Although accounting only for a fraction of total industrial valve sales, desalination is a growing market for valves and an area of significant opportunity, particularly for manufacturers of corrosion-resistant flow control equipment. Driven primarily by regional water scarcity and growing populations, the market is concentrated in the Middle East, but desalination is a truly global industry, supplying water for both residential and industrial use in more than 160 countries.

By Matjaž Matošec, Research Manager, Resolute Research

Desalination plant in Hamburg, Germany

Desalination: a growing market for valves

The total number of desalination plants worldwide, including those already under construction, is more than 20 thousand. This sizeable fleet of facilities includes plants of all types and sizes, ranging from micro facilities catering for industrial, commercial and residential clients to mega-sized plants operated by municipal, regional and national water utilities responsible for supplying drinking water to customers in large urban areas. Municipal desalination represents only about a quarter of all plants, but because municipal plants generally have larger capacities than those for industrial and other clients, they account for around 60% of total installed capacity. Similarly, more than 60% of desalination capacity currently under construction has been commissioned by the utility sector. For these reasons, the following discussion will focus on the municipal desalination market.

Market drivers

The growth of the desalination market reflects several factors, all of which are driving demand for drinking water. Rapid population growth and increased urbanisation, particularly in coastal regions of many developing countries, is putting a strain on locally available freshwater resources, making seawater desalination the obvious solution to overcome water shortages, and in many cases a necessity. Additionally, rising population and economic growth are in-

About the Author

Matjaž Matošec is Research Manager at Resolute Research where he leads a dynamic team of market analysts. Resolute Research is a market research and consultancy firm providing global clients with world-class market intelligence on industrial valves, pumps and flowmeters, in the form of market reports, databases and custom research. Collectively, Resolute Research possesses decades of experience in providing consulting services to professionals working in the industrial process industries. For more information, you can contact Matjaž at m.matosec@resoluteresearch.com or visit www.resoluteresearch.com.

creasing the demand for food and in turn drive water-intensive agricultural production, forcing urban water users to develop new water resources.

Groundwater depletion caused by sustained overexploitation of groundwater resources is another negative development inextricably linked to demographic trends, creating increasing demand for brackish water desalination.

Last but not least, global warming and changes in climate patterns are increasing the frequency and severity of droughts which are no longer restricted to arid regions but are affecting large parts of our planet, placing water security high on the political agenda of many countries and often rendering desalination the only viable alternative for water resources.

Geographic opportunities

According to the United Nations, over two billion people live in countries experiencing high water stress. Furthermore, nearly half the global population are already living in potential water scarce areas at least one month per year, and this could increase to more than five billion in 2050. While about 73% of the affected people live in Asia, countries in the Middle East and North Africa (MENA) experience the highest levels of water stress.

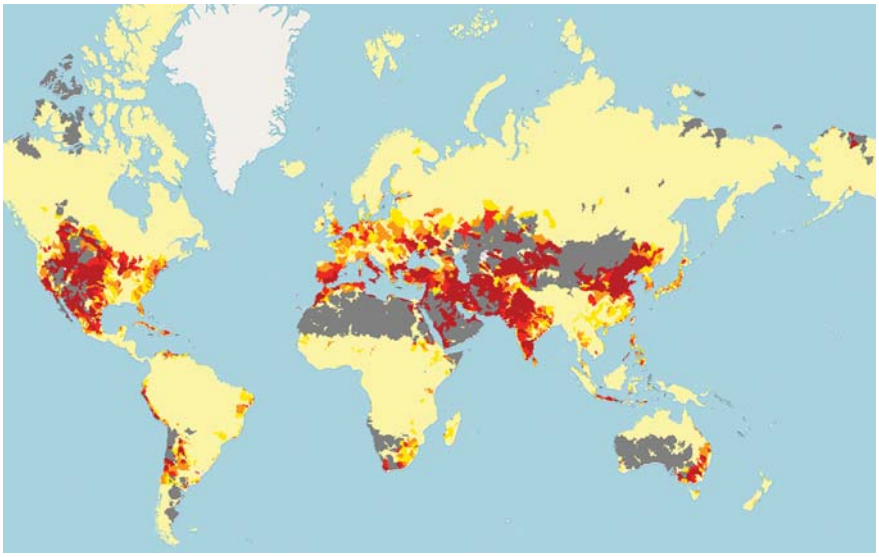
It is therefore no surprise that the MENA region is the largest market for desalination, accounting for about 61% of the municipal capacity currently installed worldwide, and for nearly 75% of the municipal capacity under construction.

