

La innovació en el camp de la fabricació de membranes per dessalinització

 Dr. Eng. Químic. Guillem Gilabert-Oriol

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Càtedra ATL de l'Aigua Potable



Where can we get new water from?

Rivers have a limit



that depends on raining

Seas have not limit



that ensures availability and protects natural resources

Or

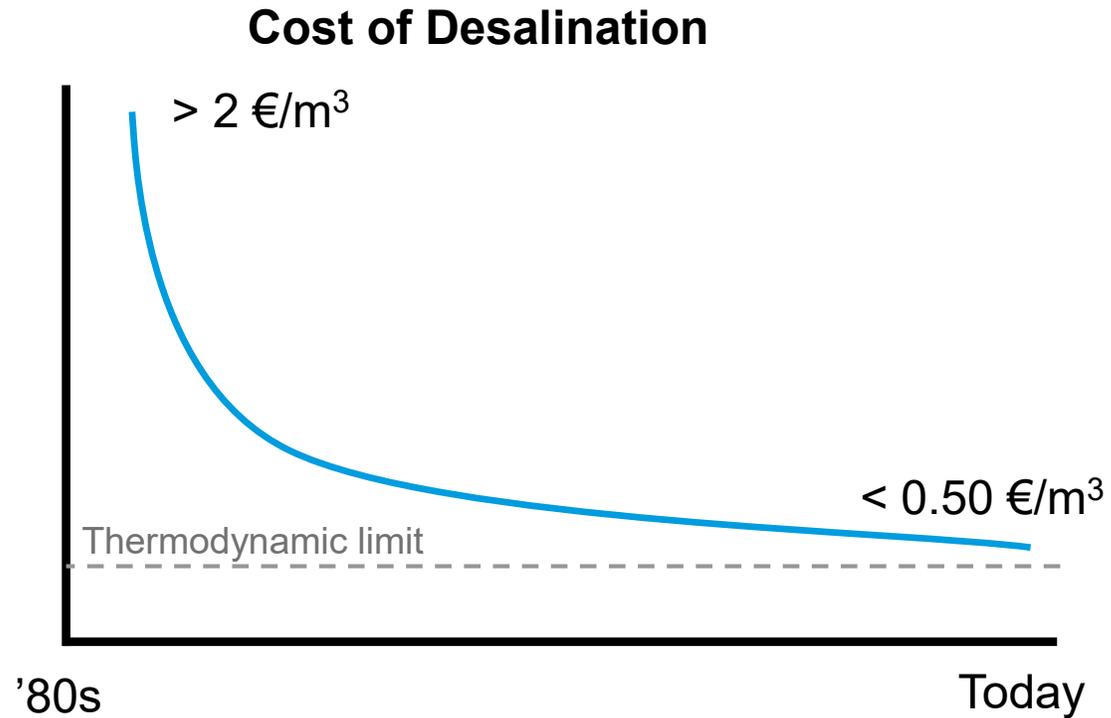
A desalination plant



Brover, S., Lester, Y., Brenner, A., & Sahar-Hadar, E. (2022). Optimization of ultrafiltration as pre-treatment for seawater RO desalination. *Desalination*, 524, 115478.

Cost of Desalination

- Technology improvements have reduced its cost



Not inflation adjusted
Shrivastava et al., Energy efficiency breakdown of reverse osmosis and its implications on future innovation roadmap for desalination, Desalination, 2015. 368: p. 181-192.



Is it expensive?

- $0.5 \text{ €/m}^3 = 0.05 \text{ ¢/L}$



Is it energy intensive?

- The cost of desalinated water for a family of 4 people equals the cost of a refrigerator for 1 year



How much does it cost to build?

- A desalination plant to serve a population like l'Hospitalet de Llobregat like a mid-size private jet and can fill a water reservoir like Sant Ponç

Private jet



L'Hospitalet de Llobregat



Sant Ponç



What about the discharge?

