

RO Membrane Technology— Advances Improve Global Access to Clean Water

Desalination systems based on reverse osmosis technology are increasing the availability and quality of clean drinking water in Toas Island in Lake Maracaibo, Venezuela

Historically, the world market has been in the equatorial zone, arid environments and island coastal communities. Remote communities have led the way with this technology, but as quality water sources become more and more scarce, both industry and municipalities are recognizing the need for RO desalination.

Until recently, the thought of drawing drinking water from the sea to serve the masses was considered largely out of reach due to high costs. Ten years ago, pulling 1,000 gal. of water from the sea and making it drinkable utilizing reverse osmosis (RO) would cost a municipality close to \$5. Thanks to advances in technology, the cost has dropped dramatically to roughly \$2. For the first time, coastal communities are able to draw and desalinate water from the sea for nearly the same price they likely used to pay to have clean water piped in from inland freshwater sources. This spells hope for a thirsty world, especially the six billion people who reside in coastal areas.

Developments in RO membrane desalination technology are making the option increasingly attractive from a technical and financial viewpoint. In fact, current estimations of the membrane desalination market show that it will generate \$3 billion per year in new business over the next decade, largely due to the falling cost of water produced by RO systems. Both advancements in membrane manufacturing and applications engineering have made RO the leading process in the worldwide water desalination market.

Desalination Brings Clean Water to Island Community

ITT – Aquious Water Equipment Technologies recently implemented a reverse osmosis solution to supply useable water to Toas Island in Venezuela. Toas Island was one of the country's poorest sections in this country. Today, the island enjoys enough fresh water to consider starting a tourist business.

Toas Island is located in the middle of Lake Maracaibo, once one of the world's

largest fresh water lakes. For over half a century, the lake has been channeled to the sea for freight traffic that over time has allowed seawater intrusion—making it unsuitable for drinking, cooking or other everyday needs.

Island residents were dependent on a corroded water pipeline from the mainland that only ran twice a week for four hours, and a rusted, undependable barge that would make two trips a week for water. That was when it wasn't broken.

Last year, ITT – Aquious oversaw the complete installation of a reverse osmosis desalination system that is pumping 1.5 million liters of water to Toas residents every day. One of the key design features is a system that is flexible in its operating parameters. Depending on tide swings and seasonal shifts, the salt levels in this area of Lake Macacaibo change drastically—ranging from 8,000 parts per million (ppm) all

the way up to sea water levels of 32,000 ppm. The higher the salinity level, the more pressure is needed to push water through the reverse osmosis membranes.

In addition, ITT – Aquious's system is designed so operators can take constant measurements and make the appropriate pressure adjustments.

The system is also durable enough to handle the mud, silt and suspended particles being pulled in from the lake. ITT Industries' pumps are used to transport the water from the lake to the clarification tanks, the multimedia filtration system and finally to the reverse osmosis systems.

After it was designed, the system had to be transported by boat and truck to the remote island. The water from the desalination plant is sent through more than 10 kilometers of piping to a 1.5 million liter storage tank located at the highest point of the island. Gravity does the rest, supplying fresh

By Jorg Menningmann



ITT -Aquious reverse osmosis desalination system pumps 1.5 million liters of water per day to Taos residents.



water to the 2,500 households on the island.

ITT's system has done much for the island community.

"The first day with water, children were outside my window at 2 a.m., playing in the mud because they couldn't believe there was enough extra water to even create mud. The smiles were incredible and very real," remembers Mainor Vega, business manager, Latin America, for ITT – Aquious Water Equipment Technologies.

The water is transforming the island on a larger scale, too. As a result, the island is thinking of building a tourist business—something that would never be possible without clean, potable water.

Municipalities and Commercial Entities See Promise in Desalination

ITT Industries designed a seawater reverse osmosis system capable of producing drinking water from the Red Sea. The

Red Sea has an incredibly high salinity level, approximately 43,000 ppm. The high salinity level made it imperative for the system designed to not only perform efficiently, but also to be capable of withstanding the harsh conditions of the application. The system is now producing 134,000 gal. per day of high-purity drinking water at the same or better cost than trucked in well water of much higher salinity. Today, almost all the resorts in this area rely on seawater desalting for their water needs.

In the U.S., California, Florida and Virginia are among the many states using desalination. With a pending shortage of drinking water, a municipal water utility in Newport News, Va. employed the technology of a reverse osmosis system to tap a brackish groundwater supply. With design, technical support and operator training from ITT – Aquious Water Equipment Technologies, the municipality was able to quickly augment its safe drinking water supply and enhance the quality of its overall water supply. The facility is capable of producing 5.7 million gal. per day.

Beyond these examples, approximately 9,500 desalination plants worldwide have an aggregate capacity of 8.5 billion gal. per day (32 billion liters). Forecasts from Global Water Intelligence also suggest a greater than 100% increase in installed global capacity from 2005 to 2015, creating a total market worth \$95 billion over the next decade.

Supporting these forecasts is the fact that an RO desalination system marketplace is justifiably anywhere that there is lack of adequate fresh water supplies and a good source of available seawater or brackish water. Essentially there is a candidate for desalination by RO anywhere that there is growth and development and a shortage of clean drinking water.

In California, Florida, Mid-Atlantic and Gulf States, the Caribbean, Central and South America, the Mediterranean, Middle East and Pacific Rim, RO desalination is a viable resource for the world's constantly increasing fresh water requirements. *wqp*

About the Author

Jorg Menningmann is the general manager at ITT – Aquious Water Equipment Technologies. Menningmann has a degree in Ocean Engineering from Florida Atlantic University in 1977. He has served as a principal investigator projects for the Office of Water Research and Technology to collect and analyze data on 24 commercial membrane type desalination facilities, as well as a proposal engineer for a variety of reverse osmosis desalination applications. Additional information is available at 561.684.6300 or at www.itt.com.

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