On the country level, Saudi Arabia is the largest market, followed by the United Arab Emirates and the United States. These three countries are also the fastest-growing desalination markets, providing attractive opportunities for both new and aftermarket valve sales. Other major markets include Spain, Kuwait, Algeria, Israel, Qatar and Australia, with significant new capacity expected to come online by 2022 also in Oman, Egypt, China, Morocco, Singapore, Iraq, India, Kenya and Tunisia.

Technology trends

There are several desalination methods, with two processes being prevalent, namely membrane and thermal. The most widespread membrane technology is reverse osmosis (RO), while the predominant thermal technology is multi-stage flash (MSF). RO is a process whereby feedwater is forced

Water Stress in 2020

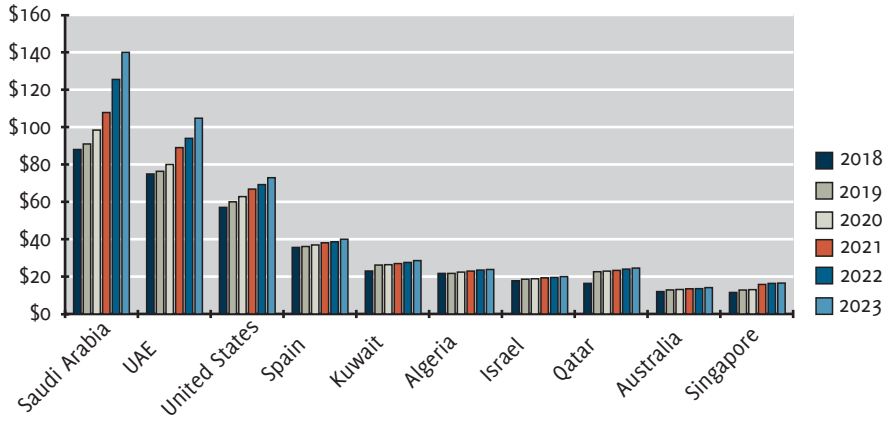


Low (<10%) | Low to medium (10–20%) | Medium to high (20–40%)
High (40–80%) | Extremely high (>80%) | Arid and low water use | No data

