

SEAWATER DESALINATION: INNOVATION TRENDS FOR A SUSTAINABLE FUTURE

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Nuova Fiera del Levante, 27-28 novembre 2024

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DESALINATION FACTS AND FIGURES



The predominant desalination technology is **reverse osmosis**.

Countries with the world's largest desalination water production capacity:

Middle East
lead by Saudi Arabia

Spain
Largest market in Europe

There are approximately

18.000
desalination plants

in the world.



5.800
million USD

of desalination
CAPEX in 2022.

\$

8.200
million USD

of desalination
OPEX in 2022.

\$

5
million
m³/D

of desalination
contracted capacity
in 2022.



Source: GWI and DesalData

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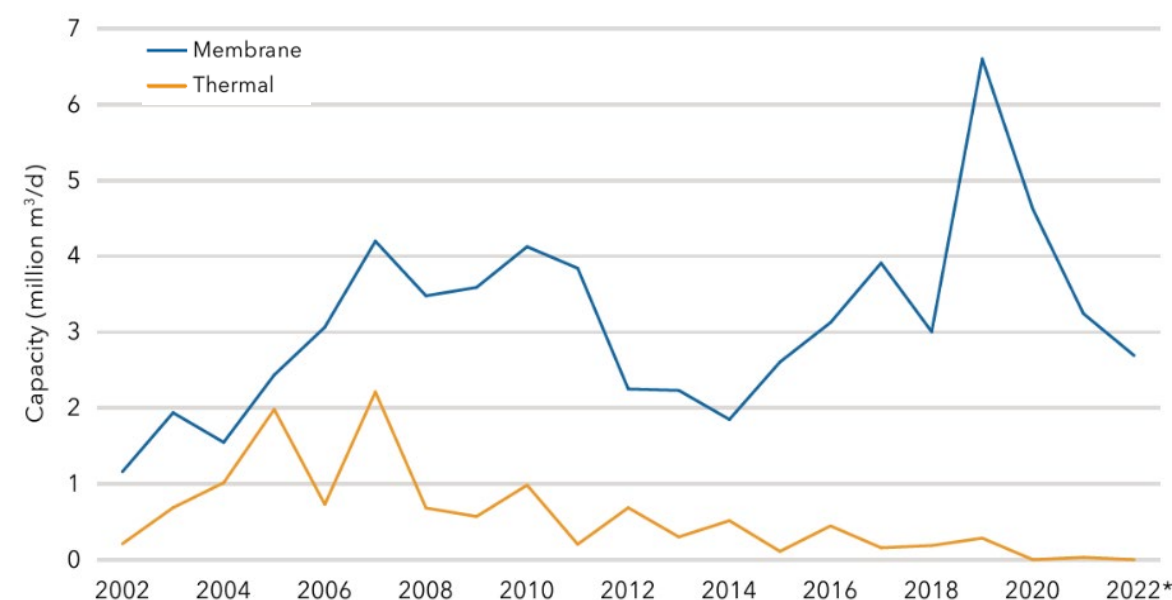


