

WATER DESALINATION REPORT

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United Kingdom THAMES DESAL PLANT CONSTRUCTION AT 25%

Work on the UK's first large-scale desalination plant is approximately 25 percent complete and on target for a late 2009 start-up. The 150,000 m³/d (40 MGD) Thames Gateway BWRO plant is being constructed near Beckton, on the north bank of the Thames River in the east London Borough of Newham.

A consortium including Acciona Agua, Interserve and Atkins Water is building the £200 million (\$373 million) plant. The project includes a 14km (9 mile), 1200mm (47-inch) diameter pipeline, which is being constructed by Murphy Plc, to transfer the desalted water to northeast London.



Plant site relative to London and the English Channel

London's former mayor opposed building the plant, arguing that it was energy-intensive, saying that Thames Water should spend the money fixing its existing system rather than building a new plant. In May, less than two weeks after being elected mayor, Boris Johnson dropped the legal challenge after agreeing to a package of environmental measures offered by Thames Water. The plan includes a legally binding commitment to power the plant with renewable energy

Julio Zorrilla Velasco, Acciona's international construction director, told *WDR* that feedwater will be abstracted from the Thames River estuary during the periods when the TDS is approximately 11,000 mg/L. "By taking water during the three hours leading up to low tide, we will minimize the feedwater salt concentration to less than one-third that of seawater at most. This means the plant will require approximately half as much energy as would be required to treat seawater," he said.

According to Zorrilla, the pretreatment will consist of coagulation, flocculation, and sand filtration followed by a Norit X-Flow UF system. He said that Outokumpu will supply the stainless steel, Hydranautics will furnish the RO membranes, and Flowserve will furnish the high-pressure pumps. Calder will provide energy recovery turbines for the plant, which has a total plant energy requirement estimated at 6.3 MW.

Concentrate from the plant will be blended with treated effluent discharge from the nearby Beckton Sewage Treatment Works—the largest sewage treatment plant in the UK—at a dilution factor of approximately 50, so its salinity will be lower than the river itself.

The plant was initially proposed to be used only when necessary and was expected to operate approximately 40 percent of the time over the next 25 years.

Desal Data 2007 DESAL CAPACITY GROWS BY 24.5%

A review of the desalination data being compiled for the 21st edition of the *IDA Worldwide Desalting Plant Inventory* shows that contracted desal capacity has been growing at a compounded annual growth rate of 16.8 percent since 1997. For 2007, the contracted capacity grew 24.5 percent

over 2006 for a total 6.7 million m³/d (1,770 MGD). The total contracted global desalination capacity now stands at 63.6 million m³/d (16,800 MGD), of which 53.0 million m³/d (14,000 MGD) has been commissioned.

The full edition of the *IDA Worldwide Desalting Plant Inventory* will be available for download to all *DesalData* subscribers by the end of August. Contact Jack Ceadel at jmc@globalwaterintel.com for details. Others can wait for highlights in the *2008/2009 IDA Desalination Yearbook* available in early October.

Australia

MINING FACILITY TO GET SWRO

Yet another large-scale seawater desalination project has been awarded in Australia. Israel's IDE Technologies announced last week that it has received a contract valued at over €100 million (\$149 million) to furnish a 140,000 m³/d (49 MGD) SWRO.

Although it was not announced, *WDR* understands the plant was purchased by Hong Kong-based CITIC Pacific Mining and will supply process water for the company's Sino Iron project in Cape Preston, 1,800km (1,125 miles) from Perth on Australia's northwest coast in the Pilbara region. The magnetite iron ore mine is the first of its kind in Western Australia and will produce 27.6 million tonnes of magnetite pellets and concentrate per year.

When the project was originally conceived, it was understood to have considered thermal rather than membrane desalination as a source for process water to conserve the limited fresh water resources in the region.

IDE president Avshalom Felber said the project—which is scheduled for a 2010 startup—will be one of the most challenging projects the company has received.

Company News

AECOM SPLITS UP EARTH TECH ASSETS

Los Angeles-based AECOM Technology Corp has completed a \$510 million acquisition of Tyco International's Earth Tech and immediately began the divestiture of some of the assets. The agreement to acquire the Earth Tech was announced in February, at the same time as the company's acquisition of Boyle Engineering.

AECOM said it will retain Earth Tech's consulting engineering business, but it has sold Earth Tech's Water & Power Technologies (WPT) equipment group and its North

American O&M contracts to Suez Environnement.

Suez's Virginia-based Infilco Degrémont will absorb WPT, a Utah-based manufacturer of RO, EDI and other high purity water systems with 2007 revenues of \$40 million. Meanwhile, Suez's United Water will take over 130 of Earth Tech's existing operating services contracts in the US with annual revenues of \$50 million.

Chinese, Mexican and several other international water assets valued at approximately \$60 million are being divested separately.