Source: World Resources Institute – Aqueduct Water Risk Atlas

Valve Sales by Country (Top 10), in USD million

Municipal desalination market

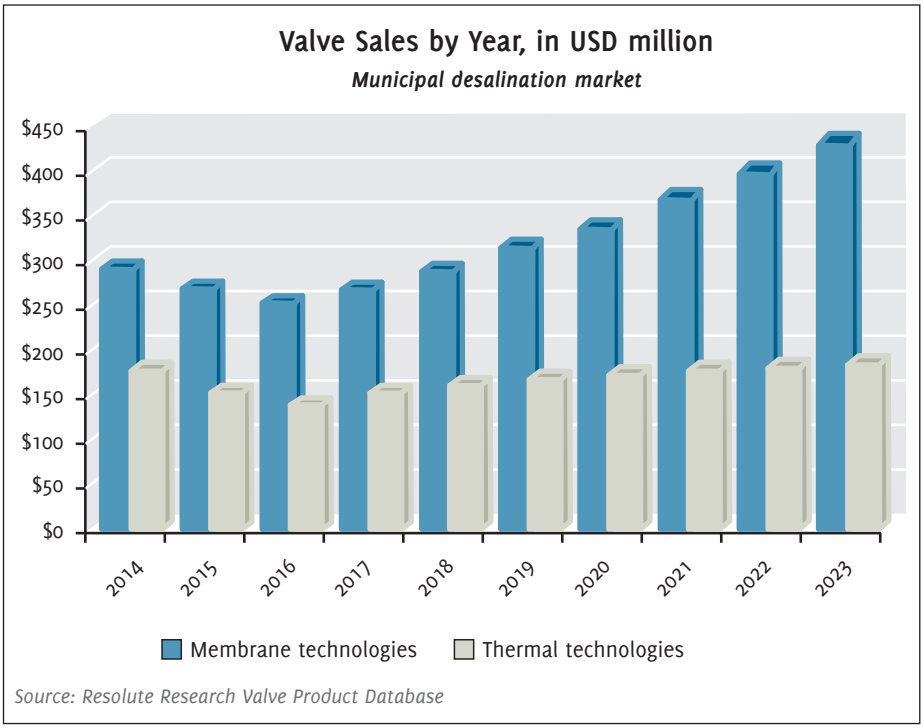


Source: Resolute Research Valve Product Database

through a semipermeable membrane at high pressures to remove salt and other impurities. MSF, on the other hand, is a multi-stage distillation process that involves evaporation and condensation, resulting in the generation of brine and distilled water.

Historically, there has been a preference for thermal technologies in the Middle East and North Africa, and particularly in Saudi Arabia and the United Arab Emirates which together account for nearly 70% of global municipal MSF capacity. However, while highly reliable and capable of producing extremely pure water from the saltiest seawater sources, MSF requires large amounts of energy and is characterised by higher capital costs and larger footprint than RO. These factors have led to the dominance of RO technology, which now represents more than 60% of the total installed utility capacity and 85% of new capacity currently under construction.

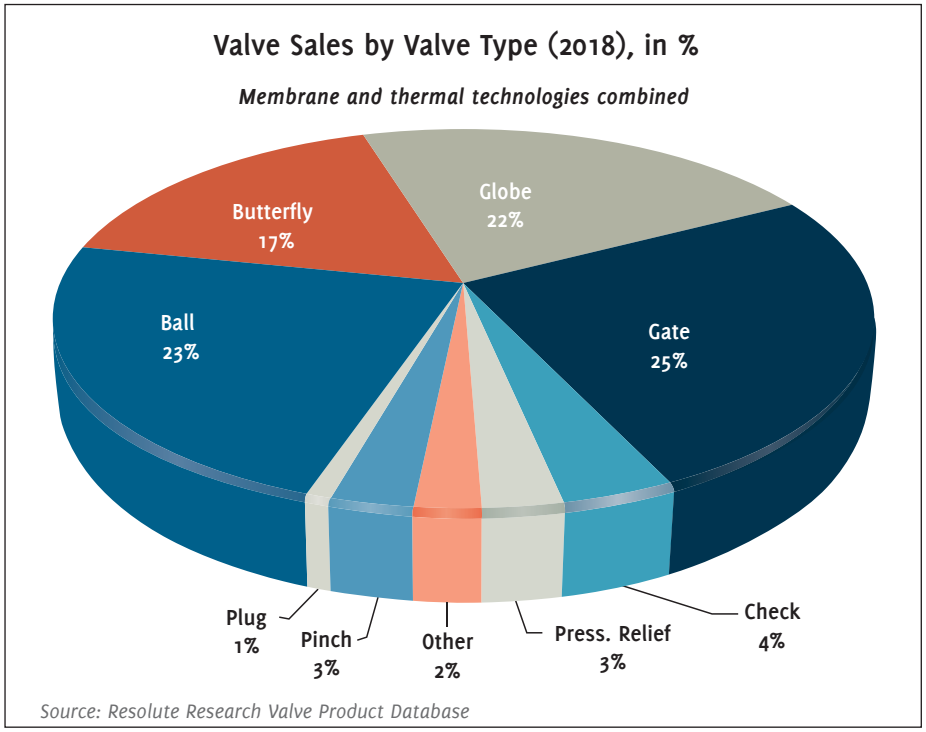
Accordingly, the RO market will generate the majority of new and aftermarket valve sales in the desalination industry, whereas the thermal market is expected to plateau, with valve sales limited largely to maintenance, repair and overhaul (MRO) parts.



