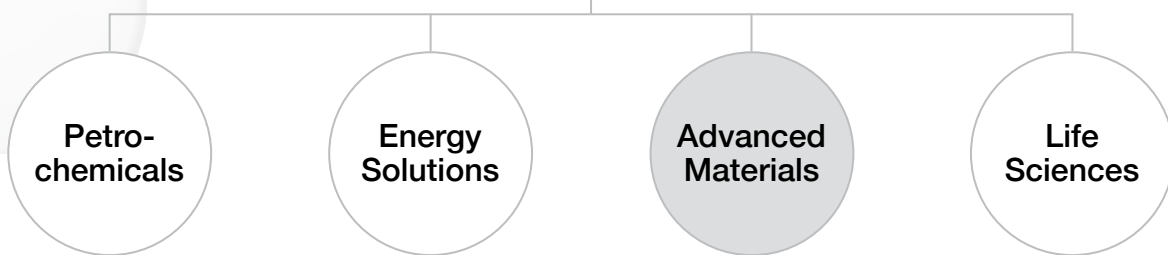


# LG Water Solutions

## Brackish Water RO Membranes Application Flyer



# LG Water Solutions



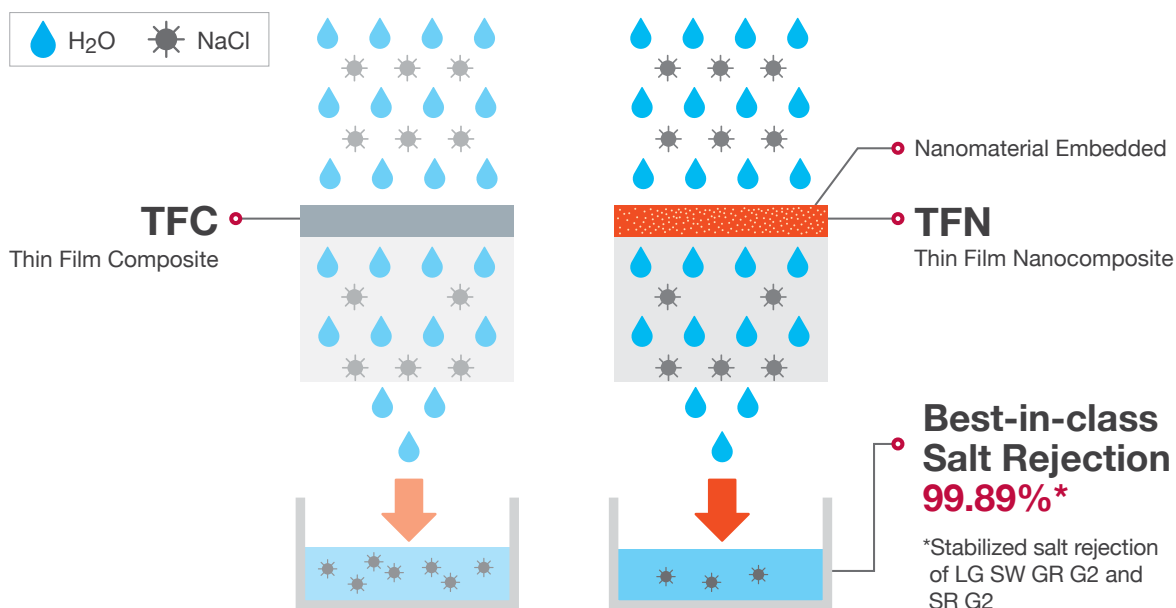
## LG Water Solutions

*Nano:H<sub>2</sub>O™*

LG Chem manufactures the full line of NanoH<sub>2</sub>O™ seawater and brackish water reverse osmosis (RO) membranes based on innovative Thin Film Nanocomposite (TFN) technology. We are constantly evolving and have had great success in winning large desalination projects and continue to strengthen market leadership for seawater RO. Beyond SWRO, our BWRO products have already proven their performance and quality that have led to repeat customers.

## Technology

Thin Film Nanocomposite (TFN) technology improves membrane performance by embedding benign nanoparticles in the surface of the membrane. This innovative technology increases membrane flux without compromising salt rejection.



