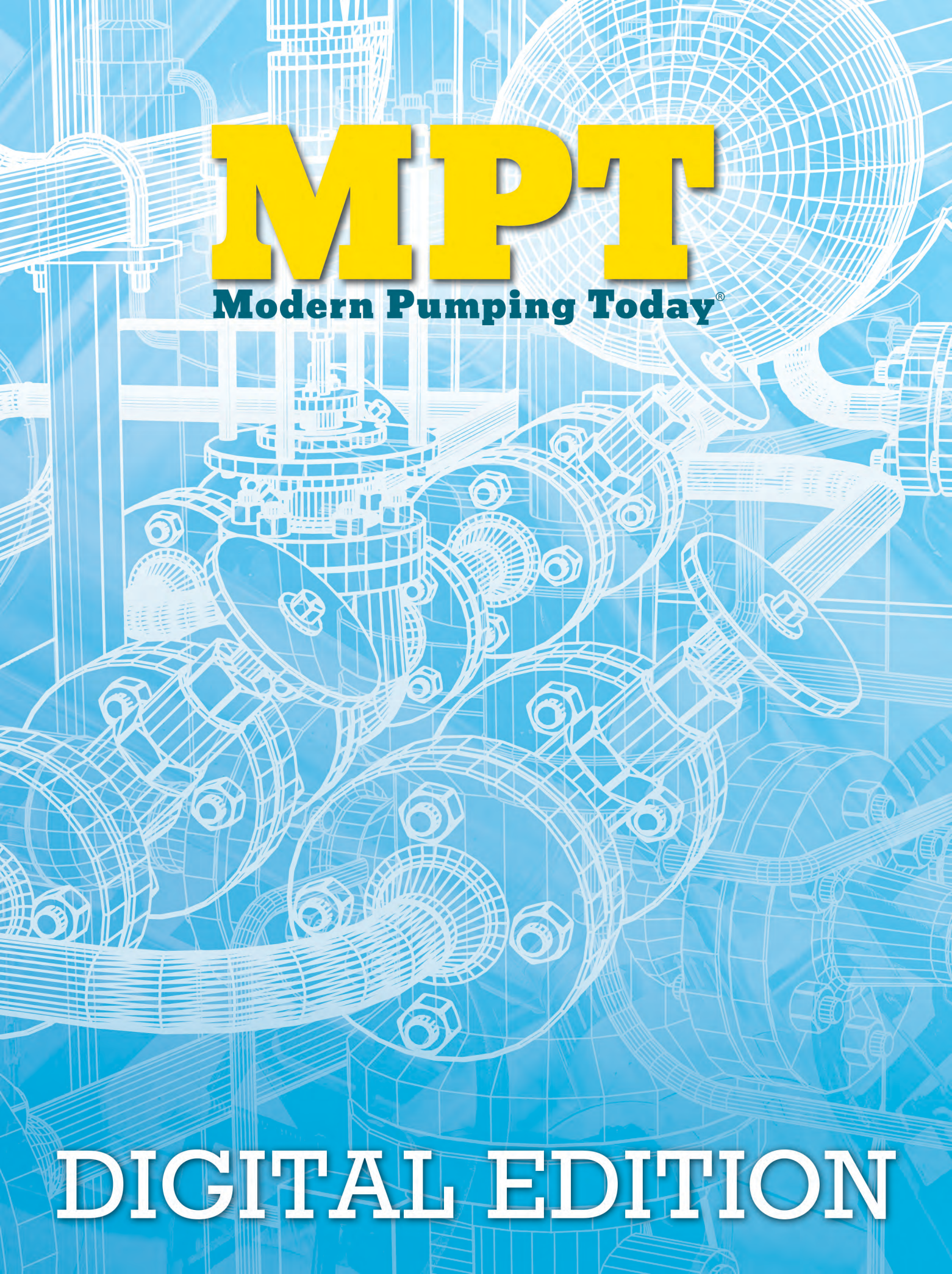
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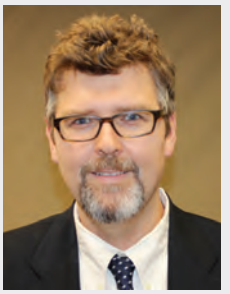

J. Campbell, Editor
Modern Pumping Today

Welcome to a new year and a new issue of MPT. Kicking this issue off in our Case Studies section, Sulzer's Susanne Bromert identifies how a Dutch utility is investing in new infrastructure to improve the performance of its wastewater treatment systems while also reducing its impact on the environment (pg. 20). The utility is aiming to become energy neutral by 2030, and Sulzer technology is helping it to realize this goal.

Water operators have long been stewards of an essential resource, but today's water systems are also major sources of global greenhouse gas emissions. Austin Alexander, Xylem's chief sustainability officer, offers insight on how water utilities can cut emissions in half and help decarbonize the water sector in this month's Water & Wastewater Focus (pg. 24).

Also, momentum for digital technologies in lab research is growing and was accelerated by the COVID-19 pandemic, which caused researchers to rapidly adopt digital tools and rethink their current processes. In "The Lab of the Future" (pg. 32), a team from Lux Research lay out a roadmap for adopting digital technologies in research and development across several industries.

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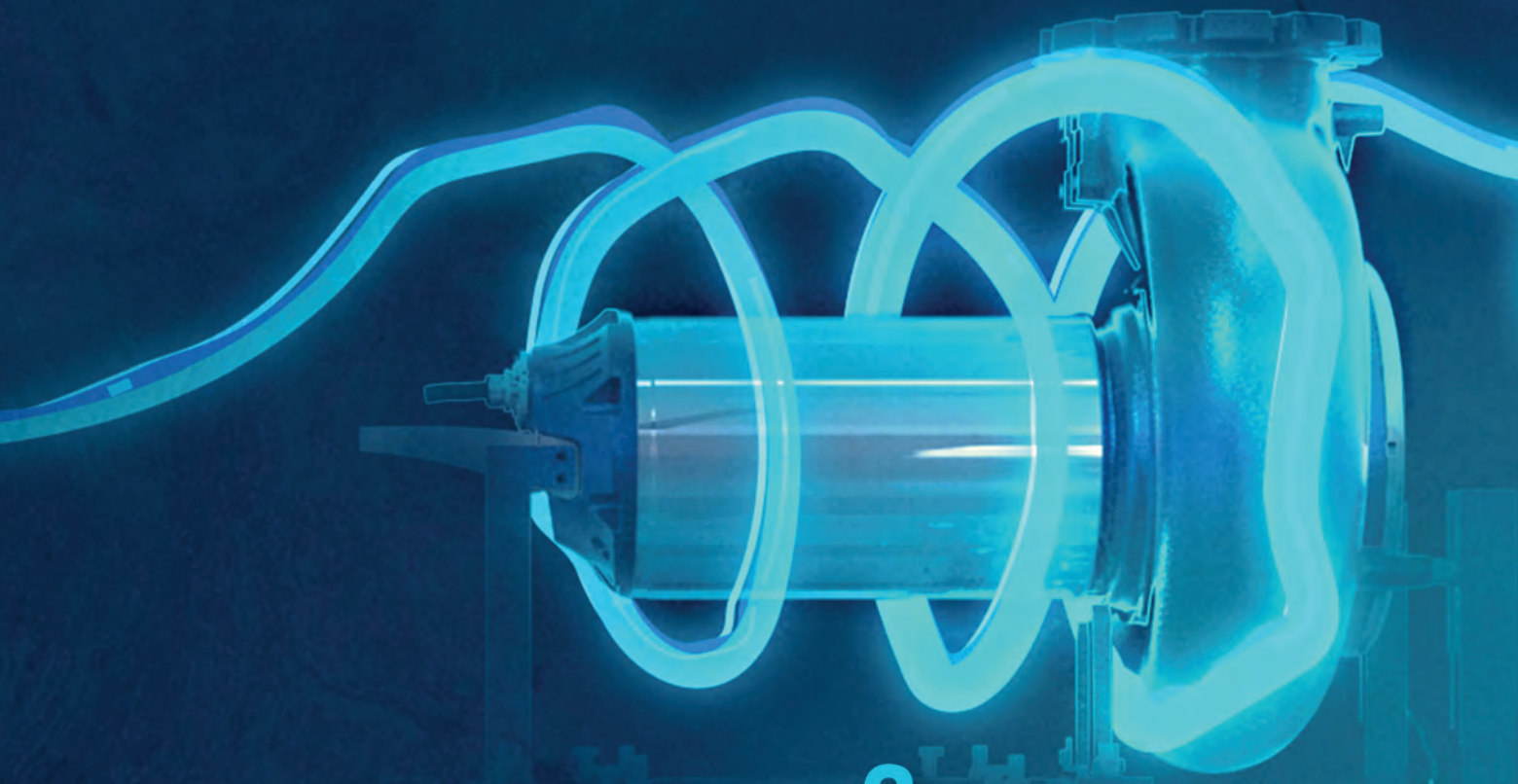

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KP ENGINEERING APPOINTS NEW PRESIDENT AND CEO

KP Engineering has named William E. (Bill) Preston as its new president and chief executive officer. Based in both Tyler, Texas, and in Houston, Preston has served as KPE's president and chief operating officer since 2015. During that time, he has been responsible for leading significant growth and upholding KPE's core operational values of respect and integrity. As CEO, he will be responsible for the overall direction, execution, and global expansion of KPE.

Preston is a recognized process industry leader with thirty-four years of experience successfully leading and growing technology-based businesses in the engineering, oil and gas, energy, and chemical production sectors, including Texaco and GreatPoint Energy.

Preston comments, ''I am proud to work alongside a talented group of industry professionals that are dedicated to engineering our customers' success, and I look forward to overseeing exciting developments and global growth within KPE through 2022 and beyond.''

Preston is joined in executive leadership by Michael Roberts, senior vice president of operations; Mahesh Thadhani, senior vice president of business development; Doug Schnittker, vice president of projects; and Ken Fischer, vice president of technology.

SHIMIFREZ INC. EXTENDS AS9100 CERTIFICATION TO INCLUDE SECTION 8.3 DESIGN AND DEVELOPMENT

Shimifrez Inc. announces it has secured AS9100 Section 8.3 certification for design and development ahead of its plans to introduce a series of components to redefine manufacturing protocols for the aerospace and automotive industries. Developed by the SAE and the IAQG, the AS9100 standard codifies the quality management system requirements for companies that design, develop, or manufacture aviation, space, and defense products.

A recognized global leader in designing and manufacturing, Shimifrez creates precision photo-etched, electroformed, thin and thick sheet metal parts for a wide variety of industries, from life sciences to automotive, and aerospace.

"We're extremely happy to announce this AS9100 extension," adds Hassan Nojoumi, president of Shimifrez. "We've been in the precision sheet metal parts business for quite a while now and we've certainly discovered a thing or two about manufacturing and design. We've been quietly developing a range of proprietary processes and products specifically engineered to effectively reduce weight and boost efficiency for both the aerospace and automotive industries. The new certification will allow us to unveil and rollout these designs in the coming months, offering them as innovative solutions."


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EXPANSION AND INVESTMENT SPUR JOB GROWTH AT INVERT DRIVES

Invertek Drives will create an expansion to its global variable frequency drive (VFD) manufacturing and distribution center, along with the development of a new Application Center. The expansion will create eighty-five new jobs over the next twelve months on top of the 280 people already employed at the global headquarters and follows a major recruitment drive over the past year in both its production and research and development departments.

Shaun Dean, CEO of Invertek Drives, says, ''We've seen significant growth in sales and turnover over the past eighteen months despite the global pandemic. Invertek's approach to maintaining strategic stock of components has ensured we've been able to continue manufacturing our Optidrive range of VFDs despite the global supply chain problems currently facing many manufacturers.''

The company designs and manufacturers VFDs used for the accurate control of electric motors used in many applications and industries globally. These range from conveyors to CNC machines, HVAC and ventilation systems, to water pumping applications. The VFDs are also major contributors to creating energy savings and reducing associated carbon emissions in processes by making electric motors more efficient.

SEEQ ANNOUNCES INDUSTRIAL DIGITALIZATION AGREEMENT WITH ARAMCO

Seeq Corporation, a provider of manufacturing and Industrial Internet of Things (IIoT) advanced analytics software, has reached an agreement with Saudi Aramco to further expand its operational analytics strategy as part of the company's ongoing Digital Transformation program. The agreement will provide Saudi Aramco engineers and subject matter experts with Seeq's self-service analytics, predictive modeling data analytics, and visualization tools.

''Seeq is empowering our engineers and subject matter experts with easy-to-use analytics tools to truly democratize data science. We see this as a key element for scaling operational analytics across the organization,'' says Walid A. Al-Naeem, manager of process and control systems department, Saudi Aramco.

''We are pleased to partner with crucial solutions and services (CSS) to collaborate on Aramco's industrial digitalization initiatives,'' adds Lisa Graham, CEO of Seeq. ''We will do this by leveraging big data, machine learning, and computer science innovations.''

Seeq recently announced closure of a $50 million Series C funding round, led by global venture capital and private equity firm Insight Partners, including participation from existing investors Altira Group, Chevron Technology Ventures, Cisco Investments, and Aramco Ventures.

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VOITH REPORTS STRONG ORDERS RECEIVED THANKS TO FOCUS ON SUSTAINABLE TECHNOLOGIES

The Voith Group has again successfully managed the effects of the coronavirus pandemic and was able to improve its main financial figures in a challenging market environment characterized by global supply chain bottlenecks and substantially higher raw material costs. The Voith Group's orders received increased by almost a quarter, due mainly to the successful large plant business and was higher than it has been for almost a decade on the reporting date of September 30, 2021.

Dr. Toralf Haag, CEO of the Voith Group, explains, "Our much higher orders received show that our strategic alignment focusing on the megatrends of digitalization and decarbonization has been the right approach. There is growing demand for sustainable technologies for a climate-neutral industrial society, and Voith is in an excellent position to benefit from this."

In terms of sales, in the last fiscal year, Voith almost completely made up for the downturn that occurred in the first year of the pandemic with an increase in consolidated sales of 4 percent adjusted for currency effects. This was also facilitated by the acquisitions of the previous years. Voith is making also progress with tapping into new business segments, such as the international wind turbine business.

