

Water treatment

Increasingly complex solutions

Demand for water—for drinking and for industrial processes—exceeds supply, and the gap will widen as the world population continues to grow in number and relative wealth. As the world faces the challenge of climate change, industrialization and a lack of infrastructure in emerging countries are putting pressure on water quality. These challenges add to the many already faced by the water-treatment industry.

▼ Michael Ravenscroft

A number of major trends are driving demand and innovation in the water-treatment industry, including an increasing level of regulation, scarcity of supply, the need to reduce cost, and environmental aspects such as energy consumption and discharges. Other environmental factors include the desire to reduce the volume of chemicals used in water treatment, and the volume of water released after treatment. “The need for water treatment is widespread and, in many cases, urgent,” says Nanette Hermsen, global marketing director/reverse osmosis at

Dow Water Solutions, a DowDuPont subsidiary.

Ecolab, a major player, sees three major trends in the next decade, all interconnected—the world needs more water, more energy, and more food. The company says its strategy is to help its customers reduce water consumption to maximize performance at optimized costs. “We do this through a total water-management approach across our customer operations,” says Ecolab. “While demand for water is growing, the supply of water is not growing at the same pace.” Industry is increasingly aware that water availability is coming under pressure, and companies are looking for

water-treatment solutions that allow them to do more with the same amount of, or even less, water, according to Ecolab.

Ecolab adds that the major drivers for the water-treatment business include optimizing operational performance and reliability, including safety; reducing the total cost of operation; regulatory compliance; reducing the amount of wastewater and energy; and protecting brand reputation. “There is growing demand by industry to better use the water they have in their plants,” says Jean-Marc Vesselle, head of the liquid-purification technologies business at Lanxess.

Recycling wastewater and closing the

resource loop are still growing trends, driven by increasing competition for available water and by discharge regulations that have become stricter worldwide, according to Dow. “Regulation is the main driver, and it is getting stricter in all regions,” says Kemira. Removal of micropollutants from drinking water and wastewater is starting to be enforced in EMEA and North America.

Phosphorus-discharge limitations are also getting lower and, in addition, recovery of phosphorus is starting to be required. Sludge treatment is being mandated more strictly in APAC, and drinking-water chemicals have new purity limitations. “Consumer demand and legislation go hand in hand,” says Hermsen. “As consumers become more aware and discerning, they demand more from their water in terms of quality and availability.”

Although it covers 75% of the surface of the planet, water is being recognized as a valuable resource that is not available in unlimited quantities. By 2025, 1.8 billion people will be living in regions with absolute water scarcity, and two-thirds of the world’s population could be living under water-stressed conditions, according to Dow. The Middle East and North Africa, which together account for 6% of the world’s population and possess less than 2% of the world’s renewable water supply, will continue to face water-scarcity challenges that demand water-treatment solutions. The challenge is even greater in China—and growing. “Although home to 21% of the world’s population, China contains only 7% of the world’s freshwater supplies,” says Hermsen.

Water scarcity is positive for business, water-treatment firms say. “Increasing water scarcity leads to a need for more water treatment and reuse that are also positive developments for Kemira,” says Kemira.

The high rate of population growth across the APAC region has also reduced overall access to safe drinking water. At the same time, continued industrialization in countries such as India and China has significantly reduced the quality of local water resources. “Without the necessary infrastructure in place to meet these evolving water challenges, the demand for residential water-treatment solutions will continue to grow,” Hermsen says. In light of increasing demand and finite water supplies,

especially in water-strapped areas, it is imperative that water sources are recycled and renewed where possible. “The challenge is to develop technology that addresses a range of wastewater streams, while at the same time using the right combination of technology to treat water to different levels based on quality specifications and uses,” she says.

The water-treatment business is also becoming more intricate. “We see increasingly that the water that has to be treated is becoming more and more complex,” says Vesselle. “We see more cases where a combined approach is required, with a

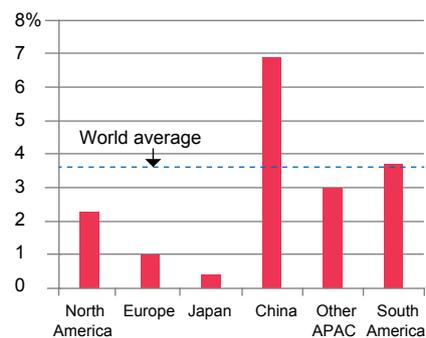
mixture of ion-exchange resins (IEX) and membranes in order to be able to treat the water, because this water is not coming from a clean river, a reservoir, or from underground, but more often is coming from process water that has already been used,” Vesselle says. “This water contains some form of chemical



HERMSEN: Outlook for the water treatment industry is positive.