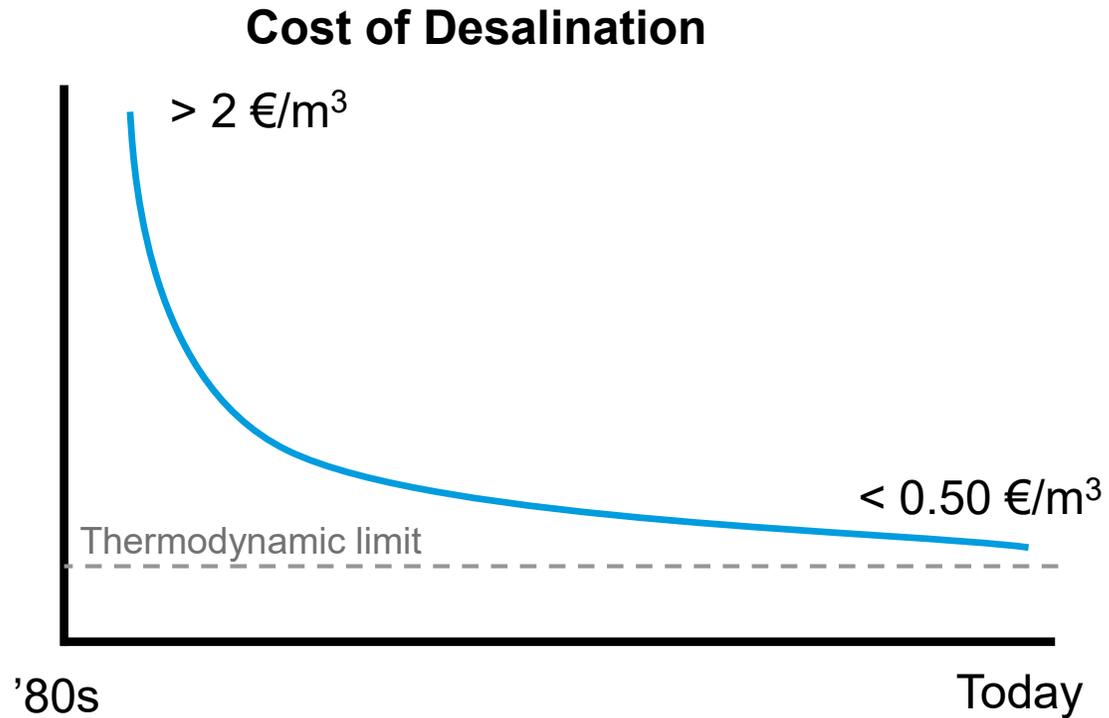
- Seawater discharge has twice salinity
- Diffusers are used to return it to the sea while keeping salt levels in normal ranges
- Brine can be valorized



Fernández-Torquemada, Y., Carratalá, A., & Sánchez Lizaso, J. L. (2019). Impact of brine on the marine environment and how it can be reduced. DWT 167, 27–37.

Innovations in desalination

- What else can be done in the innovation space as we approach the thermodynamic limit?



