

WATER DESALINATION REPORT

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Technology

SOLAR POWER + RO MAY BE LOW COST OPTION

Water and power have always shared a unique relationship, and desal plant economics and environmental impacts are often governed by that relationship. Energy costs can represent more than half of a desal facility's operating expenses and the plant's carbon footprint is directly related to its energy requirement. Because of this, there is a constant search for less expensive, more sustainable energy options.

One of the 'hottest' and most environmental-friendly power generation technologies currently available is concentrating solar power (CSP).

CSP technologies are based on the concept of concentrating solar radiation to provide high-temperature heat for electricity generation in conventional power cycles. Most systems use parabolic troughs, glass mirrors or solar dishes that continuously track the sun's position to concentrate solar energy to boil water and generate steam that drives a turbine to produce up to 200 MW of electric capacity. To generate one Megawatt-hour of solar electricity per year, 4–12 m² (43–130 ft²) of land area is required. This means that 1 km² (247 acres) of arid land could continuously and indefinitely generate as much electricity as a conventional 50 MW fossil fuel power station.

Solar heat collected during the daytime can be stored in concrete, molten salt, ceramics or phase change media and extracted from the storage to run the power block at night.

Acciona Energy constructed the 64 MW Nevada Solar One CSP in Boulder City, Nevada last year and the \$266 million plant produces electricity at \$0.15–\$0.17/kWh. Although not yet as inexpensive as gas or coal-fired power, CSP has the advantage of not generating greenhouse gases.

The German Aerospace Center (DLR) recently conducted a study entitled *CSP for Seawater Desalination* that analyzed the technology's potential for use with seawater desal in the Middle East and North Africa (MENA) region. The result is a database on technology options, solar energy resources and the potential markets for solar desal in MENA countries. The report also includes a long-term scenario quantifying CSP's socio-economic and environmental impacts.

Reference system capital costs for a 21 MW CSP power plant and SWRO and MED desalination plants producing 24,000 m³/d (6.34 MGD) and 21 MW of solar power were

estimated at €76.4 million (\$117 million) and €84.9 million (\$130 million), respectively.

The report concludes that within 20 years, energy from solar plants will be the least cost option for electricity at less than \$0.04/kWh and a desalted seawater cost of less than €0.40/m³ (\$0.61/m³; \$2.32/kgal).

Franz Trieb of the DLR's Institute of Technical Thermodynamics oversaw the study and told *WDR*, "Solar power's resource potential dwarfs global energy demand by several hundred times. Its cost is now equivalent to the price of oil at about \$50/barrel and the cost will reduce by 10 to 15 percent each time the world's installed capacity doubles. By 2025 it should be equivalent to \$15 to \$20/barrel oil."

Like many technology options being considered, CSP is not a panacea, but this report goes a long way towards enhancing its credibility as a viable option to consider. Dr Trieb summed things up by saying, "This study is a roadmap, not a wheelchair: it helps identify the medium and long-term goals and shows how we can achieve the goal, but it won't carry us there, we'll have to walk by ourselves."

California

1ST PHASE SEAWATER NF/NF A SUCCESS

Long Beach Water Department has completed the first phase tests of its proprietary, dual-stage nanofiltration seawater desalination process. Known as *The Long Beach Method*, or *NF2*, the process was developed by Long Beach's Diem Vuong and employs a two-pass nanofiltration system with the first pass NF operating at 525 psi (36 bar) and the second at 250 psi (17 bar). The goal is to reduce energy consumption over conventional SWRO and provide a double barrier to increase water quality reliability.

A pilot test of the NF2 process has been in operation since October 2001, and for more than seven months, a 0.3 MGD (1,135 m³/d) demonstration project has been in operation to evaluate the side-by-side performance of the process to conventional SWRO.

Robert Cheng, Long Beach's assistant manager for operations, told *WDR* that the two systems recently underwent two, 48-hour performance tests to evaluate their performance. "Our goal during these phase one tests was to evaluate the relative energy consumption of the Long Beach

Process and SWRO while operating on seawater pretreated by microfiltration and producing permeate that met TDS requirements for potable water,” he said.

“We were able to demonstrate that the optimal, reproducible energy consumption for the NF2 process was 10.1 kWh/kgal (2.67 kWh/m³) versus 14.2 kWh/kgal (3.75 kWh/m³) for the SWRO with both systems operating on the same feedwater and an overall process recovery of 33 to 35 percent. Both systems are fitted with ERI’s PX energy recovery device and the energy consumption reported in the test includes the feedwater transfer pump and the high-pressure booster pumps,” said Dr Cheng.

After completing the first phase of testing, the SWRO will be dismantled and replaced with a second NF2 system. Further research will focus on membrane optimization, vessel configurations and new concepts for disinfection and microbial fouling control of the membranes utilizing ultraviolet light and chlorine dioxide.

Long Beach and the Bureau of Reclamation are also constructing an under ocean floor intake and discharge demonstration system to demonstrate an alternative currently in operation on an SWRO facility in Japan.

Additional information on the project is available at www.lbwater.org/desalination/desalination.html

TEXAS

DESIGN-BUILD PROCUREMENT FOR BWRO

San Antonio Water System’s (SAWS) board of trustees has approved a resolution to use a design-build project delivery method for its proposed 20 MGD (75,700 m³/d) brackish groundwater desalination project. The \$200 million project will desalinate water from the Wilcox Aquifer to supplement the region’s water supply from the Edwards Aquifer.

Until last year, Texas was one of the few states with severe restrictions on alternative project delivery procurements. During its last legislative session, a bill was passed to allow the phase-in of design-build project delivery arrangements for certain infrastructure projects including water and desalination facilities.

Seventeen consultants responded to SAWS’ solicitation for information on alternative project development and financing strategies. After interviewing many of the respondents, SAWS selected the design-build approach. According to Janelle Okorie, SAWS’ vice president of strategic resource and business planning, “The design-build process will provide a huge benefit to our ratepayers. It will enable

certain design and construction activities to be completed in a faster time frame and, consequently, at reduced cost when compared to the traditional procurement options.”

Project procurement activities are expected to start later this year and the plant is expected to be on-line by 2011.

Company News

SHIP-BASED DESAL ABOUT TO SET SAIL

Water Standard Company (WSC) has announced that the company has received a commitment of up to \$250 million in equity funding to develop its ship-based desalination technology. Company CEO Amanda Brock told *WDR* that the funding commitment is set to be finalized later this week, and the company has plans to immediately move forward with the final design and construction of a large-scale vessel-mounted SWRO.

“We’re in negotiations with several interested parties and look forward to closing one or more of the contracts very soon. Our financial partners are well connected globally and very experienced in infrastructure development. We’ve put together a team of veteran desalters and marine architects who have prepared a reference design that includes our patented seawater intake and concentrate outfall, and we plan to develop a fleet of vessels that can be deployed around the globe under both long-term and short-term contracts,” she said.

The vessels will include power generation capabilities and on-board seawater desalination systems with scalable production capacities of up to 200 ML/d. Potable water will be transported to shore by undersea pipeline or a flexible hose system.

WSC founder Andrew Gordon said the company has developed a strong intellectual property position for vessel-based, large-scale desalination and wastewater treatment. The company holds issued and pending patent applications in over 90 countries.

Desal Research

A DROP IN THE BUCKET

As the US’s largest water wholesaler, the Bureau of Reclamation brings water to more than 31 million people and produces irrigation water for farmland that produces 60 percent of the nation’s vegetables and 25 percent of its fruits and nuts. Reclamation’s mission is to “assist in meeting the increasing water demands of the West while protecting the environment and the public’s investment in these structures.”