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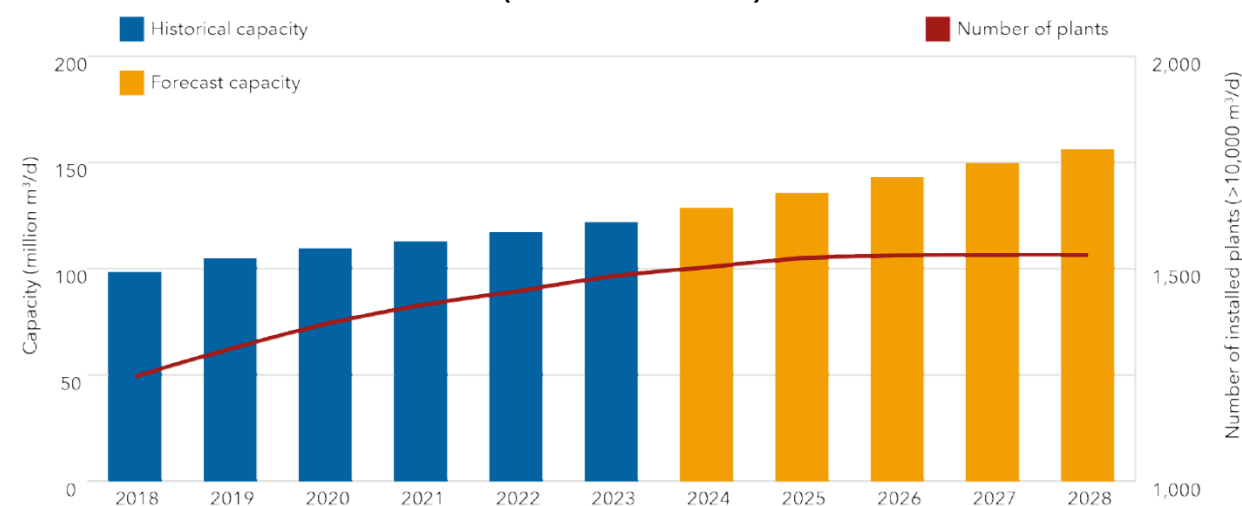
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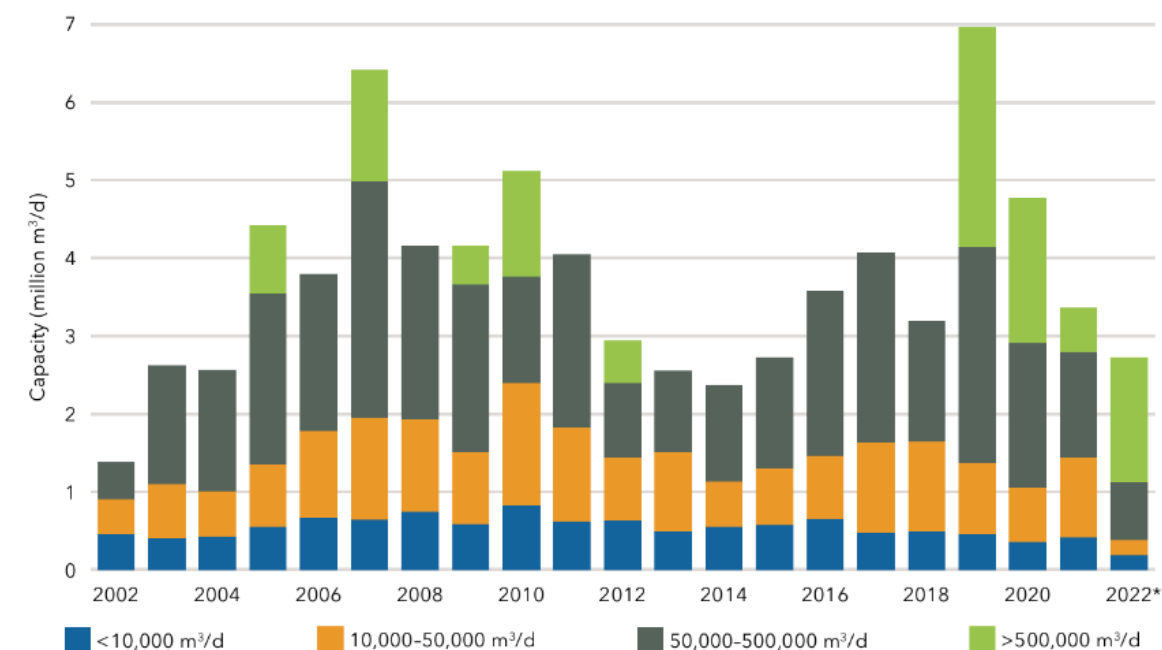
DESALINATION AS AN ALTERNATIVE WATER SOURCE.