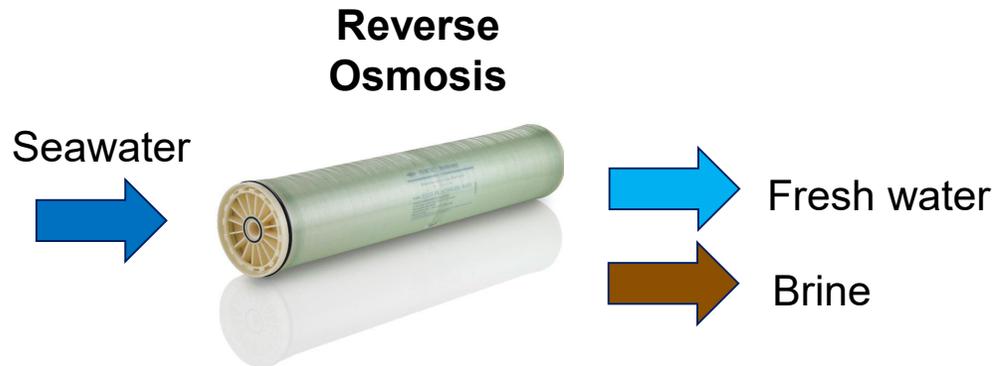
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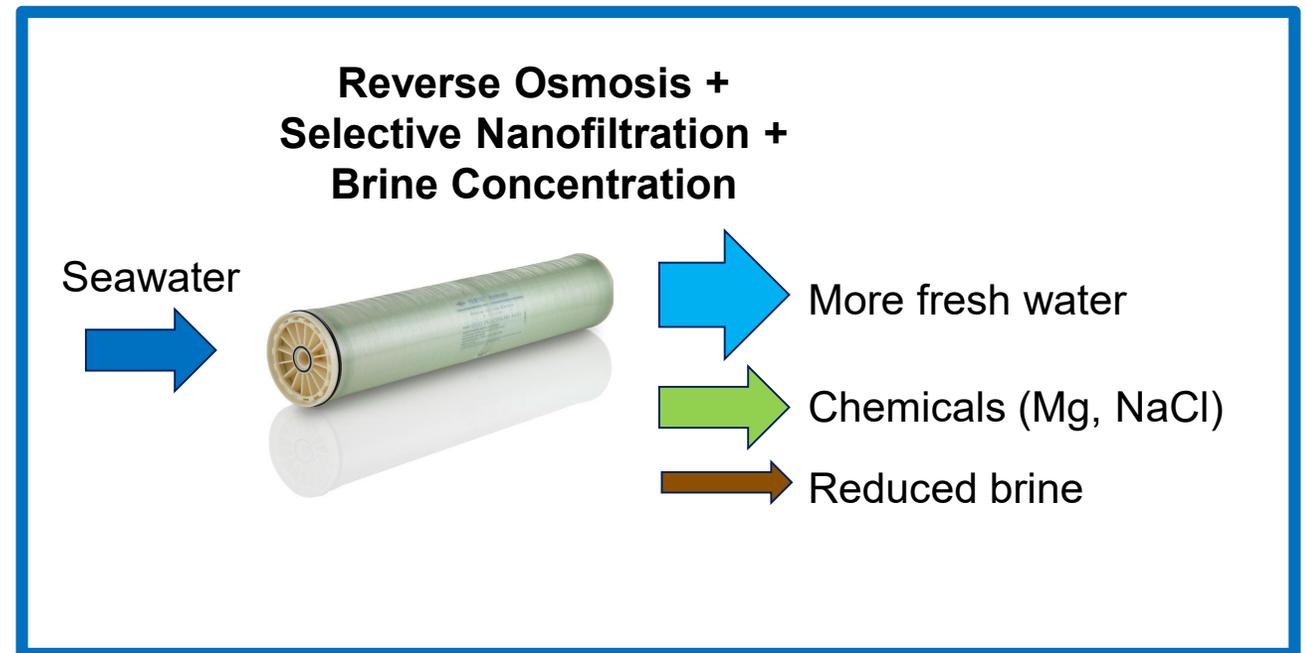
Brine valorization

- Brine recovery allow desalination plants to increase the water produced, while producing chemicals and reducing its water discharged

What if we can **move from this...**



...to **this**



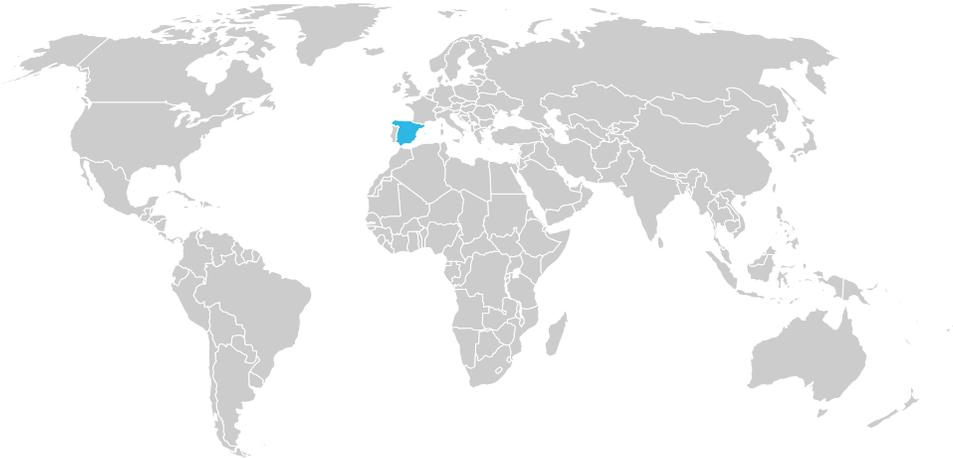
Superior membrane life

- Well designed and operated membranes can last very long

Alicante Desalination Plant

> 6,000 membranes

14+ years in operation



Large-scale municipal desalination plant in Alicante, Spain runs reliably with FilmTec™ technology

The challenge

Freshwater supplies in southeast Spain are significantly impacted by climatic change and population growth. The Alicante II Seawater Desalination Plant, located in the Spanish Mediterranean coast, was built with the aim of minimizing the effects of water scarcity and drought conditions suffered by local communities.

