.

Water Treatment

Filtration

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Industrial Filtration Market Worth USD30.78 Billion by 2021

Today, countries around the world are witnessing a rapid surge in industrial activities. According to the **Food and Agriculture Organization**, industrial water is the fastest growing sector of the global water market. The market for industrial water treatment technologies, as per a **GWI** report, is expected to be worth more than USD11 billion in 2020. On the basis of technology, the industrial filtration market is projected to grow from an estimated USD22.91 billion in 2016 to USD30.78 billion by 2021, registering a CAGR of 6.1 percent from 2016 to 2021, according to a report by **MarketsandMarkets**. Liquid filtration is estimated to hold a large market share, as it is being widely used for the treatment of supply water in water & wastewater treatment facilities, especially in emerging economies.

Stringent government emission regulations, rising demand for high-quality products, and growing environmental concerns are expected to boost the growth of the industrial filtration market during the forecast period. Liquid filtration is estimated to account for over 76 percent of the market share from 2016 to 2021, adds MarketsandMarkets' report. Moreover, the growth of industries that are dependent on water, such as chemicals, oil & gas, power generation, pharmaceuticals, and food & beverage, is also expected to fuel the demand for this kind of filtration. It is worth mentioning that coal is one of the most water-intensive methods of generating electricity. According to the **International Energy Agency**, coal will account for 50 percent of the growth in global water consumption for power generation over the next 20 years. Globally, 8,359 existing coal power plant units already consume enough water to meet the basic water needs of 1 billion people, according to a new **Greenpeace International** report. The top countries with proposed additional coal plant capacity are China (237 GW), India (52 GW) and Turkey (7 GW). Greenpeace research shows that if the proposed coal plants come online, their consumption of water will increase by 90 percent.



In like manner, water is also extremely important for the manufacturing sector. As a matter of fact, the MarketsandMarkets report states that the manufacturing industry is the largest contributor to the

“Liquid filtration is estimated to account for over 76 percent of the market share from 2016 to 2021”

industrial filtration market, and also acts as a key driver of the market. Furthermore, the demand for high-quality products from consumers has boosted the demand for advanced filtration equipment in several manufacturing and process industries. According to the report, the Asia-Pacific region is expected to witness high growth in the power generation, manufacturing,

process, healthcare, and oil & gas industries from 2016 to 2021. Moreover, new policies to control environmental pollution will likely fuel the growth of the industrial filtration market in this region.

Key players in the industrial filtration market, according to the report, are trying to penetrate emerging markets, and are adopting various strategies such as contracts & agreements, expansions, mergers & acquisitions, and new product launches to increase their market share. Some of the leading industrial filtration market players are **Mann + Hummel GmbH** (Germany), **Donaldson Company, Inc.** (U.S.), **Alfa Laval** (Sweden), **Clarcor Inc.** (U.S.), and **Parker Hannifin Corporation** (U.S.). ■

Fatima Saab
Content Editor & Researcher

تشهد الدول في جميع أنحاء العالم اليوم زيادة سريعة في الأنشطة الصناعية. ووفقاً لمنظمة الأغذية والزراعة، تعد المياه الصناعية القطاع الأسرع نمواً في سوق المياه العالمي. كما نشرت شركة جي دبليو أي (GWI) تقريراً توقعت فيه أن تبلغ قيمة سوق تقنيات معالجة المياه الصناعية أكثر من 11 مليار دولار أمريكي في عام 2020. وبحسب تقرير نشرته شركة ماركيتس أند ماركتس (MarketsandMarkets)، من المتوقع أن ينمو سوق الترشيح الصناعي من حوالي 22,91 مليار دولار أمريكي في عام 2016 إلى 30,78 مليار دولار بحلول عام 2021، مسجلاً معدل نمو سنوي مركب بنسبة 6,1 في المئة من العام 2016 وحتى العام 2021. ويقدر أن يحتل الترشيح السائل الحصة الأكبر من السوق، إذ أنه يستخدم على نطاق واسع في معالجة إمدادات المياه في مرافق المياه ومعالجة مياه الصرف الصحي، وخصوصاً في الاقتصادات الناشئة.

MEMBRANE Offers Complete Filtration Packages

MEMBRANE is an OEM that provides turn-key solutions in the fluid treatment business, based on proprietary know-how and patents. The company's solid engineering background stems from 1450 units installed in all 6 continents and offshore, proprietary know how competence since 1936, a SAP-based organization, a 3D-based engineering,

ISO 9001, OHSAS 18001, ACHILLES certifications. MEMBRANE's filtration units are designed according to ASME, ANSI, UNI standards whichever are applicable. Electrical and Instrumentation components may be for safe area or ATEX compliant. Pressure vessels are designed and tested according with ASME VIII, ASTM and PED. The company's recent installation

is a filtration package with ASME VIII pressure filters with special selected media (for dual-media filters) for industrial water reuse in a refinery. The complete chemical dosing package necessary to the process is supplied with the filters. The complete unit, with steel parts painted to harsh environment specifications, includes valves, piping, pumps for feed and backwash and blowers for air scouring, and comes pretested at the company's factory. The whole process is PLC controlled, with the company's exclusive software. Flowrates ranging from 480 m³/h to 500 m³/h are treated. The unit finely removes suspended solids and particulate with an exceptional 99 percent removal of suspended solids down to 60 micron without any chemical addition in its basic configuration. The goal has been achieved with extensive studies and fine tunings over the decades. The customer in this case is a major oil & gas company operating in the Mediterranean Sea. ■



ASME VIII Multimedia Filters Unit

Modernization of Drinking Water Treatment Plants with Festo

Ensuring water availability in a specific quality is becoming a challenge for the entire human race. Increasing bottlenecks in energy supplies, sinking groundwater levels and contamination of global water resources are causing this vital commodity to become scarcer. Industrial automation of potable and wastewater

treatment plants facilitates the access of this resource whenever needed. Bursa, the fourth largest city in Turkey, with 2.8 million inhabitants has a daily need of fresh water of 700,000 m³, which makes the modernization of drinking water treatment plants highly recommended. The modernization improves the reliability

of operation by consistent automation in order to reduce backwashing water use and heavy sand loss and therewith lowers the costs of the water treatment process. Together with the responsible planning engineers of The Bursa Water Supply and Sewerage Administration BUSKI, **Festo** developed an analysis of needs for the treatment process: the filter basins, the dosing, the sedimentation tank, the slurry thickener and the chlorination. The result was a persuasive automation concept with up to 500,000 m³ to be treated daily in 28 newly automated filter basins. Every filter was equipped with a kiosk type panel and a pneumatic control cabinet with modular electrical terminals, pneumatic linear and quarter turn actuators replaced the out-of-date actuator technology of the armatures. All data is sent to a SCADA system in order to maintain a smooth operation and easy maintenance. ■



Festo quarter-turn-actuators are dosing necessary chemicals

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Temperature
Depth

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Accuracy 0,1 °C
0,02 %FS, up to 200 m

The KELLER
Water Website



keller-H2O.com



SATI Bets on the Middle East

SATI S.r.l. is an Italian company founded in 1980 which has been specialized in the field of filtration and treatment of primary water, wastewater and process water, and it has rapidly developed a line of self-cleaning automatic filters, wholly designed, manufactured and tested within its facility in Italy. Support provided by the modern techniques of solid modelling and the use of selected materials like Technopolymers, Stainless Steel and Duplex, provide SATI filters with the best requisites for reliability and long-term use even under the heaviest working conditions. Research & Development plays a key role in the company's strategy, with attention constantly focused on investment and technical innovation, in close collaboration with University Institutes and private Laboratories of the highest level. Today, the company is in a position to provide a wide range of practical solutions, for current and future market demands, based on its large range of technological,



SATI filters

state-of-the-art products. The SATI products range includes traditional filters, self-cleaning screen filters, pleated cartridges, melt blown cartridges and membrane filters, covering the entire field of basic filtering, with separation degrees ranging from 2,000 to 0,1

micron. SATI filters are used in complex industrial applications, ranging from the more traditional sectors of drinking water and irrigation to successful advanced application, satisfying the specific requirements in the Mining sector, Oil & Gas sector and in Sea Water treatment. ■

A Leap Forward in Ultrafiltration Technology

With a constant rise in demand for fresh water, recycling and reuse have become requirements



QUA Q-SEP Modules

in many projects around the world. Ultrafiltration (UF) as a technology has gained momentum in water recycling plants as a pre-treatment to reverse osmosis (RO), replacing conventional media filters. **QUA**[®], manufacturer of advanced membrane products for water, wastewater, and water reuse applications, has developed Q-SEP[®] Hollow Fiber Ultrafiltration membranes, an innovation that takes UF technology to the next level, offering superior performance characteristics and product water quality that surpasses the quality from conventional UF modules. Q-SEP Hollow Fiber Ultrafiltration modules are manufactured using QUA's patented "Cloud Point Precipitation" method. The cloud point precipitation process ensures a high pore density along the length of the fiber and uniform pore size distribution in the membrane. The

uniform pore size distribution with low trans-membrane pressure results in consistent water quality, with low silt density index (SDI) and excellent rejection of bacteria and viruses, greatly enhancing reverse osmosis system performance. Q-SEP UF modules are made from a hydrophilic polyether sulfone (PES) material that provides high fiber strength and excellent low fouling characteristics, resulting in higher productivity. These hollow fiber membranes operate under low transmembrane pressure in an inside-out flow configuration for superior performance. Applications of Q-SEP Hollow Fiber Ultrafiltration modules include pretreatment to reverse osmosis systems (brackish and seawater applications), purification of surface and well water for potable applications, filtration of industrial water, and wastewater recycle and reuse. ■

Energy-Efficient Aeration in Focus

If energy-efficient Aeration is not your priority – even when it is well documented that Aeration accounts for a pretty staggering 50-70 percent of a treatment plant's power consumption – then please, turn the page. Historically, and still to this day - the well-worn 'handbook' for determining the SCFM (standard cubic feet per minute) for the use of Fine Bubble Diffused Air Systems in an Activated Sludge Process says something along the lines of: Calculate the air flow required for the oxygen demand. Then, calculate the air flow required for mixing. Use the greater of those two numbers to size your blower. That's it! But, according to two companies with more than 170 years' experience between them, it may be time to tear up that handbook, or with more and more treatment plants now on a path towards becoming energy neutral, at least bring it into the 21st century.

“Traditionally, plug-flow aeration basins for the nitrification of activated sludge were not built with submersible mixers in mind”, says **Landia** (established 1933) Director *Soren Rasmussen*, “but continuing to follow ‘the old handbook’ can result all too often in also using equipment such as a blower that is way over-sized for mixing, which wastes large amounts of energy, especially during the night when loads are so much lower.”

He added: “If that first number in the calculation which asks for the amount of air required for nitrification is greater than the second number for how much air is required for mixing, then fine. But if that second number is greater than the first, then there is an opportunity for power savings. Air flow through diffusers works great for oxygen transfer, but it's terribly inefficient for mixing. Instead it's time to bring in a submersible mechanical mixer, which can keep solids in suspension with just a fraction of the horse power that the blower would consume. The use of submersible mixers in a plug-flow aeration basin will further enable the plant to reduce aeration during low-load periods (summer/winter or night time), without losing mixing in the tank.”

For many, optimizing the all-important process will naturally outrank energy efficiency concerns; even though up to a staggering 25 percent of a whole city's total energy use can be consumed by aeration at its treatment plants.

However, new grants, **EPA** funding options and Energy Savings Performance Contracts (ESPCs) should help incentivize the opening to make significant, guaranteed savings, especially as federal agencies can procure energy savings and facility improvements with no up-front capital costs.



Landia's Air Jet consists of a Landia chopper pump and an ejector system

'Energy Savings too in Oxidation Ditches'

One company that also uses submersible mixers to actively help its customers reduce their aeration-led energy bills without compromising on their process is **Lakeside Equipment Corporation** (established 1928), who back in 1964, first introduced the 'oxidation ditch process' to the United States. Vice President, *Warren Kersten* says: “To optimize the process for oxidation ditches and save energy, we use rotor aerators, supplemented

controls and speeds, including the use of high-speed Turbo blower systems and air-bearing technology to efficiently produce air flow, but as Kersten continues, the introduction of a mixer – designed for purpose - can play a vital processing and economic role. “The mixers are put into operation purely for mixing, which unlike other equipment is truly optimized to keep solids in suspension and prevent the tank from going septic. For blowers, variable speed drives may help reduce the amount of power

being used, but at the end of the day, a blower is designed to add oxygen, not for mixing. They're not dual-purpose. We've created a cycle so that when the DO (Dissolved

Oxygen) drops below 0.5ppm, the bacteria switch from using the free O₂ provided by the rotors to attacking the nitrate molecule to obtain their oxygen. We then switch the rotors back on. It enhances the process, and has the added bonus of reducing energy costs.”

“For many, optimizing the all-important process will naturally outrank energy efficiency concerns”

by Landia's submersible mixers. During the aerobic phase we have the mixers switched off, but then later when we switch them on, we turn the rotors off so as not to add oxygen.” In more recent Aeration handbooks, you'll find all sorts of advice on energy efficiency, largely about

Energy savings achieved with this Cyclic Aerobic/Anoxic operation using Lakeside Magna Rotors during the aerobic phase and Landia mixers during the anoxic phase will, according to Kersten, reduce oxygen requirements by around 27 percent. This saves considerable power costs over the typical 20-year life of the project. Based on a 1 MGD plant, using the national average of 10.12 cents per kilowatt hour, this can reduce energy costs by approximately USD18,000 per year.

For both oxidation ditches and plug-flow aeration basins, most treatment plants prefer to work with DO levels of activated sludge from 0.5ppm, even up to 2ppm, Rasmussen and Kersten agree that anything above that, be it 3, 4 or 5ppm is simply more aeration than required – and a waste of energy. In addition to wasting energy, too much dissolved oxygen can cause an upset in anaerobic and/or anoxic selectors by having a high DO in the return activated sludge or mixed liquor recycle. It can also allow certain filamentous organisms to flourish

that reduce the effectiveness of the final clarifiers due to a higher settled sludge volume and sludge volume index.

The DO level acts as a buffer, giving the bacteria just enough to work with, but there is really no logic in anything over 2ppm. Too much oxygen may inhibit the bacteria where nitrates are used for the O₂ source, so you won't achieve denitrification. This could mean having

“In addition to wasting energy, too much dissolved oxygen can cause an upset in anaerobic and/or anoxic selectors”

to add another carbon source, such as methanol, which further adds to costs and labor.

‘Substantial off-peak savings with submersible mixers’

Landia's Rasmussen added: “On capital costs, adding 1 or 2 mixers should reduce the number of operating blowers. At the appropriate times, especially at night, switching off two 50 HP blowers

for two 10 HP mixers creates savings that easily runs into tens or hundreds of thousands of dollars – and much better mixing is achieved. To bring about the best possible conditions for the process, you must have enough liquid velocity to adequately mix the reactor biomass. Initially, mixers mean more capital costs, but energy savings make the return on investment (ROI) very short indeed.” If you've decided to address

those perhaps unnecessarily high energy costs and enhance your plant's activated sludge process with a mixer, then Rasmussen's advice is to look for a low speed mixer with a stainless steel propeller. “With low speed, a

mixer will gently mix the sludge without causing floc shear, whereas the shearing by a high speed mixer will disrupt and damage the process,” he says. “Also, the initial capital cost of a mixer with a stainless steel propeller shouldn't be a deterrent because it has such a long lifetime. Recently we've been replacing motors that have come to the end of their natural life, but can still use the propellers after 20 or so years in an oxidation ditch because there's absolutely nothing wrong with them. So when a plant undergoes an upgrade, reusing our mixers' original propellers represents a big reduction in capital costs for customers. Together with energy savings from using much less horse power, we can help treatment plants on their way to becoming far more sustainable and ultimately, energy-neutral.” ■



Combining mixing and aerating, Landia's AirJet eliminates odors from wastewater

Lakeside Equipment Corporation

Web: www.lakeside-equipment.com

Landia, Inc.

Web: www.landiainc.com

إذا كانت التهوية الموفرة للطاقة ليست هي الأولوية الخاصة بك – حتى لو ثبت أن التهوية تستأثر بنسبة مذهلة من استهلاك الطاقة في المحطة المعالجة تبلغ 50-70 في المئة – فرجاءً لا تقرأ هذا المقال. تاريخياً، وحتى يومنا هذا، يتضمّن "الكتيب القديم" لتحديد القدم المكعب القياسي في الدقيقة لاستخدام نظم النشر الهوائي في عملية الحمأة المنشطة شيئاً على غرار: احسب تدفق الهواء المطلوب للأكسجين، ثم احسب تدفق الهواء المطلوب للخلط. استخدم الرقم الأكبر من هذين الرقمين لتحديد حجم النافخ الخاص بك. ولكن وفقاً لشركتين لديهما أكثر من 170 عاماً من الخبرة، قد يكون حان الوقت لتمزيق ذلك الكتيب، أو تحديثه ليصبح ملائماً للقرن الواحد والعشرين في الوقت الذي يزداد فيه عدد محطات المعالجة التي تتجه نحو الطاقة المحايدة. يقول مدير شركة لانديا (Landia) التي تأسست عام 1933 سورن راسموسن أن أحواض التهوية الدفقية لنتيجة الحمأة المنشطة لم يتم بناؤها مع أخذ الخلاطات القابلة للعمل تحت الماء بالإعتبار. ويضيف راسموسن أن الإستمرار في اتباع الكتيب القديم يمكن أن يؤدي في كثير من الأحيان إلى استخدام معدات مثل نافخ الهواء وهي تفوق الحجم المطلوب للخلط، الأمر الذي يهدر كميات كبيرة من الطاقة، وخاصة أثناء الليل عندما تكون الأحمال أقل بكثير.

KEO International Consultants Strongly Rooted in the GCC

KEO International Consultants' history in the treatment of sewage in the GCC is long and successful. Examples include the provision of treatment facilities for future tourist areas as well as addressing the population growth across the region. KEO's vision is to deliver cost effective and sustainable infrastructure solutions to meet its clients' ever changing needs and expectations. With respect to sewage, safe treatment is critical and viewed as a priority for the continued health of our communities. KEO is committed to implementing the most innovative technology in the most cost effective and appropriate way, to ensure this goal is realized. Expansion of the Ardiya Wastewater Treatment Plant (WWTP) in Kuwait, increased its capacity from 200,000 m³, to 250,000 m³ per day in order to meet the growing demands of the area. The redesign of Jahra WWTP



Mesaieed, Qatar

in Kuwait also successfully increased the plant's capacity from 60,000 m³ to 140,000 m³ per day. In Qatar, design of the plant and associated works at Mesaieed, provided 3 raw sewage pumping stations, trunk sewers, and rising mains to service the entire Mesaieed Industrial City. On the Palm Jumeirah in Dubai, KEO was involved in the design of a plant to polish the TSE

from an existing STP and provide 15,000 m³/day district cooling make up water for the Palm Jumeirah Trunk's cooling units. KEO's pursuit for excellence in sewage treatment continues, and the firm's environmental and wastewater specialists are looking forward to establishing partnerships with new and past clients for many years to come. ■



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HUBER Coarse Screen TrashMax[®] Proves its Capability

In the second largest city of Sweden with about 500,000 inhabitants, the municipal company of the region **Gothenburg Gryaab** determined to replace its existing coarse screens on the city's main sewage treatment plant by new ones. The city's wastewater and that of the whole Gothenburg region is collected on this sewage treatment plant and pumped into the inlet to four 20 mm coarse screens. The effluent from the coarse screens is pumped into a grit trap from where it flows by gravity through a 3 mm fine screen and then into the biological treatment system. Due to the increasingly stringent limits for effluent discharge into surface waters the sewage treatment plant is continuously under technical optimization. As one of the optimization measures, one of the existing coarse screens on site was replaced by a **HUBER Coarse Screen TrashMax[®]**



The HUBER Coarse Screen TrashMax[®]

10510/2000/2172 with 20 mm bar spacing. The function of the TrashMax[®] is based on the operation principle of a multi-rake bar screen and designed as a heavy-duty coarse screen. Due its benefits, the **National Water Company** will now

replace the four existing coarse screens of the North Plant on the main sewage works Manfouha in Riyadh by TrashMax[®] units. Furthermore, they will install another 100 mm TrashMax[®] screen as first treatment stage for phase 3 of the Al Kharj plant. ■

FUCHS OXYSTAR Aerators Equip Paper Mill

FUCHS Enprotec GmbH was founded in 1973. Today FUCHS is a globally respected manufacturer of aspirator aerators with broad experience and know-how in the field of municipal and industrial wastewater. The focus

is on aerated lagoons, the upgrading of municipal activated sludge plants and biological treatment of industrial wastewater. The company offers well-proven solutions for beverage and food processing industries, olive oil

production, pulp and paper industry and textile mills. FUCHS provides high-quality products and tailor-made solutions based on forty years of experience. The design of FUCHS OXYSTAR Aerators is highly suitable for use in wastewater treatment. It provides very high aeration efficiency and mixing capability. The design and the high quality of used materials grants nearly maintenance-free operation. Due to its low weight existing plants can be retrofitted easily. UCHS OXYSTAR Aerators are installed in several paper mills around the world. In 2006 a paper mill in Bosnia needed new aerators for their waste water treatment plant. In cooperation with the company's Turkish representative **ENVIROTEK**, 20 OXYSTAR Aerators OS 25.0 were installed at bridges with mounting brackets. They ensure ventilation and mixing in a two-stage activated sludge process. The circular tanks have a total treatment volume of 6,500 m³. ■



FUCHS OXYSTAR Aerators

Hybrid Desalination Systems: A Solution to Energy & Environmental Challenges

The hybrid desalting concept is the combination of two or more processes in order to provide better environmental solutions and a lower water cost product than either alone can provide. Early suggestions for hybrid desalination were based upon elimination of the requirement for a second pass to the RO process so that the higher-salinity RO product could be combined with the better-quality product from an MSF or MED plant. This is the simplest application of hybrid desalination. Since then, other concepts have been proposed for hybrid desalination. Today, although RO can produce potable TDS in one pass, blending allows a simple solution where national standards require low levels of boron. The hybrid system received significant attention recently with implementation of desalination and power plants at Fujairah I and Fujairah II in UAE, Ras Al -Khair in Saudi Arabia, SWRO expansion plants in Fujairah I and Az-Zour South in Kuwait and current ongoing competition for hybrid of power and MSF-RO or MED-RO desalination for Az Zour North phase 2 in Kuwait. While various hybrid concepts have been explored, this article focuses on the combination of distillation and membrane processes with power generation and the hybridization with renewable energy sources. Hybrid offers many additional advantages including the opportunity to better align demand for combined water and power production, reduce energy consumption, increased recovery and further minimize environmental impacts of power/desalination plants. With formation of Global Clean Water Desalination Alliance-“H₂O- CO₂” hybrid combinations with renewable energy become focus of extensive research and development.

