Low Energy Consumption in the Ashkelon Seawater Desalination Plant

**Key words:** desalination, reverse osmosis, energy recovery, Ashkelon

**Corresponding target:** 2.3.2 Create an Energy Task Force, and develop a guide allowing to achieve a 20% energy reduction in desalination by 2015

**The Solution is an EXISTING solution**

**DESCRIPTION**

**Description of the solution**

*Category (technical, institutional, legal, policy, financial, communication, others (please specify)):*

*Brief description of the solution word limit: 300 words*

Ashkelon successfully provides its full capacity of drinking water (120M m3/year) at the lowest production cost for this type of project. The project was developed as a BOT (Build, Operate and Transfer) by VID Desalination Company Ltd, a consortium comprised of Veolia Water of France and IDE Technologies Ltd of Israel, under a 25 year BOOT contract.

Operation reliability and robustness were key priorities in the design process. The plant is essentially made up of two independent facilities, each operating independently to provide 165 ML/day of drinking water. The seawater intake, pumping station and the final post-treatment are common to both plants, but have been designed with sufficient flexibility to allow separate operation of each. The Ashkelon plant includes the following process units:

- Offshore intake pipe
- Pump station
- Pretreatment system (dual media contact filtration and cartridge filtration)
- Reverse osmosis
- Post-treatment (remineralisation and chlorination)

The traditional concept of RO trains including a high pressure pump, energy recovery turbine and membranes is not optimal for large scale desalination plants. A centralized rather than local approach was developed for the Ashkelon plant. Pumping seawater to high pressure in a centralized system is more economical. The centralized approach to energy recovery using Dweer, a high efficiency energy recovery device, allows flexibility and efficiency of the system (95% of energy recovery).

The plant is connected to the electrical grid, but a dedicated combined cycle gas turbine (cogeneration) power station has also been installed. 56 MW of the 80 MW produced by the power station is used by the desalination process.

The Ashkelon plant was awarded “Desalination Plant of the Year” through the Global Water Awards 2006.

**Location**

*Where was/is the solution implemented? word limit: 50 words*

Located in the south of Israel, the Ashkelon plant alone makes a significant contribution to the water supply of large southern Israeli cities. This is approximately 15% of the water consumption in the domestic sector.
Who had initiated the project? What were the stakeholders’ drivers?
Which actors proved strategic in the implementation? At what stage were they brought in?
Who has ensured follow-up of the solution at the local level?

This plant is part of a desalination master plan launched by Israel in 2000 to help solve the country’s water resource problem. The water deficit is due to:

- Drought conditions;
- Limited availability of natural water resources due to climatic factors (low precipitation level and prolonged droughts);
- Increase in demand for water due to population growth and economic development — 60% more water required by 2020;
- Saline invasion into existing water resources

State of progress

What is the current development status of the solution (if relevant, please describe the steps already taken and ongoing/planned activities leading to the full development and preliminary testing of the solution)?

The Ashkelon seawater reverse osmosis was commissioned in 2005 and has been operating at its full production capacity since 2006.

STRATEGIC FIT & ADDED VALUE

Problem to solve

Key question your solution aims to answer (i.e. if your Solution is the answer, then what is the question) and how does that fit with the target?*

How does the solution contribute to the target’s effective implementation and attainment?

The 120M m3/year Ashkelon plant demonstrates seawater reverse osmosis technology on a large scale with one of the lowest water prices for a desalination plant. The combined use of an energy recovery system and centralized pumping system provides low electrical consumption of < 3.9 kWh/m3. The plant met all design and operation parameter requirements and consistently supplies high quality potable water to the national water system.

Added-value and cost effectiveness

What are the solution’s key outputs and what impacts did the solution have given the investment level (not only financial)?*

Can the solution continue to deliver tangible impacts on the long term?*

The specific energy consumption, 5 years after commissioning, is 3.52 kwh/m3, despite membrane aging and low renewal rate. The Ashkelon plant has reached outstanding performance with regard to energy efficiency, remaining below the 3.9 kwh/m3 guaranteed maximum nominal consumption (9.7 % saving in energy consumption) .

The use of advanced reverse osmosis (RO) technology, state-of-the-art energy recovery systems to reduce operating costs and contractual structure with proper risk allocation has achieved one of the lowest water prices (US $0.53/m3) ever offered for this kind of operation. About 42% of this price covers energy costs, variable operation and maintenance (O&M) costs, membranes and chemicals costs. 58% covers capital expenditure and fixed SPC and O&M costs.

Monitoring

In the process of effectively implementing this solution, what are some of the key qualitative and quantitative indicators of success over time (i.e. what would you expect to see change, where and when)?*

Veolia Water Solutions & Technologies and IDE Technologies have to meet a very high quality level for both the drinking water produced and the wastewater discharged. The cutting-edge Scada supervisory control and data acquisition system optimizes the reliability and continuity of the
information obtained in order to ensure the plant’s consistently high quality.

WIDER APPLICATION

Replication and up scaling potential
Given your experience, who would / should be most interested in this Solution and why? How will it help them?*
In what context do you think this solution could / would work best and why?*
Given your experience, what would be needed to upscale this solution, for example to a political or/and a regional level ?*
word limit: 300 words

The Ashkelon plant was a true technological challenge that involved gathering and integrating all the available know how in the 2000s. The plant has proved that reverse osmosis technology has reached sufficient maturity for such large plants. Indeed, the largest RO plants at the time did not reach more than 100 000 m³ /d.

The Ashkelon experience has opened the way for RO plants to be scaled up to 500 000m³ /d and more, thus reaching, and even exceeding, the capacities of the largest thermal plants. The plant also set a new benchmark for the cost of desalinated water.

Key lessons learnt
What tips and guidance (dos and don’ts) would you give to others interested in applying this solution in their own context?*
What is the minimum investment necessary (in terms of human resources, time, energy, infrastructure, financial resources, political will, etc.) in order to effectively implement this solution?*
What are the main factors of success that you wish to emphasize?*
word limit: 400 words

A comprehensive mathematical model has to be built to address the issue of operation of few pumps with several RO trains at different conditions of temperature, age, salinity and fouling. The model has to allow the prediction of the interaction of the high pressure pumps and booster pumps with different numbers of RO trains, as a few trains may be taken out for cleaning.

The main investment is in human resources, mathematicians, chemists and hydraulic professionals. The main factor for success is a comprehensive understanding of the hydraulic, chemical and mechanical processes involved in the RO desalination processes.

Future actions will focus on analyzing actual operation results, polishing mathematical characteristics and developing more accurate modeling instruments.

Existing commitments
Have some organisations/institutions/committees already committed to implement or replicate this solution?*
word limit: 100 words

CONTACT

Key contact institution
Where can people go for more information, help or advice on this solution?*
Details of the contact person* (e.g. name, address, e-mail or phone number)
word limit: 100 words

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ADDITIONAL INFORMATION

Supporting material
Website, Video, podcast, report, PowerPoint presentation, photo album, creative support, etc. please do not hesitate to
**Strategic Direction:** 6th World Water Forum SD  
**Priority for Action:** 6th World Water Forum PFA/CS  

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