The solution

Since installing roughly 6,300 DuPont FilmTec™ reverse osmosis (RO) elements in 2008, the plant has delivered high-quality drinking water throughout the region without issue.

The benefits

The plant operates at a recovery of 45% for the single pass seawater RO. The well-maintained membranes have demonstrated excellent operating performance and durability for 12 years with no replacements.

Fast Facts

Country: Spain
End-user: Mancomunidad Canales de Taibilla (MCT)
Technology: DuPont FilmTec™ SWRO
Total # of elements: 6,272
Plant capacity: 65,000 m³/day
Start-up date: 2008
Feed water quality: 41,000 ppm TDS, 5 ppm B
Product water quality: <250 µS/cm TDS, <1 ppm B
Temperature range: 14-30 °C
Pretreatment: Dual media filters

14+ years operating membranes without replacement.

See how much you could be saving

www.desalapp.com



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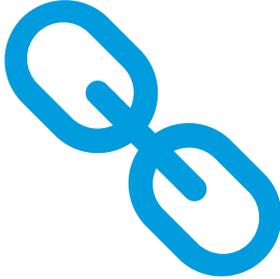
Fouling resistance

- FilmTec™ SW30XFR-400/34 element is fouling resistant and it can reduce the number of chemical cleanings by up to 33%, thus extending the operation between cleanings by up to 50%, while having up to 40% lower pressure drop
- This saves energy, increases uptime and membrane lifetime, thus reducing the total cost of water