Hybrid Systems

Dual purpose power-desalination plants make use of thermal energy extracted or exhausted from power plants or generated by renewable source in the form of low pressure steam to provide heat input to thermal desalination plants for multistage flash (MSF) or multi-effect (MED) distillation processes. Today a lot of innovative solutions look at combining renewable energy: solar, geothermal, solar pond or ocean thermal energy conversion with desalination processes. The electrical energy can be also effectively used in electrically-driven desalination processes like Reverse Osmosis (RO) and Vapor Compression Distillation (VCD) processes. In the simple hybrid, MSF+RO or MED+RO desalination power process, a seawater RO plant is combined with either a new or existing thermal desalination plant. This integrated technology offers several advantages.

- A common, considerably smaller seawater intake can be used.
- Product waters from the RO and MSF/MED plants are blended to obtain suitable product water quality.
- Product waters from the RO and MSF/MED plants are blended, therefore allowing higher temperature of distillate.
- A single pass RO process can be used.
- Blending distillation with membrane products reduces strict requirements on boron removal by RO.
- The useful RO membrane life can be extended.
- Excess power production from the desalting

Cover Photo Courtesy of SIDEM



AZN1 10.84 MIGD MED unit at night

complex can be reduced significantly, or power to water ratio can be significantly reduced.

The fully integrated MSF/RO desalination power process, which is particularly suitable for new seawater desalting complexes,

“Some components of seawater pretreatment process can be integrated”

takes additional advantage of integration features. These include:

- The feedwater temperature to the RO plant is optimized and controlled by using cooling water from the heat-reject section of the MSF/MED or power plant condenser.
- The low-pressure steam from the MSF/MED plant is used to de-aerate or use de-aerated brine as a feedwater to the RO

plant to minimize corrosion and reduce residual chlorine.

- Some components of seawater pretreatment process can be integrated.
- One post-treatment system is used for the product water from both plants.
- The brine discharged reject from the RO plant is combined with the brine recycle in the MSF or is used as a feed to MED.
- The hybridization of nanofiltration as softening membrane process for feed of distillation plants MSF and MED could lead to significant improvement in productivity of desalination plants.

In general, the hybrid idea allows part of the distillation plant's heated coolant reject to be de-aerated, using low-pressure steam from the distillation plant to reduce corrosion and residual chlorine, and used as the feed to the SWRO plant.

The higher temperature of the feed improves membrane performance (flux, at constant pressure, increases by 1.5–3 percent for each degree Celsius). This is particularly important during the winter, when seawater temperatures can drop to as low as 15°C. The MSF or MED plant's distillate, at less than 20 ppm TDS, is blended with the SWRO plant's product, making it possible to meet potable water standards for maximum TDS and chloride concentrations with higher SWRO plant product salinity. This, in turn, means that the SWRO plants can be operated at higher conversion ratios, thereby reducing consumption of energy and chemicals and extending membrane useful life. The use of all or some of the preheated seawater cooling water discharge from a thermal desalination plant as feed to a SWRO plant enables elevating and controlling the SWRO plant's operating temperature at its optimal or any other higher desired value. As important eliminates need for built new intake and outfall structure as demonstrated by 30 MIGD Seawater RO expansions in Fujairah I and Kuwait Az-Zour South plants. Feed water temperature affects the two main performance characteristics of a membrane: flux and salt rejection. Higher feed water temperatures increase not only flux but also salt passage. For all membranes, water production is a function of temperature, at constant feed pressure. Production will go up with temperature increasing by 1.5 percent to 3 percent per degree Celsius for nearly all membranes, thereby enabling reduction of the number of RO membrane modules required for a given permeate capacity. (This, of course, assumes that feed water quality is sufficiently good that the membrane fouling rate will not increase during operation at higher flux.) The increase of recovery rate at constant feed pressure at increased temperature in a RO hybrid system leads to

reduction of specific power consumption. Issue of concern is the compaction of membrane material (permeability decline) during long term operation at high feed pressure and elevated temperature; today maximum temperature for continuous operation for most of the membrane is 40°C, but clearly, we need membranes capable for continuous operation above 50°C. I am convinced that such membrane for seawater will be developed in view that in summer, in some places of the Gulf like in Dubai **DEWA** plants, the intake seawater exceeds 42°C.

“The blending of SWRO and thermal plants’ products makes it possible to use the low-salinity”

In Nanofiltration systems, the increase in temperature of seawater feed results in higher rate of water permeability increase more than is expected in RO unit. In Nanofiltration membranes, the concentration polarization increase with temperature is lower than in RO membranes due to significantly higher salt transport through NF membranes and operating pressures of NF are significantly lower from 10-20 bars. In hybrid systems, the use of Nanofiltration membranes operating at higher temperatures in combination with RO and MSF/MED provides additional opportunities to reduce desalination costs due to available heat from the power plant condenser or reject section of distillation plants. Specifically, by using feed comprising variable proportions of softened seawater and water containing a higher concentration of hardness ions than the softened stream, concentration of hardness is sufficiently reduced, thereby allowing a beneficial increase in the Top Brine Temperature (TBT) of the distillation desalination process. Higher operating temperatures provide an increase in productivity, recovery and

performance at lower energy and chemical consumption. Thus, the cost of desalinated water production, including operation and maintenance, could be significantly reduced.

Hybrid plants have the potential to increase the average annual membrane permeate flow through increased flux rate and reduce the required membrane surface in the SWRO plants. The blending of SWRO and thermal plants’ products makes it possible to use the low-salinity (less than 20 ppm TDS) distillation plant product to compensate for higher salinity SWRO plant product.

However, if the plants are designed to operate at the high conversion ratios used today in most modern SWRO plants (45–50 percent), it is projected that product salinity will exceed 500 ppm TDS after about four years of operation, because of membrane performance degradation. Recovery ratio (conversion) is one of the key RO design parameters. It determines the size of the feedwater handling system (e.g., intake, pretreatment, high pressure pumping) for a given plant size. Higher recoveries decrease the cost of the feedwater handling system and the required electrical and chemical consumption, while increasing the initial and replacement costs of the membrane system. The results imply that the energy consumption of RO can be reduced using a simple integration of MED+RO or MSF+RO hybrid arrangement in which the RO plant is fed the preheated seawater rejected from the heat rejection section of distillation plants.

Energy Conservation Using Hybrid Systems

In view of the dramatic concern with global climate conditions and a dramatic reduction in renewable generated power cost, hybrid (RO + distillation), hybrid (NF+distillation) or tri hybrid (NF+RO+distillation) systems offers significant savings in energy costs in comparison with the distillation-only option.

Hybrid System Using Multi-Effect Distillation

Multi-effect distillation (MED) is, in our opinion, the most important large-scale evaporative process offering significant potential for water cost reduction. Particularly MED and MED-NF has great potential with thermal renewable energy like thermal solar both concentrated or low temperature, geothermal, solar ponds or alternative nuclear energy. The major potential



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The 10 MED-TVC units of 107 MIGD AZN1 water plant

advantage of the MED process is the ability to operate at relatively low temperatures and produce a significantly higher Performance Ratio (PR) more than 15 pounds of the product per pound of steam, where MSF limits PR to 11. For the energy consumption in thermal plants, we have two parameters of efficiency. We need heat and electricity. The first parameter is the amount of produced water per unit of steam, called gain-output ratio. That historically was about 8 pounds of water per pound of steam coming from the power plant. Today, we already have plants exceeding a ratio of 11. The second parameter in thermal desalination plants is electric power consumption, which for MED is about .9 to 1.5 kWh/m³ per ton of water processed. As a matter of fact, in 2016 **Veolia/Sidem** inaugurated Az Zour North Phase 1 (AZN1) desalination plant IWPP - 1550 MW +107 MIGD an EPC contract built

in Kuwait with a daily production capacity of 486,400 cubic meters of water. The plant is MED-TVC with 10 x 10.84 MIGD units in total 107 MIGD. But most important is the ability to lower the process power consumption to 0.9 kWh/m³ with GOR 11; meaning that 1 ton of steam generates 11 ton of desalinated water. **Hyundai** will be responsible for building the 1,500-MW power station. The key here is that the energy for the desalination plant is provided by backpressure steam from combine cycle power plant typically at 2.7 bars. The lower the pressure of the steam we can use for the desalination and the higher GOR the less power loss is experienced in the power cycle. This loss is assigned to energy consumption of desalination. The future calls for increasing the top operating temperature, finding new ways to improve heat transfer performance to reduce the heat exchange area, searching for an increase in heat transfer performance by tube enhancement, and using a very thin wall in tubular materials. The critical

challenge is to adopt Nanofiltration as means to dramatically increase output and increase the efficiency of MED plants.

Hybrid Using Nanofiltration - Membrane Softening

Novel Thermal Hybrid systems in combination with clean renewable and nuclear energy. Nanofiltration Softening Membranes with Multi-Effect Distillation solutions, which will be able to operate with low temperature sources of thermal energy, like high efficiency solar water heating panels, solar pond both with pure water or salinity gradient and using low temperature geothermal resource as well

“The second parameter in thermal desalination plants is electric power consumption”

as coupled with more conventional lower temperature concentrated solar Parabolic Trough Collectors or Low-cost, high-efficiency non-tracking trough CSP receiver, or geothermal energy, to produce relatively low temperature heat source needed for desalination. Membrane softening technology adapted to hybrid with distillation processes could lead to a significant increase in the productivity of existing and future distillation plants as well as resulting in better process economics. As a result, the selectivity of NF membranes for monovalent and bivalent anions is significantly different as compared to regular RO membranes. Specially designed NF membranes have the capability of high rejection for divalent ions (Ca, Mg and SO₄), while allowing relatively high passage of monovalent ions (Cl, Na and K). The nanofiltration membrane performed significantly better than the design specifications. Sulphates rejection exceeded always 95 percent rejection, calcium hardness was reduced by over 55

percent, magnesium hardness by over 80 percent. These results were achieved at feed temperature controlled at 35° C. Pioneering work on Nanofiltration membrane NF softening technology as applied to desalination processes and specifically to seawater desalination was developed by two groups: **Leading Edge Technologies Ltd (LET)** and the **Saline Water Conversion Corporation (SWCC)** of Saudi Arabia. The great potential of Nanofiltration membrane softening technology was brought to focus by an award by **Sharjah Electricity and Water Authority (SEWA)** to LET and Besix Consortium for the first commercial LET Nanofiltration System to increase the capacity of an existing MSF plant from nominal 22,7000 m³/day to 32,800 m³/day (5 MIGD to 7.2 MIGD). This 40 percent+ increase in capacity of MSF unit was a result of a two-year demonstration and

simulation program developed jointly with SEWA. The additional capacity is achieved without building a new intake structure or new power plant in a very limited space that would not allow construction of a new desalination plant. The system involves construction of a NF plant to provide partial membrane softening of feed to MSF as well as modifications to existing MSF plant to be capable to achieve the increased capacity. NF membrane softening technology could significantly improve operation and reduce the cost of the MED process, by eliminating the risk of scaling and fouling. NF technology will permit an increase in the top temperature resulting in a significant increase in output and the performance ratio. ■

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يجمع مفهوم التحلية الهجينة بين عمليتين أو أكثر من أجل توفير حلول بيئية أفضل وإنتاج مائي أقل تكلفة من اعتماد كل عملية على حدة. وقد استندت الاقتراحات الأولية للتحلية الهجينة للمياه على إلغاء شرط المرور بمرحلة ثانية في عمليات التناضح العكسي لبيتم مزج منتج التناضح العكسي ذو الملوحة المرتفعة بمنتجات ذات جودة أفضل من محطات التقطير الومضي متعدد المراحل أو محطات التقطير متعدد التأثير. وهذا هو أبسط تطبيق للتحلية الهجينة. ومنذ ذلك الحين، تم اقتراح مفاهيم أخرى للتحلية الهجينة للمياه. واليوم، على الرغم من أن التناضح العكسي يمكنه أن ينتج مواد صلبة ذاتية صالحة للشرب خلال مرحلة واحدة، فإن المزج يوفر حلاً بسيطاً، إذ تتطلب المعايير الوطنية مستويات منخفضة من البورون. ولقي النظام الهجين اهتماماً كبيراً في الآونة الأخيرة مع تركيب محطات تحلية المياه ومحطات الكهرباء في محطتي الفجيرة ١ والفجيرة ٢ في الإمارات العربية المتحدة، ومحطة رأس الخير في المملكة العربية السعودية، وتوسيع محطات تحلية مياه البحر بالتناضح العكسي في الفجيرة ١ ومحطة الزور الجنوبية في الكويت، والمنافسة الحالية القائمة حول الطاقة الهجينة والتناضح العكسي الومضي المتعدد المراحل والتناضح العكسي الومضي متعدد التأثير في المرحلة الثانية من مشروع محطة الزور الشمالية في الكويت. في حين تم استكشاف مفاهيم هجينة مختلفة، تركز هذه المقالة على الجمع بين عمليات التقطير وتقنية الأغشية وبين توليد الطاقة والتهجين من خلال مصادر الطاقة المتجددة.

Feature

Water Management

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Saving Energy, Water & Money with Efficient Water Treatment Technologies

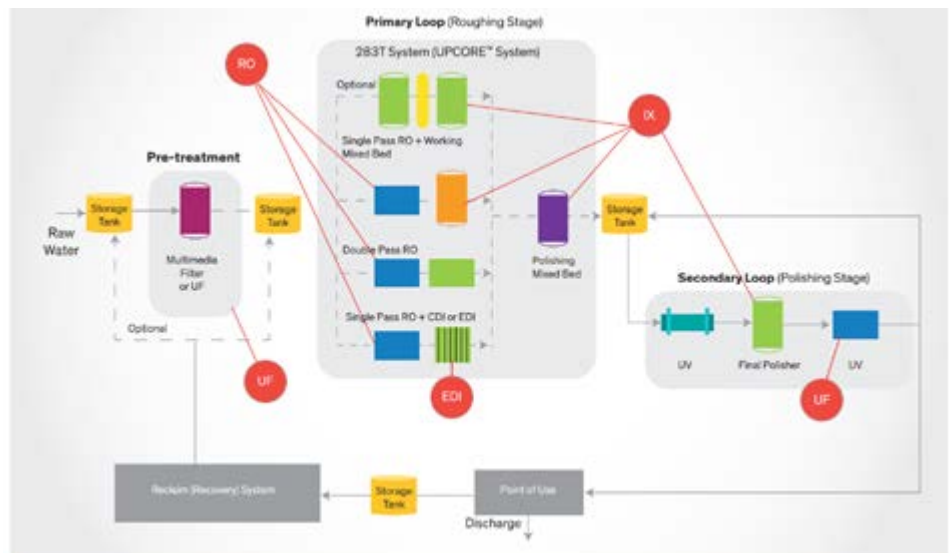
In every corner of the globe, from developing countries to industrialized nations, clean water is essential to sustain life. From providing hydration and nourishment, to lighting up our cities and manufacturing goods, water is the lifeblood of human progress. Population growth leading to an increase in water requirements will also necessitate increased energy requirements, and water and energy are inseparable – water is required to make use of energy, and energy is required to make use of water. The lack of technology, poor management or inefficiencies in one area can affect the sustainability of the other.

Desalination and water reuse in industry has emerged as one of the most important themes in the water sector over the past five years. During the next five years, the technologies associated with salt removal and turning low-quality wastewater and raw water sources into high-quality process water will become an essential part of sustainable economic growth.

The manufacturing industry has the opportunity to play a key role in helping manage water and energy resources. The industrial use of water is one of the largest uses of treated water. Industrial Reverse Osmosis (RO) applications provide water for manufacturing, fabricating, processing, washing, steam generation and cooling, and for incorporating into the products themselves. Consequently, increasing water scarcity has driven companies to seek out both time-tested and new ways to purify water and promote water reuse that are both cost-effective and environmentally conscious.

After nearly 30 years of incremental change in RO technology, predominately focused on improving existing membrane chemistry, water researchers have been able to develop a new, breakthrough polymer chemistry, resulting in best-in-class performance from a new family of RO products. Scientists have reduced the energy required to purify water by focusing both on membrane innovation and the configurational aspects of module design. The building blocks of this new technology are an advanced, thin-film polyamide membrane chemistry and a new, low pressure-drop feed spacer configuration. The upgraded membrane chemistry provides high salt rejection at lower pressures than previously possible, while

Figure 1: DOW FILMTEC™ ECO Membranes show increased water permeability and decreased salt permeability compared to earlier generations



the new feed spacer is variously deployed to provide either low membrane fouling, low pressure drop, or high packing density.

These new RO Elements produce demineralized water from contaminated water sources, such as surface water, ground water, treated wastewater

“The industrial use of water is one of the largest uses of treated water”

effluent, well water or tap water, and offer unparalleled solids rejection and flow performance for industrial water needs. RO membranes now offer the possibility of higher rejection of salts at significantly reduced operating pressures, and therefore, reduced costs. The innovation reduces energy consumption and ion exchange regeneration costs through improved hydraulic balance and lower feed pressure, resulting in operational savings between 16 and 19 percent.

The chemistry breakthrough hinges on re-engineering the polymer structure and composition of the product, while the technological upgrades in the feed spacer of the product ultimately lower energy and chemical consumption. The technology is ideally suited for industrial RO plants and replacement systems, allowing improved energy efficiency across a broad temperature range, operation with low energy membranes which enable savings from lower feed pressure, and offering high value and optimized performance. Resource-efficient Reverse Osmosis membranes are gaining a global presence across a wide range of industries and industrial water applications, including:

- **Power:** Improves uptime and reduces chemical use for utility providers;
- **Ultra-Pure Water:** Increases the rejection at lower feed pressure to accommodate increasing purity needs for electronic manufacturing;

- **Food and Beverage:** Saves on energy use and chemical use and increasing capacity by improving uptime;
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Globally, water is required in virtually everything people touch, from growing and processing food to industrial processes and energy production. The

Food and Agriculture Organization of the United Nations (FAO) and UN-Water have established that water use has been growing at more than twice the rate of population increase in the last century. In meeting this global water challenge, **Dow Water & Process Solutions** is setting a new standard across the industry – with technologies such as FILMTEC™ ECO RO Elements combining exceptional high rejection and flow performance, as well as low energy consumption,

to reduce businesses' ecological and economic footprints. Through innovation, Dow continues to drive the science behind plentiful water supplies, creating economic, environmental and social benefits for customers and communities across the globe. ■

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تعتبر المياه النظيفة أساسية لحياة مستدامة في كل ركن من أركان الكرة الأرضية، إنطلاقاً من الدول النامية وحتى الدول الصناعية. الماء هو شريان الحياة بالنسبة للتقدم البشري، إذ تتمثل أهميته في توفير الترطيب، والتغذية، وإضاءة المدن، وتصنيع السلع. كما يؤدي النمو السكاني إلى زيادة الاحتياجات المائية، الأمر الذي سيستلزم زيادة في احتياجات الطاقة. فالمياه والطاقة أمران لا ينفصلان، إذ يتم الاعتماد على المياه لتوفير الطاقة، ويعتمد على الطاقة لاستخدام المياه. ويؤثر الافتقار إلى التكنولوجيا، وسوء الإدارة، أو إنعدام الكفاءة في منطقة واحدة على استدامة منطقة أخرى. وقد برزت عملية تحلية المياه وإعادة استخدامها في الصناعة باعتبارها واحدة من أهم المسائل في قطاع المياه خلال السنوات الخمس الماضية. وستغدو التقنيات المرتبطة بإزالة الملح وتحويل مياه الصرف الصحي ذات الجودة المنخفضة ومصادر المياه الخام إلى مياه معالجة عالية الجودة جزءاً أساسياً من النمو الاقتصادي المستدام في السنوات الخمس المقبلة. لدى الصناعة التحويلية فرصة للعب دور رئيس في المساعدة في إدارة موارد المياه والطاقة. ويعد استخدام المياه في مجال الصناعة واحداً من أضخم استخدامات المياه المعالجة.