Company News

ERD GETS AN UPGRADE

Calder AG president Beat Schneider told *WDR* that the company's DWEER isobaric energy recovery device has undergone modifications that will improve the unit's performance and lower its cost. "We've completed a one year development program that led to several developments including a new seal design that reduces high pressure brine leakage from 1–1.5 percent to essentially zero. The improvements have also led to a capital cost reduction," he said.

The first project to use the new design shipped at the end of July. A consortium of Cadagua and Sadyt awarded Calder a contract for 36 units for the 180,000 m³/d (47.6 MGD) Aguilas Project in Spain. The 12-train SWRO facility is scheduled for commissioning later this year.

Technology

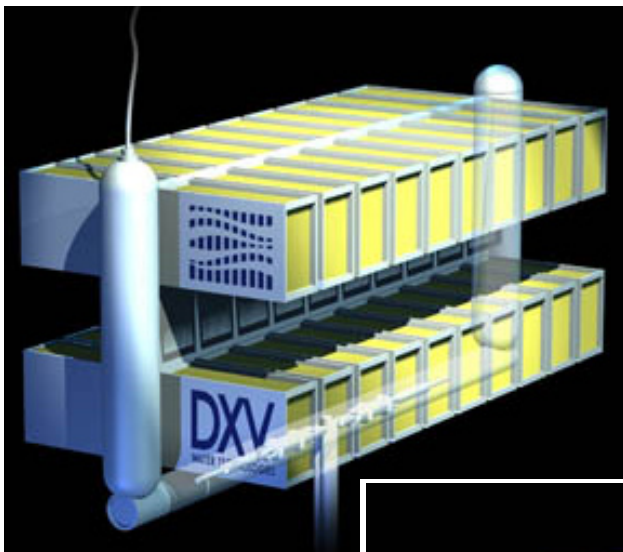
A NEW APPROACH TO DEEP SEA RO

If a membrane is placed deep enough in the sea, the static pressure will provide enough head to drive the reverse osmosis process. All that's needed is a pump to deliver the product water to the surface and you would have a desalter's version of a perpetual motion machine. The concept has been around since the development of the RO membrane. Unfortunately, nature is not quite so accommodating and the permeate pump would require the same energy as the high-pressure feed pump on a conventional SWRO system equipped with an isobaric energy recovery device.

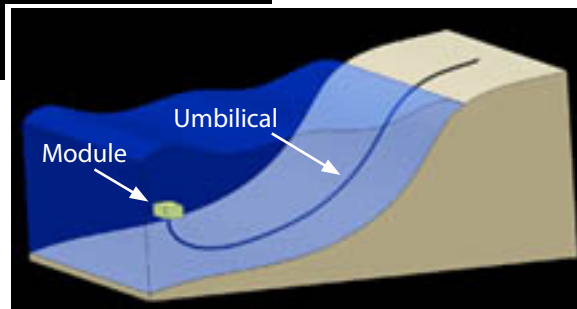
But a California-based company told *WDR* that it has come up with a practical embodiment of the concept using an innovative approach developed by Diem X. Vuong, the

inventor of a two-stage nanofiltration process for seawater desalination. Vuong, who retired from the Long Beach Water Department in 2005, developed the ‘depth exposed membrane for water extraction’ (DEMWAX) process now being tested by DXV Water Technologies.

Using vertically-oriented, flat sheet membrane elements, DEMWAX employs the natural pressure differential that occurs at depths of more than 850 feet (260m) to overcome the osmotic and transmembrane pressures required to drive the process. The elements are spaced approximately 1/4-inch (6mm) apart and arranged in modules coupled with horizontal product water manifolds. The neutrally-buoyant modules are tethered about 100 feet (30m) from



Conceptual Module Layout



System Arrangement

the seabed and connected to land by an umbilical package that includes a permeate conveyance line, a power line to drive the submersible permeate pump—the system’s only moving part—and a vent to atmosphere.

Curt Roth, DXV’s vice president of engineering, said the ability to perform at a low flux and low recovery is key to operating at the relatively low pressure. “We’ve designed the system to operate at a flux of 1.5–2 gfd [2.6–3.4 Lmh] and a 2 percent recovery, using conventional RO membranes. Even at such a low flux, it’s interesting to see what impact gravity has on the ability to maintain the necessary cross-flow velocities,” he said.

Because DEMWAX operates at depths below the photic zone, there is little concern over biological growth, and no pretreatment or pretreatment chemicals are required. Roth said the system mitigates or eliminates many of the environmental issues facing conventional land-based SWRO, noting, “Impingement and entrainment are virtually eliminated and the low recovery means that the ‘concentrate’ reaches background salinity within a couple of meters. For seawater applications, the energy consumption ranges from 4.5 to 5 kWh/kgal [1.2–1.3 kWh/m³], dramatically lowering operating costs and greatly reducing greenhouse gas impacts.”

Many readers have grown numb to reports of new desalting techniques claiming energy reductions of 50 percent or more, but the DEMWAX energy claims are coupled to a system operating at a very low recovery. And, as this newspaper recently noted, the theoretical minimum energy required for a seawater system operating at a near zero recovery is 2.65 kWh/kgal (0.7 kWh/m³), an amount which rises exponentially with recovery rates.