SUNDYNE APPOINTS NEW CHIEF HUMAN RESOURCES OFFICER AND VICE PRESIDENT OF ENVIRONMENTAL, HEALTH, AND SAFETY

Sundyne announces that Rodney Vinegar has joined the company as new chief human resources officer and vice-president of environmental, health, and safety. In this role, Vinegar will enhance the professional development of Sundyne's global workforce. The team he leads will guide Sundyne's growth by attracting additional talent that fits Sundyne's culture.

Vinegar brings extensive human resources and leadership experience to Sundyne. He most recently worked at the Brace Industrial Group of Houston, where he developed and led the successful execution of a multi-year HR strategy. During his twenty-five-year professional career, he has been responsible for talent management, professional development, HR strategy, merger integration, workers' compensation, safety processes and policies, labor relations, and HR operations with global companies including UBS Investment Bank, Colgate Palmolive, Sanofi, PepsiCo, and Ashland Chemical.

"Rodney is a seasoned executive who knows how to build world-class teams, and his experience in the areas of professional development, M&A, and change management will serve Sundyne well," says Sundyne's CEO Mary Zappone."

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ASHRAE WINTER CONFERENCE AND AHR EXPO

This combined event shows off the best in the heating and ventilation industry

2022 ASHRAE WINTER CONFERENCE AT A GLANCE

WHEN: January 29–February 2, 2022

WHERE: Caesars Palace, Las Vegas, Nevada

WEBSITE: www.ashrae.org

AHR EXPO AT A GLANCE

WHEN: January 29–February 2, 2022

WHERE: Las Vegas Convention Center, Las Vegas, Nevada

WEBSITE: www.ahrexpo.com

After previous events were rescheduled or hosted virtually during the past two years, the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) announced that its 2022 Winter Conference as well as AHR Expo will occur simultaneously—both as an on-site event January 29 through February 2, 2022, in Las Vegas, Nevada, and as an online hybrid learning opportunity.

With more than 50,000 members from over 132 nations, ASHRAE is a diverse organization dedicated to advancing the arts and sciences of heating, ventilation, air conditioning, and refrigeration to serve humanity and promote a sustainable world.

The physical portion of the conference will be held at Caesars Palace, where HVAC&R professionals can participate in-person for this highly anticipated conference offering the latest industry updates, a chance to reconnect with peers, attend the AHR Expo, and more. Although several conference offerings will also be made available online, this combined event in Las Vegas will mark ASHRAE's first large in-person event since the COVID-19 pandemic.

THE BEST OF BOTH WORLDS

In-person attendees can expect typical ASHRAE Winter Conference offerings in terms of social events, tours, and the much-ballyhooed Technical Program. Virtual attendees will have access over a dozen livestreamed sessions via the conference's virtual environment that will undoubtedly look familiar to attendees of ASHRAE's 2020 and 2021 virtual conferences.

Additionally, virtual or hybrid committee meetings can be accessed online by ASHRAE members. Once the meeting is selected, attendees can click "Enter Session" on the date and time of the meeting to join remotely. Whether a member is in Las Vegas or half a world away, ASHRAE is committed to ensuring participation across the heating, ventilation, air conditioning, and refrigeration industry.

Furthermore, all attendees, both in-person and virtual, will receive access to the "Virtual Conference Environment," where all registrants can access livestreamed sessions, playbacks of livestreamed sessions, and all audio recordings synced with slides of all sessions within the Technical Program for on-demand viewing as well as downloadable conference papers and the opportunity to chat with conference sponsors.

COMMITMENT TO LEARNING AND SAFETY

ASHRAE is also is working to provide small tour experiences for in-person attendees to visit the facilities that support the city's infrastructure and related businesses. The tours range from large public works efforts to the cutting edge of HVAC&R technology in action.

Attendees can tour the River Mountains Water Treatment Facility, which began delivering treated Colorado River water from Lake Mead to the Las Vegas valley in 2002. Currently, the facility can treat up to 300 million gallons of water per day but was designed to expand to meet Southern Nevada's needs. In the future, the River Mountains facility will be able to treat up to 600 million gallons of water a day. The facility uses ozonation and sodium hypochlorite to disinfect the water. The treatment facility received the Partnership for Safe Water's Excellence in Water Treatment award in 2018, making the Southern Nevada Water Authority only the fourteenth of the nation's 50,000-plus water systems to earn this elite designation.

For attendees looking to explore the flexibility and adaptation of local business, another tour offers a look at the Resorts World central utility plant, which started its life in 2007 as part of the failed Echelon Casino project. The central plant was designed by JBA Consulting Engineers and constructed by Bombard Mechanical. The Rockwell Group purchased the central plant, and it was intended to operate as a separate entity, selling BTUs to the Echelon Casino. The 2008 Great Recession put a halt on the Echelon project. The hotel tower was stopped at the foundation and construction on the low-rise casino had yet to begin. However, the central plant was 80 percent constructed with major equipment in place.

Finally, take a look at one of the Western United States' growth industries and enjoy a behind-the-scenes tour of the world's largest marijuana dispensary and entertainment complex featuring the world's first marijuana production display kitchen. Discover how the marijuana industry utilizes C1D1-rated systems to provide butane and ethanol THC extraction and distillation, infusion technology including brewery/beverage creation and packaging, gummy candy kettle use, and chocolate bar molding and cooling tunnels.

EARN PDHS/CEUS

In addition to what attendees can learn off-site, the ASHRAE Learning Institute (ALI) will offer a full slate of instructor-led seminars and short-courses during the Winter Conference and AHR Expo. Attendees can choose from six-hour, three-hour, and two-hour courses on topics related to the latest technology and trends affecting the HVAC&R industry. Professional Development Hours and Continuing Education Units are available.

2022 INDUSTRY OUTLOOK

SWPA's annual member survey casts a positive light on the future

BY ADAM STOLBERG, SWPA EXECUTIVE DIRECTOR

Every year, the membership of the Submersible Wastewater Pump Association gathers their opinions for the organization's Industry Outlook Survey, which presents a unique forecast based on professionals' input. SWPA members span the submersible wastewater pump industry—including recognizable brands such as Crane, Flygt, KSB, Sulzer, and more—and embody a spirit of collaboration and professionalism. Therefore, SWPA's annual member survey has an established reputation as a voice to listen to.

A LOOK BACK

Before we talk 2022, let's go back to the expectations our members had for the past year. Some of the key factors SWPA members targeted in the 2021 version of the survey ended up being prophetic, including a rise in infrastructure funding and a highly fluctuating workforce participation rate. Factors specific to 2021 also tied into changes for the submersible wastewater pump industry, such as shortfalls in product deliverability and availably, the impact of work-from-home employees, and COVID-19 vaccine distribution.

One constant refrain we heard from members looking back on 2021 was a good news/bad news scenario: they were busier than ever, but it took longer than normal to fill an order. With that said, SWPA members reported that numbers were positive across several segments. For example, grinder pump shipments saw positive growth both for small units (2 horsepower and below) and larger ones (greater than 2 horsepower).

LOOKING FORWARD

Building off those numbers, SWPA membership projects continued growth in pump orders for 2022, albeit tempered somewhat when compared with the dynamic surge in purchases from the previous year. For example, members expect grinder pump offerings to continue to expand. As more individuals work from home, demand will increase for these pumps to take on the rise in flushables entering residential wastewater streams.

Additionally, according to the survey, SWPA members are bullish on the future of solids-handling pump shipments—forecasting increases across the entire field, ranging from 3-inch to greater than 12-inch discharge units. Even though these units are losing market share to grinder and chopper pumps, the stable and reliable reputation these pumps have earned across the industry makes them a highly sought-after purchase for infrastructure projects, which bodes well for this segment in an era of increased government project funding.

Whether we're talking about grinder pumps or more traditional wastewater handling options, the common thread is the constantly growing number of clogs in municipal streams. For some municipalities and private concerns, this will mean switching out older systems with newer grinder or chopper designs. Similarly, those systems who continue with traditional solids-handling pumps will also be chasing down innovation, only in this case it will be inventive and more powerful anti-clog impeller designs.

TRENDS BEYOND 2022

SWPA membership also shared their thoughts on big-picture concerns for the submersible wastewater pump industry. Recent years have brought forward an emphasis on premium and ultra-premium efficiency motors, and our members see no reason for that to slow down. In fact, given the increasing adoption of IoT devices for data capture and remote monitoring, submersibles should be on the precipice of a golden age of improved performance and efficiency.

For example, system monitoring is gaining—and hopefully will continue to gain—widespread use throughout the United States pump market. Members also report an expanded use of remote systems, including artificial intelligence.

FACING THE CONTRADICTIONS

Another long-term trend is the growing contradiction of improving quality of and access to water in the face of an aging infrastructure. On the one hand, a growing population is good for demand throughout the domestic pump market, but there are several factors outside the industry's control. Those include a shortage of raw materials, limitations of product availability, continued long lead times, and the logistical cost concerns that pop up throughout every step of infrastructure breakdowns.

However, SWPA members also forecast several strategies the industry can take to face down these potential problems. For one, increased motor efficiency should bring down life-cycle costs for pumps across the board. Additionally, preventative maintenance programs have presented themselves as an alternative to the pump-replacement business model. These two trends can come together to create new revenue opportunities for several markets as manufacturers adopt more AI and virtual tools to bring down maintenance and operating costs.

THE FUTURE IS BRIGHT

Overall, buttressed by increased government funding and growing demand, the outlook is very good for the submersible wastewater pump industry. Although, SWPA members report they are experiencing an excessive backlog due to supply chain issues, many projects that were previously delayed are now starting up again. Furthermore, they report customers are seeking out complete "package systems" from one manufacturer as a hedge against long lead times and high prices that might result from building a system from several different suppliers.

Hopefully, 2022 will be the turning point where the pandemic and its related supply chain issues can be put behind us. Although it may take months to undo the damage these slowdowns have brought, the future is bright for the submersible wastewater pump industry.

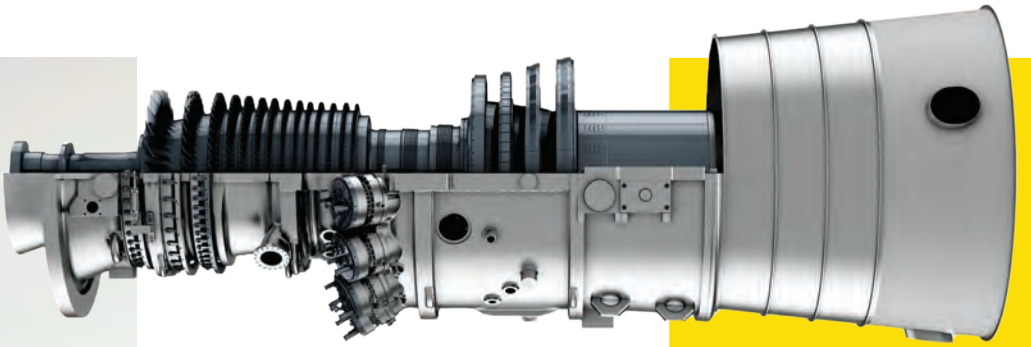
CHARGING UP A HYDROGEN-BLENDED NATURAL GAS FUELED POWER PLANT

GE 9HA heavy-duty gas turbines support China's decarbonization roadmap

BY LAURA ARESI AND JUNE CONG, GE GAS POWER

A new power plant is expected to deliver 1.34 gigawatts of electricity to China's Guangdong province and steam for the industrial process of the chemical complex present in Huizhou, and a powerful partnership from GE and Harbin Electric Corporation will play a vital role. In late 2021, the two companies announced that Chinese state-owned power utility Guangdong Energy Group Co., Ltd. has ordered two GE 9HA.01 gas turbines for its Guangdong Huizhou combined cycle power plant in Guangdong province, in the Greater Bay Area.

Expected to burn up to 10 percent by volume of hydrogen blended with natural gas upon start of operation, the gas turbines will be the first to burn hydrogen blended with natural gas in mainland China. The project is expected to be operational in 2023 providing 1.34 gigawatts of power to the Guangdong province, which is an agglomeration of cities, to strengthen international cooperation and promote lower-carbon, inclusive, coordinated and sustainable development. Harbin Electric Corporation will also provide steam for the industrial process of the chemical complex present in Huizhou. The project marks first GE 9HA.01 gas turbines blending



hydrogen in mainland China and first manufactured from GE-Harbin Electric HDGT joint venture in Qinhuangdao

ROADMAP TO DECARBONIZATION

China is committed to the coal-to-gas transition and implementing its policy to reduce coal's share to under 58 percent of the energy mix. Hydrogen-blended natural gas-fired generators have the lowest CO_2 emissions of all fossil power generation fuels—a 10 percent hydrogen-blended natural gas-fired combined cycle plant has roughly 40 percent of the CO_2 emissions of a similarly sized coal plant, and lower emissions levels for other pollutants such as mercury, NOx, SOx, and particulate matter.

"GE has long been our preferred partner when transitioning our power plants from coal to natural gas, exceeding our expectations in projects such as our Dongguan Ningzhou power plant" a representative of Guandong Energy Group adds.

"In Guangdong, we focus on meeting the growing electricity and steam needs while reducing carbon emissions, and we are proud our plant will be GE's first hydrogen-blended natural gas fueled facility in mainland China. This project will be foundational in promoting the use of hydrogen blending in power generation across other provinces."

"GE sees hydrogen-blended natural gas serving as a catalyst accelerating the world's efforts towards decarbonizing the power generation sector," says Ma Jun, utility sales general manager of GE Gas Power China. "We are pleased that Guangdong Energy Group once again has selected our H-Class technology to deliver highly efficient power generation that will emit even less carbon when blended with hydrogen. The units will initially operate on a blend of up to 10 percent hydrogen by volume, with potential for an increase in future."

A PIONEERING PROJECT

The project marks the first localized 9HA.01 manufactured by General Harbin Electric Gas Turbine

PARTNERSHIP PROFILE: GE AND HARBIN ELECTRIC

GE Gas Power has continuously deepened its cooperation with its local partner, establishing a strategic partnership with Harbin Electric. The two companies established Qinhuangdao Energy Service Center in 2004, focusing on the maintenance and services of heavy-duty gas turbines hot gas path components. At present, the repair center has carried out the repair work of heavy-duty gas turbines hot gas path components worldwide and has become one of the most important enterprises in GE global supply chain.