Water treatment chemicals

(Growth rates, 2017-22 in percent)



Source: IHS Markit.

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that needs to be removed, and it’s not usually done by running through one process.”

Wastewater treatment often requires know-how in more than one technology and application in order to design and apply the most effective system. Implementing a “one size fits all” water-treatment system is not effective or cost-efficient, according to Hermsen. Individual water-treatment technology design tools are useful, but can make it difficult to optimize systems that require multiple technologies, she says.

Dow uses what it calls system-optimization services to run a battery of sophisticated assessments using a variety of equipment and methods to identify critical issues affecting

ultrafiltration (UF), reverse-osmosis (RO), and IEX systems. In addition to performance testing, cleaning recommendations, membrane autopsy, resin analysis, and water analysis, Dow provides comprehensive reporting with a discussion on the implications that test results may have on individual operations.

“Our customers are being squeezed at both ends due to declining feed water quality and increasingly complex discharge requirements,” says Hermsen. “As this water vice tightens, advanced water treatment becomes a much more attractive option,” she says. Dow is seeing a broad range of industries turn to seawater, brackish water, and recovered water for sourcing, and a need to improve this water to a quality level fit for their operations, whether they are using water as an ingredient or a process utility. “The barrier here becomes capital, and each company and industry has to balance that against regulations, fees/fines, and brand reputation,” Hermsen says.

Water-treatment customers want the most efficient water-treatment technology available. They are asking for better reliability, higher uptime, lower maintenance, less waste, reduced use of chemicals, and improved energy efficiency. “We are working with them and other industry leaders to deliver cutting-edge, yet functional, solutions that conserve water and reduce cost,” according to Hermsen. “Customers need complex solutions because the water is complex,” Vesselle says.

In certain respects, the water-treatment business is also becoming more focused. “We are confronted with a growing number of demands regarding removal of specific contaminants,” says Vesselle. “Last year, we have seen a pickup in demand for removal of chromium(vi) from drinking water, and we have produced a new product in the IEX line specifically for removal of chromium(vi), which is really a nasty chemical. We are now offering a solution that is several-fold better than that which existed in the market before,” he says.

Next-generation IEX resins, in combination with optimized system design, can offer up to 10% greater productivity from raw water, helping lower the total cost of water for industrial operators, according to Dow. Such innovations are filling critical gaps in cost-performance in a variety of industrial water-treatment and reuse applications, including oilfield water, food and beverage, heavy industry, cooling towers, and mobile applications, according to Hermsen.

Another key water-management issue is balancing the connection between water and energy, according to Dow. Advances in membrane technology have made renewing resources, such as desalination, a more viable, energy-feasible option. Energy consumed by using membrane technology has been cut by a factor of almost three, making up 33% of total operating costs. The desalination plant at Carlsbad, California, which uses reverse osmosis, requires 12% less energy to yield the same quality and quantity of water compared with the technology being used 10 years ago.

“From a technology perspective, we see that automation and digital solutions are becoming more common,” Ecolab says. Kemira is using digital solutions and online control and monitoring to create value for its customers by optimizing the applications where its chemicals are applied. “Customers are demanding new solutions that help them manage aging assets and minimize costs,” Kemira says. Digital solutions are a suitable answer as they help to enhance the operations of the plant and make customer processes more stable and predictable, optimizing the use of chemicals, increasing treatment capacity, and reducing energy consumption.

Such digital services are also reducing the total cost of ownership, according to Kemira. “One of the main drivers for digitalization in water treatment is aging assets and lack of funding to renew them,” says Kemira. “With digital solutions, the efficiency and operability of older assets can be enhanced and prolonged with relatively small investment.”

The industry will continue to push to reduce costs further and to lower its environmental impact by using less water and lower volumes of chemicals, or by using water of lower quality in the process, according to AkzoNobel.

“Existing technology will not solve all of these problems,” says John Anderson, global water treatment marketing manager at AkzoNobel.