Source: Resolute Research Valve Product Database

Valve requirements

Desalination requires a wide spectrum of valve technologies capable of handling large volumes of water, including gate, ball, globe, butterfly, check, pressure relief, pinch and plug valves. High-salinity media such as brine (a by-product of the desalination process) are highly corrosive, necessitating the use of special materials capable of withstanding chloride-rich environments, most typically duplex and super duplex stainless steels. Corrosion protection is required not only to combat salinity contained in the water, but also that present in the air, considering that the majority of desalination plants are situated in coastal areas where the atmosphere can be very humid and corrosive. Furthermore, reverse osmosis is a high-pressure process during which some control valves experience a significant pressure drop and possible damage from cavitation. This requires the use of high-pressure valves as well as control valves featuring anti-cavitation trim.



Source: Resolute Research Valve Product Database

Chemical treatments

Desalination in general and RO systems in particular require several types of water treatment involving not only mechanical filtration but also the use of chemicals for membrane protection and post-treatment of desalinated water.

Chemical pretreatment of feedwater is designed to remove solid and organic contaminants ahead of the RO membrane, to prevent scale formation and membrane fouling. This process involves, among other things, the use of various coagulants and flocculants to precipitate solids, chlorine dioxide to kill microbes, and treatment with sodium bisulfite to eliminate any traces of residual chlorine in the feedwater that can seriously damage RO membranes.

Periodic backflushing of membranes with mild citric acid is used to remove scale and keep the membranes operating at peak efficiency over the life of the membrane cartridge. Post-treatment of product water also involves the addition of various chemicals, including minerals essential for potable water (remineralisation with calcium hydroxide and other chemicals), caustic soda to adjust pH, and sodium hypochlorite for disinfection, plus other chemicals for the protection of distribution piping networks. The wide usage of chemicals in desalination requires the use of metering pumps and associated isolation valves which are often supplied in engineered polymers or lined with PTFE or PFA to provide corrosion resistance.

Industrial market

As already mentioned in the introduction, desalination is a growing market, which is true also for the industrial sector. The power generation industry accounts for the largest installed desalination/ultrapure water capacity, followed by upstream oil & gas, refining, mining and other industries. Major industrial markets and applications for reverse osmosis (RO), microfiltration (MF) and ultrafiltration (UF) membrane technologies include:

- Boiler feedwater treatment across many industries (ultrapure water for supercritical utility boilers);
- Condenser water treatment;
- Semiconductor market for ultrapure rinse water;
- Food & beverage market for ultrapure process water;
- Pharmaceutical market for ultrapure water for injection (WFI); and
- General industrial wastewater treatment for zero liquid discharge (ZLD), and water conservation in general.

The combined markets for highly engineered desalination valve and pump products for municipal water utilities and industrial markets create a demand that is truly global in scope and intersects nearly all industrial markets.

Jebel Ali M-Station in UAE

Jebel Ali M-Station is the largest power and desalination plant in the United Arab Emirates and the fourth largest desalination plant in the world, with a desalination capacity of 636,440 m³/d. M-Station is located within the Jebel Ali Power Plant and Desalination Complex on the outskirts of Dubai, which accommodates multiple other large-scale desalination plants with a combined capacity of 1.72 million m³/d. All plants use thermal MSF technology and are operated by the Dubai Electricity & Water Authority (DEWA) which is responsible for providing drinking water to more than three million residents of the sprawling city of Dubai. Earlier this year, construction on a new desalination plant at the Jebel Ali Power and Desalination Complex commenced. The plant with a capacity of 181,840 m³/d is expected to become operational by May 2020 and will use RO technology, reflecting the general industry trend toward membrane processes. Photo © Haider Y. Abdulla – stock.adobe.com

** Note: All data on existing and future desalination capacity is derived from DesalData.com.*