From 2017, GE Gas Power entered this strategic partnership to build a gas turbine manufacturing joint venture in Qinhuangdao. Both of the 9HA.01 gas turbines to be installed in the Guangdong Huizhou combined cycle power plant will be built at the GE-Harbin Electric joint venture in mainland China. GE has long operated with a commitment to a comprehensive localization structure that effectively increases GE's responsiveness to customer needs and reduces the cost of new units and services.

THE POWER OF MODULARITY

GE's HA gas turbine auxiliary systems are pre-configured, factory assembled and tested modules engineered to reduce field connections, piping, and valves. This translates to a simpler installation that reduces field schedule and installation quality risks while improving overall installation times—up to 25 percent quicker compared to GE F-class gas turbine enclosures.

(Qinhuangdao) Co., Ltd. in mainland China. The joint venture was formed in 2019 between GE and Harbin Electric as a joint effort to focus on heavy duty gas turbine localization, aiming to deliver efficient and reliable support for China natural and hydrogen-blended gas power plants. In addition, Harbin Electric will provide steam turbine, generator, and balance-of-plant equipment for the Guangdong Huizhou power plant.

GE's H-Class gas turbine portfolio currently has the capability to burn up to 50 percent by volume of hydrogen when blended with natural gas. This capability is enabled by the DLN2.6e combustion system that is standard on current 9HA.01/9HA.02/7HA.03 gas turbines offerings. The technology in this combustion system was developed as part of the U.S. Department of Energy's High Hydrogen Turbine program, and enabled combustion of high hydrogen without diluent. This technology has enabled the DLN 2.6e combustion system to operate on blends of natural gas and hydrogen, and GE has a technology roadmap to achieve 100 percent hydrogen in this platform.

A LEGACY OF PROVIDING POWER

GE and Harbin Electric have been suppliers for Guangdong Energy Group for many years. GEG selected GE's two 9F gas turbines for Xinhui Power Plant. Additionally, GE is currently supporting the plant operator's transition from coal-to-gas at its Dongguan Ningzhou power plant. GEG selected GE's three 9HA.02 gas turbines and Harbin Electric's stream turbine, generator and other auxiliary equipment for the Dongguan Ningzhou combined cycle power plant in Guangdong province, also in the Greater Bay Area.

GE Gas Power serves over 100 customers' needs for more than 200 gas turbines in mainland China, with an installed power capacity of 46 gigawatts. Built on 129 years of heritage, industry expertise, and leadership, GE Gas Power is among the first international manufacturer and supplier of gas turbine technology to enter China.

GE Gas Power is a world leader in natural gas power technology, services, and solutions. Through relentless innovation and continuous partnership with our customers, we are providing more advanced, cleaner, and efficient power that people depend on today and building the energy technologies of the future. With the world's largest installed base of gas turbines and more than 670 million operating hours across GE's installed fleet, we offer advanced technology and a level of experience that's unmatched in the industry to build, operate, and maintain leading gas power plants. For more information, visit **www.ge.com/power/gas**.

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ENSURING THE RIGHT MIX

New technology plays a key role in an innovative bio-power plan

BY SUSANNE BROMERT, SULZER

A total of five SCABA agitators were installed in the reactor tanks.

The Rivierenland Water Authority in the Netherlands is investing in new infrastructure to improve the performance of its wastewater treatment systems while also reducing its impact on the environment. The utility is aiming to become energy neutral by 2030, and Sulzer technology is helping it to realize this goal.

The newly expanded Sleeuwijk wastewater plant serves around 64,000 people and has been designed to optimize the performance as well as efficiency of sewage treatment in western Rivierenland. Consolidating three older wastewater facilities into one, an important part of the rationale for the new treatment plant was the opportunity to install a more efficient sludge digestion facility where methane gas is upgraded to natural gas quality, after which, it is introduced into the Dutch natural gas network.

ENTER THE ENERGY FACTORY

The "Energy Factory" at Sleeuwijk is one of the first facilities of its type to use Ephyra technology, an innovative approach to sludge digestion that offers greater capacity in a smaller space. Developed by Royal Haskoning DHV, this process breaks down sludge more effectively than conventional reactors, increasing gas production by 20 to 30 percent. The system requires fewer chemicals for sludge thickening and generates

an end-product that is easier to dewater before disposal. In addition to the sludge generated on-site, the Sleeuwijk energy factory is also designed to process material shipped in from a number of smaller wastewater treatment plants in the west Rivierenland region.

The Ephyra system uses the plug-flow digestion concept. The reactor vessel at the Energy Factory is divided into three compartments, with sludge moving between the compartments under computer control. The concept allows the different stages of digestion to be optimized separately, maximizing the efficiency of the process while reducing dwell time in the tanks to as little as seven and a half days in the Ephyra reactor and seven and a half days in the after digester.

SULZER IN THE MIX

In order to work effectively, the Ephyra system relies on efficient mixing of the material in each tank compartment. After searching the market for possible solutions, the main contractor selected Sulzer as a key supplier and technical partner for the project. Flow through the system is highly complex, impacted both by the performance of the mixers and the effect of the pumps that move material between the tank compartments. Using computational fluid dynamics (CFD) simulations, Sulzer wastewater treatment specialists developed a customized sludge mixing approach that met the project's requirements for performance and energy efficiency.

The Sulzer solution uses a combination of five top-entry SCABA agitators, ranging in size from 2.2 kW to 11 kW. Since the reactor tanks produce potentially explosive gases, each unit is built to Zone 1 ATEX specifications.

After digestion, the sludge is pumped to another tank for concentration and nitrogen removal using the NAS-ONE anaerobic ammonium oxidation (anammox) process. In this part of the system, air is blown through the sludge to remove excess nitrogen, and once again, the contractor responsible for the work called on Sulzer's expertise. Compressed air for this process is generated by two highly efficient HST 2500 turbocompressors, and enters the bottom of the tank through 480 DDS PRK 300 disc diffusers, arranged in three banks. One of Sulzer's floor-standing flow boosters, the XSB 2232 LX, further ensures efficient mixing of air and sludge in the NAS-ONE system.

The annamox process uses 480 disc diffusers supplied by two HST 2500 turbocompressors.

The floor-standing flow booster optimizes the sludge and air mixing process.

Compressed air for this process is generated by two highly efficient HST 2500 turbocompressors.

The configuration of the disc diffusers and pipework was designed by Sulzer for optimal efficiency.

Elsewhere on the site, two XFP submersible pumps were installed in a sewerage pumping station and two others are responsible for pumping effluent to a buffer tank, from where it is transferred to the heat pump by one of Sulzer's SNS pumps.

A PARTNERSHIP TO BE PROUD OF

Execution of the whole project required Sulzer's teams to work closely with the different contractors responsible for the Ephyra and NAS-ONE systems, delivering and installing equipment in accordance with the tight build schedules. Controls for the plant are complex and highly integrated too, with all equipment on-site connected to a master SCADA system. In the case of the NAS-ONE in particular, the HST compressors require extremely precise control to ensure the correct volume of air is always sent to the system, a feature that is built in to these products.

Construction and commissioning of all the equipment was completed on schedule during 2020. The Energy Factory began full operation at the beginning of 2021 and has been performing efficiently since.

Sulzer is a global leader in fluid engineering that specializes in pumping, agitation, mixing, separation, and application technologies for fluids of all types. Sulzer customers benefit from a commitment to innovation, performance, and quality and from the company's responsive network of 180 world-class production facilities and service centers across the globe. For more information, visit **www.sulzer.com**.

WATER UTILITIES MOVING FAST TOWARD A ZERO-CARBON FUTURE

How will water utilities cut emissions in half and help decarbonize the water sector?

BY AUSTIN ALEXANDER, XYLEM

Water operators have long been stewards of an essential resource, and water infrastructure is a cornerstone of every prosperous economy. But today's water systems are also major sources of global greenhouse gas (GHG) emissions. Water utilities account for approximately 2 percent of GHG emissions—the equivalent of the world's shipping industry. And this figure is set to spiral as utilities work towards the United Nations' Sustainable Development Goal of universal access to water and sanitation by 2030.

Assessments by Xylem and our partners indicate utilities could dramatically reduce electricity- and process-related GHG emissions across water and wastewater infrastructure—quickly and cost-effectively—using existing, high-efficiency technologies. A growing number of utility operators are committing to "net-zero" emissions targets, along with detailed route-maps to achieve them. Efficient technologies—together with changes in process, policy and practice—can drive rapid progress without adding costs to current operations.

By embracing these opportunities today, utilities can free up capital to fund water and wastewater infrastructure upgrades at the same time as they reduce their GHG emissions. As a sector built on serving communities and protecting the environment, it is time for water to take its place in the greater climate discussions—and lead the way with action. The water

WASTEWATER COLLECTION		
THE SOLUTION	HOW IT WORKS	HOW IT CONTRIBUTES TO RACE TO ZERO
Intelligent wastewater pumping systems	Clog-free pumping systems reduce inefficiencies, eliminate emergency call-outs for sump cleaning	• Maximizes energy efficiency potential • Cuts energy use by 70 percent in wastewater pumping • Reduces fossil fuel combustion and carbon emissions from emergency service mileage
Real-time decision support systems	AI-based wastewater networks ensure best management of hydraulic volume, eliminate sewer overflows	• Maximizes energy efficiency potential • Enables monitoring and modeling of process optimization • Reduction of carbon emissions from unnecessary construction

WASTEWATER TREATMENT		
THE SOLUTION	HOW IT WORKS	HOW IT CONTRIBUTES TO RACE TO ZERO
Real-time decision support systems	Treatment system optimization ensures compliance with treatment permits and reduces energy and chemical use	• Enables monitoring and modeling of process optimization • Cuts energy use by up to 30 percent • Reduces chemical use in biological activated sludge treatment
Real-time decision support systems	AI-based wastewater networks ensure best management of hydraulic volume, eliminate sewer overflows	• Maximizes energy efficiency potential • Cuts energy use by up to 25 percent compared to conventional mechanical mixers • Enables monitoring and modeling of process optimization • Reduces process emission of GHG by limiting production of nitrous oxide

sector could become one of the fastest sectors to decarbonize, and a powerful example to others. This paper outlines some of the ways utilities can get started on their race to zero.

DECARBONIZING THE WATER SECTOR AT NEUTRAL TO NEGATIVE COST

Xylem's initial study of wastewater infrastructure, "Powering the Wastewater Renaissance," assessed eighteen distinct electricity related emissions abatement opportunities across three regions: the United States, Europe, and China. Core findings from this study, and from a follow-up analysis of the clean water sector, include:

- 50 percent of energy-related emissions from the wastewater sector can be abated with existing technologies, such as intelligent wastewater pumping systems, adaptive mixers with variable speed drives, and real-time decision support systems. According to a Water UK report, 95 percent of the impact is achievable at zero or negative cost.
- Reduction of energy-related emissions in the wastewater sector is directly related to the pace of adoption of existing technologies. It does not require new technologies or carbon pricing policies.
- Existing technologies can also reduce process emissions. For example, intelligent mixing and aeration systems enable monitoring and modeling that can reduce process-related GHG emissions by limiting production of nitrous oxide.
- In clean water, readily deployable high efficiency technologies also have a material impact on emissions reduction. Technologies such as ultraviolet (UV) disinfection and advanced metering infrastructure (AMI) deliver significant emissions abatement throughout the water production plant and the water distribution network.

Infrastructure decisions made today will have consequences for decades to come. While there is investment and research still required to advance the sector's ability to eliminate emissions, particularly in regard to process emissions, the technology and solutions exist today to make meaningful impact. In the United Kingdom alone it is estimated that utilities could save up to 10 million tons of greenhouse gas by reaching net zero in 2030.

LEADING UTILITIES ARE MAKING SWIFT PROGRESS TOWARD NET ZERO, TODAY

Water utilities around the world are already setting firm net-zero targets—and beginning to deliver on them. For example, water companies in the UK have almost halved operational emissions since 2011 through a combination of energy efficiency measures, renewable energy and the production of biomethane from sewage treatment processes.

In the United States, the city of Gresham's wastewater treatment plant is the first in the Pacific Northwest to generate more electricity than it consumes each year through the use of biogas

WATER RESOURCE MANAGEMENT AND PRODUCTION		
THE SOLUTION	HOW IT WORKS	HOW IT CONTRIBUTES TO RACE TO ZERO
UV disinfection	High-efficiency, chemical-free disinfection process for drinking water production	Maximizes energy efficiency potential and avoids onsite production and use of energy-intensive chemicals

generation and recovery, saving the city about $500,000 per year. These experiences demonstrate that by prioritizing emissions reduction, water operators can deliver big results quickly, affordably, and at minimal risk.

As of October 2021, Global Water Intelligence identified 65 water and wastewater utilities with net-zero, carbon, and climate neutrality targets. They include some of the largest utilities in the world, serving over 185 million people. From Melbourne Water to the Metropolitan Water District of Southern California and Thames Water in the United Kingdom, utilities across geographies are increasing their accountability on the path to net zero.

Innovative approaches are fueling progress. As part of its strategy to achieve net-zero emissions by the middle of this century, PUB, Singapore's national water agency, plans to award $4.82 million to incentivize innovative solutions that can eliminate carbon emissions from water treatment facilities. The agency is seeking carbon capture, utilization, removal, and other solutions at any technology readiness level that can be integrated with its operations and reach commercial scale within a decade or sooner.

The opportunity is clear. The components of success are available: technologies, experience, funding, collaboration and, increasingly, regulatory incentives.

GETTING OUT OF THE GATES FAST: HOW TO MAKE A QUICK START REDUCING EMISSIONS

The faster water utilities deploy these high-efficiency technologies, the faster emission targets are achieved, contributing to the containment of climate change. Here are some steps that can help accelerate water utilities' race to zero:

1. Make Firm Commitments to Reduce Emissions

Leading utilities are already joining the water sector's race to zero. Led by the United Nations' High-Level Climate Champions for Climate Action, the race to zero is a global initiative, rallying companies, cities, and regions to take immediate action

WATER DISTRIBUTION NETWORK		
THE SOLUTION	HOW IT WORKS	HOW IT CONTRIBUTES TO RACE TO ZERO
Advanced metering infrastructure (AMI)	Two-way communication for real-time data transfer to smart water meter	• **Reduces water use and apparent water losses, saving energy from water treatment and pumping** • **Reduces fossil fuel combustion and carbon emissions from utility vehicles**
Leak detection and condition assessment	Acoustic free-swimming sensors and data analytics detect gas pockets, water leakages, and zones at risk of failure in pipes for targeted rehabilitation	• **Eliminating real water losses saves energy consumed in the treatment and transport of water** • **Reduction of CO_2 emissions from unnecessary pipe replacement and civil construction**

to halve global emissions by 2030 and deliver a healthier, fairer zero-carbon world in time.