USD3.2 Million MBR Plant Delivering 99 Percent Water Recovery

ACWA Emirates, part of the **ACWA Group**, has completed a new state-of-the-art wastewater treatment plant for **Saudi Aramco**, the world's top exporter of crude oil and natural gas, to support the residential complex at the company's expanding Shaybah oil field

in the Empty Quarter. With the emphasis on the highest levels of water recovery, essential in the remote and challenging conditions of the Empty Quarter, the new plant incorporates the latest Membrane Bio-reactor (MBR) technology to provide increased capacity and environmental

performance, replacing a conventional and out of date sewage treatment plant originally built by ACWA in 1997. The new plant is designed to treat a works flow of 750m³ per day with sufficient additional capacity to support growing demand at the Shaybah Field and is delivering 99 percent water recovery with high quality effluent for use in irrigation, in line with Aramco's strict environmental quality standards. Under the contract ACWA has been responsible for all aspects of design, engineering, installation and commissioning for the new plant including a six month operation and maintenance package to provide assistance and training. The 20 month project was handed over in December 2016. Key components of the new plant include inlet pre-treatment headworks incorporating screens, grit and FOG removal, evaporation ponds with feed and return pump chambers, anoxic tanks, aeration tanks, plus the Membrane Bio-reactor tank with air blowers, self-cleaning jet filters and all controls and instrumentation. ■



MBR treatment works for Saudi Aramco Shaybah Oil Field residential complex

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PepsiCo Highlights Innovation in Water Management

Countries, especially in water-stressed regions, are realizing that demand caused by population growth is increasing pressure on scarce water resources. Gains in efficiency and productivity in water management and use are helping to reduce the risk of severe water shortages. According to a new report called 'The Future', authored by strategy consultants **Booz Allen Hamilton**, 25 countries will lack sufficient access to water to meet daily needs by 2025, leaving almost half the world's population without adequate access to water. According to the **Water Resources Institute**, a global research

organization that works closely with leaders to sustain the world's natural resources— 14 of the world's 33 likely most water-stressed countries in 2040 will be in the Middle East. In 2015, **PepsiCo** globally improved operational water-use efficiency by 25.8 percent since 2006. That exceeded the company's goal of 20 percent by the end of the same year, a commitment outlined under PepsiCo's 'Performance with Purpose' vision which is rooted in the fundamental belief that business success is inextricably linked to the sustainability of the world we share. By the end of 2015, the PepsiCo Foundation

and its partners provided safe water access to more than nine million people since 2006, significantly exceeding PepsiCo's goal of six million people by 2015. In the beverages and snacks operations in AMENA, PepsiCo uses effective water conservation practices in line with the company's global commitments. As a result, PepsiCo increased its water-use efficiency in AMENA by 50 percent between 2006-2015. In the GCC snacks business alone, PepsiCo has reduced its water use by an average of 69 percent per unit of production in the past decade. In Jordan, PepsiCo's business has cut water use by more than 40 percent per unit of production since 2006. PepsiCo partners with Jordan's Ministry of Water and Irrigation on projects that include the construction of dams for rainwater harvesting, launching a community water-awareness campaign, and installing a treatment unit to give the local community access to clean water. ■



PEPSICO

Integrated Water Management Summit to Address Water Challenges in the ME

The Integrated Water Management Summit, which will involve the participation of key government authorities and representatives from leading organizations, will take place on the 3 to 4 May, 2017, in Dubai, UAE. Supported by the **Ministry of Energy**, UAE, the event will bring together water authorities and engineering experts in the Middle East. The Middle East is among the most water-scarce regions

in the world, but has one of the highest per capita water consumption. The rapid increase in population has further escalated the demand for water. As per reports, government authorities have invested more than USD116.9 billion in water and wastewater projects to meet the increasing demand for water in the region. The Integrated Water Management Summit will serve as a platform for water bodies in the region to discuss regulations, water management strategies and emerging technologies in water desalination and wastewater treatment. Dr. *Matar Al Neyadi*, Undersecretary, Ministry of Energy UAE, will inaugurate the event with a keynote session. He will speak about the UAE Ministry of Energy's Plans to establish sustainable water security and its initiatives to develop the 2036 water security strategy. *Fatima Al-Foora Al Shamsi*, Assistant Undersecretary for Electricity Clean

Energy and Desalination of Water, Ministry of Energy, UAE, will also partake in the forum as a keynote speaker. The ministry's participation in the event highlights its efforts to address the water crisis and the challenges faced by the Middle Eastern region. With the primary objective of achieving water sustainability, the event will explore solutions to the challenges faced in the operation and maintenance of water services. It will also cover existing and emerging technologies in smart water grid management, maintenance of water services, waste water reuse methods and water asset management. The two-day event will also cover ministry regulations and water management strategies and challenges, as well as industrial water treatment. Several regional and international experts in water sustainability are expected to speak at the Integrated Water Management Forum 2017. ■



INTEGRATED
WATER MANAGEMENT
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MENA Region Strides toward Sustainable Water Management in Agriculture

Dealing with water scarcity has proven to be a challenge worldwide. There are now less than 1,000m³ of renewable water resources per person in MENA, as compared to 4,500m³ in East Asia Pacific countries, and 9,000m³ in the United States, according to the **World Bank**. Competing demands among agriculture, population growth and rapid urbanization are putting immense pressure on the region's scarce water resources. Consequently, more attention is presently being paid to water saving techniques in irrigation practices. Micro irrigation, specifically drip irrigation, is one of the solutions that countries in the MENA region are currently exploring to promote sustainable irrigation and water management.

The micro irrigation systems market is projected to grow at a CAGR of 18.3 percent from 2016 to 2021, to reach USD6.81 billion by 2021, according to a report by **MarketsandMarkets**. With the increasing water scarcity, higher yield requirement, and increasing adoption of irrigation tools in countries such as South Africa, Saudi Arabia, India, China, and Brazil, the market for micro irrigation systems is continuously expanding. The types of micro irrigation systems used mainly include micro sprinkler and drip. A **Transparency Market Research** report states that drip irrigation helps in saving both fertilizers and water by letting water drip slowly near the roots of the plants. Drip irrigation works effectively through a network of pipes, emitters, valves, and tubing. Drip irrigation systems are designed by taking into consideration the growing issues of water scarcity worldwide. The variation in water and fertilizer supply can be regulated through drippers and valves. It also helps in lessening soil erosion.

On the other hand, shifting to drip irrigation, in particular for smallholders, requires a substantial behavioral change, according to a report by the **International Renewable Energy Agency (IRENA)**. Drip systems are often expensive and difficult to manage, and require advanced skill sets. In addition, over-pumping and salinity may actually



result in reducing the efficiency of the system if the network is not adequately cleaned and maintained. Therefore, IRENA states that the technology should be customized to adapt to local conditions, especially

“... shifting to drip irrigation, in particular for smallholders, requires a substantial behavioral change”

with respect to capacity building across the value chain. The report also notes that the adoption of technologies, such as drip irrigation, may increase water and energy use efficiency, but might increase overall consumption owing to an expansion in irrigated areas and/or an increase in the intensity of cropping and irrigation. Therefore, countries in the MENA region are striving to increase productivity across all scales of water and energy-use efficiency.

They aim to save money, use water more efficiently, increase crop yields and reduce pollution. To illustrate, **USAID** is supporting the region's water resources management movement by funding the **Massachusetts Institute for Technology (MIT)** for a new Ultra-Low Energy Drip Irrigation program for Middle East and North African (MENA) countries. This three-year activity implemented in Jordan and Morocco is valued at over USD2.3 million, states a **USAID** report. The objective is to design and test ultra-low pressure drip irrigation systems for the MENA region that will cut pumping energy by 50 percent (for electric or diesel pumps), enable drip systems to run on low-pressure municipal water supplies, and facilitate the dissemination of low-cost, solar-powered drip irrigation solutions. ■

Dana Hani
Senior Content Editor & Researcher

لقد ثبت أن التعامل مع ندرة المياه هو تحدٍ في جميع أنحاء العالم. ووفقاً للبنك الدولي، يتوفر الآن أقل من ١٠٠٠ متر مكعب من موارد المياه المتجددة للفرد في منطقة الشرق الأوسط، مقارنة بـ ٤٥٠٠ متر مكعب في بلدان شرق آسيا والمحيط الهادئ، و ٩٠٠٠ متر مكعب في الولايات المتحدة. وتماثل المطالب التنافسية في الزراعة والنمو السكاني والتوسع العمراني السريع ضغوطاً هائلة على موارد المياه الشحيحة في المنطقة. ونتيجة لذلك، يجري حالياً إيلاء مزيد من الاهتمام لتقنيات توفير المياه في عمليات الري. ويعتبر الري المصغر، وتحديدًا الري بالتنقيط، أحد الحلول التي تعمل البلدان في منطقة الشرق الأوسط على استكشافها حالياً لتعزيز الري المستدام وإدارة المياه. ووفقاً لتقرير صادر عن شركة ماركيتس أند ماركتس (MarketsandMarkets)، من المتوقع أن ينمو سوق أنظمة الري المصغر بمعدل سنوي مركب تبلغ نسبته ١٨,٣ في المئة بين العامين ٢٠١٦-٢٠٢١.

Investment in Sustainable Irrigation Can Reduce Food Prices, Global Hunger

Investments in increased irrigation and water use efficiency could substantially lower food prices for both staple and more nutrient-dense crops by 2030, according to new analyses summarized by *Claudia Ringler*, deputy director of the Environment and Production Technology Division of the **International Food Policy Research Institute (IFPRI)**. The analysis found that a combination of accelerated irrigation development with increased investments in water use efficiency would reduce prices of rice, wheat, and maize by 7.4 percent, 3.6 percent, and 1.5 percent, respectively by 2030. "Although some of these investments might seem expensive, they would provide huge benefits to communities in the developing world and have the potential to help millions leave poverty and hunger behind," adds Ringler. "Irrigation improvements coupled with increased

water conservation provides food in the lean season, stabilizes production at the national scale and lowers food prices globally." With 70 percent of the world's irrigated crop area in South and East Asia, Africa south of the Sahara is the area with the greatest need for irrigation projects and efficiency upgrades. At present, only five percent of harvested land in Africa south of the Sahara is irrigated. And while the global population is expected to grow by one billion over the next 15 years, funding for international agricultural research and development has declined over the last several years. Failure to make further investments in agricultural research and irrigation could have dire consequences, Ringler suggests. "By midcentury, half of global population, GDP, and grain production could be at risk of water shortages affecting livelihoods and economic growth." The analysis was



developed using IFPRI's International Model for Policy Analysis of Agricultural Commodities and Trade. The International Food Policy Research Institute (IFPRI) seeks sustainable solutions for ending hunger and poverty. IFPRI was established in 1975 to identify and analyze alternative national and international strategies and policies for meeting the food needs of the developing world, with particular emphasis on low-income countries and on the poorer groups in those countries. ■



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Biogas Comes of Age

Digester methane is taking its place as a mainstream renewable fuel. Today's fuel treatment and engine-generator technologies help make biogas a highly attractive and earth-friendly energy source for power generation and heating. As recently as 10 or 20 years ago, billions of cubic feet of methane from landfills and wastewater treatment plant anaerobic digesters was flared off and wasted or – even worse – simply released to the atmosphere. Today, this biogas has become a prized source of fuel, and the potential is significant. But while we're using more biogas – many municipal wastewater treatment plants with capacities over 30 million gallons per day (113,500 m³ per day) now use it to generate power – we're also making more of it. Growing numbers of wastewater treatment plants feed organic materials to their digesters to boost gas production, and stand-alone digesters that produce biogas from manure, food waste and other products are receiving serious consideration. With this in mind, the time is right for businesses that generate volumes of organic waste to evaluate the benefits of transforming that waste material into fuel.

The Business Case

A variety of industries can potentially benefit from biogas-to-energy projects. Feedstocks for anaerobic digesters can include silage from energy crops like corn and sweet sorghum, crop residues, green cuttings from landscape maintenance, food waste from restaurants and cafeterias, fats and oils, and wastes from food and beverage facilities like sugar plants, fruit and vegetable processors, and meat processing plants. Animal waste alone is among the lowest biogas producers – the recipe can be improved by co-digesting with fats and oils or vegetative material.

Revenue side

The analysis of benefits begins with estimating revenue. The base calculation assumes an estimated fuel flow and fuel quality, and an engine-generator of a given capacity operated continuously

for one year. For example, a 20-cylinder generator set rated at 2,000 kW can generate USD112 per hour based on an electricity sale price of USD0.056 per kWh. Based on 8,760 hours per year, that unit theoretically could generate USD981,120 in revenue annually. Of course, no generator can operate

“Predictive maintenance can help extend service and overhaul intervals and reduce service costs by up to 15 percent”

around the clock for a year. Real revenue is determined by the theoretical revenue multiplied by capacity factor – the percent of its total potential output the units actually achieves. It is also important to understand how tradeoffs between generator set capacity factor and generator set electrical efficiency affect

revenue. Assume there are two 1,000 kW units with an electricity sale price of USD70 per MWh and a fuel production cost of USD2/MMBtu (USD70.63 /Nm³). Now assume that both units operate at 96 percent capacity, but that Unit A is 39 percent efficient while Unit B is 42 percent efficient. In that scenario, Unit B has a 2.2 percent net revenue advantage. Now for the same two units, assume that electrical efficiency is the same at 42 percent, but that Unit A's capacity factor is 90 percent and Unit B's is 96 percent. In this scenario, Unit B has a 6.25 percent revenue advantage.

Expense side

Owning and operating expenses fall on the opposite side of the ledger, usually measured in cost per kilowatt-hour sold or produced. The kilowatt-hour figure needs to account for conditions that reduce generator output: parasitic loads, capacity factor, derates and others. In biogas applications, the major expenses are capital costs (including fuel treatment) and maintenance and repairs. The latter includes routine engine maintenance as well as periodic top-end, in-frame and major overhauls. Maintenance practices should not follow a fixed calendar schedule, but should be based on predictive indicators. Predictive maintenance can help extend service and overhaul intervals and reduce service costs by up to 15 percent.

Caring for Fuel

The biggest variable affecting biogas project costs is fuel quality. Depending on its source, biogas contains a variety of impurities that can increase wear and shorten maintenance and service intervals. These impurities include:

Figure 1: Same Capacity Factor, Different Efficiency

	UNIT A	UNIT B
Generator set kW	1000	1000
Gas Price \$/mmbtu	\$ 2.00	\$2.00
Value of Energy Produced \$/MW-hr	\$70.00	\$70.00
Generator Efficiency	97.0%	97.0%
Engine Heat Rate BTU/min	145,000	135,000
Capacity Factor	96.0%	96.0%
Generator Set Electrical Efficiency	39.2%	42.1%
Fuel Consumed/year mmbtu	73,163.52	68,117.76
Cost of Fuel/year	\$146,327	\$136,236
MW-Hour Produced	8,410	8,410
Fuel Cost/MW-hour	\$17.40	\$13.20
Value of Power Produced	\$588,672	\$588,672
Net Revenue (Fuel Cost vs Power Produced)	\$442,345	\$452,436

2.23% revenue advantage

Figure 2: Same Efficiency, Different Capacity Factor

	UNIT A	UNIT B
Generator set kW	1000	1000
Gas Price \$/mmbtu	\$ 2.00	\$2.00
Value of Energy Produced \$/MW-hr	\$70.00	\$70.00
Generator Efficiency	97.0%	97.0%
Engine Heat Rate BTU/min	135,000	135,000
Capacity Factor	96.0%	90.0%
Generator Set Electrical Efficiency	42.1%	42.1%
Fuel Consumed/year mmbtu	68,117.76	63,860.40
Cost of Fuel/year	\$136,236	\$127,721
MW-Hour Produced	8,410	7,884
Fuel Cost/MW-hour	\$16.20	\$16.20
Value of Power Produced	\$588,672	\$551,880
Net Revenue (Fuel Cost vs Power Produced)	\$452,436	\$424,159

6.25% revenue advantage

Hydrogen sulfide, Silicon, Siloxanes and Water. There are three basic ways to deal with fuel impurities. They can be used alone or in combination, depending on the fuel quality, ambient conditions, financial objectives and other considerations.

1. Treat the Fuel: While effective at reducing contaminants in the fuel, fuel treatments do add to biogas-to-energy system capital costs, add parasitic loads to the system, and require additional maintenance materials and labor.
2. Choose a 'hardened' engine: Some manufacturers offer engines with design features that "harden" components and systems against biogas fuel impurities. These units can operate for near-normal maintenance intervals with less intensive fuel treatment.
3. Accelerate maintenance: In some cases, it may be more attractive to owners to defer on the installation costs associated with advanced fuel treatment systems, and accept the operating costs associated with shorter maintenance and overhaul intervals. This 'pay me now or pay me later' dilemma is often decided based on a developer's assessment of risk and reward.

Evaluation tradeoffs

Dealing with fuel impurities means weighing the pros and cons of different engine technologies and fuel treatment systems as well as initial and long-term costs. For example, if the fuel quality

falls within the limits prescribed for hardened low-energy-fuel engines, then that engine can be used with minimal or no fuel treatment equipment, likely saving hundreds of thousands of dollars in capital and fuel treatment operating costs. On the other hand, if the fuel impurities are such that extensive pretreatment is required regardless of the engine technology, then high-compression/high efficiency engines may be a prudent choice, as operating savings from the efficiency gains will help offset the costs of installing, operating, and maintaining the treatment system.

Knowing the gas

In choosing a strategy for dealing with impurities, there is no single right answer. The best approach for a given

"It is critical to understand the volumetric energy content in the fuel"

site depends on operating conditions, financial objectives and, above all, on biogas quality. Fuel needs to be analyzed over time to understand the level of impurities, the methane content and heating value, and how much those parameters vary over time – hourly, daily or seasonally. Trending of all these is important. It is common for biogas originating from anaerobic digestion to contain about 60 percent methane, 35 percent carbon dioxide, and the balance

other gases. It is critical to understand the volumetric energy content in the fuel. For example, a lower-quality biogas with just 30 percent methane content means doubling the gas flow to deliver the same energy – and exposing the engine to twice the amounts of impurities. In addition, the fuel low heating value – the actual Btu/ft³ (MJ/Nm³) – influences the size of the fuel delivery system.

The fuel's carbon dioxide content is also critical. Carbon dioxide affects flame speed in the cylinders, and the temperature must fall below a certain maximum level to keep exhaust and valve temperatures in a safe operating range and minimize maintenance. Another key variable is the ratio of methane to free inert gases, including carbon dioxide and free nitrogen (nitrogen not entering naturally from air in the fuel). Excessive inert gas content hinders fuel ignition, causing lean misfire and resulting in a loss of power and increased in exhaust emissions.

Siloxane content is a critical variable found primarily in biogas from landfill and wastewater treatment plants. High-compression ratio engines are often preferred in biogas applications for their greater efficiency, but they are also less tolerant of siloxane contamination. Sites using high-compression-ratio engines may have no choice but to add fuel siloxane treatment, and its initial cost and ongoing maintenance needs to be considered in the project financial profile.