# Superior Quality Leads to Repeat Customers



## Brackish Water RO Membranes



Wastewater Reuse	Power Generation	Petrochemical /Refinery	Automotive	Semiconductor /Display	Food & Beverage
<ul style="list-style-type: none"> <li>OCWD</li> <li>West Basin</li> <li>Santa Clara Valley Water District</li> <li>Scottsdale Water Campus</li> <li>Groundwater recharge</li> <li>Industrial process water</li> <li>Indirect potable reuse</li> </ul>	<ul style="list-style-type: none"> <li>الشركة السعودية للكهرباء Saudi Electricity Company</li> <li>KEPCO</li> <li>Boiler feed for steam generation</li> <li>Cooling tower makeup water</li> <li>FGD process makeup water</li> </ul>	<ul style="list-style-type: none"> <li>IndianOil</li> <li>PEMEX</li> <li>PETROBRAS</li> <li>Desalting water</li> <li>Cooling tower makeup</li> <li>Treatment of cooling tower blowdown</li> </ul>	<ul style="list-style-type: none"> <li>CHRYSLER</li> <li>GM</li> <li>KIA</li> <li>Paint booths</li> <li>Electrocoat and phosphatizing lines</li> <li>Parts rinsing</li> </ul>	<ul style="list-style-type: none"> <li>infineon</li> <li>Panasonic</li> <li>LG Display</li> <li>Cleaning and etching agents</li> <li>Chip fabrication</li> <li>Silicon wafer dicing</li> </ul>	<ul style="list-style-type: none"> <li>Coca-Cola</li> <li>pepsi</li> <li>Bottled water</li> <li>Syrup blending</li> <li>Boiler feed for steam production</li> </ul>

## Overview

LG Chem's NanoH<sub>2</sub>O™ brackish water RO membranes serve various municipal and industrial applications and have been operating in the major utilities around the world. Incorporating innovative Thin Film Nanocomposite (TFN) technology, all LG BWRO membranes provide superior performance along with intrinsic anti-fouling property and are suitable for applications where consistent and reliable performance is a must.



### LG BW R G2

Superior Rejection, High Flow, High Durability

### LG BW R

High Rejection

### LG BW R Dura

High Rejection, High Durability

### LG BW AFR

Anti-Fouling, High Rejection

### LG BW ES

Energy Saving

### LG BW ES L

Energy Saving  
Equipped with fouling tolerant low dP spacer technology

### LG BW UES

Ultra Low Energy

# BW Case Study

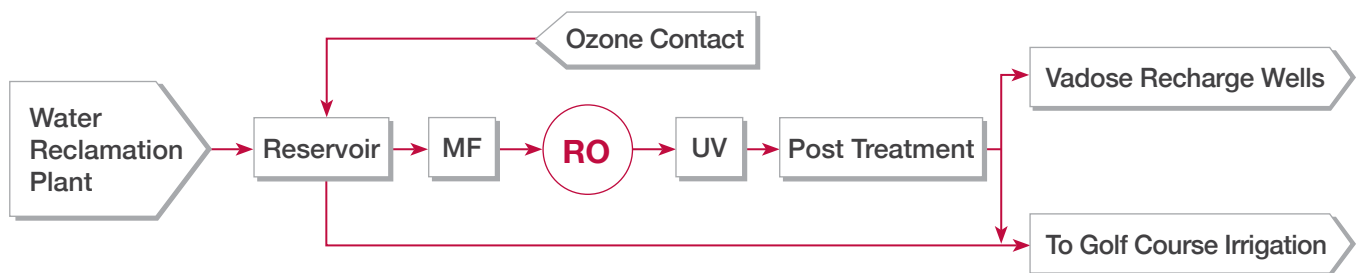
## USA

## Water Treatment for Indirect Potable Reuse, Scottsdale Water Campus

LG Chem NanoH<sub>2</sub>O™ BWRO membranes delivered lower system feed pressure to reduce energy consumption and improved permeate quality in one of the largest wastewater reuse plants in the US.