2. Deploy High-efficiency Technologies to Make Meaningful, Early Progress—Affordably

For example, intelligent wastewater pumping systems can cut energy use by up to 70 percent in wastewater pumping by reducing inefficiencies and emergency call-outs associated with clogging. In clean water, leak detection technologies can eliminate real water losses, saving energy consumed in the treatment and transport or water.

3. Define the Supporting Processes, Policies, and Practices to Reach Net Zero

Water UK's net zero 2030 route-map details the broad range of approaches that are required to deliver on this commitment and provides specific actions to create accountability, reduce the costs and risks of the transition to net zero, and to unlock new benefits.

CONCLUSION

By implementing high-efficiency technologies and making emissions focused changes to operational processes and practices, water utilities can win the race to zero, while delivering the essential services on which their communities' health and prosperity depend. High-efficiency technologies, including digitally-enabled solutions, are helping utilities realize dramatic emissions reductions across both clean water and wastewater activities.

AUSTIN ALEXANDER is Xylem's chief sustainability officer. Xylem is a leading global water technology company committed to solving critical water and infrastructure challenges with innovation. Xylem's more than 16,000 diverse employees delivered revenue of $4.88 billion in 2020. Xylem is creating a more sustainable world by enabling its customers to optimize water and resource management, and helping communities in more than 150 countries become water-secure. For more information, visit **www.xylem.com**.

THE NETWORK INFRASTRUCTURE FOR INDUSTRY 4.0

SEE •PART ONE• VISIT www.mptmag.com

As smart technologies take over plant operation, SPE's stability shines

Part 2 of 2

BY SIMON SEEREINER, WEIDMULLER

As we introduced in part 1 of this article last month, the potential of Single Pair Ethernet (SPE) is huge and experts consider it to be the next generation of communication architecture in automation. Originally developed for automotive applications, it promises nothing less than a continuous connection from the sensor to the cloud. And this is the case in practically every application, whether in industry, logistics, buildings, or wherever data is generated. The concept behind it is essentially an extension of the Ethernet to the sensor, that is wherever "tracks" (in the literal sense) rather than data highways are needed in every inch of space within the plant—it is compact, flexible, and offers extensive reach.

This explains why there is such a high level of interest in standards across all industries and why the standardization process is well underway. Naturally, at this stage of the process, some manufacturers tend to communicate proposals as regulations without further ado in order to issue their product as a new standard.

THE CONNECTOR IS THE FIRST STEP

Weidmüller supports connector development for the IEC 63171-2 variant for IP20 environments and the IEC 63171-5 variant for IP67 environments. With a focus on cross-sections in the range AWG 26—AWG 22, an extremely user-friendly portfolio can be established—with M8 connectors for plugs and sockets. This applies both to free connectors on the cable as well as the fixed variant on the housing. This means there is no need for extension cables that only have plugs or sockets at both ends. This is essential for PoDL especially, as the live side must always be designed as a socket. A third advantage of this solution is the significantly improved HF performance compared with competitor products, which means that the cabling will also meet even higher performance demands in the future.

A further advantage of the solution is that the connection systems in accordance with IEC 631712 (IP20 environment) and IEC 63171-5 (IP-67 environment) have the same mating face. Both can therefore be freely combined. This compatibility is most beneficial in field measurement technology. Furthermore, the mating face can also be used independently of any application, from the workstation through computing centers and industrial cabling and to the cloud.

On this basis, the developers have established the key properties for SPE connectors used at machine level in order to satisfy all forms of industrial application. Initially the product range is wide, although this does not mean a plethora of different components, but rather components that are as versatile as possible to use. This includes the above mating face that is the same for IP20 and IP67 environments. This limits the number of components without reducing the application possibilities, which is advantageous in warehousing. The mating face naturally needs to be available as a free connector and also on the device side as both male and female. PoDL and daisy chaining are thus supported, as was already typical for devices with M12/

Figure 4: The Single Pair Ethernet connector range is freely combinable and supports end-to-end, application-independent transmission, from the workstation through the industrial cabling to the cloud.

M8 connectors. This also includes straight and angled variants with and without LED for IP20 printer circuit board connectors; as well as continuous IP67 cabling on the basis of M8/M12 connectors.

A further point is unrestricted industry suitability, which includes a robust locking mechanism as is the case with RJ45 connectors. The pull-out force is at least 50 N. Also, all components should also be easy to assemble in the field. Typical key technical data defined were cabling in the AWG 26—AWG 22 range, an industrial dielectric strength of 2.25 kV DC and a permissible pollution degree of 2 on the printed circuit board. The electrical and mechanical connection must also be guaranteed in extreme applications at machine level. A Flexion Test in accordance with IEC 60998-2-X provides evidence for this. As part of this test, not only is the cable tested for axial strain, it is also loaded vertically. This simulates the loads that the cable is subjected to on a robotic arm, for example

As there is virtually no space for cabling in many Industry 4.0 applications, the design must remain compact. With a pitch of 7.62 millimeters, this version is just half the size of an RJ45 connector. This means that two Single Pair Ethernet ports can be installed in the space occupied by an RJ45 PCB connector, doubling the port density. These points go together as they ensure flexibility in terms of faster transfer rates in further development and also enable existing installations to be expanded. The connector therefore offers investment security in all respects.

This is guaranteed through aspects including high TCL (transverse conversion loss) as well as good RL (return loss). The return loss describes the impedance behavior between the connector and the socket. A high return loss ensures optimal data transfer to the interface.

Figure 5: Double port density thanks to halved size compared to RJ45 connectors.

The TCL describes the connector symmetry. Optimal symmetry minimizes external interference and is therefore an important characteristic for robust industrial environments. The connector is also suitable for use in multi-gig applications (2.5, 5, 10 gigabit), as it is designed for data transfer rates of up to 4.0 GHz. This mating face thus provides a solution for transfer rates of 10 megabit to 10 gigabit, from the sensor to the cloud.

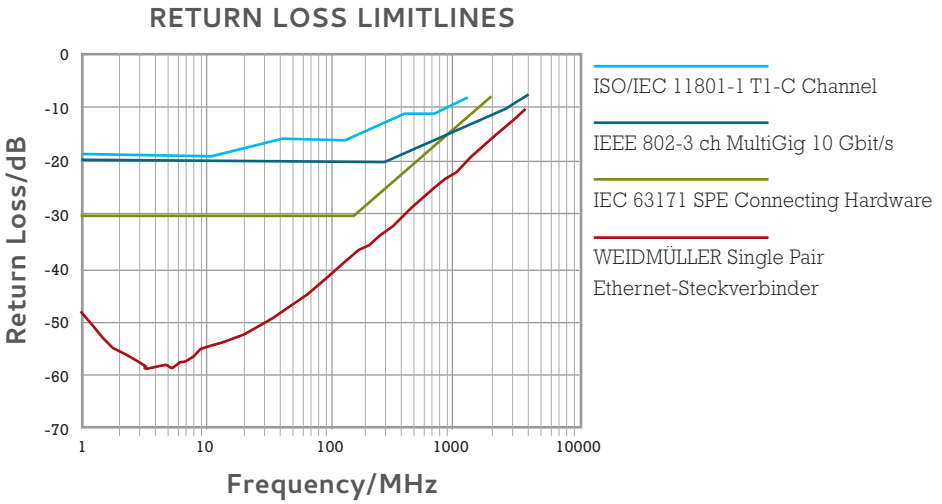

Figure 6: The connector's return loss compared with current standards.

GREATER FLEXIBILITY WITH A FOUR-CHAMBER SOLUTION

Besides the connector for a single cable as described above, Weidmüller is also planning to bring a four-chamber version onto the market that can be used to achieve four SPE cablings via one interface (cable sharing). The arrangement of contacts allows for ideal electrical properties. The contact pairs are arranged perpendicular to each other and minimize interference between the individual cables. The additional shielded cross reduces the remaining interference.

Thanks to this extremely compact design, four Single Pair Ethernet ports are possible in the installation space of an RJ45 connector. A typical application would be a welding robot with closely spaced sensors at the far end of the arm. These can be connected without the need for an additional switch or via trunk cable. This kind of bundled structure is difficult to implement using other connection technologies.

Due to the increased demand for these connectors in category 8.2 in accordance with ISO/IEC 11801-1:2017-12, the four-paired connection technologies can be used in accordance with IEC 63171-2 and IEC 63171-5, independently of any application. Computing centers, offices, homes

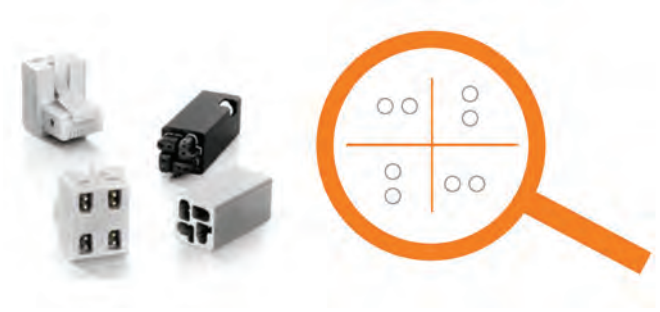

Figure 7: The arrangement of contacts in the four-chamber system.

and industry are equally conceivable areas of use. With these features, the SPE solution from Weidmüller offers perspectives that go beyond those generally required in industry. The offering will be completed with active components in the future, meaning that the user will have a complete SPE infrastructure from a single source.

THE RIGHT CABLE

Standardization also deals with cabling of course. Manufacturers are currently developing lighter, thinner, and more cost-effective cables that allow more Ethernet channels in existing cable runs, while supporting PoDL and enabling data and power to be transferred over distances greater than 3,000 feet. They are also distinguished by broader bandwidth and robustness to electromagnetic interference. In the future, this will enable a cabling and network standard that can communicate with each sensor or actuator while supplying it with power. Just like the connectors, the cables also need to be robust enough for industrial use. Typical examples include a smaller bending radius for installations where there is a shortage of space as well as the flexion test previously mentioned.

IMPULSES FROM THE AUTOMOTIVE INDUSTRY

To conclude, let us take a look at the latest developments from the automotive industry, the original initiator of SPE. This sector is also driving forward standardization. Ethernet systems are being increasingly installed in the current vehicle generations. Further innovations in the areas of driver assistance systems, such as LIDAR (light detection and ranging, used for detecting objects), high-resolution displays, autonomous driving, 4K cameras, and infotainment can only be achieved by networking control units and sensors. The development of the automotive Ethernet has resulted in two official IEEE standards: 100BASE-T1 (100 megabits per second based on BroadR-Reach technology) and 1000BASE-T1 (1 gigabit per second).

Fundamentally, this was centered around defining limit values for the connector and cable components as well as associated measurement methods based upon the requirements of the entire channel that was defined in the IEEE standard.

HARDWARE FOR THE ETHERNET OF THE FUTURE

SPE will play a major role in many areas of communication architecture. It offers continuous, scalable, and deterministic networking from the sensor to the cloud. Thanks to PoDL, besides a data interface it also delivers power wherever it is needed, even where there is a severe shortage of space—provided that the cabling is suitably compact. Weidmüller has, therefore, developed a connector that is only half the size of an RJ45 connector and offers the same mating face for both the IP20 and the IP67 versions. It can be used from the workstation through to computer centers and machine-oriented sensors. This makes the Weidmüller solution the ideal tool for IoT and Industry 4.0 applications.

SIMON SEEREINER is head of product management for sensor-actuator interface and industrial ethernet and cable harnessing. Since 2005, he is expanding the range of solutions for the passive, industrial networking of the Weidmüller Group. In addition, Seereiner works in various national and international committees for industrial networking. For more information, visit **www.weidmueller.com**.

THE LAB OF THE FUTURE

Digitization in research and development is commercially viable and essential

BY COLE MCCOLLUM, SHRIRAM RAMANATHAN, AND KEVIN SEE, LUX RESEARCH

Momentum for digital technologies in lab research is growing and was accelerated by the COVID-19 pandemic, which caused teams to rapidly adopt digital tools and rethink their current processes. While there are many digital use cases and technologies available to enhance lab research, they can be broadly broken up into three categories: modeling and informatics, knowledge management, and lab automation.

Based on primary interviews, we identified key technologies and use cases for each segment that range from those that are ready to adopt now (e.g., property optimization) to those that should be explored or monitored (e.g., quantum computing). Overall, we found modeling and informatics to have the greatest impact and expect lab automation to take longer to mature. Lastly, we found that cultural barriers pose as significant a challenge to adoption as technology barriers do.

LAB EFFICIENCY DECLINES, WHILE INNOVATION CHALLENGES EMERGE

The digital transformation of innovation and R&D is a theme that Lux has covered before. While innovation and R&D consists of many activities, this article specifically dives deeper into lab research and takes a fresh look at where the key digital developments are occurring. These digital solutions are sorely needed; they come at a time when industries that make heavy use of lab research, such as chemicals and pharmaceuticals, continue to face declining productivity on top of the new challenges.

- *RISING COSTS*: The rising expense of materials, instruments, personnel, and regulatory compliance, coupled with flat or decreased R&D spending, means that companies increasingly need to find ways to do more with less.
- *ENVIRONMENTAL FACTORS:* Industrywide pushes toward developing more sustainable products and environmentally friendly production processes add costs and constraints to the R&D process.
- *LONG DEVELOPMENT CYCLES*: An average material development cycle can take between ten and twenty years. With customers demanding customized products, these long development cycles are becoming unviable.
- *INFORMATION OVERLOAD:* The volume of research data generated continues to grow exponentially every year. Organizations, however, lack adequate methods for systematically managing and deriving value from this data.