Application Example: Using Biogas in a Wastewater Treatment Facility

The Encina (Calif.) Water Pollution Control Facility uses biogas from its anaerobic digester to fuel four Cat® G3516 generator sets rated at a combined 3260 kW. On a typical day, the generator sets run mostly on the biofuel; one operates on natural gas for four to eight hours per day during peak rate times. Online since 2009, the system generates 12 million kWh per year, meeting about 71 percent of the **Encina Wastewater Authority's** needs. The agency's plan calls for the wastewater facility to produce 96 percent of its energy needs on site by 2020.



Encina Wastewater Treatment Plant

Biogas is now recognized as a valuable renewable fuel. Besides creating a new source of revenue, a biogas project can help further corporate commitments to carbon footprint reduction and sustainable operations. Businesses with potential to produce and use biogas are wise to explore the possibilities in detail. ■

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أصبح غاز الميثان الهاضم الوقود المتجدد السائد حالياً. وتساعد تقنيات معالجة الوقود وتوليد الطاقة الكهربائية بواسطة المولدات اليوم على جعل الغاز الحيوي مصدراً للطاقة له جاذبية عالية وصديق للبيئة في عملية توليد الطاقة والتدفئة. هدرت قبل ١٠ أو ٢٠ عاماً مليارات من القدم المكعب من غاز الميثان المنبعث من الهاضمات اللاهوائية في مكبات النفايات ومحطات معالجة مياه الصرف الصحي، أو حتى أسوأ من ذلك، تم ببساطة إطلاقه في الغلاف الجوي. واليوم، أصبح هذا الغاز الحيوي مصدراً مهماً للوقود وله إمكانات مهمة أيضاً. ولكن في حين أننا نستخدم المزيد من الغاز الحيوي الذي تعتمد عليه الآن العديد من محطات معالجة مياه الصرف الصحي التابعة للبلدية بقدرة تزيد عن ٣٠ مليون جالون يومياً (١١٣,٥٠٠ متر مكعب يومياً) لتوليد الطاقة، فنحن أيضاً ننتج المزيد منه. إن أعداداً متزايدة من محطات معالجة مياه الصرف الصحي تغذي هاضماتها بالمواد العضوية لزيادة إنتاج الغاز. بالإضافة إلى ذلك، فإن الهاضمات القائمة بذاتها التي تنتج الغاز الحيوي من السماد والنفايات الغذائية وغيرها من المنتجات تلقى اهتماماً جدياً. لذلك، وهذا هو الوقت المناسب للشركات التي تولد كميات من النفايات العضوية إلى تقييم فوائد تحويل تلك النفايات إلى وقود. هناك مجموعة متنوعة من الصناعات التي يمكن أن تستفيد من مشاريع تحويل الغاز الحيوي إلى طاقة. ويمكن أن تشمل أعلاف الهاضم اللاهوائي مواد مثل سيلاج محاصيل الطاقة مثل الذرة والحلوة وبقايا المحاصيل والقطع الخضراء الناتجة عن صيانة المناظر الطبيعية، بالإضافة إلى فضلات الطعام من المطاعم والكافيتريات والدهون والزيوت والنفايات الناتجة عن مرافق الطعام والشراب مثل مصانع السكر ومعالجات الفواكه والخضروات ومصانع تجهيز اللحوم.

APR Energy & GE Renew Strategic Alliance in Fast-Track Power

APR Energy, a global specialist in fast-track power solutions, and **GE** announced they have renewed their strategic alliance to provide mobile turbine technology into the fast-track power rental market. The strategic alliance grants APR Energy exclusivity around the globe as the rental provider of GE mobile gas turbines under 50MW. As part of the agreement, APR Energy will acquire new Generation 8, GE TM2500+ mobile turbines in connection with its initiative to upgrade and standardize its fleet. In addition, GE and APR Energy will collaborate on leads for customers looking for interim or rental power solutions as a bridge to more permanent power solutions. The acquisition of the new mobile turbines further strengthens APR Energy's position as the world's leading provider of mobile gas turbine power, expanding its total fleet capacity to more than 2GW



– enough to power the equivalent of two million U.S. homes. *Jeffrey Immelt*, chairman and chief executive officer, GE, said, “We are very pleased to continue our partnership with APR Energy. We have been impressed with their high level of customer service and ability to deliver turnkey power generation projects in remote locations all around the world. With this strategic alliance, customers will benefit from APR Energy's expertise, and can use GE technology as a bridging solution while their permanent GE power plants are under

construction.” The original strategic alliance agreement between APR Energy and GE was signed in October 2013. The renewal includes continuation of the supply and services agreement, ensuring that GE will continue to provide support to current and future clients of APR Energy. APR Energy is the world's well-known provider of fast-track mobile turbine power. The company's fast, flexible and full-service power solutions provide customers with rapid access to reliable electricity when and where they need it, for as long as they need it. ■

ACVs Have More to Offer for Level Control than Actuated Butterfly or Ball Valves

As automation and computer control took a foot hold in the operation and control of reservoirs and elevated water tanks, the industry moved the valve control from mechanical Automatic Control Valves (ACV) to Actuated Butterfly and Ball Valves. The primary reason being that actuators can be controlled by SCADA systems, which have been almost universally implemented in modern water systems. In doing so, many water system managers and operators have stopped purchasing the mechanical "Altitude Valve" which was the standard for many years.

As a reminder, an Altitude Valve is a mechanical valve that uses a sensing line from the reservoir or tank, to a highly sensitive pilot, that allows the valve to open or close to maintain a user set level of the water. Altitude Valves can be designed to open once the water level begins to drop, usually around one to two feet (0.3m to 0.6m), or can be equipped to allow for a user to adjust draw-down of the water level to allow for more tank or reservoir turn-over. Altitude Valves are still used when a location at a tank or reservoir has no power, or where getting power to the location is extremely costly. They are also better suited to cold climates where a top layer of ice in a reservoir can interfere with electronic measurement. For smaller water suppliers that do not have the budget to implement a SCADA system, a mechanical altitude valve is still the best option.

How do Automatic Control Valves work?

All Diaphragm Automatic Control Valves work on the same principal by using a rubber diaphragm to separate the upper control chamber from the actual water moving through the valve when it is operational. By controlling the water either going into the control chamber, or leaving the control chamber, the valve can be opened fully, closed drip tight, or modulated into any position in between.

What are the advantages of an ACV?

1) The first key advantage is the fact that ACV valves are designed to modulate and control water at all varying flows, and butterfly valves were originally designed to be an open or closed valve. The advent of an actuator allowed a butterfly valve to be modulated, but it was not what the butterfly

valve was truly designed for. Butterfly valves and ball valves that are only opened a little bit are prone to cavitate and nothing much can be done to stop or control this.

2) Many ACV manufactures also have an option for an Anti-Cavitation Trim which can occur in Level Control Valves when a large inlet pressure is supplied by the system. As a general rule of thumb,

"For smaller water suppliers that do not have the budget to implement a SCADA system, a mechanical altitude valve is still the best option"

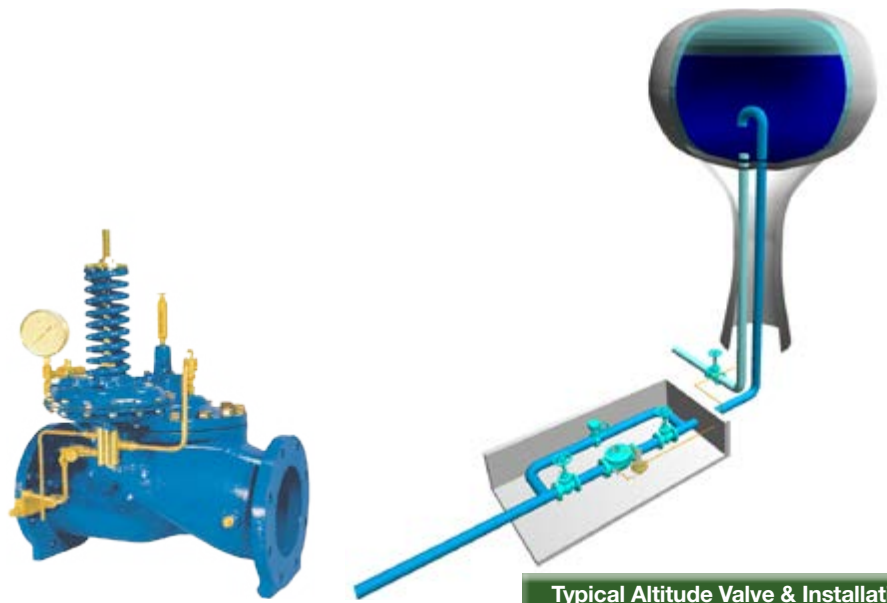
anytime the inlet pressure is more than three times higher than the reservoir tank's head pressure (which creates back pressure), the valve will cavitate. This cavitation can significantly damage the valve, as well as create a lot of noise and vibration. ACV's equipped with an engineered Anti-Cavitation Trim can stop

all cavitation damage as well as quiet the valve down and reduce vibration.

3) Almost all ACVs can be serviced in line without having to remove it from the line it is installed on. This allows for a faster service with less downtime, since keeping the system in operation as much as possible is key.

4) Costs can be more when using an actuated butterfly or ball valve. Three-phase power to run an electric actuator can be expensive, as well as the cost of a compressor with air lines for a pneumatic actuator is equally the same cost. ACVs do not require these additional costs. In the event of a power failure, battery backups for the actuators are an additional add on expense.

5) ACVs have the ability to easily add additional features to the pilot system that make the valve more flexible.



Typical Altitude Valve & Installation

It is very inexpensive to add a pressure sustaining feature, or rate of flow feature to a mechanical ACV.

Electronic Control of ACVs

In the past, all Automatic Control Valves have been controlled and operated using a mechanical pilot, which is a proven and reliable technology, but in today's water systems, having control and feedback through the SCADA system is a desired feature. This is the main reason water system managers and consultants changed over to electrically or pneumatically controlled butterfly valves. But this is not the case anymore, Most Automatic Control Valve manufactures have now adapted their ACVs to be operated and controlled electronically. There are a few different ways, but the most common is by installing solenoid valves into the pilot system that controls the water flowing into, and out of the control chamber. There is one solenoid valve that when opened for a controlled amount of time, allows water into the control chamber, thus it begins to close the valve. The second solenoid valve when open for a controlled amount of time, allows water to come out of the control chamber,



Control Valve showing the upper control chamber

which in turn opens the ACV a certain amount. By controlling how much water either moves into the control chamber, or out of it, the valve can be opened, closed, or modulated. These solenoid control valves can be pulsed open and closed as much as the user wants to have the valve open, closed, or adjust opening of the ACV to a very precise position. All that is required is a controller (Stand-alone PLC or SCADA controller) with a feedback sensor to the controller. The Controller then gets feedback from a level sensor and makes adjustments to the ACV by pulsing the solenoids to open or close the valve.

“... using an ACV equipped with electronic solenoids is a better option for level control of tanks and reservoirs”

Additional Options for Increased Confidence

While having electronic control allows for excellent control and feedback of an ACV, during a power failure or outage this all changes. With battery backups, the ACVs and Actuated Butterfly valves can be told to close fully, open fully, or maintain last position, but this can have significant side effects. If the valve is told to close during a power failure, the tank or reservoir will not be filling during the entire outage, so the tank could drain very low, or completely if the power outage last too long. If the valve is left open, the tank could overflow and a significant amount of water is lost, which costs money as well as a wasted resource. Unlike the Actuated Butterfly Valve, an ACV, which is electronically controlled, can also have a standard mechanical level control pilot



Electronic Controlled ACV

(altitude pilot) added to the valve as a backup in the case of a power failure. This way the valve would not need to go open or closed, but could now be controlled with the mechanical pilot and allow the tank to keep filling and then shut off when the desired level is reached. So it's the best of both worlds and ensures the system is working at its optimum even during power supply issues at the tank or reservoir location.

Summary

As the water supply industry continues to move to electronic control, using an Automatic Control Valve (ACV) equipped with electronic solenoids is a better option for level control of tanks and reservoirs. By adding a mechanical back up pilot system to control during power failures or outages, allows the system to work and maintain optimum water levels. In the event cavitation could occur, adding an Anti-Cavitation Trim makes the Automatic Control Valve an extremely versatile option for long lasting level control with a guaranteed back up. ■

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بعد أن أصبحت الأتمتة والتحكم بالكمبيوتر جزءاً لا يتجزأ من عملية تشغيل الخزانات والأبراج العالية للمياه والتحكم بها، نقلت صناعة الصمامات عملية التحكم من صمامات التحكم الميكانيكي التلقائي إلى صمامات الفراشة الموجهة والصمامات الكروية. ويعود السبب الرئيس وراء ذلك إلى إمكانية السيطرة على المشغلات الميكانيكية بواسطة أنظمة التحكم الإشرافي وتحصيل البيانات التي تم تطبيقها عالمياً تقريباً في الأنظمة الحديثة للمياه. وكنتيجة لذلك، توقف عدد من المدراء والمشغلين لنظام المياه عن شراء "صمام التحكم في المنسوب" الذي تم الاعتماد عليه لسنوات عديدة. وللتذكير، فصمام التحكم في المنسوب هو صمام ميكانيكي يعتمد على خط استشعار من الخزان أو الصهريج إلى صمام التحكم الذي يسمح للصمام بعملية الفتح أو الإغلاق للحفاظ على مستوى المياه المطلوب من المستخدم. وقد تكون صمامات التحكم في المنسوب مصممة بحيث تفتح عندما يبدأ منسوب المياه في الإنخفاض، عادة حوالي 2-3 قدم (0.3 متر إلى 0.6 متر)، أو يمكن أن تكون مجهزة للسماح للمستخدم بضبط السحب من مستوى المياه للسماح لمياه الخزانات والصهاريج بالدوران أكثر. ولا تزال صمامات التحكم في المنسوب تستخدم في موقع الخزانات والصهاريج التي تخلو من الطاقة، أو حيث تكون عملية الحصول على الطاقة في الموقع أمراً مكلفاً للغاية. كما أنها أكثر ملاءمة للمناخات الباردة حيث الطبقة العليا من الجليد في الخزان يمكن أن تؤثر على المقياس الإلكتروني.

Rotork Emergency Shut-Off Solution Protects Pipelines on Bridge

The Sundsvall Bridge in northern Sweden carries the European Route E4 motorway, spanning a coastal cove to bypass the city of Sundsvall. Opened in 2014, the 2.1 kilometer bridge also carries two 400 mm diameter district heating pipelines which are now protected by an emergency shut-off system incorporating **Rotork** pneumatic actuators. A quick and reliable shut-off solution on either side of the bridge was required to ensure that no damage occurs if one of these pipes bursts inside the bridge. To meet this requirement Rotork has supplied GP, RCG and RC200 scotch-yoke actuators and control panels. The spring-return heavy-duty GP actuators are fitted to DN400 ball valves installed on the main pipelines at each end of the bridge. In an emergency these actuators will shut the valves in one second. To reduce



The Sundsvall Bridge in northern Sweden. Inset: Actuator installation in progress

the strain on the main lines when this occurs, bypass lines are fitted around the main pipeline ball valves. Valves on the bypass lines are fitted with RC260 compact double-acting actuators. Speed restrictors on these actuators increase their valve closing times to

40 seconds, minimizing the risk of excessive water-hammer in the pipeline system during an emergency shut-off. In addition to the emergency shut-off valves, four valves are installed on each side of the bridge to control the routine flow of water. ■

Herrenknecht Pipe Express®: Fast Installation through Groundwater

Herrenknecht's Pipe Express® semi-trenchless method for pipeline installation completed its third successful mission south of Stockholm. **Züblin Scandinavia AB** installed a water pipeline more than a kilometer in length for Stockholm's water supplier Stockholm Vatten within just twelve days. The benefits were obvious to *Mats Ohlsson*, project manager of client Stockholm Vatten: "For open-cut construction we would have needed sheet piles and we would have had to lower the groundwater." The Pipe Express® method from Herrenknecht, however, requires no lowering of the groundwater. The construction company made the most of this enormous budget and time advantage. It used Pipe Express® for the laying of a 1,036 meter long section of a 122-cm water pipeline near Huddinge, some 10 kilometers south of Stockholm. After



The Herrenknecht Pipe Thruster

drilling started on February 22, on March 5, 2015 already the destination had been reached. In the most productive 12-hour shift, 221 meters of pipeline disappeared into the ground; the average construction performance was 0.70 meters per minute. After the pilot project in the Netherlands and the subsequent deployment in Thailand, this was the third

drive with Pipe Express®. In contrast to the conventional construction method the corridors, including construction paths, are up to 70 percent narrower. Extensive earthworks, groundwater lowering, the ramming of sheet piles are not necessary. Up to 2,000 meter long pipelines with a diameter of 900 – 1,500 millimeters can thus be laid quickly and cost-efficiently. ■



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Arab Water World

عالم المياه العربي



Arab Water World (AWW)

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Serving the Water, Wastewater, Desalination & Energy Sectors in MENA - Since 1977



KEO International Consultants' history in the treatment of sewage in the GCC is long and successful. Examples include the provision of treatment facilities for future tourist areas as well as addressing the population growth across the region. KEO's vision is to deliver cost effective and sustainable infrastructure solutions to meet its clients' ever changing needs and expectations. With respect to sewage, safe treatment is critical and viewed as a priority for the continued health of our communities. In Qatar, design of the plant and associated works at Mesaieed, provided 3 raw sewage pumping stations, trunk sewers, and rising mains to service the entire Mesaieed Industrial City.

Borouge Showcases Infrastructure Solutions Chosen for Nuclear Facilities

Demonstrating its unique abilities to add value throughout the value chain, **Borouge**, a joint venture between **Abu Dhabi National Oil Company (ADNOC)** and Austria based **Borealis**, showcased its unique-to-the-world polyolefin solutions to thousands of visitors and industry experts at the ArabPlast 2017 regional tradeshow. One such solution on display was the company's one-of-a-kind infrastructure pipe solution, the BorSafe™ HE3490-LS PE100 that was selected to produce Class 3 safety-related piping for the UAE's Barakah Nuclear Power Plant project. Borouge designed and manufactured the special plastic piping grade and optimized it for use in safety critical environments. BorSafe™ was chosen for use in such a sensitive industry due to its core properties of strength and flexibility, making it the only PE100 material in the globe to be certified for use in nuclear applications in



Pipes lying at Baraka Nuclear Energy Power Plant site

accordance with the ASME Code Case. The Barakah Nuclear Energy Plant, which is being built by the **Emirates Nuclear Energy Corporation (ENEC)**, is set to bring clean, sustainable energy to the UAE to complement the country's rich natural resources. When completed, the plant will be able to supply power to meet approximately 25 percent of the UAE's energy needs, reducing yearly greenhouse

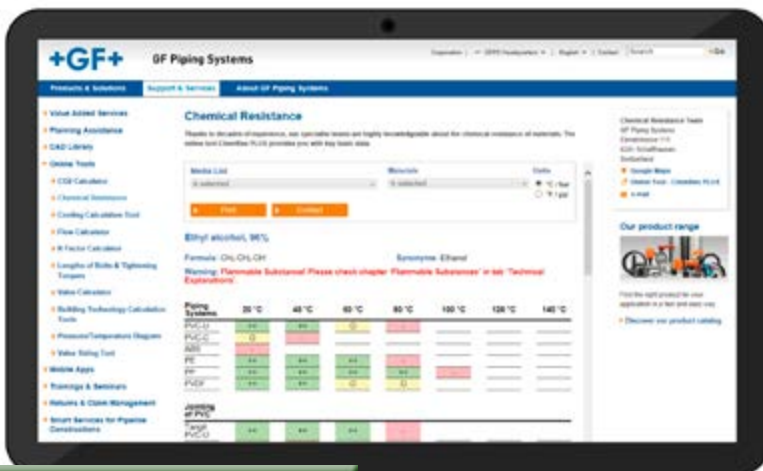
gas emissions by up to 12 million tons a year. "Borouge's infrastructure portfolio covers drinking water distribution networks, natural gas transportation, plumbing systems and industrial applications and the products are now the reference products across the Middle East, Asia and the Pacific," said *Hazeem Sultan Al Suwaidi*, Senior VP Middle East Africa and Exports at Borouge. ■

GF Piping Systems Presents Updated Online Tool

GF Piping Systems presents its updated online tool ChemRes PLUS. It offers a quick and easy understandable overview over the chemical resistance of GFs systems via website or mobile. Plastic pipes are used not only for drinking water, water for general use and wastewater, but also for transporting

chemically aggressive liquids and gases. Therefore, questions regarding the chemical resistance of piping materials to media are as important as the mechanical parameters for the installation of the piping system. Today expensive pipe designs, such as lined metal, ceramic or glass fiber reinforced pipes can be

replaced by plastic systems in many cases. The ChemRes PLUS online tool from GF Piping Systems gathers extensive data about materials and 276 media and visualizes them. Select between all materials and cements from the GF Piping Systems product range and compare to get a comprehensive overview. GF Piping Systems attempts to present resistance statements in order to identify the best suitable material for client's application. The recommendations given in the ChemRes PLUS database are not only based upon the long and extensive applicational experience of GF but origin as well from tests in GF-own laboratories. The data are subject to frequent updating and addition. GF Piping Systems is a division of the **Georg Fischer AG** group which also includes GF Automotive and GF Machining Solutions. Founded in 1802, the corporation is headquartered in Schaffhausen, Switzerland, and serves its customers in more than 100 countries. ■

