The New York Times
Green Inc.
Energy, the Environment and the Bottom Line

SEPTEMBER 21, 2009, 1:55 PM

The Pursuit of Cost-Effective Desalination

By JEFFREY MARLOW

Getty Images High-pressure pumps at Israel's Ashkelon Desalination Plant.

Water demand is increasing in many parts of the world, as populations increase, aquifers dry up and climate change makes rainfall patterns less predictable.

As a result, many communities – from Dubai to California – are placing their bets on seawater desalination.

Traditionally, the expensive process has been used only for select applications, but as costs decrease and the market widens, desalination is becoming more widespread.

The Ashkelon Desalination Plant on Israel's Mediterranean coast is at the forefront of the desalination boom.

The facility is the world's largest "reverse osmosis" plant, producing 113 million cubic meters of water each year – approximately 6 percent of the country's water budget. The process uses high pressure to push seawater through a membrane, thereby excluding salt molecules and producing clean, usable water — but according to Micha Taub, the technical manager at the Ashkelon plant, "what's innovative in this plant is not the membrane itself, but the installation and the design."

One of the most important developments is the on-site power plant, which allows the facility to avoid production disruptions and price hikes associated with grid-based power. "If you don't have a constant supply at a constant cost," notes Mr. Taub, "you have to change the production based on the cost, producing less at times of peak electricity cost."

Another key feature at Ashkelon is the energy recovery system. After the purification process, the concentrated saltwater maintains a very high pressure and can be used to generate power. A standard turbine recovers 89 percent of the input energy, but Mr. Taub has seen that figure rise to 96 percent with hydraulic pumps.

Because of these design-based innovations, the Ashkelon plant produces some of the world's cheapest desalinated water at 52.7 cents per cubic meter. (Other contenders for the title include the Singapore-Tuas plant at 49 cents per cubic meter and California's Energy Recovery at 46 cents per cubic meter.)

"Although it's quite cheap," says Mr. Taub, "it's still not so economical for agriculture."

In order to make desalinated water truly affordable for all applications, new technology will likely play a critical role.

Membranes derived from carbon nanotubes, for example, could decrease the cost by 75 percent compared to reverse osmosis, according to the technology's developers at the Lawrence Livermore National Laboratory.

"We are looking around and trying very much to stay updated," notes Mr. Taub. With some improvements on reverse osmosis — "or maybe some completely new technological breakthrough," he added, "we could have enough water for everyone at a very low cost."

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