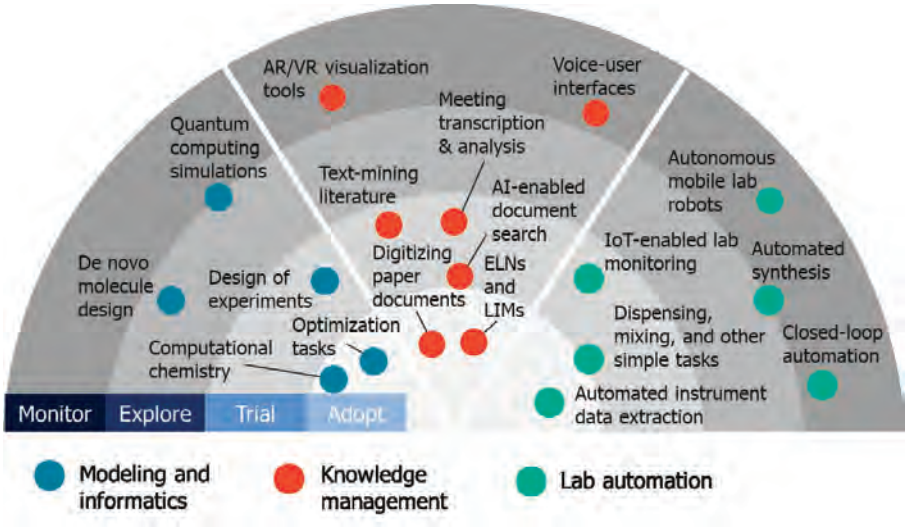

Figure 1: A roadmap for adopting key digital technologies in the lab.

MOMENTUM FOR THE DIGITAL LAB IS GROWING

Visions for the lab of the future have evolved over the past few decades, and while individual instruments and processes have benefited from digital tools like automation and analytics, it's safe to say that lab research has changed far less than many would have predicted. However, with an increasingly broad and powerful digital toolkit that includes tools like AI, robotics, and IoT sensors, the lab of the future—one that is significantly more automated, efficient, and effective—may be closer to reality.

After an initial wave of hype and activity in the late 1990s, innovation

interest in applying digital tools to the lab plateaued for nearly a decade. However, starting around 2013, there has been a steady growth in innovation interest, showing that the space may be in a phase where it could lead to a significant impact.

THREE CORE CATEGORIES OF EMERGING DIGITAL LAB TOOLS

While there are many digital use cases and technologies available to enhance lab research, they fall into three broad categories: modeling and informatics, knowledge management, and lab automation. While each category has its own defining features, there is overlap and synergy between the categories. For example, lab automation can be used to collect experimental data, which can then be fed into informatics systems to ultimately generate knowledge. Below and on the following slides, we describe these categories in more detail.

MODELING AND INFORMATICS

Using modeling and informatics tools like machine learning to accelerate the development and discovery process. Example: Using machine learning to model and predict polymer properties in order to shorten the overall polymer design time.

- *OPTIMIZATION:* Optimizing in silico or designing experiments to optimize existing chemical and/or material structures for a specific structure, properties, performance, etc. Informatics vendors typically focus on optimization, given the strong commercial interest and technical feasibility.
- *DISCOVERY:* Discovering wholly new chemicals and materials, including synthetic routes. While this is in earlier stages in the materials space, biotech and pharmaceutical companies are very active here.

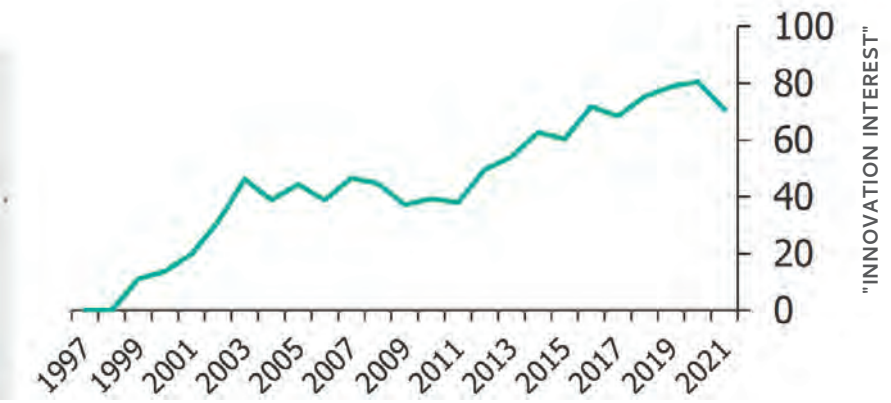

Figure 2: The Y-axis displays a summary of trends in patents, papers, funding, etc.

KNOWLEDGE MANAGEMENT

Systematically capturing, analyzing, and distributing knowledge throughout an R&D organization. Example: Using natural language processing (NLP) to sift through published literature in order to identify efficient reaction pathways.

- *DOCUMENTATION AND COLLABORATION:* Recording notes and data and enabling more seamless collaboration. Vendors in this space tend to focus on electronic notebooks and laboratory information management systems (LIMS).
- *KNOWLEDGE SEARCH:* Searching, analyzing, and extracting insights from internal and external knowledge like research papers and reports. While some companies like Sinequa offer more generic search capabilities, others like Patsnapfocus specifically on patent data.

LAB AUTOMATION

Automating physical experimentation through robotics as well as data collection and lab management through IoT and connected sensors. Example: Using robotics to enable high-throughput testing and screening of materials.

- *CONDUCTING EXPERIMENTS:* Automating experimentation steps. Players in this space include those selling hardware or orchestration software as well as those using automation for their own research.
- *LAB MANAGEMENT AND DATA EXTRACTION:* Monitoring and maintaining lab instruments and conditions as well as automating the extraction and integration of data from instruments. Vendors in this space include those that sell connected IoT devices as well as software players focused on data extraction.

OPTIMIZATION USE CASES

Modeling and informatics approaches tend to have the greatest impact in optimization use cases, where existing chemical and material structures are optimized or screened using techniques like machine learning. In particular, the optimization of small molecules, polymer-based formulations, and multiphase alloy development has some of the highest levels of activity. In many cases, companies are using these approaches to optimize the design of experiments to enable a feedback loop between traditional bench experiments and digital.

Discovering and designing new chemicals and materials from scratch—for example, by using generative machine learning models—will be the next major outcome for modeling and informatics. Already, this is starting to occur in the small molecule space, and it will begin to impact larger and more complex molecules

in the coming years. Additionally, while quantum chemistry is often simulated using conventional computers, quantum computing (QC) holds significant potential to enable more accurate simulations of large molecules. The timeline for the impact of QC will depend largely on hardware developments; however, many companies are already active in this space.

CONNECTING INFORMATION AND CAPTURING TACIT KNOWLEDGE

Over the past decade, there's been a significant rise in the use of electronic lab notebooks (ELNs) as well laboratory information management systems (LIMS) to track notes, experiments, samples, and more. More recently, companies have been adopting tools that enable researchers to search over past reports and find employees with the right expertise. Overall, companies tend to see moderate impact from the use of digital knowledge management tools.

There are three major areas of future opportunity for knowledge management. The first is digitizing sources of information that still remain analog. For example, all meetings could soon be recorded, transcribed, and analyzed for insights. The second is in connecting information sources, not just from R&D but from other business areas like manufacturing. AI tools can then automatically extract data, identify novel connections between data points, and provide intuitive interfaces for researchers to easily find what they're looking for. Finally, companies are increasingly looking to invest in tools and processes that enable the capture of tacit knowledge, although this area is still in its early stages and will require experimentation.

NEW APPROACHES TO LAB AUTOMATION

There are two major areas of impact within lab automation. The first is automating simple, repetitive physical tasks with tools and processes like high-throughput screening for testing large numbers of compounds. The second is automatically extracting data from lab equipment and instruments. Historically, pulling this data from equipment required customized scripts and integrations, but companies are actively looking to automate this process.

On the physical automation side, researchers are increasingly looking to adopt automated synthesis and flow chemistry systems for automating more complex tasks. While these efforts are still in early stages, now is the right time to begin experimenting with such solutions. Additionally, building on high-throughput screening techniques, some companies are looking toward "closed-loop" automation, where experimentation is done and decisions are made in an automated feedback loop. While promising, clients should monitor activity until it is validated further. Likewise, some researchers are utilizing autonomous mobile lab robots; however, their benefit is still questionable. Finally, companies are starting to adopt IoT sensors for automated lab management and environmental parameter monitoring.

THE COMBINED ROADMAP TO THE LAB OF THE FUTURE

If you refer back to figure 1, we show key digital technologies and use cases mapped onto the radar roadmap. Across the three segments, there are technologies that clients should be adopting today, such as material informatics for property optimization, electronic lab notebooks, and automated data extraction tools. We also show much earlier-stage technologies that clients should be actively monitoring or exploring, such as quantum computing, voice AI, and closed-loop automation, which will play an important role five to ten years from now, as well as technologies in-between these two extremes. Overall, clients should customize this roadmap to plot a course for their lab of the future.

While each segment of digital in the lab has unique value propositions, modeling and informatics will likely provide the greatest near-term impact in terms of ROI and technical viability. Within this space, clients should focus not on trying to eliminate physical experimentation or conducting more experiments faster but rather on conducting the right experiments using various optimization techniques. Looking toward the future, two significant opportunities are in de novo molecule design and in quantum computing for improving molecular simulations. Companies that are currently bottlenecked by conventional computers should explore early partnerships with quantum computing organizations, while others should closely monitor the technology to identify the right point to jump in.

Knowledge management and lab automation will also play a critical role in the lab of the future. In knowledge management, clients should focus on breaking down data silos and using technologies like NLP to make knowledge creation and accessibility frictionless throughout an organization. While some areas of lab automation, such as high-throughput screening, are becoming more mature, clients should expect complex capabilities like automated synthesis to disappoint in the near term, as the technology still isn't mature or scalable.

Finally, as mentioned throughout this report, culture and process changes are as critical as the technologies for creating a significant impact. While it's a difficult problem, clients should first focus on identifying the right KPIs and metrics that can guide their digital efforts to success (these can include performance improvements, researcher hours saved, time to market, etc.). Ultimately, while many traditional scientists may be skeptical of digital tools, true digital transformation occurs when there is both buy-in at the top and a bottom-up push from employees to adopt

these tools as part of their workflows. Start small to gain traction and gather results. The best way to convince skeptical scientists and researchers of the value of these tools is to come armed with data. Clients should also work directly with the researchers and technicians in the lab to design these digital tools to further increase buy-in and adoption.

DIGITAL WILL BECOME A KEY COMPETITIVE ADVANTAGE

Currently, the three segments of modeling and informatics, knowledge management, and lab automation often operate in somewhat separate ecosystems; however, we expect the lines between these areas to grow increasingly blurry over time. As part of this process, we expect to see consolidation in this space, where materials informatics companies may acquire a lab notebook or lab automation company. While clients should seek to avoid lock-in to specific vendors, vendors that create ecosystems of tools that interoperate and share data seamlessly will be well-positioned in this space.

As R&D becomes increasingly digitized, we also expect to see more overlap among research, product development, manufacturing, sales (e.g., with digital sales platforms), etc. Instead of just predicting the property of a specific formulation, companies will try to predict the eventual cost to produce the product, where and how it could be manufactured, how long it will take to produce, etc. Once these steps are all digitized, companies can optimize each part of the process and cut down the time it takes to go from research to finished products from years to months or even weeks.

While there is no shortage of near-term challenges in this space, we expect digital capabilities to provide a significant competitive advantage longer-term. These data-driven capabilities will compound over time as companies collect more data and build better relationships with customers by understanding their needs through data. Eventually, those who effectively invest in and adopt these tools will be able to operate at a speed and level of effectiveness that will be unmatched by those who do not. While clients should start by working with vendors to adopt digital tools, they should also have an eye toward bringing these capabilities in-house to build up a core competency in this space.

Lux Research is guided by four principles: Conduct the primary research, leverage technology to harness the data, focus on the "so what" for actionable insights, and make the call (the signature "Lux Take"). For more information, visit **www.luxresearchinc.com**.

Though titanium dioxide may appear to be a fine powder, in reality it is very abrasive in slurry form, which is its general state when used in paint and coatings production. Therefore, when AODD pumps are used in its transfer, the diaphragms must be able to withstand outer-piston abrasion.

Wilden® Pro-Flo® SHIFT AODD Pumps outfitted with Chem-Fuse integral piston diaphragms (IPD) will optimize efficiency, service life, product containment, and safety when used in the transfer of titanium dioxide slurry

OPTIMIZING DIAPHRAGM PERFORMANCE WHEN PUMPING TITANIUM DIOXIDE

New Chem-Fuse diaphragm improves AODD pump protection

BY JAMES FARLEY, WILDEN

There is scarcely a painted surface in the world—be it house, portrait or child's toy—that has not been covered by a paint containing titanium dioxide, or TiO_2, which is a fine white powder that is produced most often through the mining of the mineral ilmenite. The reason that titanium dioxide is used as a white pigment in most of the world's paints and coatings is simple: it possesses the highest refractive index of any material in the world. In other words, because titanium dioxide does not absorb visible light, any paint containing it has a high level of opacity, or hiding power, which is a needed characteristic for a high-performing paint or coating.

THE BACKSTORY

Because of its indispensability as a paint and coating component, the global titanium dioxide market is a robust one, which is buoyed by the fact that it is also commonly used in the production of plastics, paper, pharmaceuticals, inks, food colorings, and cosmetics, among many others. In fact, according to market-research firm Research and Markets and its "Global Titanium Dioxide Market 2019-2023" report, the titanium dioxide market will experience a compound annual growth rate (CAGR) of 4 percent through the year 2023.

The size and importance of the global titanium dioxide market make it imperative that paint and coatings manufacturers identify and deploy a pumping technology that can reliably

introduce it to the production process and then transfer the finished paints and coatings in the high volumes that are required to meet the demands of strict composition characteristics and production schedules. This article will illustrate how positive displacement air-operated double-diaphragm (AODD) pumps have risen to the fore as a first-choice technology for titanium dioxide pumping, with a new generation of diaphragm designs adding to their ability to deliver optimized titanium dioxide handling performance.