### Project Overview

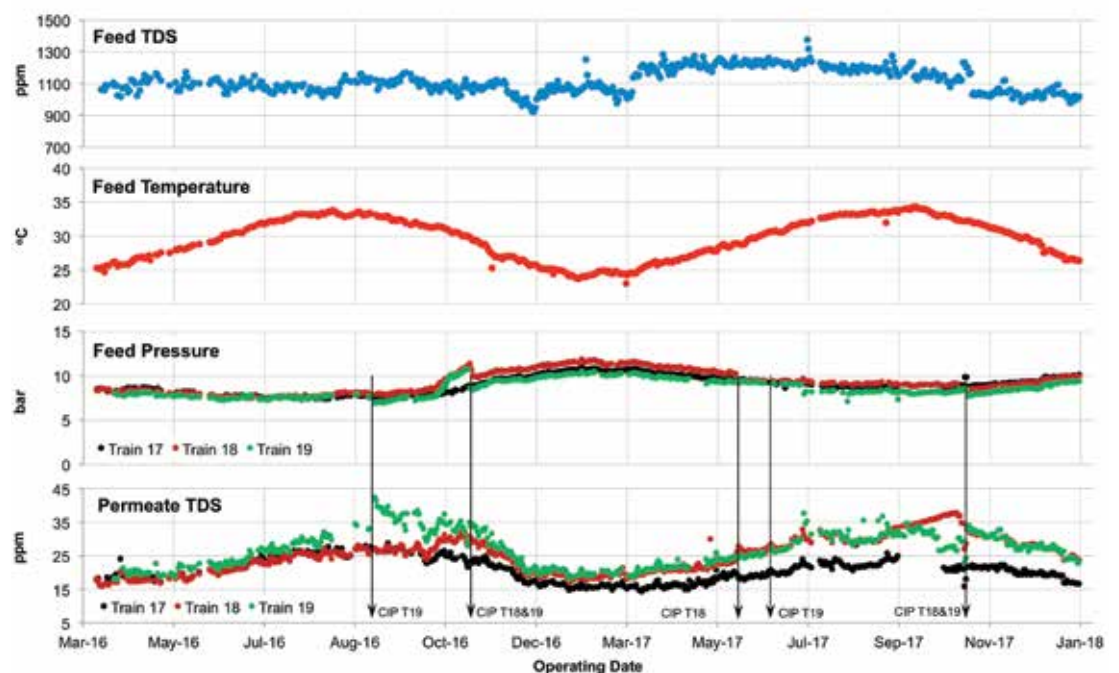
Scottsdale Water Campus commissioned in 1999. Currently it produces over 20 MGD of treated water for ground water aquifer injection.



<b>Client</b>	City of Scottsdale, Arizona
<b>Start-Up Date</b>	Phase 1: 2016, Phase 2: 2017
<b>Feed Water Intake</b>	24- 34°C and Wastewater plant tertiary effluent
<b>Application</b>	Indirect potable reuse water
<b>Plant Configuration</b>	7 three-stage trains with various configuration
<b>Recovery</b>	85%
<b>Total Project Capacity</b>	27,000 m <sup>3</sup> /d (7.1 MGD)
<b>Feed Temperature Range</b>	24- 33°C (75 - 93°F)
<b>LG Chem NanoH<sub>2</sub>O™ Membrane Model</b>	LG BW 400 R
<b>Total Number of LG Chem NanoH<sub>2</sub>O™ Elements</b>	1,542
<b>Feed Pressure Range</b>	7.4 – 8.3 bar (106 – 120 psi)

- Performance is stable and on target after 3 years of operation.
- LG BWRO membrane shows high rejection on most ions.
- Permeate quality is well within the three-year target set by the client.
- Stable permeate TOC concentration and well within California's 0.5 mg/L target for Soil Aquifer Transfer (SAT) application.
- LG BWRO membranes perform better than competitors' products previously installed at the client's site.

## Operation Data | Phase 1: Train 17, 18, and 19



## USA

## Municipal Drinking Water Treatment, RO Plants in the State of Mississippi

Two municipalities located in the State of Mississippi installed LG Chem NanoH<sub>2</sub>O™ BWRO membranes in the municipal RO water-treatment facilities to deliver crystal-clear water to the residents of these communities.

### Project Overview

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Commissioned in the late 2000s, the two municipal RO water treatment systems produce 5.0 MGD and 2.0 MGD of drinking water, respectively. The plants are fed from local wells. Both plants replaced old RO membranes with LG Chem NanoH<sub>2</sub>O™ BWRO membranes in 2017.