Fouling Resistant

✓ Cleanings reduction



Durable

✓ Stable rejection after cleanings



Low Pressure Drop

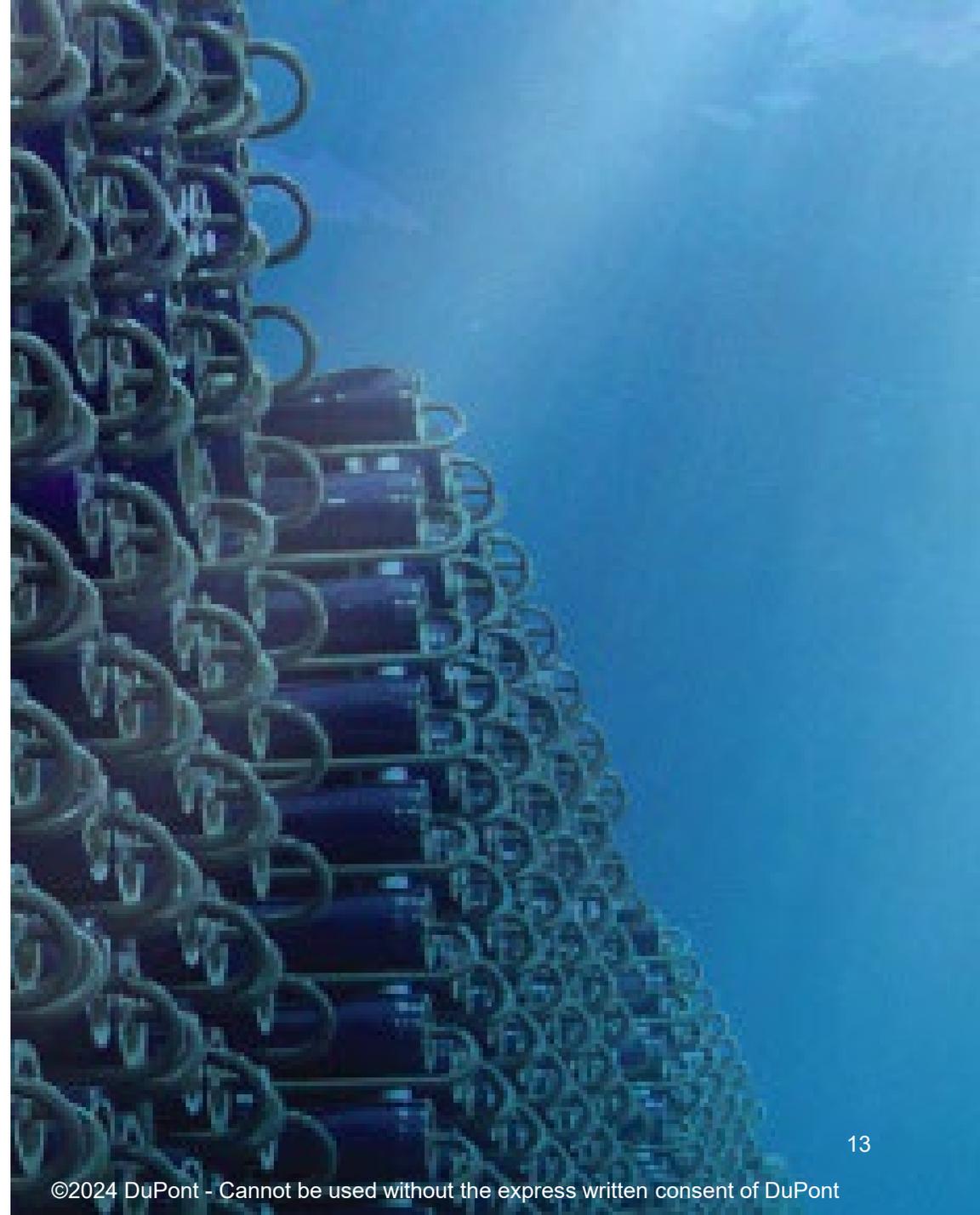
✓ Better cleanability

Low energy membranes

- FilmTec™ Seamaxx™-440 elements offer up to 5% energy savings
- Useful for installations with:
 - High energy consumption, low temperature
 - High electricity cost
 - No or low efficiency energy recovery systems



Energy savings compared to FilmTec™ SW30XLE-440 element



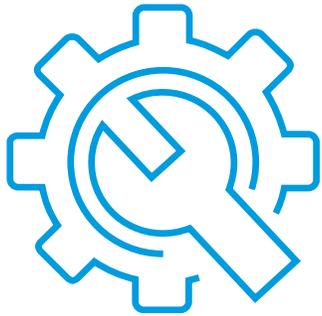
High rejection membranes in second pass

- The new FilmTec™ BW30XHR PRO-440 element is a high rejection brackish water membrane increases rejection from 99.7% to 99.8%
- Can save up to 9% energy in Desalination plants with second passes