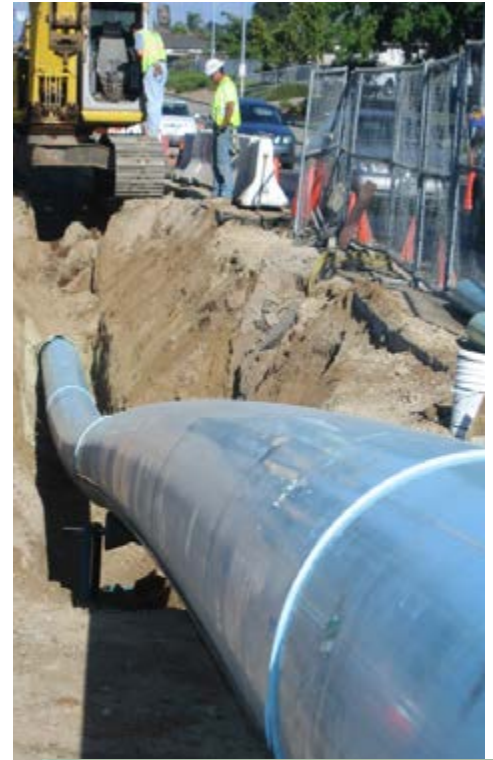


The updated online tool ChemRes PLUS

PE100+ Association Launches Online Assistant for Trenchless Pressure Pipe Installation

An online guide that will help civil engineers identify the most suitable trenchless methods for installing 'PE100' high density polyethylene (HDPE) pressure pipe has been launched by the **PE100+ Association**. The association, whose aim is to promote a consistent and high level quality in production and use of polyethylene for PE100 pipes, is made up of HDPE producers from around the world. The pipe designation PE100 is based on the long-term strength of the material, known as minimum required strength (MRS) of at least 10 MPa in accordance to ISO 9080. The new 'No-Dig Technical Guide' covers new installation and rehabilitation of existing water and gas pipelines using trenchless methods. It was developed by the PE100+ Association in collaboration with co-sponsors **TEPPFA (the European Plastic Pipes and Fittings Association)**; independent Swedish pipe pressure testing institute **Exova**; UK-based **Radius Systems**, which offer solutions spanning the entire pipe lifecycle; and **Downley Consultants**, a provider of global business and engineering consulting services in trenchless technology and geosynthetics. The online tool guides users through a decision-making process based on the hydraulic

capacity and pressure requirements of the pipeline and the physical and geotechnical conditions of the project. It then calculates the diameter and SDR (Standard Dimensional Ratio, the ratio of outside diameter to wall thickness) of PE100 pipe necessary. It also identifies feasible methods for installation of the pipe. Users of the guide can access in-depth information to help them better understand the capabilities of the various installation methods, as well as practical aspects such as cleaning and inspection, excavation and space requirements, end fittings, and safety. For each method, links are provided to enable the user to contact suppliers of materials and equipment and to find more information about the technologies and their applications. "PE100 pipe is at the heart of water and gas distribution systems all around the world, so it is critical that designers and engineers make the right decisions when they develop projects for new trenchless pipe installations or rehabilitation of old pipelines," says *Hans Pierik*, president of the PE100+ Association and Global Marketing Manager at **SABIC**. "This guide will help users decide whether or not trenchless techniques can be used to install PE100 on a specific project, which techniques are the most effective, and what key points



Trenchless refurbishment of old pipeline with welded PE100 pipes

need to be considered in using them." PE100 is the preferred pipe material in small and medium diameter pressure networks in many countries. It is also ideally suited for use with a range of trenchless technologies. Trenchless technologies are often the most efficient and cost-effective, and least disruptive, methods to use. ■



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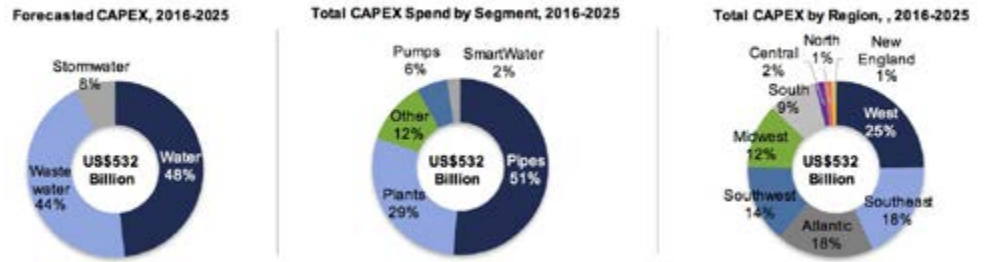
US Municipal Water Infrastructure Forecast Reaches USD532 Billion

Capital expenditures (CAPEX) for U.S. municipal water & wastewater utilities – including spending on pipes, plants, and pumps – are expected to exceed USD532 billion between 2016 and 2025, according to new forecasts from **Bluefield Research**. This new outlook, which draws heavily from planned utility budgets, represents a 28 percent increase over CAPEX during the last ten years. “Our research indicates that the water utility sector has finally emerged from the economic downturn, which undercut public spending in water infrastructure by almost 15 percent from 2009 to 2014,” according to Reese Tisdale, President of Bluefield Research.

“We anticipate a surge of network upgrades to address aging infrastructure, scaling populations, and tightening environmental regulations nationwide that will usher in new infrastructure technology and financing solutions,” adds Tisdale. While CAPEX is forecasted to rebound, a significant decrease in federal funding for water utilities– which has fallen to USD4.3 billion in 2014 from USD16 billion in 1976– passes the burden onto states, municipalities, and ultimately ratepayers. Residential and sewer bills have increased 5 percent and 20 percent annually, respectively since 2000, but their impact is expected to continue falling short of infrastructure needs.

The enormity of the municipal sector’s capital requirements is compelling utility decision-makers to adopt new, more advanced and cost effective approaches to infrastructure management and build-out, according to Bluefield’s report. Going forward, markets for trenchless technologies, real-time data & analytics, or smart water, and advanced treatment solutions are expected to show significant growth. Opportunities for private capital in the municipal water sector are also expected to proliferate. Staying ahead of 1.6 million miles of rapidly aging underground water and wastewater pipe networks poses the

Table 1: Sizing the Market – U.S. Municipal Water and Wastewater Outlook



single largest financial challenge facing the nation’s municipal water utilities. Bluefield has forecasted an almost doubling of CAPEX on pipe networks from the previous decade, reaching nearly USD300 billion over the ten-year period. While construction companies and traditional pipe suppliers will maintain a stronghold on the spend, adoption of

& analytics solutions, or smart water. Without more real-time insights into customer demands, network leakages, and bill management, utilities will continue to struggle with capital and operating costs, as well as cost recovery. Bluefield forecasts the burgeoning smart water sector to total USD12 billion over the forecast period.

“Opportunities for private capital in the municipal water sector are also expected to proliferate”

cured-in-place pipe rehabilitation and pipe bursting replacement is expected to surge as utilities seek to extend the life of installed pipe networks with limited system disruption. A critical input for utilities to address overall system issues most efficiently will be found through data

“Unfortunately, all of this spend is not expected to cover the full cost to catch up to an aging system, particularly if the federal government is not going to step in,” reflects Tisdale. “It is for this reason, among others, that public-private partnerships will begin to take on greater significance. They enable deployment of more advanced solutions in an industry that does not lack technology options, but rather capital.” ■

Bluefield Research

Web: www.bluefieldresearch.com

وفقاً لتقرير حديث صادر عن شركة بلوفيلد للأبحاث (Bluefield Research)، من المتوقع أن يبلغ حجم النفقات الرأسمالية (CAPEX) للمياه البلدية والصرف الصحي والمرافق في الولايات المتحدة أكثر من 532 مليار دولار أمريكي بين عامي 2016 و 2025، بما في ذلك الإنفاق على الأنابيب والمحطات والمضخات. وتقول مديرة شركة بلوفيلد للأبحاث ريس تيسدايل: “تشير أبحاثنا إلى أن قطاع مرافق المياه قد تجاوز أخيراً الإنكماش الاقتصادي الذي قوّض الإنفاق العام في البنية التحتية للمياه بحوالي 15 في المئة بين عامي 2009 و 2014“. وتضيف تيسدايل: “نتوقع حدوث موجة تحديث الشبكة لمعالجة تهاك البنية التحتية وقياس عدد السكان وتشديد الأنظمة البيئية على الصعيد الوطني، وهي من شأنها أن تقود إلى حلول تكنولوجية جديدة في البنية التحتية والتمويل“. ووفقاً للتقرير، تجبر ضخامة متطلبات رأس المال في القطاع البلدي صنّاع القرار في المنشأة على اعتماد نهج جديد، أكثر تقدماً وفعالية من حيث التكلفة لإدارة البنية التحتية.



Water Associations Challenge EPA Steam Power Plant Rule

In a brief filed in the 5th Circuit Court of Appeals, the **American Water Works Association** and the **National Association of Water Companies** challenged a new rule on steam power plant discharges, arguing that it does not adequately protect drinking water consumers. In challenging the **U.S. Environmental Protection Agency's** final Effluent Limitation Guidelines for Steam Power Plants (ELG Rule), the water associations contend that the portion of the rule addressing bromide discharges should be sent back to EPA for further review. AWWA and NAWC point out that bromide discharges impact source water quality and result in elevated levels of harmful disinfection byproducts in finished drinking water. "This is a case where the independent operation of the Clean Air and Clean Water Acts yielded negative consequences for drinking water users

downstream of power plants," said *Tracy Mehan*, AWWA executive director of government affairs. "EPA needs to address this threat to public health and support drinking water utilities in their efforts to meet the requirements of the Safe Drinking Water Act." EPA's decision imposes compliance challenges and additional costs on downstream water treatment plants instead of on the upstream power plants responsible for the pollution. "While the increased levels of bromide in surface waters may not have been EPA's primary focus in this rulemaking and while some of the science on this issue may have been only recently developed, it was arbitrary and capricious for EPA not to address the problem by either requiring the steam electric industry to meet discharge limits consistent with technologies that exist and are effective at removing bromide from the wastewater discharges at steam



American Water Works Association

electric power plants or consider other binding alternatives," the brief states. There are already observed instances in which downstream water systems have exceeded Stage 2 Disinfection Byproduct Rule standards due to the influence of these outfalls. EPA acknowledged that a danger to public health existed because the release of bromide from steam electric power plants was documented to cause the formation of carcinogenic disinfection byproducts at water utilities located downstream of power plants where new air pollution technologies were being employed. ■

US Saw a Record-Shattering 4.1 Gigawatts of PV installed in Q3

The United States solar market just shattered all previous quarterly solar photovoltaic installation records. According to **GTM Research** and the **Solar Energy Industries Association's** Q4 2016 U.S. Solar Market Insight report, 4,143 megawatts of solar PV were installed in the U.S. in the third quarter of the year, a rate of 1 megawatt every 32 minutes. That pace is even faster today, with the fourth quarter on track to surpass this past quarter's historic total. "Coming off our largest quarter ever and with an extremely impressive pipeline ahead, it's safe to say the state of the solar industry here in America is strong," said *Tom Kimbis*, SEIA's interim president.

"The solar market now enjoys an economically winning hand that pays off both financially and environmentally, and American taxpayers have noticed. With a 90 percent favorability rating and 209,000+ jobs, the U.S. solar industry has proven that when you combine smart policies with smart 21st century technology, consumers and businesses both benefit." The report points to an "unprecedented rate of project completion" in the utility-scale segment as a key growth driver. In fact, the utility-scale segment represented 77 percent of solar PV installed in the third quarter of the year. GTM Research anticipates that a massive 4.8 gigawatts of utility PV projects will come on-line in the

fourth quarter of the year -- that's more than was installed across the entire utility PV segment in all of 2015. "Driven by a large pipeline of utility PV projects initially procured under the assumption of a 2016 federal ITC expiration, the third quarter of 2016 represents the first phase of this massive wave of project completion -- a trend that will continue well into the first half of 2017," said *Cory Honeyman*, associate director of U.S. solar at GTM Research. The non-residential segment posted its second-largest quarter ever. With 375 megawatts installed, the segment grew 15 percent over the second quarter of the year and 37 percent annually. Part of this growth is attributed to a community solar pipeline that is finally beginning to materialize, a segment that accounted for a record 20 percent of the non-residential PV market in Q3 2016. ■

gtmresearch



JWC Environmental to Acquire FRC Systems International

JWC Environmental (JWC) and **FRC Systems International (FRC)** have announced the finalization of the transaction for the acquisition of FRC Systems by JWC Environmental. The acquisition of FRC, a specialist in industrial wastewater process design and equipment, expands JWC's offering of high-quality solutions for its industrial and municipal wastewater customers. "We are excited to welcome FRC Systems International into the JWC Environmental family of companies," said *Ken Biele*, Chief Executive Officer of JWC Environmental. "FRC Systems represents the type of organization that complements the strategy of JWC — providing best-in-class wastewater technologies while maintaining

the flexibility to meet the unique challenges our customers present us." Since 1979, FRC Systems has been an industry specialist in dissolved air flotation (DAF) systems for some of the largest industrial companies in the world. The products and expertise FRC offers have been used extensively in a variety of wastewater applications spanning the food and beverage, meat and poultry processing, and oil and gas industries, as well as a wide range of general manufacturing applications. "JWC and FRC share a similar vision of providing reliable and proven solutions to wastewater customers regardless of the industry they serve," said Biele. "FRC's strong position within industrial wastewater furthers JWC's ability



to provide a full lineup of products for critical solids preconditioning, pump protection and liquid/solids separation applications in multiple industries. Additionally, FRC's expertise in DAF technologies increases JWC's ability to help municipal water and wastewater customers solve challenging problems." As part of the acquisition, *Adriaan van der Beek*, President of FRC Systems International, will join the JWC Environmental executive team and continue to lead the ongoing business. ■



20th Annual Drilling School

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Vortex Flow Meter Improves Reliability for Utility Applications

Emerson Automation Solutions

expands its vortex flow meter portfolio with the addition of the Rosemount® 8600 Utility Vortex Flow Meter, designed specifically for utility applications. Its application-specific design reduces installation costs, provides accurate and reliable flow measurement, and extends vortex technology into a wider range of applications. The Rosemount 8600 Utility Vortex delivers the benefits of vortex technology by minimizing potential leak points and eliminating impulse lines – improving reliability and reducing installed cost. With no moving parts to repair or maintain, the Rosemount 8600 reduces maintenance and downtime. For saturated steam applications, a multivariable measurement option provides temperature compensated mass flow output directly from the meter. Unlike traditional multivariable vortex



The Rosemount 8600

designs, the Rosemount 8600 Utility Vortex with the multivariable option uses an isolated temperature sensor. This allows the temperature sensor to be verified or replaced without breaking the process seal. Operator safety is enhanced by limiting personnel exposure to process conditions and throughput is maximized by eliminating

the need to shut down the process to maintain the temperature sensor. The Rosemount 8600 is part of the broadest portfolio of vortex flow meters designed for a variety of process and utility applications. From the most aggressive flows, to clean fluid applications, Emerson offers a range of tailored vortex solutions to meet any requirement. ■

Mody Submersible Slim-Line Pumps

Mody Pumps, Inc. a USA based international Pump Manufacturing Corporation is one of the fastest growing submersible pump manufacturers worldwide. During the first quarter of 2017, Mody will officially release an additional pump model to complement the range on its core Slim-Line Pump Series culminating in a comprehensive solution to the requests from key distributors and pump rental companies worldwide who shared their pumping needs with Mody. The Slim-line series was developed for applications where the overall diameter of the pump is critical when the pumps are fitted inside well casings or confined spaces. The complete pump line is designed to meet the rugged dewatering, mine and industrial application requirements and equipped to handle contaminated fluids at construction sites, mines and power plants. These robust, heavy duty Class “H” insulation, epoxy-coated, stainless steel-fitted pumps are ideal in any rental fleet. The Slim-line horsepower range is from 0.5HP (.4kW) to 150HP (110 kW) 60/50Hz. ■



Mody G1506 Series

Heavy Duty Solids Handling Pumps

Founded in 1939, **Zoeller Company** is one of the oldest independently-owned, professional pump manufacturers in North America. Zoeller products cover a variety of residential, commercial and municipal water solution needs. Today, the company has expanded to include five distinct brands. The Zoeller Engineered Products brand offers a wide range of submersible pumps. The 61 HD and 62 HD Series heavy-duty solids-handling pumps are double seal submersible models available with various horizontal or vertical discharge configurations to pass up to a 76 mm spherical solid. They feature a ductile iron semi-open impeller with two blades and top pump-out vanes for maximum efficiency. The cast iron pump housing utilizes a finned design allowing quick dissipation of heat from the motor. This helps prevent overheating and provides a longer life of smooth and reliable operation. These products are engineered for pumping stations, storm water removal, wastewater transfer and industrial wastewater applications. ■



The 62 HD pump



Environmentally Friendly Desalination Techniques for Farmers & Small-Scale Plants

In the last decade, reverse osmosis (RO) has grown as an alternative to traditional potable water sources. A major disadvantage of the RO process is the huge amount of reject brine and its negative impact as a result of its high salinity. Further research is needed for introducing environmentally friendly and economically viable management options for RO brines. RO produces a clean stream of high purity water, and as well a smaller stream of waste, referred to as concentrate or brine. Brine is a highly concentrated solution of the salts and contaminants separated from the water with the reverse osmosis membranes. Brine requires proper disposal, which many times requires permits or other regulatory compliance actions. There are many brine disposal methods available today, which all have different environmental and capital costs. The common brine disposals methods have their pros and cons. In Oman, due to the increased level of soil and water salinization along Al-Batinah region coast, an increasing number of farmers are using small-scale desalination units for producing irrigation water. Desalination technology remains still an expensive option for agriculture. In addition, it has environmental challenges that includes energy requirements, water quality, and disposal means of rejected brine which end up in many cases by contaminating their groundwater and increasing its salinity. However, it can still be an attractive option for sustainable agriculture if used within specific constraints.

Introduction

Although technological advances have resulted in the development of new and highly efficient desalination processes, little improvements have been reported in the management and handling of the major by-product waste of most desalination plants, namely reject brine. Reject brine contains variable concentrations of different chemicals such as anti-scale additives and inorganic salts that could have negative impacts on soil and groundwater. By definition, brine is any water stream in a desalination process that has higher salinity than the feed. The characteristics of reject brine depend on the type of feed water and type of desalination process. They also depend on the percent recovery as well as the chemical additives used (Ahmed et al., 2000). The disposal of desalination brine (concentrate) represents major environmental challenges to most plants, and it is becoming more costly.

Brine disposal costs are high today, between 5 and 33 percent of total desalination cost (Ahmed et al. 2001), complicating implementation. This cost depends on the quality of the concentrate, treatment level before disposal, disposal method and the volume or quantity of concentrate. Disposal costs for inland desalination plants are even higher than those for plants discharging brine into the sea (Arnal et al. 2005). In spite of the scale of this economic and

Table 1: Total Cumulative Contracted Capacity of Desalination plants since 1996 in Thousand Cubic meters per day in Oman.

	Oman
Seawater	846.325
Brackish water	100.072
Brine water	0.85
Tap water	0.2
Wastewater	53.212

environmental problem, the options for brine management for inland plants have been rather limited (Ahmed et al., 2001). These options include: discharge to surface water bodies or wastewater treatment plants; ponds, concentration into solid salts and irrigation of plants tolerant to high salinity; deep well injection; land disposal; evaporation ponds; and mechanical/thermal evaporation.

“... little improvements have been reported in the management and handling of the major by-product waste of most desalination plants, namely reject brine”

To help farmers in Oman deal with the challenge of brine management, **MEDRC** joined efforts with **Sultan Qaboos University (SQU)** researchers to carry out an innovative research

project on evaporation enhancement that would include:

- 1) A comprehensive literature review on the topic of evaporation enhancement and identification of most promising ones for field situations;
- 2) Perform laboratory experiments under controlled conditions and field experiments with the most promising evaporation methods; and
- 3) Perform cost-benefit analysis of the selected methods and prepare design criteria and guidelines for practical applications.