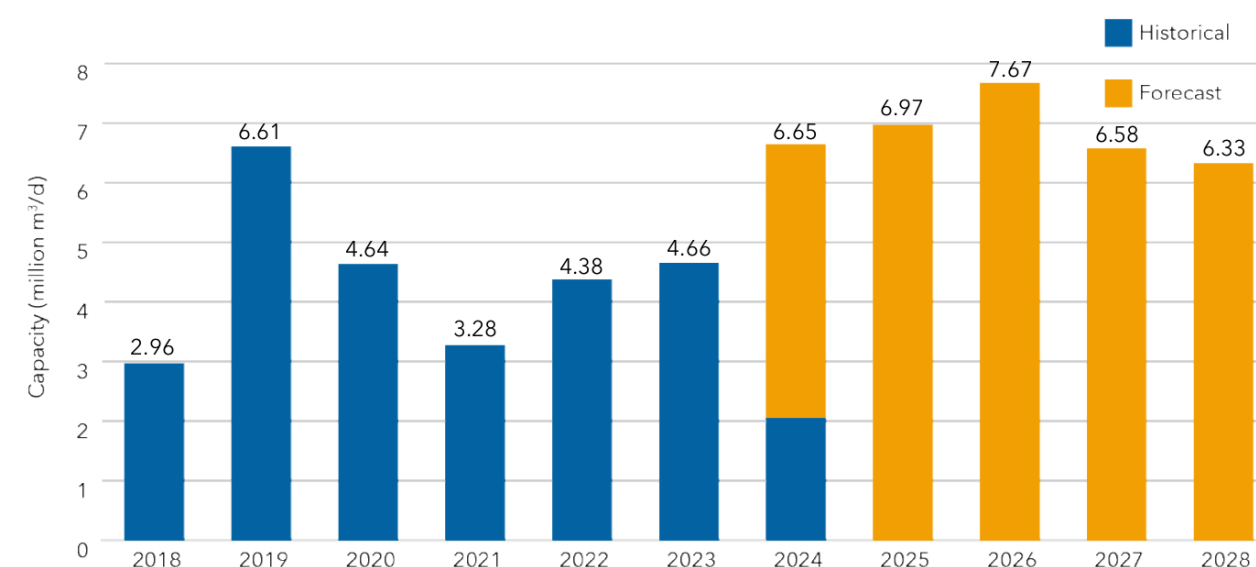
Additional contracted desalination capacity by technology (2002 - 2022).



Cumulative contracted SW/BW desalination capacity.



Contracted desalination capacity by plant size (2002-2022)



Annual contracted SW/BW desalination capacity.