Dry seawater membranes

- Delivered without preservative solution



Safer installation
due to 4 kg less weight

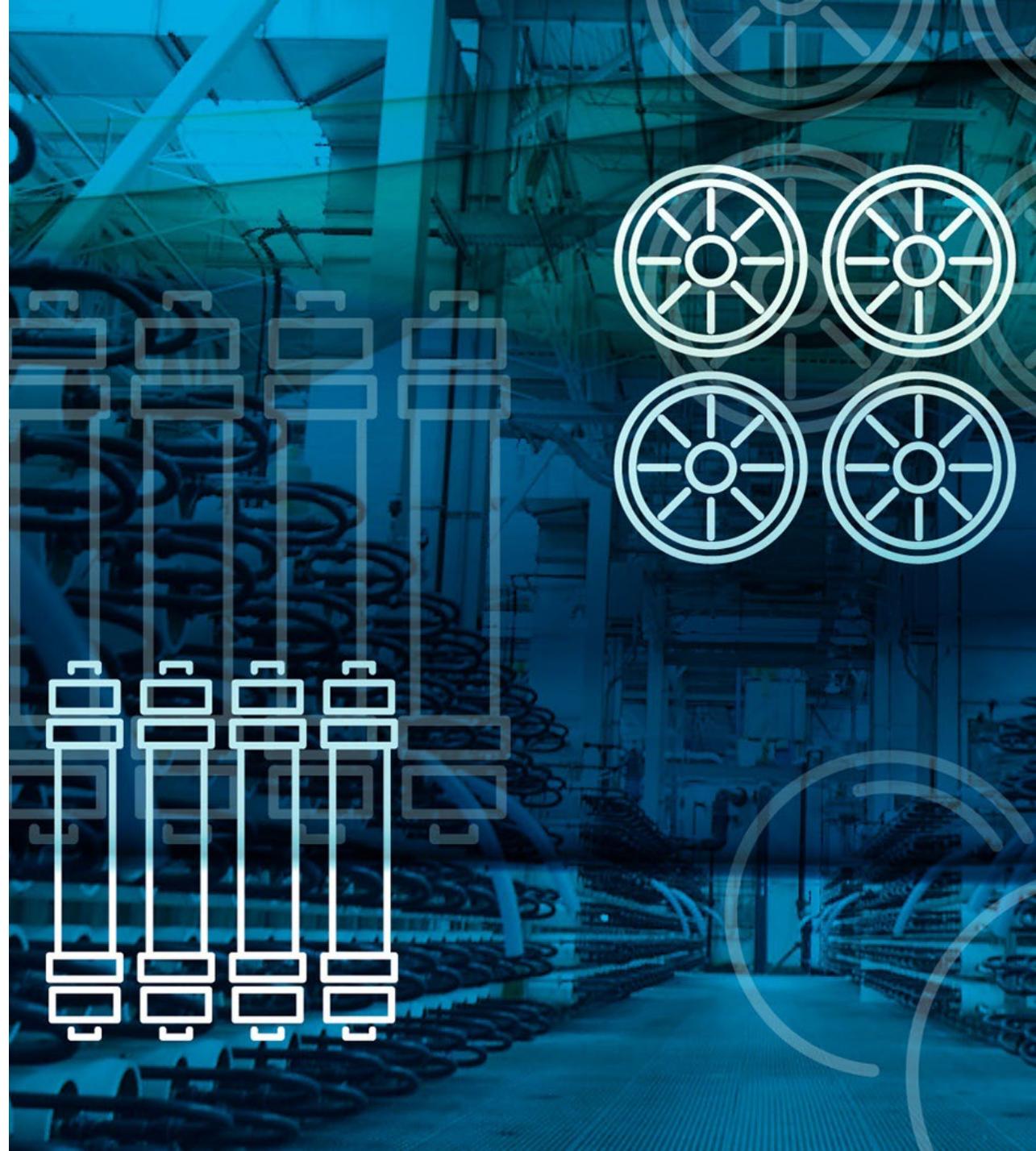


Longer Storage
due to absence of
preservative solution



Ultrafiltration

- Ultrafiltration provides excellent filtrate quality
 - Close to 100% turbidity removal
 - Efficient pathogens removal
 - Extends the reverse osmosis lifetime
- Reduces total cost of water by up to 20-50% in the pretreatment step



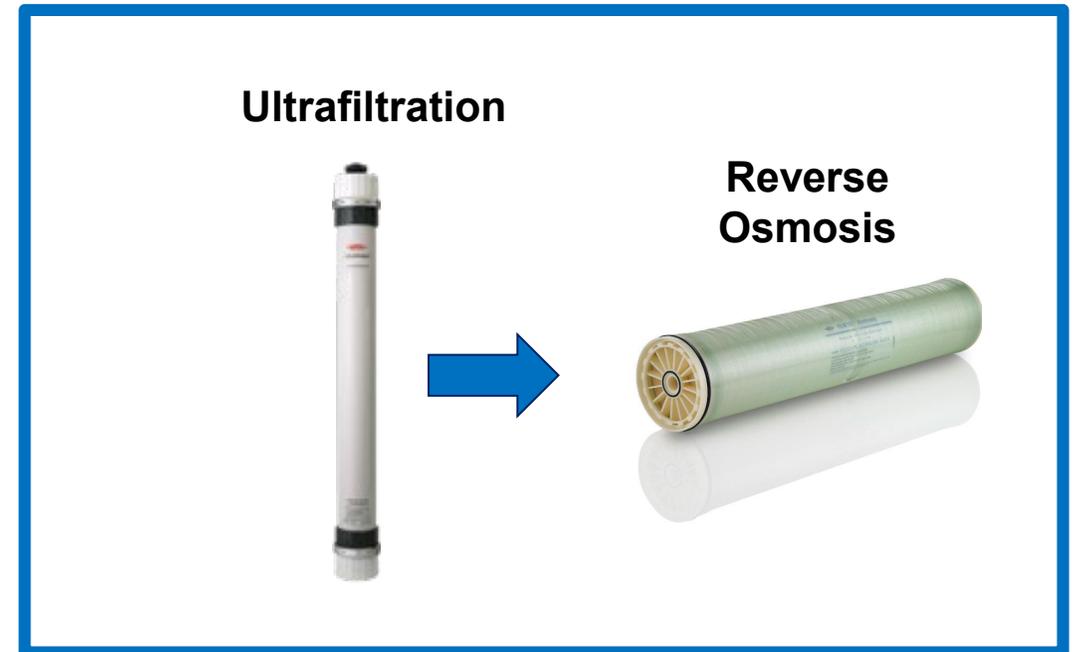
20% savings compared to single stage Dual Media Filter, and 50% compared to two stages Dual Media Filter