This project aims to assist and train Oman Farmers in adopting such methods. MEDRC goal is to enable operators of small-scale

desalination plants for agriculture:

- 1) Reduce the impact of brine discharge on the environment;
- 2) Protect their crops; and
- 3) Reduce operation costs.



Desalination for agriculture in Oman

With increasing concerns about water scarcity in Oman and the whole Gulf region, agriculture is under pressure to improve water management and explore available options to match supply and demand. In Oman, Al-Batinah coastal plain is by far the most important agricultural area located between the Hajar mountain ranges and the Gulf of Oman. Over-pumping of water in recent years has led to an alarming advance of sea water intrusion and increased salinity of groundwater. As a result, some agricultural lands of the coastal areas have become unsuitable for cultivation. Desalination remains an excellent technical option to increase the availability of freshwater both in coastal areas with limited resources and in areas where brackish waters – such as saline groundwater, drainage water and treated wastewater – are available.

Greenhouse and hydroponic farmers are beginning to use RO to desalinate and purify irrigation water for greenhouse use (the RO product water tends to be lower in bacteria and nematodes, which also helps to control plant diseases). Small

RO plants have been built in rural areas where there is no other water supply option. An increasing number of Omani farmers are changing the irrigation water supply from a contaminated surface water canal source to an RO-desalinated brackish groundwater source.

The huge amount of brine represents a negative impact as a result of its high salinity. This brine is usually discharged

“The design of an evaporation pond depends critically upon knowledge of the spatial and temporal distribution of net evaporation rates”

not far from the farms using RO systems, and end up by contaminating ground waters and increasing salinity. Failure to address this negative impact will impact the sustainability of agriculture activities and consequently the incomes of the farmers as well. Most of inland desalination plants (80 percent) in Oman are RO type of small capacities (below 10.000 m³ per day). More than 50 percent are desalinating brackish water or inland water (TDS 3000ppm - <20000ppm). (Table 1, GWI 2016)

Solar Evaporation ponds

Evaporation ponds are especially suitable to dispose of reject brine from inland desalination plants in add and semi-arid areas due to the abundance of solar energy. In irrigation projects facing a soil salinity problem due to a shallow saline groundwater table, evaporation ponds are also in use. Saline water tables are lowered by pumping or tile draining and the drainage water is stored in evaporation ponds. While evaporation ponds have long been used for salt production in many parts of the world, the disposal of concentrate from desalination plants in inland areas using evaporation ponds is of much significance

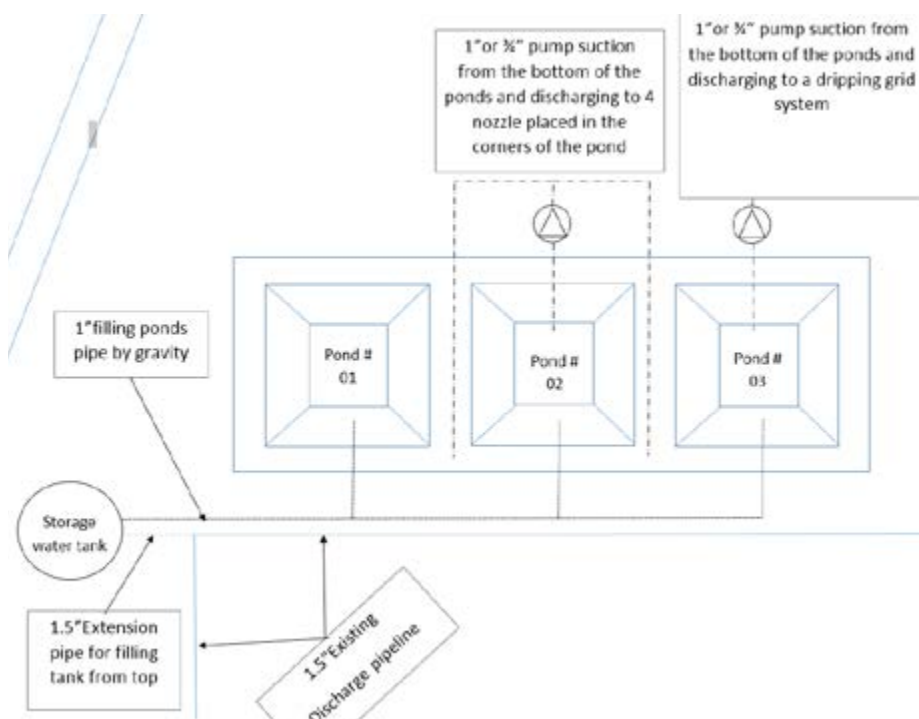
both economically and environmentally. Guidelines are needed for their design, construction, maintenance, and operation for reject brine disposal in an economical and environmentally-sensitive manner.

Solar evaporation consists of leaving brine in shallow evaporation ponds, where water evaporates naturally thanks to the sun's energy. Salt is left in the evaporation ponds or is taken out for disposal (Katzir et al. 2010). The size of the evaporation pond is a function of the rate at which reject brine is evaporated from the ponds. Different methods of calculating evaporation rates are available. If it were possible to increase/enhance the natural evaporation rate, it would be possible to reduce the size of the evaporation ponds. Such a reduction would result in substantial savings in the construction costs of ponds. The design of an evaporation pond depends critically upon knowledge of the spatial and temporal distribution of net evaporation rates and of the evaporative characteristics of the brine.

Evaporation Ponds Experiments

Evaporation ponds for disposal of concentrate from desalination plants need to be constructed as per the design and maintained and operated properly so as not to create any environmental problem, especially with regard to groundwater pollution. Liners are the

Figure 1: The Experimental setup of the three evaporation ponds





MEDRC RO Pilot Plant

most important feature of an evaporation pond and one of the major components in the construction cost. They should be impermeable to avoid brine leakages and mechanically strong to withstand stress during salt cleaning (Ahmed et al. 2000). The use of clay liners with low permeability will substantially reduce the cost of construction, although a small number of leakages are to be expected.

The idea was to construct three evaporation ponds, one as reference pond, and a second one equipped by sprinkles and spray system and a third one equipped by a dripping grid system to improve the evaporation rate. We put a storage tank for reject brine, which comes from MEDRC RO Pilot Plant. MEDRC RO Pilot Plant is a two pass plant with a production capacity of 3 m³/h. It

has been specially designed to fit with hands on training needs in operation, monitoring and troubleshooting. The

“A soil salinity mapping will be carried out to prepare cost-effective salinity alleviation measures”

brine stored at the tank and pumped in the evaporation ponds has a salinity value of salinity conditions 30,000 ppm.

We are using a weather station equipped with all necessary sensors to get: daily weather parameters (air and water-surface temperatures, relative humidity, wind speed, incoming long- and short-wave radiations, albedo), and we calculate daily evaporation from ponds (predicted versus measured), and

variables such as: EC of pond water, spray rate, pond depth, pond brine temperature. Since the early 2000s, MEDRC has conducted several research projects dealing with such issue, and we have gained substantial knowledge base in regard to the potential use of evaporation ponds. However, in practice this knowledge has not been transmitted to the end users and farmers particularly. MEDRC has now built evaporation ponds at its facilities (to be further implemented by adding solar stills), and this will help bringing up the farmers and deliver a hands-on training.

Conclusion

Finally, we will prepare guidelines for practical applications ‘brine management guidebook’, which will explicitly link different brine management options (disposal and beneficial uses) with ecosystem responses and ecosystem services, with a view that this may feed into more site specific cases related to agricultural activities in Oman. A soil salinity mapping will be carried out to prepare cost-effective salinity alleviation measures (e.g. Al-Batinah region). This research would help promoting the concept of evaporation ponds as a possible solution to the problem of brine in Omani farms. ■

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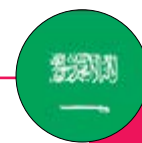
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لا تزال تكنولوجيا تحلية المياه خياراً مكلفاً للزراعة. فهي تواجه تحديات بيئية تشمل متطلبات الطاقة، ونوعية المياه، ووسائل التخلص من الماء المالح المنبؤ الذي يؤدي في كثير من الحالات إلى تلوين المياه الجوفية وزيادة نسبة الملوحة فيها. ومع تزايد المخاوف حول ندرة المياه في عمان ومنطقة الخليج كلها، تتعرض الزراعة للضغط من أجل تحسين إدارة المياه واستكشاف الخيارات المتاحة للتوفيق بين العرض والطلب. ويعتبر سهل الباطنة الساحلي في عمان إلى حد بعيد أهم منطقة زراعية تقع بين سلسلة جبال الحجر وخليج عمان. وقد أدى الإفراط في ضخ المياه في السنوات الأخيرة إلى ازدياد تسرب مياه البحر بشكل خطير وزيادة ملوحة المياه الجوفية. ونتيجة لذلك، أصبحت بعض الأراضي الزراعية في المناطق الساحلية غير صالحة للزراعة. وتبقى تحلية المياه خياراً تقنياً ممتازاً لزيادة توافر المياه العذبة في المناطق الساحلية ذات الموارد المحدودة، وفي المناطق حيث المياه المالحة متوفرة، مثل المياه الجوفية المالحة، ومياه الصرف، ومياه الصرف الصحي المعالجة. وقد بدأ المزارعون المتخصصون في الدفيئات والزراعة المائية باستخدام التناضح العكسي لتحلية مياه الري وتنقيتها لاستخدامها في الدفيئات (يحتوي الماء الناتج عن التناضح العكسي على نسبة أقل من البكتيريا والديدان الخيطية، مما يساعد أيضاً على مكافحة الأمراض النباتية). وقد تم بناء محطات التناضح العكسي الصغيرة في المناطق الريفية حيث لا يتوفر خيار آخر لإمدادات المياه. ويزداد عدد المزارعين العمانيين الذين يعملون على تغيير مصدر مياه الري أي من قناة المياه السطحية الملوثة إلى اعتماد مصدر المياه الجوفية التي تم تحليتها بتقنية التناضح العكسي.



Privatization & Renewable Energy in the Saudi Arabian Water Sector

The Middle East is one of the most water scarce regions in the world; and Saudi Arabia, the largest arid country in the Arabian Peninsula, has limited natural sources of water. The Kingdom is projected to be among the ten most water-stressed countries in the world by 2040. It currently relies heavily on desalination plants which produce roughly 18 percent of the world's desalinated water. The sharp decline in the oil price in mid-2014 contributed to the current re-thinking of its oil-based economic model. The Kingdom's economic strategy is set out in the Saudi Vision 2030 which was announced in April 2016 by Deputy Crown Prince Mohammed bin Salman. The Saudi Vision 2030 is an ambitious plan to end the Kingdom's dependence on oil by 2020, privatize government assets, and improve economic and environmental sustainability. As part of this ambitious agenda, the Saudi Government has announced intentions to privatize the water sector, to help meet future demand, which is estimated to grow roughly five percent per year until 2030. Additionally, renewable energy initiatives, such as solar-power, are rapidly emerging within the region, and Saudi Arabia intends to be a world leader in the clean energy market. These prospects can open up lucrative opportunities for international investors, but it remains to be seen whether these reforms can be implemented.

At the recent Water Investment Forum in Riyadh, the Kingdom announced plans to privatize the state-owned company, **Saline Water Conversion Corporation (SWCC)**, to attract private investment to fill the country's capital gap of more than USD53 billion. The Minister of Environment, Water and Agriculture, *Abdul Rahman Al-Fahdli*, reported that the privatization of SWCC aims to double its production over the next 15 years to meet rising demand for water. According to **Global Wire Intel**, the challenge for the Kingdom is 'to roll out projects as fast as possible, while simultaneously creating the institutional structures which are required to make the proposition attractive to private investors'.



Many Middle Eastern governments subsidize resources to provide social protection for their population and share national wealth. These subsidy schemes are generally understood as an implicit "social contract" between the ruling political elite and citizens. As reported in a previous Strategic Weekly Analysis, Saudi Arabians generally pay roughly USD0.03 per cubic meter of water due to a generous 99.76 percent water subsidy. In an attempt to decrease water consumption, the Kingdom cut utility subsidies last year; resulting in a 500 percent water price increase and public backlash, which contributed to the dismissal of the Water and Electricity Minister, *Abdullah Al Hasin*. The generous water subsidies have

“The generous water subsidies have resulted in an extraordinarily high water consumption which exceeds over 200 liters per capita per day”

Furthermore, 28.5 percent of the population is under 15 years old, and as this cohort reaches working age, economic opportunities must also be created. Consequently, Saudi Arabia must redefine the social contract to promote sustainable water consumption

while creating opportunities for the next generation of Saudi Arabians.

The Kingdom must also build more desalination plants in the face of a growing budget deficit. With domestic oil consumption estimated to be roughly 2.8 million barrels per day, however, this could prove challenging unless it develops alternative energy sources. Saudi Arabia launched the King Abdullah Initiative for Solar Water

Desalination in 2010 to foster the use of renewable energy to desalinate seawater at a sustainable cost. Built by the **Advanced Water Technology** company, a subsidiary of the commercial arm of **King Abdulaziz City for Science and Technology**, in partnership with Spanish



renewable energy group, **Abengoa**, the first solar-powered water desalination plant is anticipated to be commissioned in 2017 in Al Khafji City, in Saudi Arabia's north-east. The solar-powered desalination plant is expected to produce 60,000 cubic meters of water per day supplying roughly 150,000 people with access to drinking water and will be powered by an ultra-high concentrator photovoltaic plant to reduce operational costs and greenhouse gas emissions. This is a game-changer towards decreasing the country's energy demands and to accommodate its

growing demand for water and signals the future of Saudi Arabia's energy and water nexus.

“... Saudi Arabia must innovatively engage with renewable energy technology and redefine the social contract”

The privatization of the Saudi Arabian water sector, as well as the emerging market for renewable energy and cheaper access to photovoltaic technology, has opened potential opportunities to bring Saudi Arabia at the forefront of the global clean energy market and create job

opportunities for its young population. To fill the country's massive capital gap and safeguard long-term water and energy security in the coming decades, Saudi Arabia must innovatively engage with renewable energy technology and redefine the social contract – whether it can do this without social backlash and compromising internal stability, however, remains to be seen. ■

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الشرق الأوسط هو أحد أكثر المناطق التي تعاني شحاً في المياه في العالم. وتمتلك المملكة العربية السعودية (أكبر بلد قاحل من حيث المساحة في شبه الجزيرة العربية) مصادر مياه طبيعية محدودة. ومن المتوقع أن تكون المملكة من بين أكثر عشر دول تعاني من نقص المياه في العالم بحلول عام ٢٠٤٠. وهي تعتمد حالياً بشكل كبير على محطات تحلية المياه التي تنتج ما يقرب من ١٨ في المئة من المياه المحلاة في العالم. بالإضافة إلى ذلك، ساهم الإنخفاض الحاد في أسعار النفط في منتصف عام ٢٠١٤ في إعادة التفكير بالنموذج الاقتصادي المعتمد على النفط. كما تم إدراج الإستراتيجية الاقتصادية للمملكة في الرؤية السعودية ٢٠٣٠ التي تم إعلانها نائب ولي العهد الأمير محمد بن سلمان في أبريل ٢٠١٦. فالرؤية السعودية ٢٠٣٠ هي خطة طموحة لإنهاء اعتماد المملكة على النفط بحلول عام ٢٠٢٠، وخصخصة الأصول الحكومية، وتحسين الاستدامة الاقتصادية والبيئية. وكجزء من هذا البرنامج الطموح، أعلنت الحكومة السعودية نيته لخصخصة قطاع المياه للمساعدة في تلبية الطلب المستقبلي الذي من المتوقع أن ينمو بحوالي خمسة في المئة سنوياً حتى عام ٢٠٣٠.

Abdul Latif Jameel Energy Establishes Almar Water Solutions

Abdul Latif Jameel Energy and Environmental Services announced the establishment of **Almar Water Solutions**, a provider of specialist expertise in water infrastructure development, as part of its continued expansion and diversification strategy. Announced at the World Future Energy Summit (WFES) in Abu Dhabi, Almar Water Solutions will seek to tackle the challenges of water scarcity and contamination. It will be dedicated to the provision of global solutions that can contribute to sustainable development of the water sector, by constructing and operating water desalination and purification treatment plants. Abdul Latif Jameel Energy is now uniquely placed with its renewable energy and water treatment solutions. The establishment of Almar Water Solutions is a further

step in Abdul Latif Jameel Energy's renewable energy and environmental services strategy that builds on the successful acquisition of **Fotowatio Renewable Ventures (FRV)** in 2015. FRV has expanded rapidly over recent years, and is now the largest GCC-based solar photovoltaic provider. *Mohammed Abdul Latif Jameel*, Chairman and CEO of Abdul Latif Jameel, said: “The establishment of Almar Water Solutions demonstrates our continued efforts to become the leading developer of sustainable energy and water solutions. Almar Water Solutions' expertise and offering strongly aligns with Abdul Latif Jameel Energy's global presence, providing comprehensive water and wastewater infrastructure services that will also support the economic development of the communities where they



operate.” Almar Water Solutions' team has extensive international expertise in renewable energy and water treatment, and the company will provide the design, engineering, construction, financing, operation and maintenance of projects as well as asset and equity management for investors and other third parties. ■



Spain Continues to Suffer Major Setbacks

Spain's wastewater treatment sector is facing turmoil as a result of its inadequacy in collection and treatment of urban wastewater discharged in multiple areas across the country. According to the **European Commission (EC)**, under the Urban Wastewater Treatment Directive, starting 2001, towns and cities with more than 15,000 inhabitants must collect and treat wastewater. The country is currently subject to penalties for violation of law. By the same token, the country's renewables sector is still limping along in crisis. Although Spain's renewable energy industry is one of the most developed in Europe, the country has been struggling to make use of its significant solar and wind resources to curb greenhouse gas emissions. In recent years, Spain's solar and wind industries suffered significant setbacks due to the government's subsidy cuts.

Wastewater treatment sector

As an **EU** member state, Spain needs to adhere to EU water supply regulations such as the Urban Wastewater Treatment Directive. The Urban Wastewater Treatment Directive requires that Member States ensure that agglomerations (towns, cities, settlements) properly collect and treat their urban wastewater. However, in November 2016, a statement was released declaring the EC's decision to take Spain back to the Court of Justice of the EU for its failure to fully and completely comply with the Court judgment of 2011. According to the report, the Court of Justice of the EU ruled on 14 April 2011 that Spain violated EU law by not adequately collecting and treating the urban wastewater discharged by 37 agglomerations. Five years later, this matter remains unaddressed in 17 agglomerations (out of the 37 covered by the judgment) corresponding to 1,400,000 people. In addition, more than 15 years after the deadline of 31 December 2000 for the implementation of the applicable EU rules, the perspective for full compliance in all these agglomerations is still unclear, according to the EC statement. The lack of adequate collection and treatment of the wastewater poses significant risks



to human health, to inland waters and to the marine environment.

Renewables sector

In its fight against climate change, in 2011, the European Union confirmed its targets for GHG emission reductions

“The lack of adequate collection and treatment of the wastewater poses significant risks to human health”

by the 2050 time horizon: between 80 percent and 95 percent with respect to 1990 levels, according to a **Deloitte** report. The European commitment to GHG emission reductions of between 80 percent and 95 percent by 2050 requires

Spain to use every available technology and energy source during the transition period. That said, according to **BMI Research**, Spain's renewable energy industry is one of the most developed in Europe and total installed renewables capacity is nearly 30.9 gigawatts – the third highest in Western Europe after Germany and Italy. However, the continued expansion of the sector is at a halt, due to retroactive subsidy cuts, limited capacity available at auctions and policy uncertainty in relation to Spain's inability to form a new government. Consequently, these barriers are hindering the country's plan to meet its ambitious GHG emission reduction targets. ■

Dana Hani
Senior Content Editor & Researcher

يواجه قطاع معالجة مياه الصرف الصحي في إسبانيا اضطراباً نتيجة لعدم الكفاءة في جمع ومعالجة مياه الصرف الصحي في المناطق الحضرية في جهات متعددة من البلاد. ووفقاً للمفوضية الأوروبية، بدءاً من عام ٢٠٠١، يجب على البلديات والمدن التي يسكنها أكثر من ١٥,٠٠٠ نسمة جمع ومعالجة مياه الصرف الصحي بحسب توجيه معالجة مياه الصرف الصحي في المناطق الحضرية. لذلك تخضع البلاد حالياً لعقوبات لانتهاك القانون. ولا يزال يعاني قطاع الطاقة المتجددة في البلاد كذلك من أزمة. وعلى الرغم من أن صناعة الطاقة المتجددة في إسبانيا هي واحدة من أكثر الصناعات تقدماً في أوروبا، تكافح البلاد للإستفادة من موارد الطاقة الشمسية وطاقة الرياح الكبيرة للحد من انبعاثات الغازات المسببة للإحتباس الحراري. وعانت الصناعات الشمسية وطاقة الرياح في إسبانيا خلال السنوات الماضية من انتكاسات كبيرة بسبب خفض الدعم الحكومي.