The industry is combining efforts to comply with regulations with efforts to reuse water and reuse it more effectively. “There is a clear strengthening of enforcement of environmental-protection regulations by the authorities, with a very clear drive by a number of industries to find solutions to reuse water, in a circular-economy approach, so that they can reduce their impact on the environment,” says Vesselle.

Worldwide consumption of specialty chemicals used in water treatment, at the manufacturer’s sales level, was worth \$8.84 billion in 2017, according to IHS Markit.

Global consumption of water-treatment chemicals is expected to grow at an average annual rate of about 3.6% over the next five years, to reach \$10.6 billion in 2022, IHS Markit says. Growth in China is expected to average 6.9%/year during the period 2017–22, with South America set to grow at 3.7%/year. The more mature markets of North America and Europe will grow at 2.3% and 1%, respectively (chart). The major markets for the consumption of water-treatment chemicals in 2017 were North America and China, accounting for 33% and 31% of demand, respectively, followed by Europe at 18% (chart).

The outlook for the water-treatment business is good, partly because the economic environment is better than at any time in the past 10 years, according to Lanxess. Growth in 2017 in the European Union was the best since 2009. “Overall, we see that the demand for process treatment,



VESSELLE: EVs a really strong opportunity for the future.

economic fluctuations,” Kemira says.

AkzoNobel is similarly bullish, forecasting water-treatment growth in 2018 to exceed GDP, “based on the customer activity and commitments that we’re seeing early in the year,” says Anderson. Oilfield and mining water treatment will each have strong growth, he says.

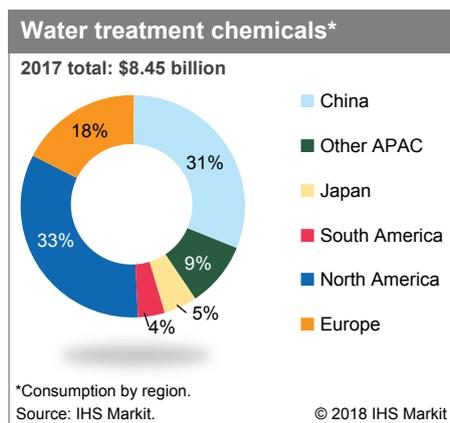
Dow expects industrial water recycling and reuse applications to expand worldwide in a response to increasing pressure on water supplies. “Our outlook for the water-treatment industry is positive,” says Dow’s Hermsen.

“We expect higher-than-GDP growth in the markets that we serve.” The residential water-treatment purifiers market is forecast to expand by 9% annually by 2027, and within this segment the demand for RO technology is expected to grow by 9.7%/year, according to Dow.

China remains the region with the most opportunities in the industrial wastewater space because of stricter discharge standards across a number of industries, including oil refining, petrochemicals, synthetic resins, inorganic chemicals, and secondary metallurgy, according to Dow.

Another major trend—electric vehicles (EVs)—is on the horizon, according to Vesselle. “There is a very clear trend that you will have more EVs,” he says. “And that means one thing—you are going to need batteries.” Battery technology revolves around lithium and a few base metals, such as cobalt. This is a major challenge, in terms of availability and especially in terms of purity. The quality they deliver for the steel or glass industries is not sufficient for making batteries. “We see a lot of activity in that space,” Vesselle says. All this means more demand for water treatment.

Mopeds are a widespread form of transport for many countries in Asia, and many of these mopeds are electric. China only has e-mopeds, and Vietnam has announced that it will only allow e-mopeds by 2025. The Indian government says that only EVs will be permitted after 2030, driving demand for batteries. “All the processes to gain high-purity metals mean hydrometallurgy, and when you do hydrometallurgy, you need IEX resins,” Vesselle says. “This is really a very strong opportunity for the future.” ■



all sorts of liquid purification, is ramping up and being pushed to their capacity limits,” says Vesselle. “Customers are asking for more, either by requiring additional capacity to be built, or better solutions to optimize what they already have. Demand is very strong currently, and we are debottlenecking our production capacity in order to support that.”

The overall picture “is unchanged compared with early 2017,” says Kemira. “We expect our addressable market overall to grow on average about 2–3% per year in the period 2017–20. We do not see major differences in this growth outlook in our various water-related businesses. Overall, the water-treatment market is growing steadily, and independently of