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Saudi Arabia

Marafiq makes First water

Construction on Marafiq's Jubail independent water and power project (IWPP) is well underway, and all 27 MED systems are in place. The first units began making water on 4 June and some are now dispatching water to the distribution system. The entire 800,000 m^3/d (211.4 MGD) desalination plant and 2,745 MW power plant are on track for full completion in May 2010.

Marafiq MEDs with Steam and Vapor Ducting

When the $3.4 billion project reached financial closure in July 2007, it was the largest IWPP in the world and the largest project finance deal signed in the power sector. It is also the world's largest MED installation.

The capital cost of the MEDs was $945 million and the water tariff has been reported at $0.827/$m^3$ ($3.13/kgal). Suez Energy and ACWA Power developed the project, and Jubail Water & Power Company will own the facility.

Aruba

12 bidders attend site visit

Thirteen bidders have been invited to participate in an indicative tender for a new SWRO system by Water-En Energiebedrijf Aruba NV (WEB), the company responsible for the island's water and power supply. Twelve of the thirteen potential bidders who participated in the non-obligatory site visit last week were Acciona Agua, Aqua-Chem, Aquatech, Befesa, Biwater, Consolidated Water, Doosan, GE, ITT, Seven Seas, Severn Trent and Veolia. IDE Technologies did not attend.

The site visit is part of the tender's first phase, which will add 24,000 m^3/d (6.3 MGD) of desalination capacity at the existing Balashi site, which currently has six 6,000 m^3/d (1.6 MGD) and one 8,000 m^3/d (2.1 MGD) SWRO units. WEB intends to replace four of the existing MSF units with the new SWRO system.

Since an availability and reliability analysis will be performed, WEB will consider alternative proposals that provide the required capacity and acceptable reliability and availability values when compared to the MSF option, and in consideration of any NPV evaluation differences in the proposals.

The new SWRO unit will be located adjacent to the existing unit commissioned by GE Water in March 2008. The existing open shallow lagoon intake and outfall pipeline will be employed, and the plant will produce potable water with a total dissolved solids (TDS) concentration of less than 30 mg/L at a target energy consumption of 3.75 kWh/m^3 (14.2 kWh/kgal).

WEB intends to develop the project on a fast-track basis with the contract to be executed by a general contractor on a design-build/turn-key basis, in accordance with FIDIC conditions. Tendering has been split into two phases to streamline the process. The first phase will include an indicative tender from which no more than four bidders will be shortlisted, with a second-round tender subsequently submitted to the shortlisted bidders.

Indicative tenders are due on 7 September. Final tender documents will be issued in mid-October, with tenders due in late November. A January 2010 contract award is planned with final commissioning and plant hand-over to occur in March 2011.

California

Board votes "yes" for desal

In a 4 to 0 vote, Marin Municipal Water District's (MMWD) board of directors approved a 5 MGD (18,925 m^3/d) desalination facility that is expandable to 15 MGD (56,775 m^3/d). The vote follows the board's previous actions to invest in an aggressive water conservation program, improve its reservoir system, expand the recycled water distribution system and improve the reliability of its imported water supply.

Global Water Intelligence

Tom Pankratz, Editor, P.O. Box 75064, Houston, Texas 77234-5064 USA

Telephone: +1-281-857-6571, www.waterdesalreport.com, email: tp@globalwaterintel.com

MMWD has been studying desalination since 1990 and initiated work on an environmental impact report (EIR) in 2001. A 2005-2006 pilot study demonstrated various technical aspects of the project including seawater intake, pretreatment and SWRO arrangements, evaluated potential environmental impacts and established budgetary pricing.

Based on the pilot study and the accompanying environmental study results, it is expected that the plant will employ an offshore passive screen intake, MF/UF pretreatment and a concentrate discharge system that would blend RO concentrate with wastewater effluent from the Central Marin Sanitation Agency.

The plant is planned to be located on a seven-acre (2.7 ha) shoreline site in San Rafael and could cost $105 million. MMWD will now initiate the permitting process, and a plant could be operational by 2014.

Company News

ROSA ON STEROIDS

At first glance, the similarities between rocket propulsion systems and seawater reverse osmosis (SWRO) systems are not immediately apparent. But Pratt & Whitney Rocketdyne (PWR) has looked beyond the obvious and recognized that both systems share a very similar goal: the pursuit of maximum operational efficiency of a predominantly hydraulic system. The company has been using physics–based models of complex systems in both rocket and jet engines for over 50 years and is now applying those same tools to design and operate SWRO systems.

When PWR engineers began looking into SWRO system design, they noticed that most initial designs were developed using proprietary software developed by RO membrane manufacturers based on a typical set of design conditions. They also saw that energy recovery equipment suppliers independently modeled their energy recovery systems based on their own proprietary software.

Using modular modeling architecture built for analyzing thermal/hydraulic propulsion systems, PWR developed a physics-based model using a library of modules that can run numerous design points while simultaneously varying feed water characteristics, flow capacity, recovery and permeate quality requirements. The model quickly and accurately solves numerous implicit equations simultaneously.

Rather than using arithmetic or logarithmic averages across an entire RO pressure vessel, the thermodynamic state at the entrance and exit of each element is evaluated, and ionic species are tracked. The model not only has the ability to create a design point for a given configuration, it can perform a variance analysis to determine the 'maximum design condition'. It can also perform steady state and transient off-design simulations and can be used for anomaly resolution.

Unlike a rocket engine life cycle analysis that is measured in minutes, the model would allow the SWRO evaluation to be projected over years of operation, and users could collapse 30 years of operating results into a few minutes.

Leveraging a Universal Configuration Template with a single input file, a designer can compare different plant configurations and component selections as part of the complete SWRO system, rather than in isolation. Once a preliminary design has been selected, the designer is able to optimize it with further iterations and trades.

Plants designed with this tool can also use it as a real-time advisor for plant operation with the ability to identify and flag plant performance outside normal boundary limits and recommend maintenance action based on a probabilistic failure analysis. Existing plant configurations can also be easily inputted to create this capability. The program is currently functional with sodium and chloride, with work underway to allow tracking of up to 20 ionic species and a routine to calculate chemical equilibrium.

Preliminary results indicate that this modeling tool could lead to the development of an optimal design and operating approach that may improve current SWRO system energy usage by 5 to 10 percent.

According to information provided to *WDR*, "When chemical equilibrium solutions are fully implemented, the modeling architecture will be pushed to some software limits." In other words, the number of simultaneous equations that need to be resolved to mathematically optimize a SWRO design and its operation is greater than the number required for the design and operation of a state of the art liquid rocket engine.

Who said SWRO isn't rocket science?

Technology

INNOVATION IMPROVES BWRO RECOVERY

Brackish water reverse osmosis (BWRO) systems usually operate at product:concentrate recovery rates of 70 to 80 percent. A system's actual recovery rate depends on a variety of design factors, but it is usually determined by the feedwater's scaling potential. For many inland locations, the cost of concentrate disposal is the fatal flaw that determines a project's economic viability.

Last week, researchers at Israel's Ben Gurion University in Beer Sheba announced a new development that they say could allow BWRO operation at recovery rates up to 95 percent, and result in cost savings of $0.09/m^3 ($0.34/kgal).

As water permeates the RO membrane, the concentration of salts in the feedwater channel gradually increases, reaching