Fluytec Launches the Next Generation of UF Solutions

Fluytec, specialized company in Pretreatment Filtration and expert in FRP Cartridge Filter Housings launches the Next Generation of Ultra-filtration (UF) Solutions: Continuous Ultrafiltration (c-UF) and Integrated Ultrafiltration (i-UF). Both of them simplify UF configurations adding extra benefits at the same time for product flows from 8 m³/h up to 310 m³/h. After designing and manufacturing conventional UF systems, Fluytec R&D department developed and patented the idea of Continuous Ultra-Filtration (c-UF), achieving a continuous permeate production by cleaning one UF module at a time. This reduces the need for auxiliary equipment with consequent savings on capital expenditure and space at plants. In another step forward, the Integrated Ultra-Filtration (i-UF) was launched and patented with a view to installing UF systems outdoors. It



Fluytec filtration technology

comprises a filter body which integrates two stages that are traditionally set up separately in water treatment plants: primary or coarse filtration (Self Cleaning Strainer) and ultra-filtration (UF membrane cartridges). Vessel is available in different materials and membrane cartridges in various configurations. This approach admits unlimited design pressures and dramatically decreases the footprint requirements and membrane replacement

cost. Fluytec's R&D Department has been working on piloting processes for both units since 2015, in different locations and applications (waste water and seawater) showing positive results in performance, quality and operational costs. Continuous UF and Integrated UF come to expand the filtration spectrum of the company, which makes them the ideal partner for any design requirements, be it conventional or membrane type. ■

Bombas Ideal Presents New Range of Pumps

Over 114 years of experience in manufacturing centrifugal pumps, **Bombas Ideal** has been guided by three main principles; Quality, Service and Innovation. This makes the company a Spanish world reference in design and manufacture of pumps. Having references all over the world, and thousands of success stories worldwide

validates the company as a professional solution provider for clients' pumping needs. Proof of this is the presence of the company's equipment installed in various prestigious projects developed in each of the five continents. By having a large number of international delegations, the company offers fast and high-quality service. The Research,

Development and Innovation (R&D&I) department is equipped with the latest technology in CFD software. Supported by one of the best automated tests facilities in Europe, the company implements the latest technological advances to obtain multiple parameters to a specific computing platform for the management and subsequent analysis of the data obtained. Bombas Ideal, as an innovative and specialized company, responds to the specific needs of each one of the markets in all of the countries where it is present. As a result of the innovative capacity of Bombas Ideal, both vertical turbine pumps and split case pumps of the fire fighting sets are according to NFPA20 and are UL approved and FM listed to provide the maximum security for customers. The ARS pumps series for sewage and wastewater submersible pumps are designed specially for heavy-duty applications with a range up to DN 600. ■



The ARS pumps series

A detailed photograph of an industrial facility, likely a water treatment plant. The scene is filled with complex machinery, including large blue and silver metal cabinets, intricate piping systems with various valves and gauges, and a prominent red spherical tank in the foreground. The lighting is bright, highlighting the metallic surfaces and the organized layout of the equipment.

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Siemens Inaugurates New Wind Turbine Blade Factory

Siemens has officially inaugurated the new rotor blade factory for offshore wind turbines in Hull, UK, in an event attended by the Secretary of State for Business, Energy and Industrial Strategy *Greg Clark* and representatives of the local community. The site at Alexandra Docks has been transformed in under two years from a derelict industrial wasteland to a busy high-tech manufacturing hub. Now, the state-of-the-art factory has completed the first 75-meter-long blades which are currently stored on racks on site. Shipping to the first offshore wind project Race Bank is expected in early 2017. "Our new factory in Hull which we are today officially inaugurating is located in one of the most significant markets for offshore wind power and will produce rotor blades for our 7 and 8-megawatt wind turbines," said *Michael Hannibal*, CEO Offshore of Siemens Wind Power. "The new

SIEMENS

manufacturing plant is part of our efforts to establish offshore wind power as a key pillar of a sustainable energy mix in Europe. At the same time we are creating 1,000 attractive jobs here and thereby supporting sustainable regeneration in the Humber region." With its partner **Associated British Ports (ABP)**, Siemens is investing USD389 million in Hull to create a world-class center for offshore wind manufacturing, assembly and logistics. The centerpiece of the investment, the wind turbine blade factory, is now fully operational. The full Alexandra Dock site, including a new harbor for pre-assembly and load-out of wind turbine components, will be fully on stream in 2017. Siemens had employed almost 700 people in Hull so far. A further

100 permanent staff are employed at Alexandra Dock working for Siemens' suppliers and additional recruitment up to a total of 1,000 people will continue into 2017 as the site becomes fully operational. Hundreds more jobs have been created during construction and in the supply chain. The new production site has an area of 540,000 square meters, including an area reclaimed from a wet dock. The new factory itself covers 40,000 square meters and has an optimized material flow based on the Siemens Production System (SPS). Storage, supply chain and assembly work are interconnected with modern database systems to produce 75-meter-long rotor blades for offshore wind turbines of the seven and eight-megawatt class. ■

BlueInGreen Co-founder Scott Osborn Named Engineer of the Year

BlueInGreen co-founder Dr. *Scott Osborn* has been named the Engineer of the Year by the Arkansas section of the **American Society of Agricultural and Biological Engineers (ASABE)**. Osborn, who is also an associate professor of biological and agricultural engineering at the University of Arkansas, was chosen for his ongoing contributions to the engineering profession, both inside and outside of the classroom. In 2004, Osborn and Dr. *Marty Matlock*, a professor of biological and agricultural engineering at the University of Arkansas, co-founded BlueInGreen with support from VIC Technology Venture Development. Osborn holds 12 patents related to gas dissolution for water treatment, wastewater treatment, ecological restoration, oxidation and pH adjustment. "Dr. Osborn has been

BlueInGreen

solutions for water quality

a friend and mentor to the entire team at BlueInGreen, but his impact reaches far beyond this company," said Product Manager *Jessica Hart*. "His ideas, innovation and instruction have directly and indirectly benefited many people around the world." A licensed professional engineer, Osborn served as BlueInGreen's President and Chief Technology Officer during its initial stages as a University of Arkansas startup and worked with its team of engineers to design and implement the company's first commercial installations. BlueInGreen's systems are currently being used at 27 sites in 14 states and Canada, treating over 700 million

gallons of water each day. The company has contributed significantly to the economy of Arkansas through sales revenues, grants and investor funding. Osborn was previously named a Ford Foundation Design Fellow, where he worked to introduce engineering design into the curriculum at the Dwight Look College of Engineering. Osborn is also a recipient of the Massey-Ferguson Educational Gold Medal, awarded for the advancement of engineering knowledge and practice in agriculture soil. He has helped establish biological engineering programs at Louisiana State University, Texas A&M University and the University of Arkansas. ■

APSP & NSPF Boards Announce Unification Process Ends

The Board of Directors of The **Association of Pool & Spa Professionals** and the **National Swimming Pool Foundation®** announced they will not continue with the unification process to consolidate the two organizations. After reviewing the discovery information and recognizing the work and financial investment required to create one unified organization, the APSP and NSPF Boards have decided to align their efforts, where both entities will still remain independent, but strive to enhance the collaboration and synergy between the organizations. They will continue to seek opportunities to work collaboratively to positively impact the aquatics community. In April 2016, the two organizations began unification negotiations with the goal of creating a unified organization

to work as one for the industry. The APSP and NSPF Boards met in person several times throughout 2016 and hired a professional services firm to perform due diligence analysis, facilitate strategic discussions with both boards, and conduct qualitative research with Board members and key volunteer leaders. APSP Board Chairman *Jack Manilla* and NSPF Board President *G. Bruce Dunn* stated: "Both Boards have been diligent, transparent, and tireless in their respective efforts to create a path forward. From the beginning of this process, the goal was to create more swimmers, more swimming pools and more hot tubs that will allow users to gain from the health benefits of swimming activity, aquatic immersion, and hydrotherapy. Although the outcome is not of one unified organization, both APSP and



NSPF recognize and embrace that this is the time to create accelerated change through enhanced collaborative efforts." NSPF will continue to focus on encouraging healthy living through education and research while APSP's focus will remain on protecting the industry through government relations and standards. Both organizations will continue to offer high quality aquatic education central to the success of the industry. ■

New UK Appointment for Pulsar Process Measurement Ltd.

British level and flow measurement and control instrumentation specialists, **Pulsar Process Measurement Ltd**, have strengthened their UK sales team with the recent appointment of *Thomas*



Thomas Lyon, Regional Industry Sales Engineer

Lyon as Regional Industry Sales Engineer. Thomas joins the growing Pulsar team who provide support to customers throughout the UK. Thomas is a recent Electrical Engineering Masters graduate and has previous experience within the Industrial Sales Engineering field. Thomas will be helping to promote Pulsar's world-leading range of non-contacting devices for level and flow control along with sludge blanket detection and non-invasive flow measurement. He will be focused on supporting Pulsar's industrial customers and developing new customer relationships within the Midlands region. *Alistair MacKinnon*, Director of Sales and Marketing, says, "We are excited that Thomas has joined our strong UK sales team and has been absorbing all the knowledge and expertise from

our experienced staff. He'll be further helping us to provide our renowned support to customers and developing the company as we celebrate our 20th anniversary." Thomas is based in the Leicestershire area and is set to marry his fiancé in summer 2017. Pulsar Process Measurement Ltd manufacture, supply and support non-contacting level and flow measurement and control instrumentation. Their products are used extensively within the water and wastewater industry and in many industrial applications where reliable, maintenance-free and robust non-contacting measurement is required. All manufacturing is completed in the UK and the company has offices in the USA, Malaysia and China and a network of dedicated distributors support their products throughout the rest of the world. ■

UltraTab™ Provides High Degree of Mixing in Compact Space

Turbulent blending is the mechanism for mixing in many applications such as Water Treatment and Desalination plants. Oftentimes, there are installation space restrictions, pressure drop limitations and pipe run constraints inherent in the application. Launched in 2013, the Kenics UltraTab mixer optimizes all three of these over competitive designs according to independent testing conducted by **British Hydraulic Research**. The new Kenics UltraTab range of mixers incorporate the latest industry requirements for turbulent flow applications with a high degree of mixing and low head loss in a compact space. This makes the UltraTab ideal for applications in desalination plants. Additives are injected upstream of the element and are charged into the high-

energy dissipation zone of the mixing. The single tab element provides an extremely low pressure drop as compared to other designs, and the mixing is completed to a maximum 0.05 CoV level in less than three pipe diameters downstream of the element. The Carbon Steel construction of the Kenics UltraTab is more robust and cost effective for desalination applications than a traditional Fiberglass-Reinforced Plastic (FRP). This level of performance is achieved by applying 300 µm of either Rilsan® Fusion Bonded Polyamide coating or Scotchkote® 206N Fusion Bonded Epoxy coatings. These coatings have worldwide approval for contact with potable water, are resistant to UV exposure and are more resistant to sea water than other high-cost grades of



Rapid mixing of additive into the main flow

stainless steel. Kenics UltraTab mixers have been supplied for desalination applications in Saudi Arabia, Abu Dhabi, Oman, Spain and the United Kingdom in various diameters from 250 mm to 2100 mm and materials such as coated carbon steel, stainless steel, FRP and duplex stainless steel. ■

New High-Efficiency Pumps for OEMs

March 2017 will see **KSB Aktiengesellschaft**,

Germany, expand its high-efficiency circulator range by launching the Calio SI type series in four design variants.

These are intended for use in heating, air-conditioning and solar power systems where they facilitate automatic operation with constant-pressure or proportional-pressure control as well as operation with 0-10 V setpoint input or external control via PWM signal in accordance with VDMA-Einheitsblatt [Standard Sheet]. On the HMI, Dual and EcoMatch variants the user can select the required mode of operation via two pushbuttons on the control panel. The new pump sets are driven by high-efficiency wet rotor motors whose efficiencies significantly exceed ErP 2015 energy efficiency requirements. Full motor protection with integrated electronics protects the winding from overheating while excellent operating reliability is ensured by an automatic rotor deblocking system and a soft-start function. ■



The Calio SI pumps



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Handheld Sludge Blanket Interface Level Detector Introduced

For operators at municipal and industrial water and wastewater treatment plants, The Sludge Gun®, a handheld sludge blanket interface level detector from **Markland Specialty Engineering**, is a welcome addition to their toolbox. This compact, weatherproof device measures silt/sludge levels in clarifiers, settlement tanks, sedimentation basins, lagoons and ponds, and helps provide valuable sludge/biosolids level profiles. It allows users to monitor sludge bed depth for regulatory compliance and prevention of carryover, and to eliminate unnecessary dredging and pumping. The operator slowly lowers the Markland Sludge Gun® probe into the tank/pond and pulls the trigger to shine a beam of high-intensity infrared light across a gap in the probe to a matching phototransistor sensor. When the beam encounters suspended



The Markland Sludge Gun®

solids, some energy is absorbed, causing the phototransistor to activate a rear-facing speaker on the butt of the gun. As the concentration of suspended solids increases, the audible tone changes in pitch and volume. By observing depth markers on the cable, the user determines the location of both sludge blanket and overlying cloudy layer. A thumb-adjustable sensitivity control allows

the user to detect suspended solids concentrations ranging from light flocs to thick blankets. In addition, features are uniquely suited for specific applications. For example, Model 10-LP detects clear liquid surfaces; high-power Model 10-HP excels at finding the level of sludge in murky lagoons. The spring-loaded trigger turns off the gun, preventing accidental drain on the battery. No calibration is required. ■

Valmont® Irrigation Launches a New Series of Smart Panels

Growers are about to gain smarter, simpler options for controlling and managing their irrigation center pivots. **Valmont® Irrigation** introduces the smartest center pivot control available today with the new Valley® ICON series of smart panels, providing intuitive control for any center

pivot irrigation machine. “With our release of four new control panels, growers will see firsthand the ease of operation with a very simple interface that’s extremely intuitive,” explains *John Campbell*, Valmont Irrigation Manager of Technology Advancement and Adoption. The ICON panels

accommodate irrigators with varying needs. Whether buying a new center pivot, upgrading an existing panel, changing from another brand of center pivot, or switching from a different irrigation method, the advantage of operating an intuitive, full-color touchscreen interface that can be adapted to today’s quick-changing technology is key. Campbell states, “The ICON panels have expanded connectivity on a smart relay board, so they are ready for future upgrades. To bring that technology center stage, each panel comes equipped with AgSense® ICON Link, so all four models are compatible with both AgSense and BaseStation3™ telemetry technology. That makes it easy for growers to view data and control their pivots remotely, whether they’re expanding existing networks or just starting with remote monitoring and control.” ■



The new Valley ICON smart panel

INNOQUA Project Awarded EU Horizon 2020 Funding

The USD7.5 million project aims to provide an innovative, modular and sustainable waste water treatment technology with near zero CO₂ life-cycle emissions. The technology includes novel biological treatment and disinfection modules and is designed to provide safe and affordable sanitation with the flexibility for global application. These technologies resemble natural purification processes and are based on the purification capacity of earthworms (lumbricids), zooplankton and microalgae, and alternatively sunlight exposure. Environmental consultants **Aqua Enviro** and public water utility **Scottish Water** joined the **INNOQUA** consortium as part of the 4-year European research project of 20 partners that is being coordinated by **Nobatek**, a renowned French Research and Technology Organisation. This project has received funding from the **European Union's**

Horizon 2020 research and innovation program under grant agreement No 689817. Aqua Enviro teamed up with Scottish Water as the project directly addresses one of the company's strategic objectives of 'Sustainable Rural Communities'. Demonstration trials both within and outside of the EU are planned in the latter phases of the project, with Scottish Water hosting a demonstration unit. *Paul Lavender*, Business Development Manager at Aqua Enviro says "It's great that the EU has recognized the consortiums really innovative technologies and the impact these could have on meeting the challenges of decentralized wastewater treatment. Aqua Enviro are committed to driving innovation within the water industry, and this project will help us to meet this objective." A key step in the exploitation of any new technology in the water and wastewater sectors is design, installation and operation of prototype



technologies under real conditions. In total, 11 demonstration sites will be used during the project in locations across the world, and each one will run for a year in order to simulate all climatic conditions. Scottish Water will host a demonstration site in a small rural setting in the Scottish Highlands. This site will have a collective sanitation system installed aimed at demonstrating low cost, sustainable, biologically-based waste water treatment for small size housing units (20-30 people) in extreme weather conditions. ■

Crystal Lagoons Targets Qatar's USD7.2 Billion Tourism Receipts

Crystal Lagoons, the multinational water innovation company and developer of the "world's top amenity", has held a series of meetings with prominent Qatari real estate developers as the country looks to capitalize on a growth in tourism numbers and estimated revenues. "Many developers throughout the region are looking for a point of difference and



Carlos Salas, Regional Director, Middle East, Crystal Lagoons

features such as Crystal Lagoons ability to bring the idyllic lifestyle of the beach anywhere in the world not only add to the aesthetic appeal of a destination, it also provides practical recreational and leisure facilities, such as paddle boarding, sailing and kayaking, at low construction and maintenance costs. Essentially, we offer a sound return on investment (ROI), because developers can charge a premium for properties overlooking or even in the proximity of our lagoons," said *Carlos Salas*, Regional Director, Middle East, Crystal Lagoons. According to the **Qatar Tourism Authority**, the country aims to welcome between seven and nine million tourists annually, supported by USD40-45 billion worth of sector investment under the country's National Tourism Sector Strategy 2030 plan, up from an estimated 4.3 to five million in 2022 – when it is set to host the FIFA World Cup. Approximately three

million visitors arrived in 2015. "We have developed our patented technology and a proven business model to ultimately add significant value at a very low cost. Our ultrasonic filtration system means we use less than 2 percent of the energy required by conventional filtration systems, half the water of a park of the same size and 30 times less water than a golf course," said Salas. Showcased for the first time in Doha, Salas unveiled a new film-based evaporation technology. The cutting-edge technology lowers water-waste rates by up to 70 percent, further enhancing Crystal Lagoons' sustainable credentials. Exclusively manufactured in Canada for Crystal Lagoons, the technology consists of adding a special additive to the water which spreads an invisible anti-evaporation layer on the surface of the lagoon. This additive can be used at different water temperatures and withstand wind and rain. ■

DEWA Inaugurates ABB's 315kW Solar Power Plant

Saeed Mohammed Al Tayer, MD & CEO of **Dubai Electricity and Water Authority (DEWA)**, inaugurated **ABB's** new 315 kilowatt (kW) solar power plant, one of the largest of its kind in the region. ABB is a well-known Swiss power and automation technology group. The plant is located in the ABB offices at the Al Quoz industrial area and will produce electricity using solar energy. The energy produced at the plant will supply ABB offices with electricity and transfer surplus energy into DEWA's network. This supports the Shams Dubai initiative, which was launched by DEWA and allows customers to install photovoltaic panels on their rooftops to generate electricity from solar power, and connect the systems to DEWA's grid, creating, producing and using energy. "I am pleased to be here today to inaugurate the ABB 315-kilowatt (kW) solar project, as part of Shams Dubai initiative, and I congratulate ABB on this important achievement which reflects our joint efforts to achieve the directives of His Highness Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai, to diversify energy resources. The UAE now leads global efforts in clean and renewable energy. DEWA



MD & CEO of DEWA during the inauguration

is carrying out the objectives of UAE Energy Strategy for 2050 launched by His Highness Sheikh Mohammed bin Rashid Al Maktoum to increase the share of clean energy in the total energy mix to 50 percent by 2050. The energy mix will include 44 percent from clean energy, 38 percent from gas, 12 percent from clean coal and 6 percent from nuclear power by 2050. We contribute to the objectives of Dubai Clean Energy Strategy 2050 to provide 7 percent of Dubai's total power output from clean energy by 2020, 25 percent by 2030, and 75 percent by 2050,"

said Al Tayer. "Shams Dubai supports the Smart Dubai initiative, and aims to transform Dubai into the smartest and happiest city. And as of mid-January 2017, DEWA has connected a total of 302 photovoltaic systems on building rooftops. To date, 52 consultancy and contracting companies have been registered, in addition to 311 engineers that have been certified as enrolled electrical and solar photovoltaic consultants and contractors. DEWA's training course includes academic and practical training aspects," added Al Tayer. ■

Landfill Leachate Treatment

For the treatment of landfill leachate, **GEZER** was awarded to deliver a containerized 2-step Reverse Osmosis