Source: GWI and DesalData

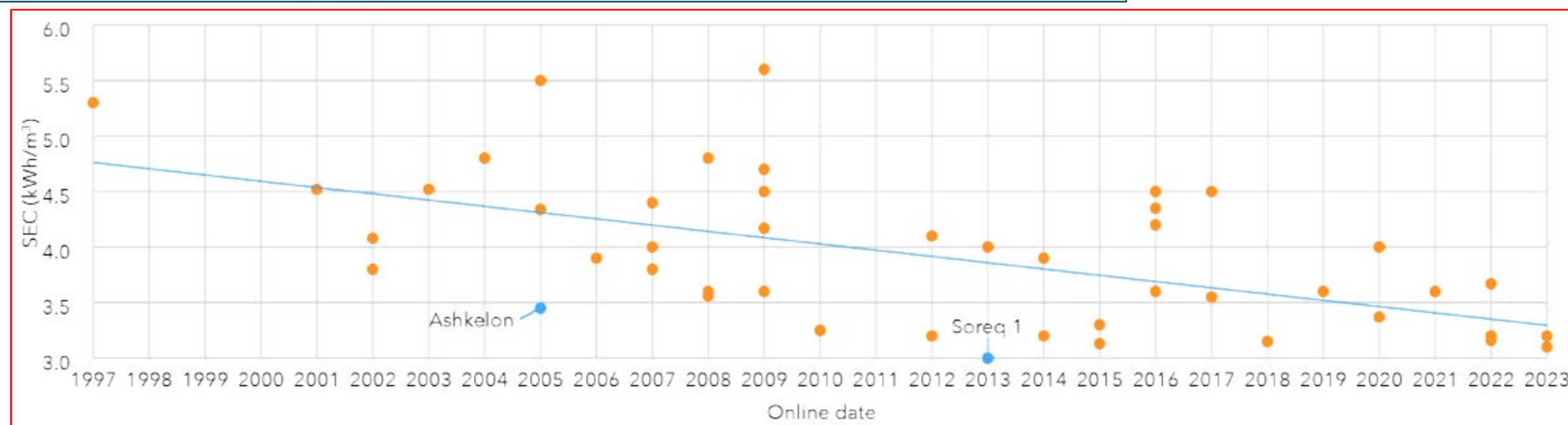
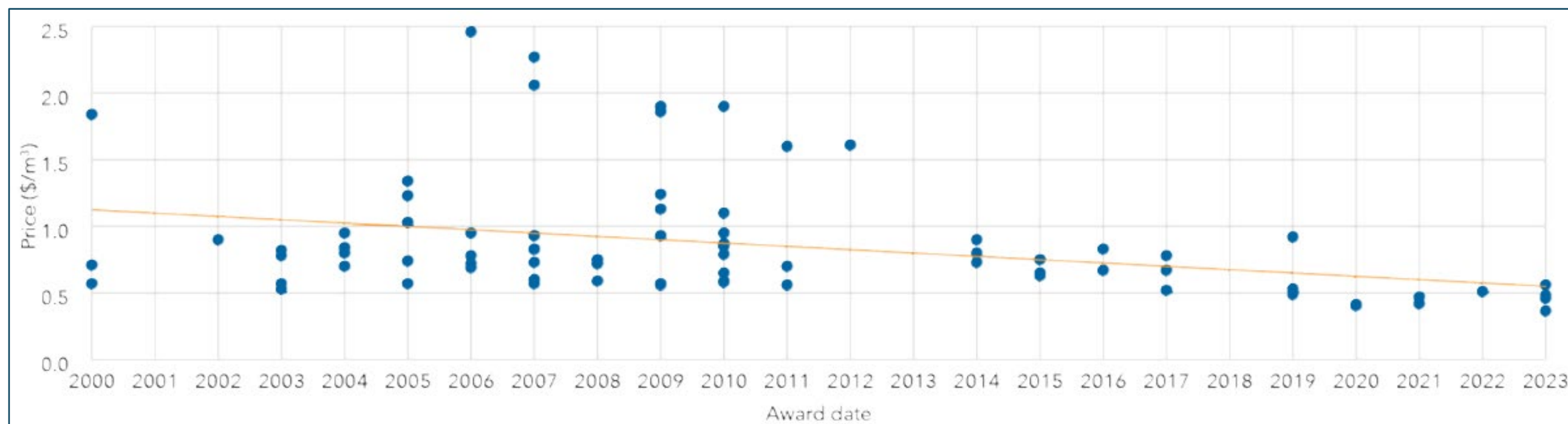
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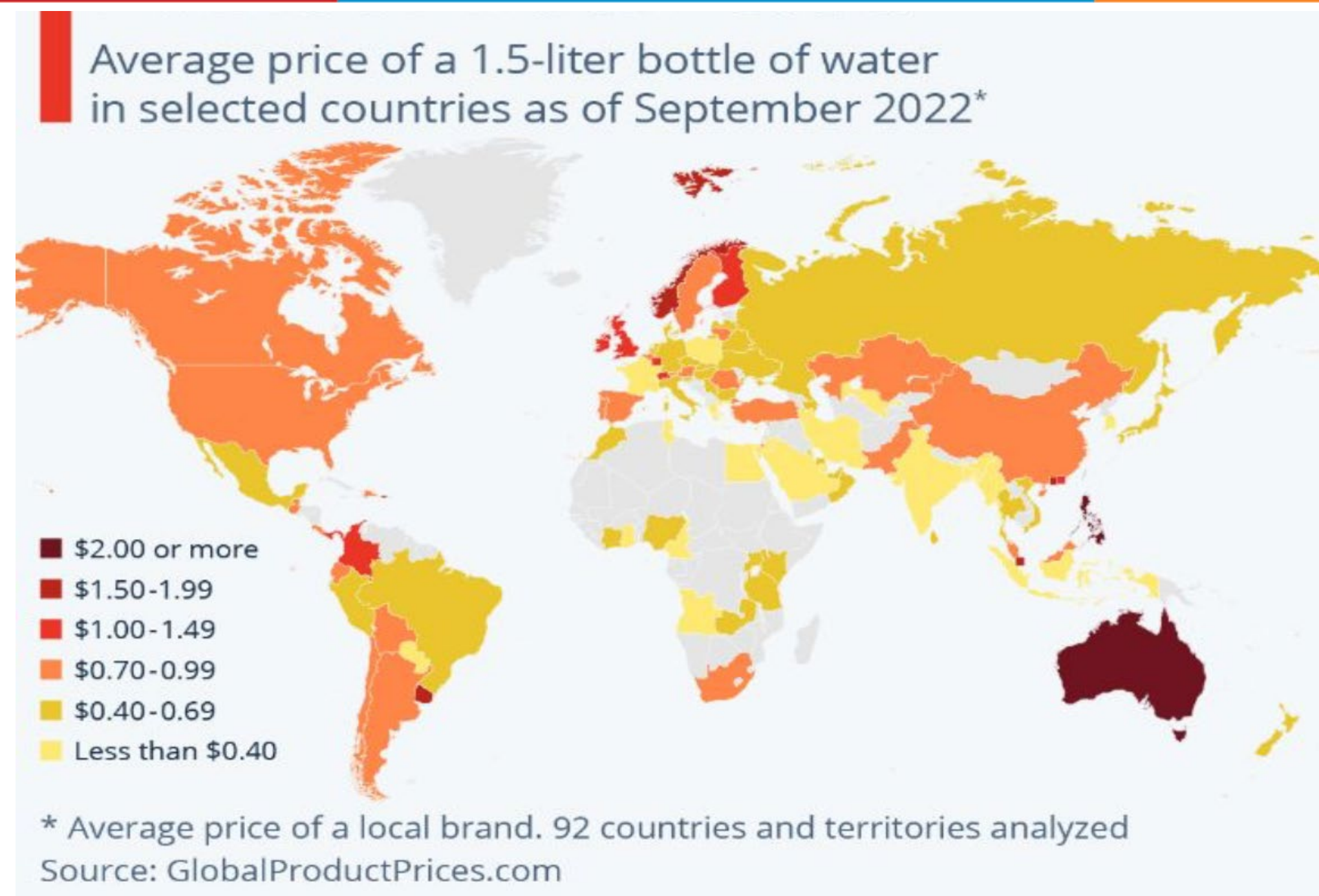
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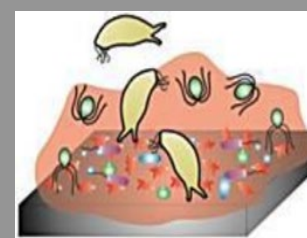
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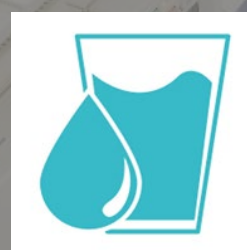