THE CHALLENGE

In paint and coatings plants, titanium dioxide is introduced to the production process as a high-viscosity slurry. AODD pumps have become an obvious choice for titanium dioxide transfer because they can handle abrasive liquids of higher viscosities that may also contain large solid particles. Their method of operation also gives them the ability to self-prime, deadhead, and run dry with low shear, which enables them to quickly reach and maintain desired flow rates throughout the entire duration of the product run while also being able to reliably handle shear-sensitive materials.

While AODD pumps can capably handle the general challenges of transferring titanium dioxide, there is one specific challenge that must be overcome—though titanium dioxide appears to be a very fine powder, it is very abrasive in slurry form, which poses a threat to the longevity of the AODD pump's diaphragms. Specifically, the high level of abrasiveness of titanium dioxide slurry exacerbates a phenomenon known as ''outer piston abrasion,'' which is a primary failure mode for AODD pumps. Outer piston abrasion happens with all standard diaphragm designs that rely on an inner and outer piston to hold the diaphragm in place. During its operation, the diaphragm flexes around the outer piston causing normal wear of the diaphragm at the point where they touch. Add a highly abrasive slurry like titanium dioxide and the touching acts like sandpaper on the diaphragm, dramatically impacting its service life. This abrasion, if left unchecked, will cause the diaphragms to fail prematurely. The result of diaphragm failure is increased pump downtime, and higher maintenance, repair, and replacement costs—and you can add cleanup costs to the equation if a product leak occurs. In these

The paint and coatings industry is one of the world's most prominent, and titanium dioxide is one of its most critical components as it provides the finished product the opacity, or hiding power, that equates to quality product. While important, titanium dioxide is also very difficult for pumps to handle.

days where reliable throughput and product containment are at a premium as manufacturing facilities look to optimize their operating costs, any interruption in the production schedule, or costs associated with a product leak, can be deleterious to the manufacturer's bottom line.

THE SOLUTION

In the realm of AODD pumps, Wilden® AODD Pumps, the operating principle of which was invented by Jim Wilden sixty-five years ago, has long set the standard in efficient, effective and safe titanium dioxide pumping. Today, Wilden offers a full range of diaphragm pumps that are ideally equipped for use in paint and coatings production. The Pro-Flo® SHIFT Series of bolted and clamped, metal and plastic pumps are outfitted with the revolutionary Pro-Flo SHIFT Air Distribution System (ADS) and operate with world-class efficiency in paint applications.

While Wilden AODD Pumps have earned their stripes over the years as a go-to technology for titanium dioxide pumping, it is a recent advancement in diaphragm technology that further differentiates the pumps from the competition—the Chem-Fuse diaphragm.

The design of the Chem-Fuse diaphragm makes outer-piston abrasion irrelevant. Specifically, Chem-Fuse diaphragms feature an innovative one-piece integral piston diaphragm (IPD) design that encases the outer piston within the diaphragm material itself. The elimination of the outer piston means that failure-causing abrasion can no longer occur. Moreover, it also eliminates a potential leak point around the outer piston, further improving pump reliability. The result of this is that Chem-Fuse diaphragms can deliver dramatic improvement in service life when compared to traditional diaphragms that are used in AODD pumps that handle titanium dioxide.

The extension of service life in typical instances is usually two to three times that of old-school diaphragms, though Chem-Fuse life spans that can be up to 10 times more than normal have also been observed. Finally, the encapsulation of the outer piston in the diaphragm material allows Chem-Fuse diaphragms to handle higher inlet pressures than standard two-piece diaphragms. This performance improvement makes the Chem-Fuse diaphragm unparalleled for use in difficult applications like titanium dioxide pumping.

Chem-Fuse diaphragms are constructed of Wil-Flex™, which makes them 50 percent less expensive than laminated models. They can also be used in all Pro-Flo and ProFlo SHIFT Series 1- to 3-inch plastic and metal pumps from Wilden, which allows them to fit into any application.

CONCLUSION

It's inherently obvious that the highest-performing paint and coatings feature titanium dioxide in their ingredient mix. It is also becoming increasingly obvious that Wilden Pro-Flo SHIFT AODD Pumps featuring Chem-Fuse IPDs are the best choice to optimize the handling and transfer of titanium dioxide. Because of its high abrasiveness nature, titanium dioxide can put traditional two-piece diaphragms under extreme stress, leading to costly leak points, failure, and downtime. Chem-Fuse diaphragms solve this conundrum through their integral-piston design, which entirely eliminates abrasion points, leading to a safer, cleaner, more reliable, and more efficient pumping process. By extending diaphragm service life, Chem-Fuse allows for unprecedented optimization of titanium dioxide-based paint and coating production.

JAMES FARLEY is the product management director for Wilden®, a leading manufacturer of air-operated double-diaphragm (AODD) pumps. He can be reached at 909.422.1700 or james.farley@psgdover.com. Wilden is a product brand of PSG®, a Dover company. PSG is comprised of several leading pump companies, including Abaque™, All-Flo, Almatec®, Blackmer®, Ebsray®, em-tec, EnviroGear®, Griswold®, Hydro Systems, Mouvex®, Neptune™, Quantex™, Quattroflow™, RedScrew™, and Wilden®. For more information, visit **www.wildenpump.com** or **www.psgdover.com**.

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SIZING PUMPS AND PUMP MOTORS

Important considerations for your application

BY EUGENE VOGEL, EASA

End users or service centers often need to specify replacement pumps or pump motors, sometimes involving a retrofit or re-application project. A successful outcome depends on accurate assessment of application requirements and a good understanding of the parameters that govern pump performance. The information here relates to rotodynamic pumps (centrifugal and axial flow impellers) and not to positive displacement pumps.

PUMP RATINGS AND POWER REQUIREMENTS

Unlike motors, pumps are rated by head and flow, not by power. There's no such thing as a 50-horsepower pump or a 100-kW pump. A pump can operate over a range of heads and flows, and the power required is determined by those and by the pump's efficiency at the particular head-flow operating point. It's helpful to know that "head" correlates to a measure of pressure. For water, it's a simple conversion: 2.31 feet head = 1 psi (1 meter head = 9.8 kPa). Here's a simple formula that describes the relationship between head, flow, pump efficiency and pump power:

$$\text{Power} = \frac{\text{Head} \times \text{Flow}}{\text{Efficiency}} \times k$$

(where k depends on the chosen units)

While this formula is helpful for quickly estimating the power required for a rotodynamic pumping application with known head and flow values, you can only get accurate power values from the manufacturer's pump curve. How to read pump curves is beyond the scope of this article. What is important here is that the power requirements vary with flow rate, so knowing the range of flow rates for the pump is essential to sizing a motor to the pump.

Sizing the Pump

The process of sizing a pump and motor starts with sizing the pump for the application's range of head and flow requirement. The following basic concepts are evident on the pump curve.

Flow Requirement

A pump may operate across a wide range of flow rates, known as the allowable operating range. Ideally, the pump should be designed to operate as close as possible to the best efficiency point (BEP) and within the preferred operating range. Pump efficiency will drop dramatically as flow rates move away from the BEP, and turbulent flow will reduce the reliability of the pump.

Head Requirement

The head that a pump can deliver must match the application. If the maximum pump head is below the system demand, the pump will not produce flow (bad!). If the maximum pump head is much greater than the system demand (more than double), the operating point will not be near the BEP, and both efficiency and pump reliability will suffer.

Cavitation

Another important concern when selecting a pump for a specific application is the possibility that cavitation may occur. If the pump is to operate across a range of flow rates (rather than always operating near a single flow rate), cavitation will be more likely at the higher flow rates. Pumps have net positive suction head required (NPSHR) ratings, which allow evaluation of the likelihood of cavitation at any flow rate using NPSHR values from the pump curve.

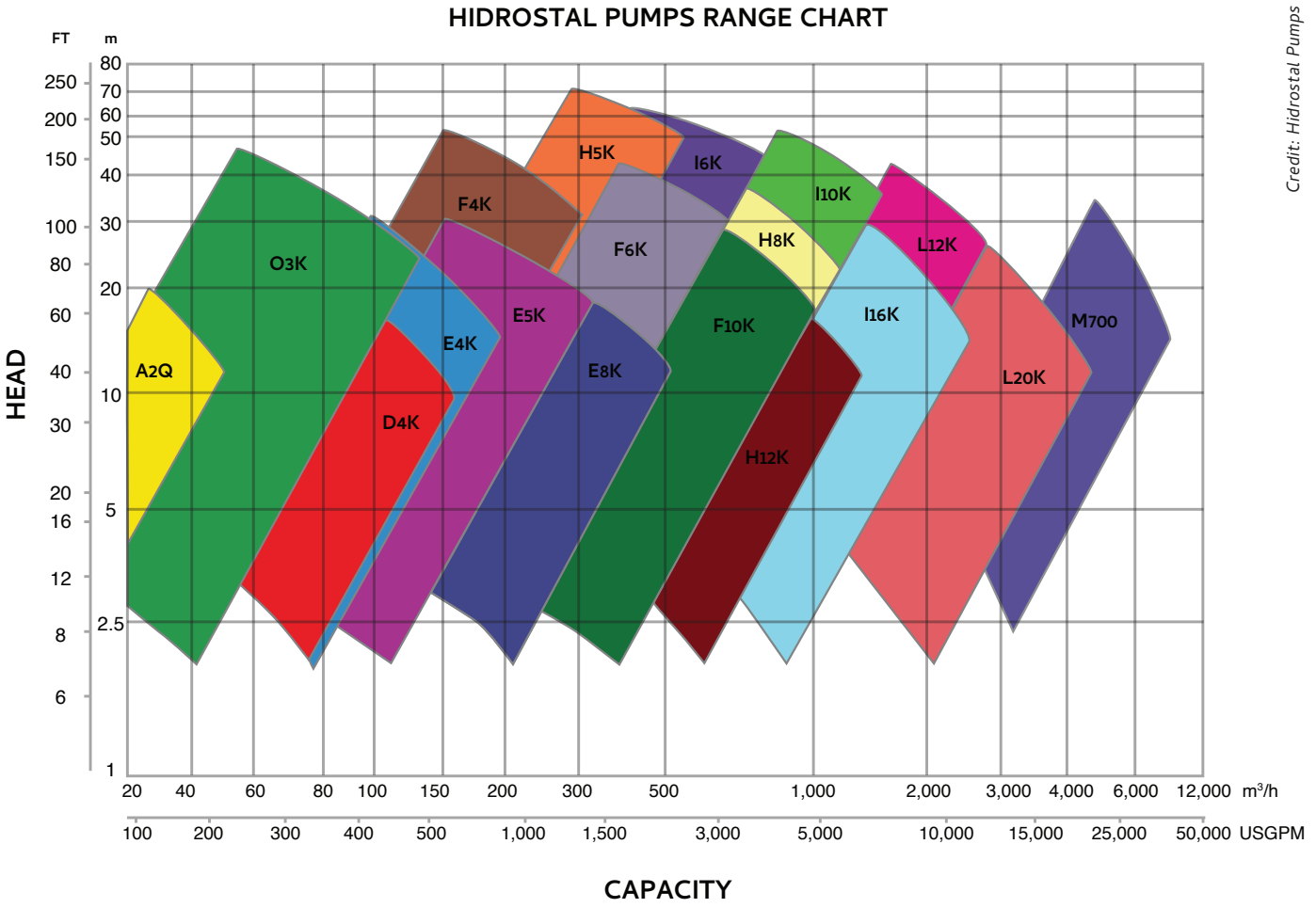
Generally, lower-speed pumps are less susceptible to cavitation than higher-speed pumps. If the application has low suction head demands, a lower operating speed will be an advantage. At lower operating speeds, a larger pump impeller diameter will be required, and thus a physically larger and more expensive pump may be needed.

SIZING THE MOTOR

Once a pump of the proper size is selected for the application's range of head and flow, the motor can be sized and selected to match the pump's requirements.

Minimum Power Requirement

For most pumps, the power requirement varies with flow rates. Power requirements may increase or decrease with increased flow. The pump curve will provide that information. Obviously, the motor must have adequate power to meet



Credit: Hidrostal Pumps

Figure 1: A pump selection chart provides generalized data from the pump curves.

the pump demand at the application flow rate with the highest power requirement. That's the minimum power requirement for the motor. But it is likely the pump will have an allowable operating range wider than the application demands.

Maximum Power Requirement

If application demands were to change at some future time, the pump might be expected to operate at a point where the power requirements are greater than the minimum power requirement. Therefore, it's wise to consider the maximum power the pump could require under any operating conditions. This value is provided on the pump curve as the no overload power (NOL) rating. In some cases, the difference between the minimum power requirement for the application and the NOL rating may be absorbed by the motor service factor. In other instances, sizing for NOL power may require a higher power motor.

CONCLUSION

Sizing a pump and a pump motor for an application is not a trivial endeavor. The application head and flow requirements must be known. The pump power formula provided above, with the "k" to match the selected units, will provide a good estimate of the size of the machine. Pump vendors have pump selection charts which are generalized versions of the pump curve that will help with pump selections. Those charts and related reference data will provide NOL power ratings. The person responsible for selecting a pump and motor should have the appropriate pump curves and motor data and know how to read them.

EUGENE VOGEL is a pump and vibration specialist at EASA, Inc., the Electrical Apparatus Service Association. EASA is an international trade association of more than 1,800 firms in nearly seventy countries that sell and service electromechanical apparatus. For more information, call 314.993.2220, fax 314.993.1269, or visit **www.easa.com**.

EMI/RFI noise occurs when different electrically powered machines and peripheral equipment operating in close proximity to each other are not shielded or filtered correctly.

MANAGING EMI IN FOOD METAL DETECTION

Reducing noise interference requires careful observation

BY CHRISTINA DUCEY, FORTRESS TECHNOLOGY

Noise is a common occupational hazard in food processing factories. From vibrating panels to mechanical rotors, stators, fans, conveyors, pumps, compressors, palletizers, and fork lifts. Additionally, some less audible disturbances can impair the performance of highly sensitive metal detection equipment. The most overlooked being EMI/RFI noise generated by ground loops and electric motor drives.

PLAYING DETECTIVE

Eric Garr, regional sales manager at Fortress Technology, examines the cause and effect of these disturbances and the measures that can be implemented to reduce noise interference. He notes that many factors determine the performance of a metal detector. The main factors are the aperture size, product effect, and operating frequency. However, environmental conditions, such as airborne electrical interference—static, radio, or earth loops—and vibration (for example, moving metal) may also affect performance.