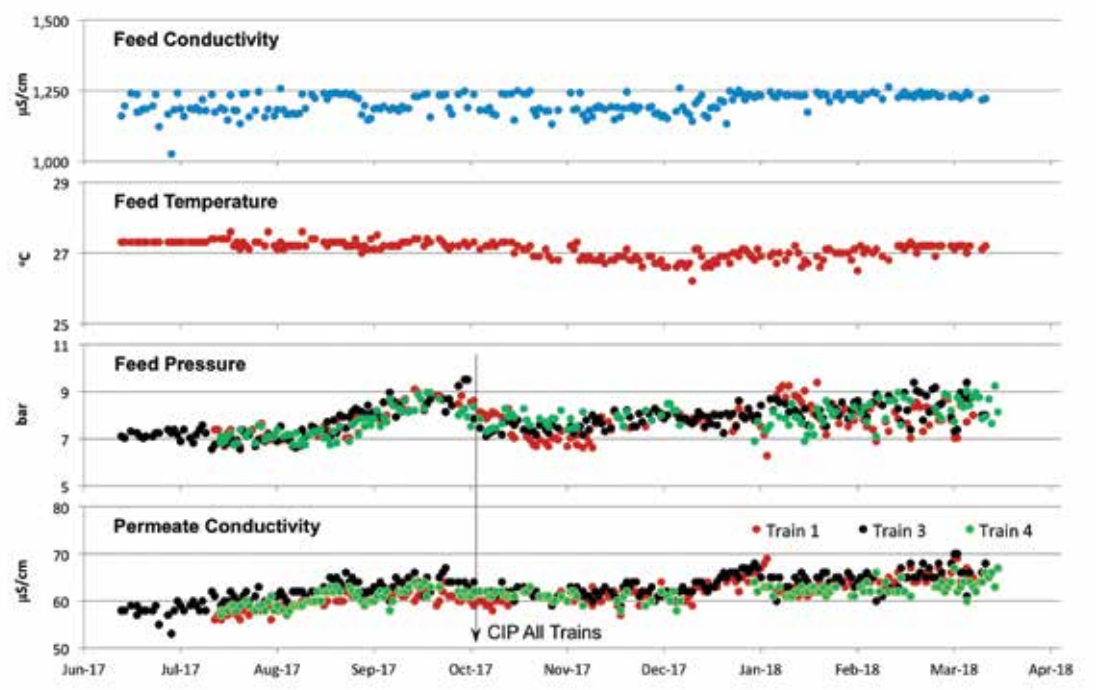
### RO Plant 1

<b>Plant Configuration</b>	Four two-stage trains, 24:12, 7 elements per pressure vessel
<b>Recovery</b>	85%
<b>Total Project Capacity</b>	18,750 m <sup>3</sup> /d (5.0 MGD)
<b>Feed Water Temperature</b>	26 - 27°C (79 - 81°F)
<b>LG Chem NanoH<sub>2</sub>O™ Membrane Model</b>	LG BW 400 ES
<b>Total Number of LG Chem NanoH<sub>2</sub>O™ Elements</b>	1,008
<b>Feed Pressure Range</b>	7.0 – 9.0 bar (100 – 130 psi)

## RO Plant 2

<b>Plant Configuration</b>	Two three-stage trains, 15:10:5, 6 elements per pressure vessel
<b>Recovery</b>	80%
<b>Total Project Capacity</b>	7,600 m <sup>3</sup> /d (2.0 MGD)
<b>Feed Water Temperature</b>	25 - 27°C (77 - 81°F)
<b>LG Chem NanoH<sub>2</sub>O™ Membrane Model</b>	LG BW 400 ES
<b>Total Number of LG Chem NanoH<sub>2</sub>O™ Elements</b>	360
<b>Feed Pressure Range</b>	10.0 – 11.4 bar (145 – 165 psi)