A containerized 2-step RO plant

(RO) plant to Balakhani landfill in Baku Azerbaijan. The decades of experience in design, delivery and operation of modern technologies for the treatment of landfill leachate and industrial wastewaters as well as the comprehensive and solution oriented approach of GEZER+WEHRLE partnership encouraged the client in his decision to entrust GEZER+WEHRLE partnership with this order. The RO plant is designed to treat 80 m³/d leachate, which is coming from old and new landfills, and to discharge a high quality effluent into a nearby lake. Leachate had high pollution load

especially in terms of heavy metals and salt (conductivity) since the ash produced by a nearby incineration plant was disposed in the landfill. The plant was designed by **WEHRLE Umwelt GmbH**. WEHRLE's Reverse Osmosis technology is based on innovative engineering and the composition of standardized single components with spiral wound membranes of worldwide availability. GEZER constructed and commissioned the containerized RO plant in summer 2016. Plant was then successfully operated. After operation, operation support by remote monitoring was supplied to the client. ■

Four Developing Countries to Get USD44.5m Funding from ADFD

Four renewable energy projects in developing countries in the Pacific and Africa have been identified by **Abu Dhabi Fund for Development (ADFD)** and the **International Renewable Energy Agency (IRENA)** to receive USD44.5 million in funding. ADFD's funding will support a diverse set of projects including a hybrid micro-grid project employing solar PV and advanced lithium-ion batteries, a hydropower project, integrated wind and solar, and a combination project consisting of micro-grid and solar home kits. The announcement of this fourth round of funding by the IRENA/ADFD Project Facility was made at the Seventh Session of the IRENA Assembly. "Over the course of the last four years, the IRENA/ADFD Project Facility has identified path breaking renewable energy projects that are helping to expand access to energy, bolster energy security and provide



صندوق أبوظبي للتنمية
ABU DHABI FUND FOR DEVELOPMENT



sustainable, affordable energy for those who need it most," said IRENA Director-General *Adnan Z. Amin*. "Importantly, this Facility is also putting in place an innovative process which supports transformational and replicable projects that can potentially bring sustainable energy to millions of people around the world." For his part, *Mohammed Saif Al Suwaidi*, Director General of ADFD said: "ADFD is committed towards steadfast development in the renewable energy sector; it's a crucial industry for sustainable continuity, long-term growth and constructive evolution of developing nations. Over seven funding cycles, our USD 350

million partnership, IRENA/ADFD Project Facility, aims to support and enhance the developing world's energy needs by tapping into their abundant renewable energy sources. This collaboration further exemplifies ADFD's mission and commitment to provide governments with the financial resources, tools, methods and instruments to safeguard against future unknowns, grasp opportunities and seize desired development goals." Since 2013, through the IRENA/ADFD Project Facility, USD189 million has been allocated to 19 projects, and has attracted over USD387 million in co-financing for a total of USD576 million in new investment inflow. ■

Yokogawa Wins Control Systems Order for Power & Desalination Station

Yokogawa Electric Corporation announces that its subsidiary **Yokogawa Middle East & Africa** has received an order from the **Sharjah Electricity & Water Authority (SEWA)** to provide control systems for the Layyah Power and Desalination Station. SEWA, the owner and operator of this plant, is an agency of the Emirate of Sharjah, which is one of the states that make up the United Arab Emirates (UAE). SEWA is retrofitting the control systems, auxiliary facilities, and utilities for units 7 and 8 at the Layyah Power and Desalination

Station. Each of these units comprises a 75 MW oil and gas-fired thermal power plant and a 27,000 m³ per day multi-stage flash (MSF) desalination plant. For this project, Yokogawa Middle East & Africa will deliver the CENTUM® VP integrated production control system for the boiler, turbine governor, turbine protection system and the desalination plant at each of these units, as well as the ProSafe®-RS safety instrumented system for burner management and boiler protection. The company will also deliver field instruments such as the

DPharp EJA series differential pressure/pressure transmitter, continuous emission monitoring systems (CEMS), and steam and water analysis systems (SWAS). In addition to being responsible for engineering, the company will provide support for the installation and commissioning of these systems, with all work scheduled for completion by September 2017. This is Yokogawa's first ever distributed control system order for a power and desalination plant in the UAE. In the UAE and throughout the Middle East, demand for electricity and water is soaring due to rapid economic growth. Power and desalination plants that rely on the region's abundant oil and gas resources make up an important part of this region's infrastructure. Backed by this order, Yokogawa will continue working to expand its control business in the power and water infrastructure market. ■

YOKOGAWA



World Future Energy Summit Sees 60% Growth in Buyer Demand

The 10th edition of the World Future Energy Summit (WFES) ended with strong growth in commercial activity surrounding the event and the number of hosted business meetings surging by more than 60 percent. Hosted by **Masdar** as part of Abu Dhabi Sustainability Week, WFES aims to promote the business case for industries involved in sustainable energy, water, and waste management. Organizers say the rapid acceleration in the renewable energy market across the MENA and South Asian market has had a clear impact on business at the event. *Mohamed Jameel Al Ramahi*, Chief Executive Officer of Masdar, Abu Dhabi's renewable energy company, said: "The success of the World Future Energy Summit over the last decade has been built on partnership – on bringing together governments and businesses, and sharing the goal to make renewable energy successful, dependable and commercially viable. We are delighted to have hosted an event that has encouraged such lively debate, based on shared knowledge from around the region and international markets. The event has also helped both new relationships to be forged, and existing relationships at home and abroad to be cultivated. Most importantly, the World Future Energy Summit has once again inspired real decision-making. We can be proud that the 10th edition of this global event has been a successful platform for new agreements, partnerships and initiatives that will take the renewable energy and clean technologies sector forward." While final attendance is yet to be confirmed, early calculations show that the figures will be consistent with pre-show estimates of around 880 exhibiting companies from about 40 countries, and 38,000 attendees from 175 countries. Attendance included around 1675 CEOs from 128 countries.

While the value of most deals signed during the event is confidential, growth in



attendance is outpaced by the indicators of business activity. Calculated at the start of the event's final day, WFES 2017 hosted almost 8,600 business meetings as part of its Business Connect matchmaking program. This compares with around 5,300 in 2016 – a rise of almost 62 percent year-on-year. WFES organizers overhauled their approach to matchmaking this year, offering a dedicated hosted buyer program, a powerful digital matchmaking tool for buyers and sellers that recommended meetings and products, onsite buyer concierge, and product and exhibitor matching booth. Those estimates do not include meetings arranged with official government delegations seeking partners for ambitious renewable energy plans.

As predicted, Saudi Arabia's plans to add almost 10 gigawatts of renewables to its energy mix offered the most immediate business opportunity. WFES organizers arranged tailored meetings between the official Saudi delegation and around 100 developers, investors and technology suppliers. Leading the delegation, the Saudi Energy Minister, *Khalid A. Al-Falih*, confirmed that the first round of tenders for about USD50 billion worth of projects would be launched in two weeks. India's plans to add 175

gigawatts of renewables by 2022 also attracted considerable interest, with a national delegation meeting potential partners in a dedicated India Investment roundtable meeting. India's Energy Minister, *Piyush Goyal*, held private meetings with organizations including Masdar and **DEWA**, along with major players in the Indian renewable energy market such as **AVAADA Energy** and **Mytrah Energy Limited**.

Major announcements at WFES included a joint DEWA and Masdar announcement of plans to start building the third stage of the Mohammed bin Rashid Al Maktoum Solar Park, which at 800 megawatts will be the world's largest PV plant on completion; a USD50-million UAE fund for renewable energy projects in the Caribbean; a cooperation agreement between Masdar, **Qatar Electricity and Water Corporation**, and **Nebras Power** to develop renewable and sustainable energy projects; Masdar's purchase of a 25 percent stake in the pilot Hywind Scotland floating offshore wind farm in the North Sea; and an agreement between Masdar and **Bee'ah** to develop a 300,000-ton waste-to-energy plant in Sharjah. Masdar will also provide consultancy services for the building of a 5 megawatt grid-connected solar power plant in Seychelles. ■

Wilo Middle East Organizes a Customer Seminar in Saudi Arabia

Wilo Middle East FZE, the well-known pump manufacturer Headquartered in Germany, organized a customer seminar at Movenpick Al Khobar in Saudi Arabia. The seminar presented a valuable opportunity for customers to inspect the solutions provided by Wilo for building services, water management and industrial sectors. The seminar witnessed the participation of senior officials from international arms of Wilo SE including *Ioannis Lappas*, Head of Business Development for Water Management, Wilo Dortmund; and *Daniel Busuioc*, Head of Business Development for Water Management, Wilo Hof. Commenting on the seminar; *Khaled Al Salama*, Country Manager KSA, Wilo Middle East stated: "Wilo has always been keen to foster its relationships with its customers, and this seminar provides a unique opportunity to educate the market about our latest technologies, and



The seminar provided customers with valuable insights to Wilo's latest solutions

allows meeting contractors, planners and government authorities. The eastern part of Saudi Arabia is a very promising region and enjoys a great significance for Wilo to enhance its presence and experiences there. We received positive feedback from the audience who attended the seminar, which gave us a push forward to strengthen our presence in this region in

the near future." During his participation, Lappas gave a presentation in which he shed light on Wilo's building services portfolio (water supply), where he showed and defined the building services and the different building types. He showcased various applications and sub-applications in the types of buildings covered by the company today. ■

Qatar Conference Focuses on Energy, Food & Water Security

Texas A&M University at Qatar hosted experts from around the world for the annual QAFCO – Texas A&M University at Qatar Conference 2017. The 2017 conference was presented in cooperation with Texas A&M at Qatar's longtime industry collaborator, the **Qatar Fertiliser Co. (QAFCO)**, which has supported the conference since 2007. *Humoud*



The conference hosted experts from around the world

Al-Mannai, Chief Technical Officer, QAFCO, said, "The QAFCO – Texas A&M Conference 2017 is a melting pot of ideas, conferences such as these will help the youth gain a better understanding of issues us today and hopefully help provide sustainable solutions." Emphasizing on the role of the industry he said, "We believe that industries like ours have a crucial role to play in providing a helping hand to the farmers to help feed the world. Investments in research and technologies, as well as forums for knowledge sharing like this one, can be a big boost to these efforts." This year's conference focused on the interconnection of food, energy and water. As the demand for fresh water, food and energy increases with population growth, economic and technological development, and climate change, this nexus will become even more critical for areas such as Qatar where fresh water is scarce and oil and gas revenues must

be consumed to generate energy for seawater desalination. Sixteen experts from around the world addressed these synergies and trade-offs between water and energy use and food during the one-day conference, which aimed to help ensure water, energy and food security for future generations. The conference featured an impressive technical program, and sessions showcased opinions and research from some of the world's most respected names in the field, including *Dr. Michael Ladisch*, professor at **Purdue University** (USA), and *Fahad Al-Attiya*, legal counsel for the Emir and the Qatar National Food Security Program. The event also provided a forum for the exchange of ideas and opportunities for future collaborations. *Dr. Konstantinos Kakosimos* and *Dr. Sherzod Madrahimov* organized this year's conference with co-chairs *Dr. Hassan S. Bazzi* and *Dr. Ioannis Economou*. ■

2017

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Dubai – UAE

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21 – 23

Parc des Expositions de l'Office des Changes

Casablanca – Morocco

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Aicom Events

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Web: www.solaireexpomarc.com

March

 Saudi Arabia**BUILDEX Dhahran 2017**

Saudi Int'l Building, Construction & Heavy Equipment Exhibition

06 – 09

Dhahran International Exhibition Center

Damman – Saudi Arabia

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Jeddah Centre for Forums & Events

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April

 Turkey**TESKON+SODEX 2017**

International HVAC, Refrigeration, Pumps, Valves, Fittings, Water Treatment & Insulation Exhibition

19 – 22

Tepekule Congress and Exhibition Center

izmir – Turkey

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May

 Turkey**SODEX ANKARA 2017**

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10 – 13

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Ankara – Turkey

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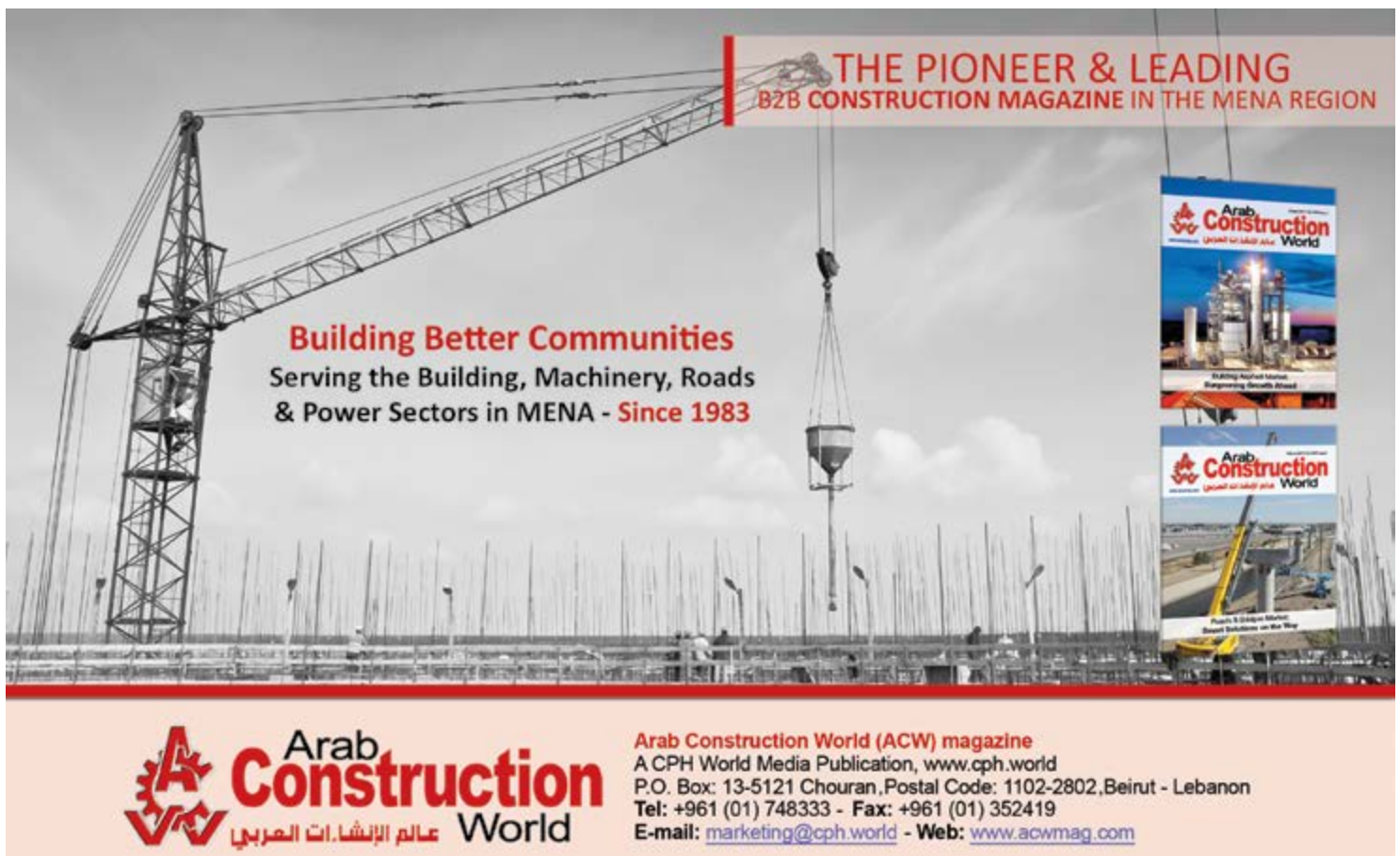
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Time to Act on Water Scarcity

حان وقت العمل لمواجهة تحدي ندرة المياه

Growing water scarcity is now one of the leading challenges for sustainable development, and that challenge is poised to intensify as the world's population continues to swell and climate change intensifies, **FAO** Director-General *José Graziano da Silva* warned. Competition for water will intensify as humanity's numbers exceed 9 billion people around 2050 — already, millions of family farmers in developing countries suffer from lack of access to freshwater, while conflicts over water resources already surpass those tied to land disputes in some regions, he noted in remarks made at the Global Forum for Food and Agriculture in Berlin.

Additionally, climate change is already altering hydrological regimes everywhere, Graziano da Silva said, citing estimates that around one billion people in dry regions may face increasing water scarcity in the near future. These are regions with a high concentration of extreme poverty and hunger. Agriculture is both a major cause and casualty of water scarcity. Farming accounts for around 70 percent of fresh water withdrawals in the world today, and also contributes to water pollution due to pesticides and chemicals. To tackle these challenges, the international community created a standalone sustainable development goal (SDG) on water and wove better management of this key natural resource throughout the entire architecture of the SDGs, Graziano da Silva said. Improved water matter is particularly important to the SDGs related to extreme poverty, hunger and malnutrition, and climate change, he added. "Agriculture and food systems bring all of these global goals together and provide opportunities for a transformational change," he said.

The FAO Director-General urged listeners to rise to the food security challenges posed by water scarcity on two fronts: first, promoting ways to both use less water and use it more efficiently, and secondly, by taking steps to secure access to water — especially for poor family farmers. Doing so will not prevent a drought from occurring, he said, but it can help in preventing droughts from resulting in famine and socioeconomic disruption. "It is time to act. Improved management of natural resources translates into better livelihoods now and in the future," the FAO Director-General urged.

José Graziano da Silva

Director-General
FAO

حذر المدير العام لمنظمة الأغذية والزراعة للأمم المتحدة (الفاو) (جوزيه غرازيانو دا سيلفا) من أن مشكلة ندرة المياه المتفاقمة تشكل أحد التحديات في وجه التنمية المستدامة وقال إن هذا التحدي سيزداد صعوبة مع تزايد عدد سكان العالم وتفاقم مشكلة التغير المناخي. وفي كلمة له في المنتدى العالمي للأغذية والزراعة في برلين، قال دا سيلفا أن المنافسة على المياه ستشدد مع تجاوز عدد سكان العالم ٩ ل مليار نسمة بحلول ٢٠٥٠، مشيراً إلى أن ملايين الأسر المزارعة في الدول النامية تعاني من عدم الحصول على المياه العذبة وأن النزاعات على مصادر المياه قد تجاوزت الآن في عددها النزاعات على الأراضي في بعض المناطق.

وقال إنه علاوة على ذلك، يؤدي التغير المناخي بالفعل إلى تغيير في الأنظمة الهيدرولوجية في كل مكان، مشيراً إلى تقديرات تقول إن حوالي مليار شخص في المناطق الجافة، حيث يتركز الجوع والفقر المدقع، قد يواجهون ندرة متزايدة في المياه في المستقبل القريب. وتعتبر الزراعة مسبباً رئيسياً لندرة المياه وضحية لها في نفس الوقت. إذ تستهلك الزراعة حوالي ٧٠ في المئة من مصادر المياه العذبة حول العالم، وتساهم أيضاً في تلوث المياه بسبب استخدام مبيدات الحشرات والمواد الكيماوية. ولمواجهة هذه التحديات، أوضح دا سيلفا أن المجتمع الدولي تبنى هدف تنمية مستدام خاص بالمياه وصاغ إدارة أفضل لهذا المورد الطبيعي الحيوي في مختلف أهداف التنمية المستدامة. وقال إن الإدارة الأفضل للمياه مهمة جداً لتحقيق أهداف التنمية المستدامة المتعلقة بالفقر المدقع والجوع وسوء التغذية والتغير المناخي. وأضاف: "الزراعة ومنظومات الغذاء تجمع كافة هذه الأهداف العالمية معاً وتوفر الفرص لإحداث التغيير والتحول".

وحث المدير العام للفاو المجتمعين على الارتقاء إلى مستوى تحديات الأمن الغذائي التي تخلقها ندرة المياه وذلك على جبهتين، الأولى هي تطوير طرق لاستخدام مياه أقل وبشكل أكثر فعالية، والثانية هي اتخاذ إجراءات لتأمين الوصول إلى المياه، وخاصة للأسر المزارعة الفقيرة. وقال إن مثل هذا العمل لا يمنع حدوث جفاف وحسب بل يمكن أيضاً أن يمنع هذا الجفاف من أن يؤدي إلى المجاعة والمشكلات الاقتصادية والاجتماعية. وقال دا سيلفا: "حان وقت العمل. الإدارة الأفضل للموارد الطبيعية تؤدي إلى سبل معيشة أفضل الآن وفي المستقبل".

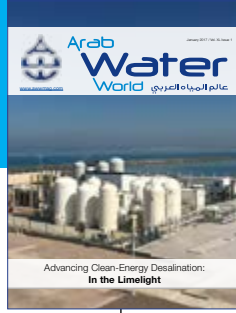
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