Unique features like Noise Immunity Structure and AutoPhase, which feature on the company's digital metal detectors, can suppress some of this interference noise, which may otherwise require reducing the sensitivity levels manually.

The main sources of electromagnetic interference and radio frequency interference include AC motor drives—for instance, variable frequency drives and servo motors—two way radios, including walkie talkies, electric loops, electrical contacts, and static discharge.

IDENTIFYING EMI/RFI NOISE

The most widespread challenge Fortress engineers encounter turns out to be quite a common issue in food processing plants. Particularly on end-to-end lines incorporating robots, bagging, flow wrapping, and conveyors. The effects of electromagnetic interference (EMI) can negatively impact the performance of metal detectors resulting in false detections, false rejections, and consequently increased food safety risks.

Packaging machines—for instance, paper and plastic film rollers, and conveyor belts—can create a certain amount of electrostatic interference. However, for this to cause an issue with the metal detector it must be very close to the coils.

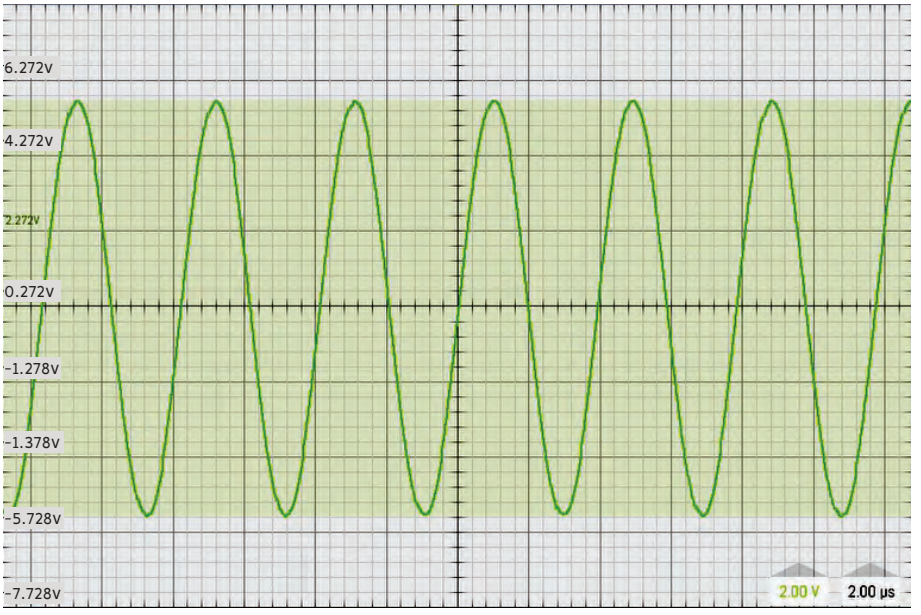
Garr explains, "Typically, this would only occur when the slider beds and belt material on the metal detector conveyor are rubbing. This could cause a build-up that eventually discharges to the metal detector case close to the coils."

EMI/RFI noise occurs when different electrically powered machines and peripheral equipment operating in close proximity to each other are not shielded or filtered correctly. It could come from an AC motor drive on the conveyor, notes Garr.

The weak points often observed are from are cables that power the AC motor drive. If not shielded correctly, this can radiate EMI.

Garr continues, "AC drives work on the principle of switching the line voltage. This switching causes a fluctuating current draw on the line resulting in broadcasting RFI/EMI noise back on the AC motor drive input line. A filter can attenuate the draw to eliminate the noise. However, even when this filtering is applied, the output cable to the motor can still radiate noise. This is when a variable frequency drive (VFD) shielded cable should be used, ensuring that noise doesn't broadcast from the cable."

The closer the source of the EMI gets to the metal detector coils, the greater the strength of the signal broadcast. Worst case scenario is when the aperture opening is in line with EMI generator as there's a clear line of sight. If the EMI is to the side, the body of the metal detector helps to shield the internal coils from the broadcast noise.



The effects EMI can negatively impact the performance of metal detectors.

RADIO WAVES

The susceptibility of a metal detector to electromagnetic interference is very dependent on its sensitivity and operating frequency. If one metal detector is transmitting a at a frequency very close to another, they risk cross talking with each other if positioned close together.

To prevent this happening, Fortress recommends spacing metal detectors at least four meters apart, or staggering the metal detectors so they aren't directly aligned. As part of a site audit, it is also good practice to note the operating frequencies of metal detectors in close proximity so that a different frequency can be selected for the new equipment.

Long and medium wave transmitters—such as walkie talkies—rarely cause problems. Providing they are operating at 3 watts or less, and not used in very close proximity to the metal detector coil receiver.

Digital communication devices, for example smart phones, are never a problem for metal detectors. This is because they operate at a much higher frequency, well out of the band that is optimal for metal detection, adds Garr.

STATIC TROUBLESHOOTING

Static electricity build up is more likely to occur on gravity and vertical metal detection applications if the pipework has not been earthed correctly, suggests Garr. It can also occur when slider and belt material are incorrectly selected causing static to build in the metal detector aperture.

Locating a metal detector on a mezzanine floor can create potential issues. Notably more mechanical noise infractions, particularly from chutes, hoppers, and conveyors.

To ensure the most reliable performance and avoid vibration, all support structures and reject devices should ideally be of welded construction. Additionally, bolted connections should be avoided across the frame where they may form very distinct loops.

Finding the source of the problem quickly and accurately is critical, as ongoing interference on automated processing lines can cause service disruptions. Fortress can deploy a technician armed with a "sniffer" to swiftly track the source of nearby EMI and RFI. Like an antenna, the sniffer measures RF and can swiftly locate the source of the competing frequencies. With this information, engineers can shield, suppress, or alter the path of the emissions.

Fortress also offers the option to retrofit existing metal detectors with newer hardware equipped with better noise immunity features. For busy production settings, including highly automated plants, this solution overcomes or greatly reduces the effect of the noise on the metal detector.

ELIMINATING NOISE

User-friendly Fortress features like automated single pass calibration can deliver an accurate system set-up within seconds and eliminate human errors. Additionally, built-in noise immunity structure—included as standard on all Fortress digital metal detectors—can dramatically reduce the effects of external electrical noise, again resulting in fewer false product rejects.

Garr concludes, "It is impossible to completely eliminate noise interference in food production environments. Yet, by taking these precautions and seeking expert guidance, our engineers can help to significantly reduce the EMI feedback and ensure metal detection performance is not compromised."

CHRISTINA DUCEY can be reached at 416.752.2898 ext. 312 or cducey@fortresstechnology.com. Fortress Technology Ltd. is a privately-owned Toronto-based company and is the only metal detection manufacturer that, since its inception in 1996, custom manufactures metal detectors to suit its customers' needs, application, and specification while ensuring optimal performance. Fortress systems are used widely within a range of food industry sectors including bakery, meats, ready meals, dairy, confectionery, fresh foods, and frozen foods. In addition to product manufacture, the company offers a range of before and after sales service and support services. For more information, visit **www.fortresstechnology.com**.

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A total of three pumps will be installed per production branch, with one pump being kept available as a stand-by unit. This results in an output of about 1,270 cubic feet per hour MEG.

To reduce pulsations and to avoid vibration-induced damage, resonators are used to ensure an even flow of MEG.

AVOIDING HYDRATE FORMATION DURING GAS PRODUCTION

German pump manufacturer ensures safe glycol injection for natural gas production off the coast of Mozambique

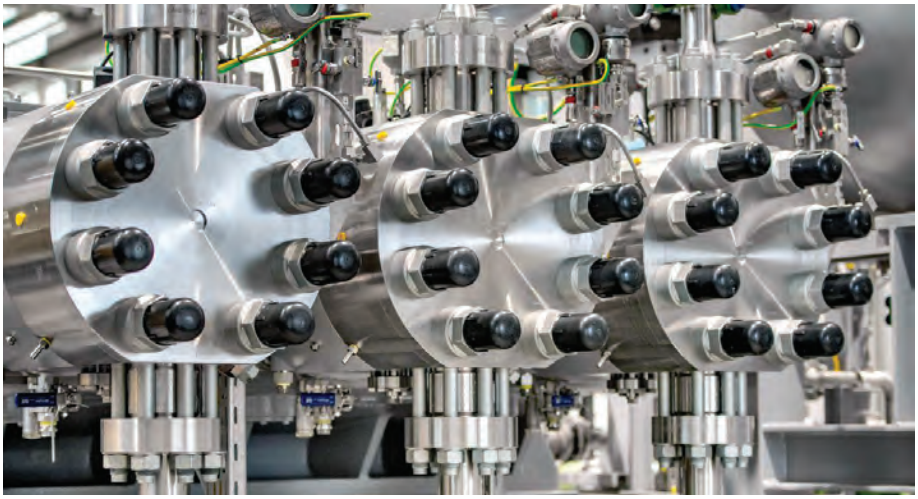
BY HOLGER HENZE, LEWA

Following the acquisition of natural gas production rights off the northern coast of Mozambique by a French oil company, modules to avoid hydrate formation needed to be set up for compression of the gas and its later conversion into LNG (liquefied natural gas). The MEG (mono-ethylene glycol) used for this purpose is injected directly at the delivery line under the sea. The company needed powerful pumps that could transport the MEG from the coast to the offshore units. The main challenge was to achieve a sufficiently high flow rate despite the high back pressure in the pipes. At the same time, maintenance work was not to lead to interruptions in production, as this would have resulted in heavy financial losses.

Due to its internationally renowned expertise in the oil and gas sector, LEWA Nikkiso America Inc., a subsidiary of German LEWA GmbH, was awarded the contract in November 2019. Six G3U triplex pumps were chosen because they are specially designed for the high-pressure range of over 500 bar. By using the M800 pump head, this model enables a flow rate of 635 cubic feet per hour per pump. Two of the six pumps are kept on stand-by for maintenance or repair work. The pumps are manufactured at the main Leonberg, Germany plant, and the base plates and resonators are supplied by LEWA Nikkiso Middle East.

GREAT CARE NEEDED IN UNPREDICTABLE CONDITIONS

When natural gas is extracted at sea, adverse weather conditions, rough seas, and high pressure under water must be taken into account, and the quality of the extracted raw material must be ensured. Natural gas contains water, which in combination with methane can form methane hydrate. This is done under high pressure and low temperature in the pipeline. If too much hydrate is formed, the pipeline can become clogged—to prevent this, glycol is injected. MEG functions here in a similar way to antifreeze. Glycol



The pump heads are special models that can also work with a PTFE sandwich diaphragm thanks to a diaphragm clamping system designed for high pressures.

injection is also necessary in a French mineral oil group's current project. Since acquiring production rights off the north coast of Mozambique, the group has begun preparations for extensive LNG production.

Since the offshore units through which the natural gas is produced are not located on a platform but underwater, the glycol is pumped from the coast via pipelines directly to the production sites. LEWA Nikkiso America Inc. was commissioned to provide the pumps required for this purpose. It is a subsidiary of LEWA GmbH, which is known for its expertise and has been active in this field for over sixty years. For the time being, two of a total of seven planned production trains were to be equipped with process diaphragm pumps.

The biggest challenge in this project is certainly the combination of high back pressure from the production site and the large amount of monoethylene glycol required, which has to be conveyed to the well around the clock. The MEG must be injected continuously despite this pressure. At the same time, we have to ensure that the pumps are 100 percent reliable so that even maintenance does not lead to an interruption in the gas drying process and thus to a costly delay of the entire pumping process. Last but not least, the aggregates should function as economically as possible.

A POWERFUL, STABLE SOLUTION

To counter these problems, the responsible persons at LEWA decided to use the proven triplex pump with pump heads specially modified for this application. The G3U variant in combination with the M800 pump head enables a flow rate of 635 cubic feet per hour per pump, despite the high back pressure of 517 barg. A total of three pumps will be installed per production train, with one pump being kept available as a stand-by unit. On the one hand, this results in a flow rate of about 1,270 cubic feet per hour MEG and on the other hand, the reserve pump can step in if maintenance work has to be carried out on one of the other pumps. Reliable, constant injection is thus ensured and interruption of natural gas production is largely excluded.

The pump heads are special models that can also work with a PTFE sandwich diaphragm, thanks to a diaphragm clamping system designed for high pressures. Comparable pumps must otherwise be equipped with a metal diaphragm to withstand the high pressure. However, for design reasons, such diaphragms are hardly feasible in the size for the drive unit used in this power class.

At the same time, the pump head takes up less space and is more compact than models with the stiffer metal diaphragm, which would require a much larger diaphragm diameter for the same degree of displacement. This would automatically lead to a larger pump head diameter. In order to reduce pulsation and avoid vibration-induced damage, resonators are also used to ensure that the medium flows evenly. Like the base plates, they are manufactured at the LEWA Nikkiso Middle East plant in Sharjah, United Arab Emirates. The final assembly, including the piping, took place in Leonberg.