## Operation Data | RO Plant 1, Train 1, 3 and 4



## USA

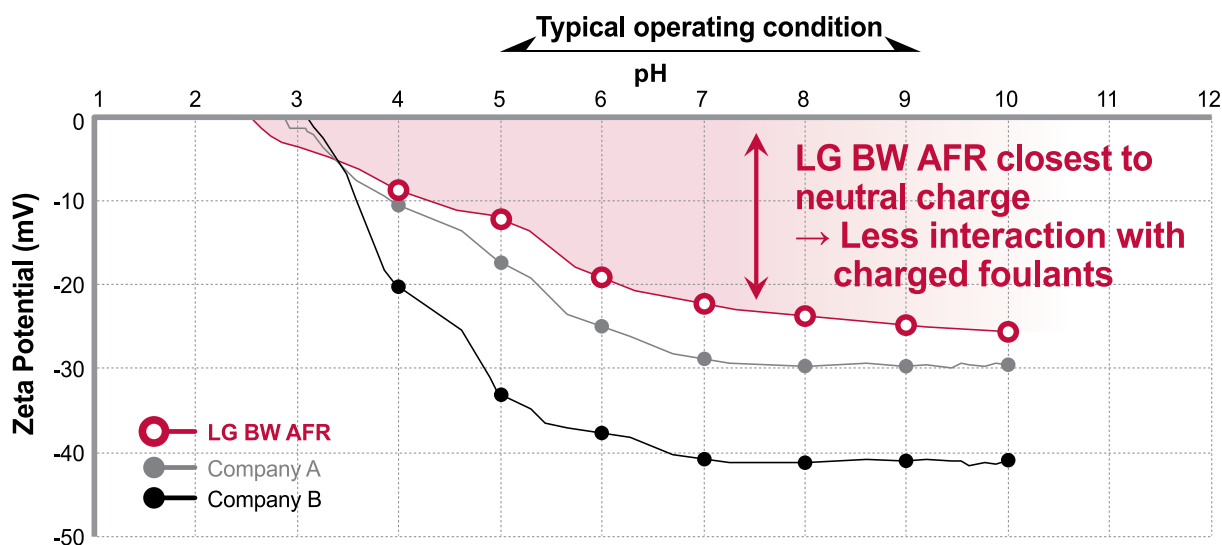
### LG BW AFR (Anti-Fouling) Membrane: Addressing Fouling Challenges in Water Treatment

LG Chem has developed a BWRO membrane that combines the advantages of Thin Film Nanocomposite (TFN) technology with anti-fouling (AF) characteristics. A unique AF formulation was added into the polyamide surface layer forming a crosslinked protective barrier permanently attached to the membrane surface.

#### LG BW AFR benefits :

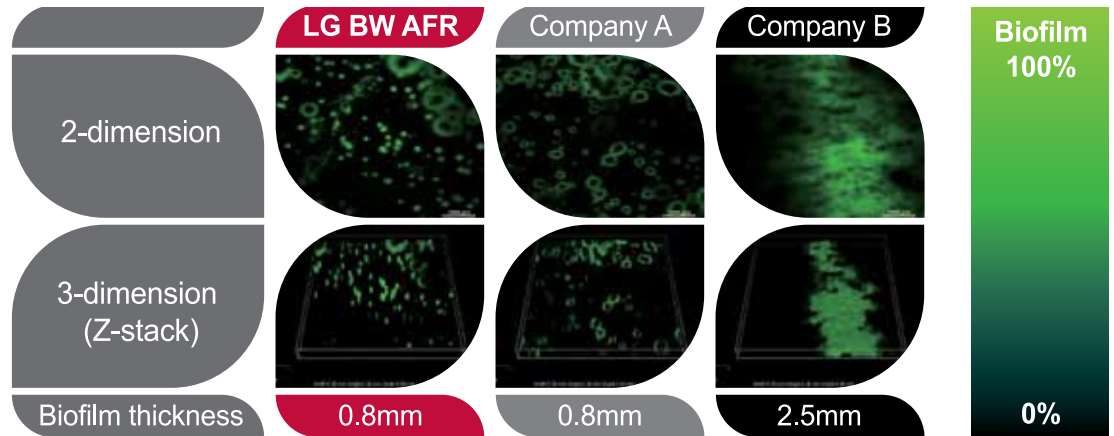
- Fouling resistance
- Easy to clean and recover flux
- Less frequent cleanings

LG BW AFR surface is more hydrophilic and has the surface charge closer to neutral compared to the competitors' anti-fouling membranes.