Energy consumption



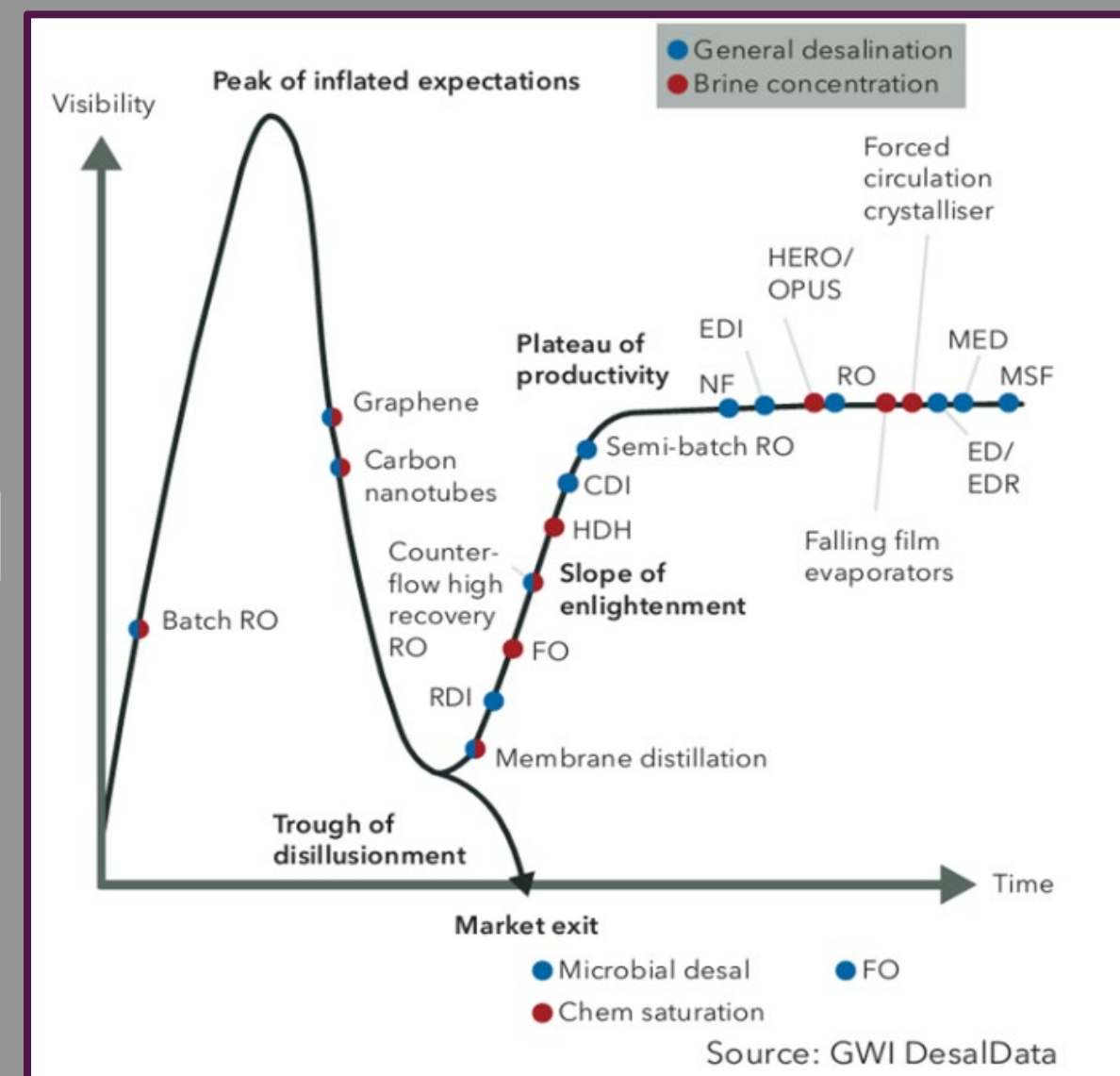
Fouling



Brine valorisation



Digital Innovation /
Advanced process
control



Energy consumption



- New configurations.
- New membranes & equipment.
- Emerging processes.
(Coupling with renewables)

Fouling



- Indicators & monitoring.
- Improved pre-treatments.
- Alternative chemicals.