Integrated prefilter in ultrafiltration

- The Ultrafiltration integrated prefilter can reduce energy consumption by up to 40% and footprint by up to 13%

What if we can **move from this...**

...to this



Pressure drop assumed for a typical prefilter of 0.2 bar. TMP assumed for an ultrafiltration membrane 0.3 bar

Operations advisor

- Patent-protected machine learning algorithms providing operational recommendations that generate measurable operating savings for Reverse Osmosis and Ultrafiltration



RO Operations Advisor

The RO Operations Advisor is designed to help customers analyze their RO plant operational data and provide recommendations for improved performance.

Go to app →





RO Operations Advisor

The RO Operations Advisor is designed to help customers analyze their RO plant operational data and provide recommendations for improved performance.



System Performance Data Input
CIP Identification
Cleaning Effectiveness
Fouling & Scaling Type Identification
5 CIP Prediction & Recommendation

Plant Information

Plant Name *

Number of RO/NF Elements

Settings*

FlowRate m³/h m³/d gpm

Permeate Quality uS/cm mg/L

Volume m³ kgal

Cost Information

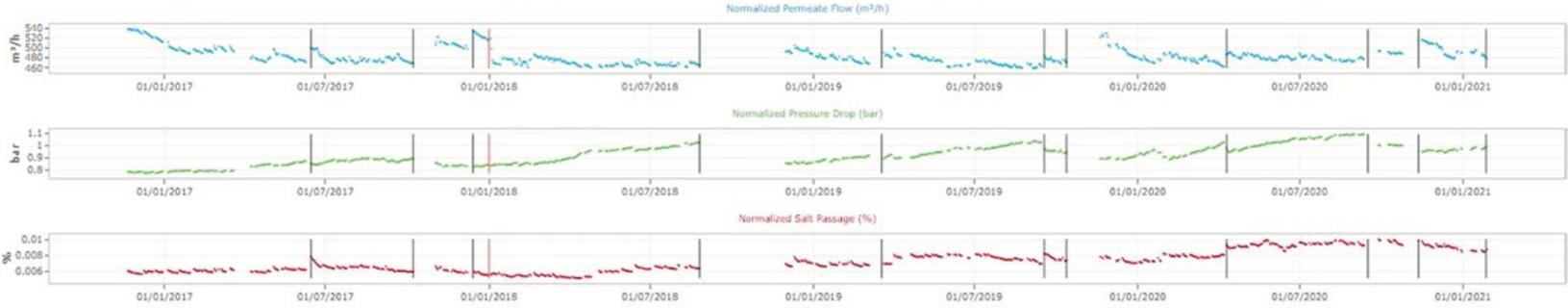
Energy Price (undefined/kWh)

Cost of Downtime (undefined/day)

Default CIP Information

Acid used per CIP (kg)

Alkali used per CIP (kg)



Projected Benefits over the Forecast Window -28/01/2021 - 30/06/2021

Total Financial Benefits 📈 : \$15,136

Energy Saving	Chemical Saving	Downtime Saving	Water Production
-0.55 % -\$4,864	57.14 % \$9	57.14 % \$20,000	-0.00 % -\$9 (-1.93 m ³)



Tarragona Global Water Technology Center

Unique capabilities

- Access to real seawater, river water and wastewater
- Operation in once-through or recirculation
- Industrial size plants

Enhanced R&D pipeline

- 25 R&D projects per year
- Accelerated product launches

Customer collaboration

- 150 customer projects per year
- More than 3,000 visitors







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