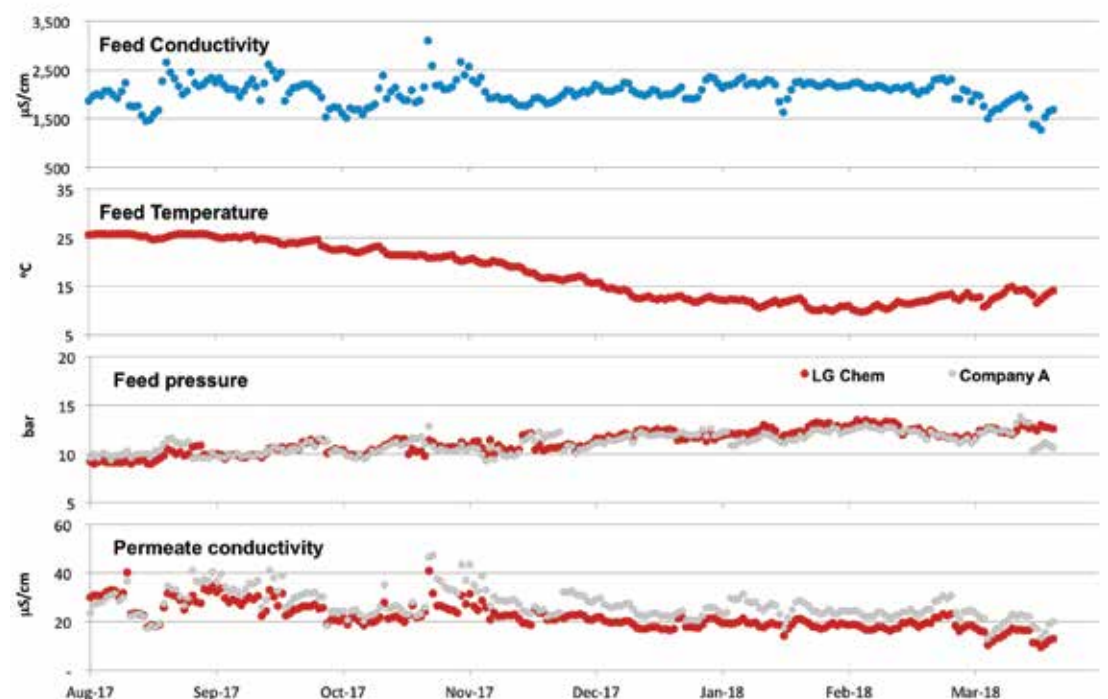
LG BW AFR demonstrated less biofilm formation with *E. Coli*.



LG BW AFR has been successfully installed in a number of brackish water systems across the globe, including Korea, China, Malaysia, India, USA, Saudi Arabia and Serbia.

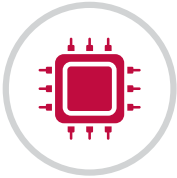
## Pohang Sewage Water Reuse Plant, Korea

Comparative study: LG Chem NanoH<sub>2</sub>O™ membrane vs Company A



## BWRO

## Selected References in Various Industrial Applications



### Semiconductor / Display (Ultra-Pure Water)



<b>Client</b>	LG Group (LG Electronics, LG Chem, LG Display, LG Innotek)
<b>Location</b>	Multiple
<b>Total Project Capacity</b>	130,000 m <sup>3</sup> /d (34.3 MGD)
<b>LG Chem NanoH<sub>2</sub>O™ Membrane Model</b>	LG BW 400 R, LG BW 440 R, LG BW 400 ES, LG BW 400 AFR



### Petrochemical / Refinery



<b>Client</b>	PEMEX Refinery
<b>Location</b>	Mexico
<b>Total Project Capacity</b>	3,456 m <sup>3</sup> /d (0.92 MGD)
<b>Plant Configuration</b>	2 trains, 19 pressure vessels per train
<b>LG Chem NanoH<sub>2</sub>O™ Membrane Model</b>	LG BW 400 AFR



## Petrochemical / Refinery



<b>Client</b>	Indian Oil Corporation Limited (Naphtha Cracker) (IOCL)
<b>Location</b>	Panipat, Haryana - India
<b>Total Project Capacity</b>	18,000 m <sup>3</sup> /d (4.76 MGD)
<b>Plant Configuration</b>	Stage 1: 5 trains, 36 pressure vessels per train Stage 2: 3 trains, 16 pressure vessels per train
<b>LG Chem NanoH<sub>2</sub>O™ Membrane Model</b>	LG BW 400 AFR