Brine valorisation

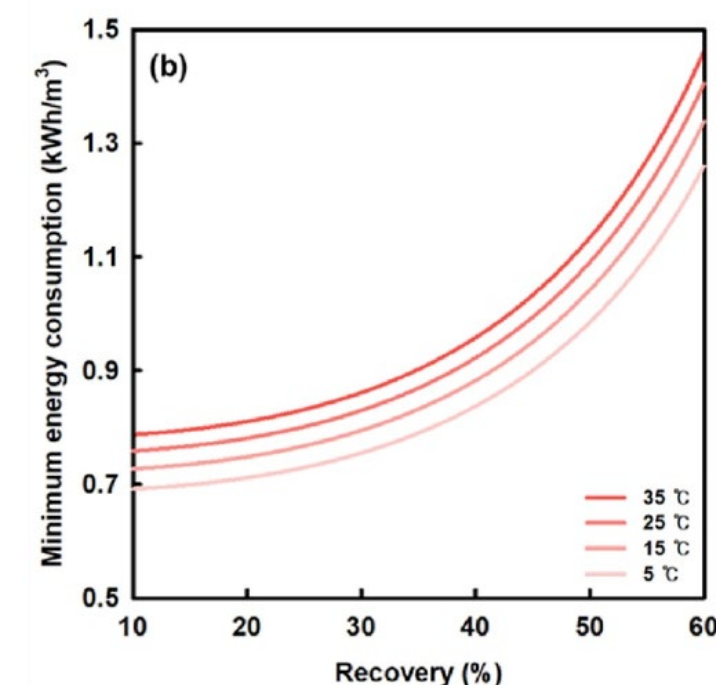
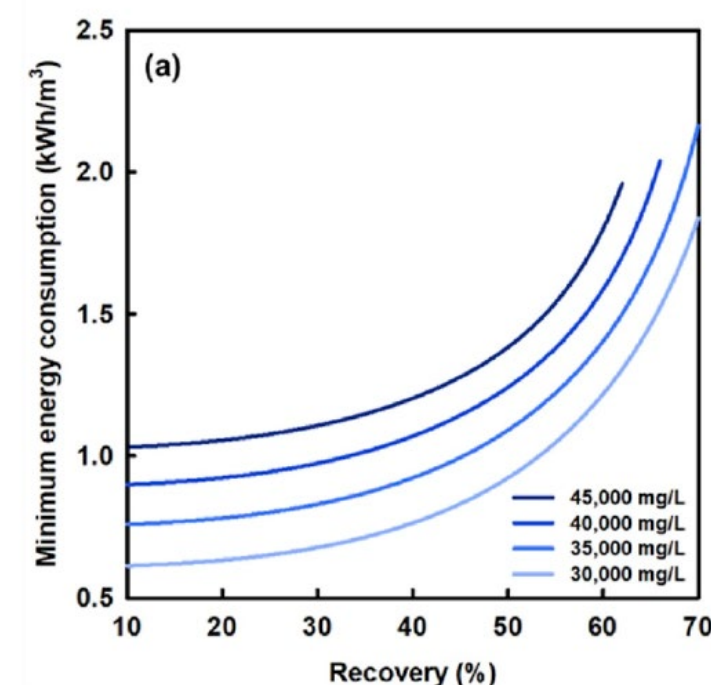
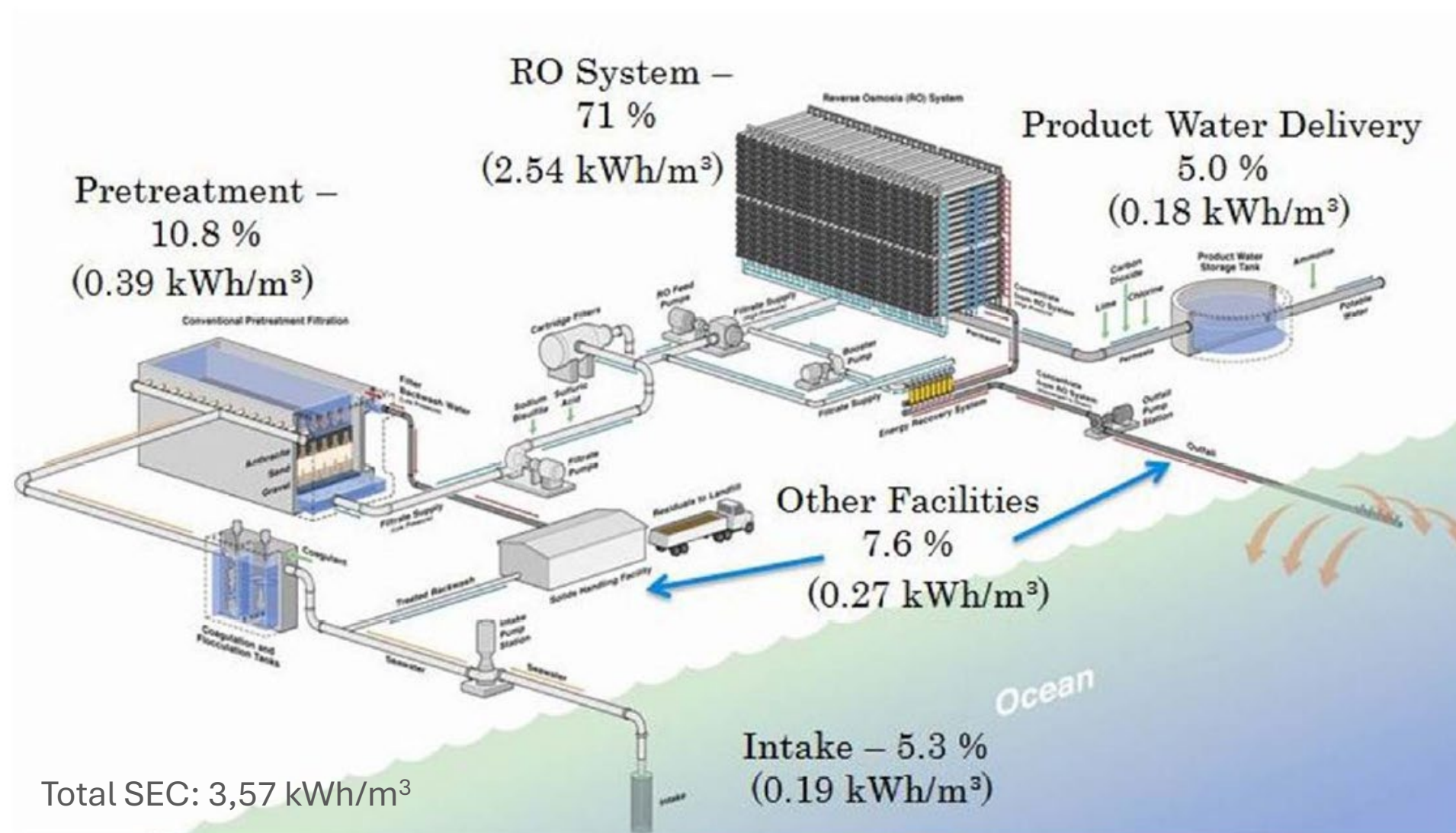


- Increased recovery.
- Obtention of chemicals / materials.
- Energy production.