LOOKING TO THE FUTURE

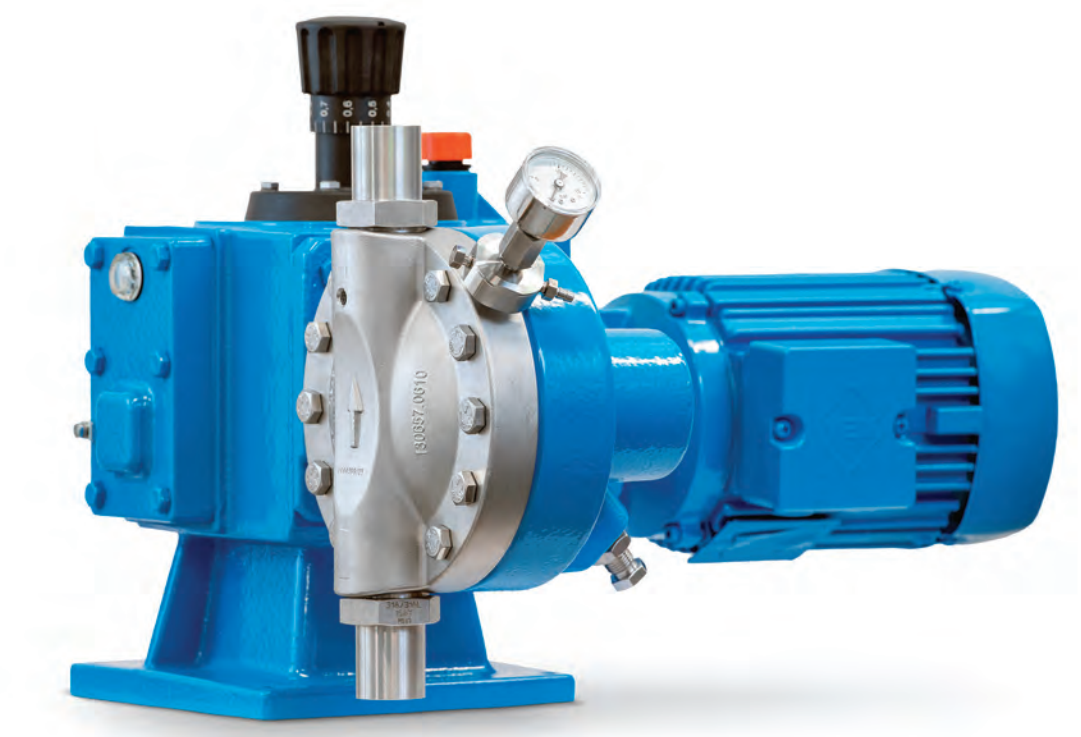
After the first three pumps were successfully accepted by the customer and the operator with a final acceptance test (FAT) in October 2020, this was also done for the second pump delivery in December. FATs are required by the operator for such big equipment to ensure that there are no surprises on site. The first three pumps were sent out in November of that year. The second delivery has also been packed and shipped to our customer in the United States. Our customer installed the pumps in larger modules and then shipped the completed modules to Mozambique.

LEWA develops technologies and provides solutions for the vast array of applications among its customers. Its products are used mainly in the oil and gas industry, in gas odorization, in refineries and petrochemicals, as well as in the production of plastics, detergents, and cleaners. Additional application areas include the chemical industry, cosmetics industry, pharmaceuticals and biotechnology, food and beverage industry, and energy utilities. For more information, visit **www.lewa.com/en/applications/gas-drying-with-glycol**.

FEATURED PRODUCT

LEWA

ECOSMART DIAPHRAGM METERING PUMP



In many applications in the oil and gas industry, the chemical industry, or even the food industry, pumps that work reliably and provide high performance are needed. At the same time, they must have convincingly low investment costs. With the Ecosmart diaphragm metering pump, the LEWA has provided a cost-attractive and safe model that is reliable for many years.

For use in applications with higher flow rates, the pump expert from Leonberg, Germany, is now expanding its product range with two new sizes. In addition to the LCA version, the Ecosmart will also be available in the more powerful LCC and LCD versions in the future. The stringent use of similar components within the Ecosmart product family keeps production costs and therefore the final price low. At the same time, a high level of safety can be guaranteed by focusing on all essential design features such as the pressure relief valve or the proven sandwich diaphragm with continuous monitoring.

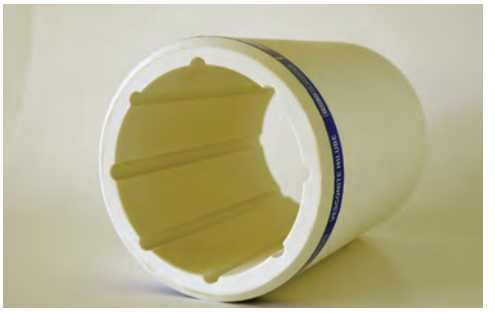
The larger versions of the Ecosmart pump are also suitable for industrial water treatment, such as in seawater desalination or industrial cooling circuits. What counts here above all is compactness and cost-effective design, which the entire LEWA Ecosmart series fulfills thanks to its innovative design principle.

For more information, visit

www.lewa.com/en/pumps/metering-pumps/lewa-ecosmart-diaphragm-metering-pump.

VESCONITE BEARINGS

HILUBE LINE-SHAFT BEARING



Vesconite Hilube bowl, stuffing box, suction, and line-shaft bearings continue to operate in a condensate pump in the United States ten years after installation. Vesconite Bearings pump representative Charlie Simpson recently returned from a six-week Mexico and U.S. customer-calling tour in which he visited a long-standing customer in Virginia to receive this report. The customer is a pump repair workshop that offers timely and cost-effective repairs and specifically offers upgrades to shafting, bearings, and wear rings to enhance performance and efficiency in older pumps as well as repairs and rebowls vertical turbine pumps. For more information, **www.vesconite.com**.

RENEWABLE LUBRICANTS

BIO-EXTREME HIGH TEMPERATURE OVEN LUBRICANTS

Bio-Extreme High Temperature Oven Lubricants perform to 1,832 degrees Fahrenheit (1,000 degrees Celsius) and beyond, making them ideal for use in refractories, foundries, steel mills, and other high temperature industrial areas. They are ideal for kiln car wheel bearings, drying ovens, paint lines, sealed for life units, automatic lubrication systems, and more. Because they are formulated from renewable carbon negative resources, these environmentally responsible lubricants help facilities to meet their sustainability initiatives. For more information, visit **www.renewablelube.com**.

Q.E.D. ENVIRONMENTAL SYSTEMS

SNAP SAMPLER® PASSIVE GROUNDWATER SAMPLING SYSTEM

The Snap Sampler system delivers a PFAS-free alternative for groundwater sampling and enables fast sampling with no limitations on analyte testing. The Snap Sampler system uses unique sample bottles with snap sealing caps that are set open at both ends. The bottles are loaded into individual Snap Sampler modules that can be stacked in series to match sampling requirements. Water within the well screen zone moves through the bottles and reaches equilibrium with formation water moving through the well. To collect samples, a manual trigger line or pneumatic actuator releases the spring-loaded caps and captures samples under in-situ conditions. For more information, visit **www.qedenv.com**.

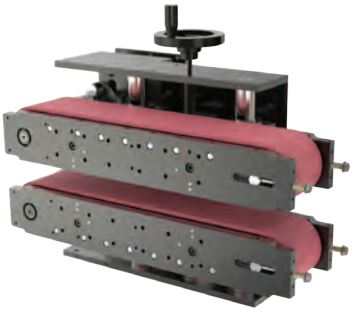
WARREN CONTROLS

SERIES 200 HIGH-CAPACITY VACUUM BREAKER

Warren Controls announces the Series 200 high-capacity vacuum breaker, ideal for use on outdoor tanks where there may be concern over falling temperatures causing tank collapse. The 200 vacuum breaker opens gradually to admit outside air to relieve the vacuum in the tank, eliminating possible damage caused when falling liquid levels and condensing steam causes a vacuum that can damage a tank. Available in cast iron, carbon steel, and stainless steel bodies and seats, the Series 200 is offered in sizes ranging from 2 to 12 inches, with a variety of trim and paint options. For more information, visit **www.warrencontrols.com/profile/type/8/16/type_200**.

VERSA PULLERS

CATERPILLAR PULLERS



Caterpillar pullers move pliable materials like tubing and profiles, safely and quickly, without deformation or crushing. Even pressure is exerted over a wider area so the materials are gripped firmly yet gently. They are available with or without drives, and are ideal for use in OEM equipment like braiding machines and extrusion lines (food grade versions available). They can also be used to automate handling of sharp materials like bandsaw blades, resulting in a much safer workplace. For more information, visit **www.versapullers.com**.

SENASYS

PRESAIR VACUUM ALARM

Presair offers a cost effective and efficient device to monitor the amount of vacuum in an airline. Much like the pressure alarm Senasys manufactures, the Presair vacuum alarm is designed to grab the attention of qualified personnel to prevent and fix issues before they cause significant downtime. This Vacuum Alarm is a perfect way to be alerted when vacuum rises or falls in your system. By pairing a vacuum switch with a quick connect coupling, this allows for effortless setup. For more information, visit **www.presair.com/products/vacuum-alarm-kits**.

LOGAN INDUSTRIES

SUBSEA GREASE INJECTION UNIT

Logan Industries has successfully delivered a subsea grease injection unit as part of a complete subsea wireline pressure control system for a major subsea oil and gas company. The grease injection reservoirs and monitoring/switching unit was part of an entire system, complete with surface intervention type hydraulic power unit (HPU), reeler and umbilical, subsea grease head and lubricators, and subsea connections. The customer required a way to provide grease to their subsea grease head by using a subsea grease supply point. For more information, visit **www.loganindustries.net**.

ARMSTRONG FLUID TECHNOLOGY

DESIGN ENVELOPE PUMP

The new Design Envelope pumps are available for use with single phase power (200-230V) from 1/3 to 2 horsepower and, for increased reliability, are built to a design standard carried over from commercial pumps. In addition, because the mechanical room piping for light-duty fluid-flow applications is often installed vertically, these new single-phase pumps can be installed and operated in vertical piping. As with all Design Envelope pumps, the technology is built around a demand based intelligent control solutions. For more information, visit **www.armstrongfluidtechnology.com**.

REGAL REXNORD

MARATHON GLOBETROTTER MOTORS

The new Marathon Globetrotter motors are high-quality three-phase general-purpose motors that can be controlled by an inverter and are rated up to 200 horsepower. Globetrotter motors are offered in open-drip-proof enclosures and rolled steel TEFC enclosures, as well as models in a cast-iron enclosure rated for areas classified as hazardous locations. A new series of three-phase permanent magnet AC (PMAC) motors, the Marathon SYMAX, can only be powered and controlled by a VFD but provide improved efficiency even at lower speeds and partial loads. For more information, visit **www.regalrexnord.com**.

KIRLOSKAR BROTHERS LIMITED

AARNA MINI PUMPS

The newly launched mini range pump from KBL offers an array of features like superior quality and higher resistance against corrosion. It has cathodic electro deposition (CED) coating and provides five times more protection over conventional painting, resulting in longer life. The advanced electrical design and wide voltage range operability offer protection against voltage fluctuations from 180 to 260 volts thereby reducing chances of motor burning. The mini pump has a thermal overload protector (TOP) for protecting the motor from overloading. For more information, visit **www.kirloskarpumps.com**.

AW-LAKE

SIGNALFIRE RANGER TRANSMITTER

Measuring and monitoring when you need it, how you want it, and where you need it has never been this easy. No matter your industry, if you need to monitor equipment, pressure, flow, temperature, level, compressors, pumps, generators, and more, the SignalFire Ranger transmitter provides flexible, secure, real-time connection in a user-friendly package. Once the Ranger transmitters are connected to your measurements, you can immediately track conditions, troubleshoot problems, change monitoring parameters, receive alerts and alarms, and take action from any web browser. No software installation is required. For more information, visit **www.aw-lake.com**.

MASS-VAC, INC.

OIL MIST ELIMINATORS

MV Oil Mist Eliminators help keep the environment clean and people safe by removing harmful oil vapors from a vacuum pump's exhaust stream with 99.9999 percent efficiency. Featuring replaceable microfiberglass coalescing filter elements with a 0.1 micron pore size, they come in four models from 4- to 10-inch diameters. Fully RoHS compliant, MV Oil Mist Eliminators can be configured to recover or recirculate costly pump fluids. For more information, visit **www.massvac.com**.

FOCUSING ON THE FEED TO CREATE MORE EFFECTIVE WASTEWATER TREATMENT

LaMarr Barnes and Brett Robison of Kurita America explain S.sensing CS technology

Across the water industry, new technologies are recognizing water as a finite resource, emphasizing resource recovery and reuse. Kurita America, the Americas branch of multi-billion-dollar, global water technology leader Kurita Water Industries, recently introduced its own innovation into the field, S.sensing CS, a cutting-edge digital automation system out of Japan for greater plant control, safety, and efficiency. Kurita America's LaMarr Barnes, chief executive officer, and Brett Robison, strategic business leader, recently discussed this new technology on MPT's podcast, The Efficiency Point. An excerpt of that conversation follows below.

MPT: ***As we look ahead to the new year, how would you assess the state of the water industry? Do you detect any changes in focus for a post-pandemic world?***

LAMARR BARNES: From a state of the market, I would say that what I'm seeing is the acceleration of trends that already existed—specifically, around digital technologies, better sensing technologies, new technologies to target, removal of very specific ions, or new types of contaminants. I see a lot of great technology developments there.

MPT: ***How did Kurita America address the challenges of the last two years and where is the future taking you?***

LAMARR BARNES: The last two years have certainly been interesting for us and for everyone. To begin with, with Kurita America we launched the new Kurita America April 1, 2020, just as the pandemic was taking hold in the United States. You may recall that Kurita America was developed from the combination of three previous operating companies, U.S. Water Services, Fremont Industries, and a smaller Kurita America that existed for some time.

MPT: ***Kurita's new S.sensing CS technology is a new approach to resource management and water treatment, so how would you best describe it for the uninitiated?***

LAMARR BARNES: All of our industry and our customers are becoming very directly involved in limiting and reducing their resource use, and water being one of those key resources. Whether you call it the circular economy, whether you talk just about green or reduction of carbon, these are so many different ways to talk about the same thing, but all of it requires us to be more mindful of our water use and S.sensing CS is certainly a technology that contributes to more effective treatment of wastewater.

BRETT ROBISON: S.sensing technology came to us through our relationship and integration into Kurita and has been used in other markets outside of the United States in North America for several years. It's proven technology, and really the concept behind it is more of the feedforward mentality.

In wastewater systems, typically you're measuring something coming in—it could be pH, could be a lot of different elements—but ultimately you're treating that system, then you're looking for a result on the back end. The issue with that is that waste streams change, and as waste streams change, it adds complexity to the treatment scheme. Whether you're feeding off a flow or you're looking at some type of constituent that you're trying to manage, oftentimes that load is fluctuating quite a bit.

It's a wide varying environment, so the S.sensing technology is using a laser approach where we're able to look at the water as it's coming into the system and we're able to control the feed of chemistry to optimize the approach and the feed system to match the actual loading that's coming in. Think of it as real-time feed control as opposed to feedback control, where you're using something on the back end of this system to change a setting or a pump to try to catch up.

To listen to an extended version of this interview, be sure to subscribe to MPT's podcast, The Efficiency Point.

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