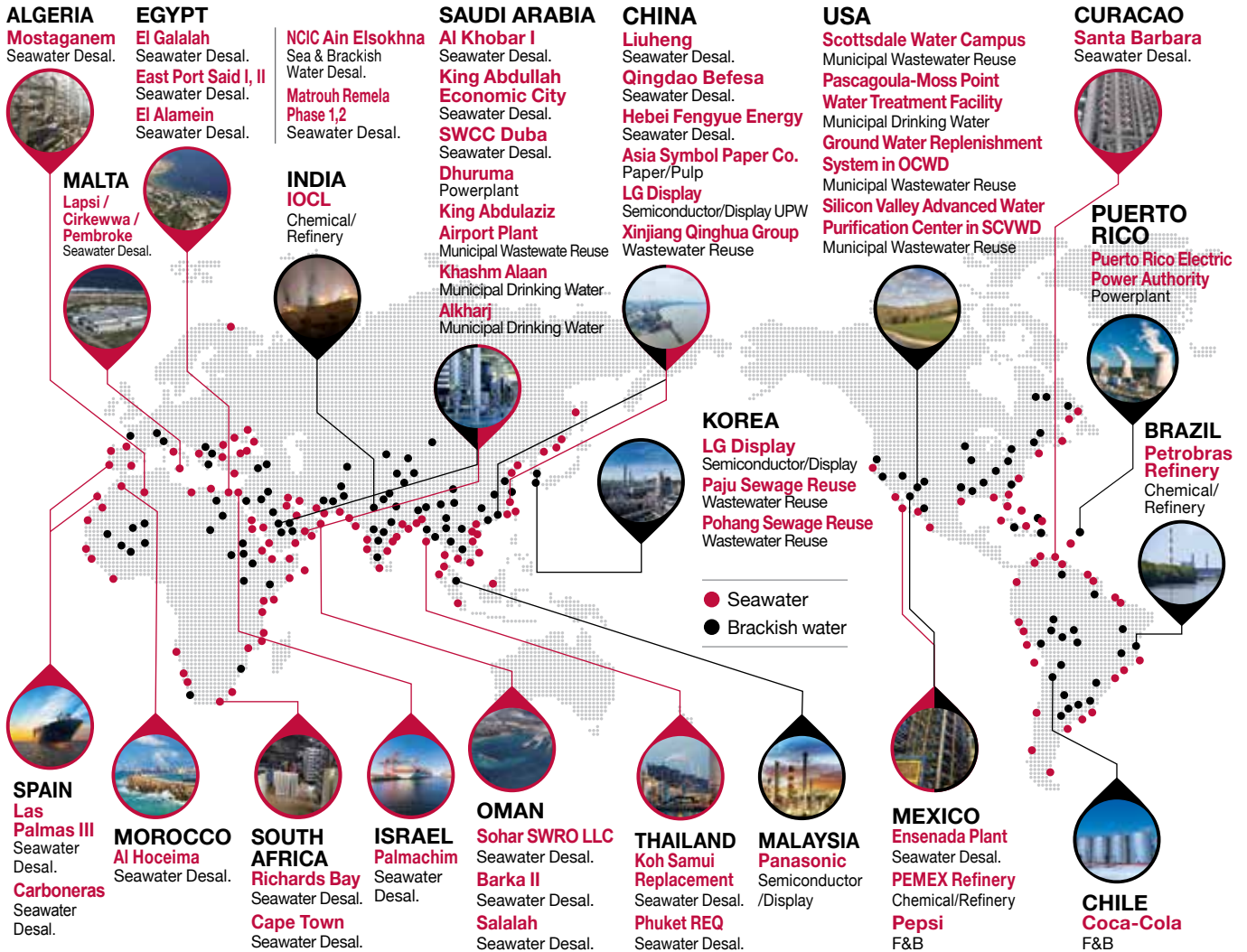
## Pulp and Paper



<b>Client</b>	Asia Symbol Paper
<b>Location</b>	Jiangmen, Guangdong - China
<b>Total Project Capacity</b>	30,000 m <sup>3</sup> /d (7.9 MGD)
<b>Plant Configuration</b>	5 trains, 48 pressure vessels per train
<b>LG Chem NanoH<sub>2</sub>O™ Membrane Model</b>	LG BW 400 R

# Proven Track Record of Performance and Quality

## Selected Global References



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