Based on an energy cost of \$0.12/kWh, the company estimates the total water cost of a seawater system at less than \$1.70/kgal (\$0.45/m³).

Michael Motherway, DXV’s president, said DEMWAX modules have been tested in pressure vessels and at depth in both seawater and freshwater applications. “The prototypes have proven our sizing and performance algorithms and taught us a lot about the design requirements for long-term operation of the units. Now that we’ve proven the process concept, we are planning to build some

50,000 GPD [190 m³/d] demonstration plants that should be operational within the next 24 months,” he said.

Motherway acknowledges locations such as the Arabian Gulf are too shallow for DEMWAX, but says there are many locations deep enough to be able to take advantage of the reduced operating costs and small environmental footprint. He said an initial \$1.5 million equity was raised privately for the preliminary development work and prototype testing. Now that the intellectual property is covered by pending patents, the company has begun to seek a second round of equity funding.

China

WATER REUSE WILL BE AN OLYMPIC LEGACY

In preparation for this year's summer Olympics, Beijing has constructed 14 wastewater treatment plants since 2001, at least three of which employ membranes for water reuse. One of the projects—the Bei Xiao He Wastewater Treatment Plant—directly serves the Olympic Park.

Siemens' Lisa Sorgini told *WDR* that the project involved expanding the capacity of an existing 40,000 m³/d (10.6 MGD) wastewater plant to 100,000 m³/d (26.4 MGD) using Siemens Memjet membrane bioreactor (MBR) technology, with 10,000 m³/d (2.6 MGD) receiving additional treatment using RO to produce high purity water.

“The plant was commissioned in December and provides repurified water used in the Olympic Park for non-potable applications, including the several fountains, artificial lakes and other architectural features,” she said.

Dow Water Solutions' Lance Johnson said his company has provided more than 5,000 RO elements for three Olympics-related wastewater reuse projects, including the Bei Xiao He project and the reuse plant for Beijing airport's Terminal 3—the world's largest airport building. He said the three membrane projects are only a start as Beijing embarks on its goal to reuse 50 percent of its water.

IN BRIEF

The deadline for consortia interested in participating in the pre-qualification process for 100 million m³/yr (72 MGD) **Soreq SWRO** project has been extended for a third time. The new deadline for submissions is 7 September. The 25-year BOT project, formerly known as 'Schafdan', is to be located south of Tel Aviv and will be the country's fourth large-scale desalination facility.

Doosan Heavy Industries will supply its MSF technology for the new 454,610 m³/d (120 MGD) Shuweihat 2 IWPP. GdF Suez Energy signed the \$2.5 billion contract for the project that includes a 1,500 MW power station. Abu Dhabi Water and Electricity Company will purchase water from the facility at a tariff of \$1.13/m³. The plant is scheduled to come on line in late 2011.

Oman Power and Water Procurement (OPWP) has issued a call for tenders to consultants interested in providing advisory services in the development of two new

IWPPs. The first project involves a 1,000 MW coal-fired power plant at Duqm on Oman's central coast, with most of the water production capacity to be used for industrial purposes. The second project is a 500 MW power plant and 25 MIGD (30 MGD) desalination plant to be located adjacent to the existing Al Ghubrah site near Muscat. Bids are due 22 September and an award is expected by the end of the year.

The **South Central Membrane Association (SCMA)** will hold its 2008 annual conference and membership meeting on 27–29 October in Austin, Texas. The conference agenda will focus on troubleshooting and problem solving in membrane treatment facilities. More information is available at www.scmembrane.org/081027-scmconference.php

Consolidated Water Company (CWCO) released its operating results for the first six months of 2008 last week, showing an increase in revenues of \$4 million over the first six months of 2007. Net income was \$3.65 million for the first half of 2008, down from \$6.2 million for the same period last year. The company said it decided to adjust results of its OC-BVI subsidiary as a result of its ongoing dispute with the British Virgin Islands' government over ownership of CWCO's Baughers Bay SWRO plant. CEO Rick Taggart said, “[It] led to a downward variation in our second quarter net income of more than \$1.2 million when compared with the prior-year period.”

Energy Recovery Inc (ERII) reported its second quarter results last week, its first such report since its recent IPO. Net income for the first half of 2008 rose to \$2.78 million or \$0.07 per share from \$0.70 million or \$0.02 per share in the same period last year. Net revenue rose to \$21.08 million from \$10.59 million in the prior-year period. The financial effect of the \$77.1 million net proceeds from its IPO will be reflected in the company's third quarter results.

SembCorp Industries and Fujairah 1 IWPP partner **Abu Dhabi Electricity and Water Authority (ADWEA)** have appointed Mott MacDonald to conduct a feasibility study to consider the expansion of the existing 100 MIGD (120 MGD) seawater desalination facility. The MSF (Doosan)/SWRO (Degremont) hybrid was started in 2003 and the facility was privatized in 2006.