Digital Innovation



- Machine learning.
- Digital twins.
- IoT's
- Remote control.



RO system ≈ 71% of the total SEC.

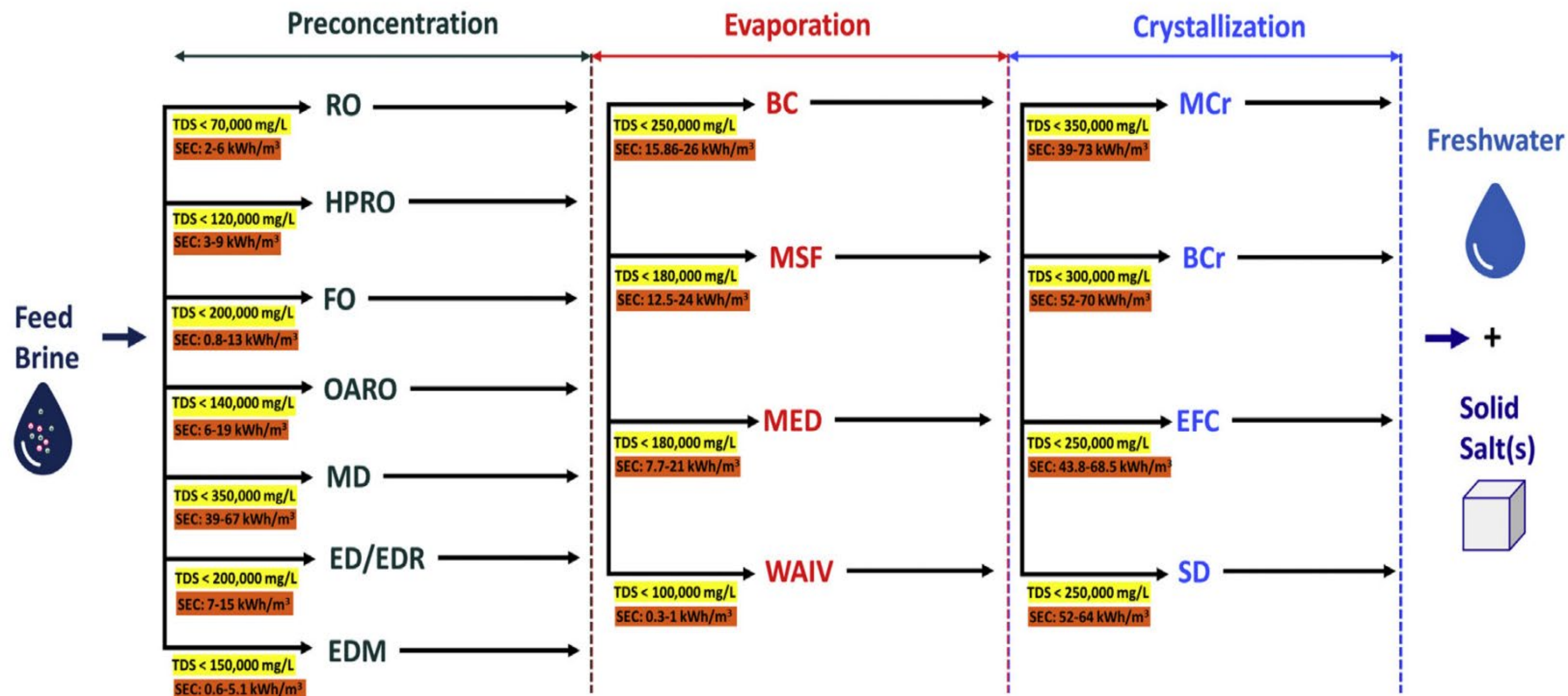
For 50% recovery, theoretical minimum SEC = 1.1 kWh/m³

Minimum SEC increases with:

- salinity.
- recovery.
- Temperature.



- Indicators definition, Monitoring & Modelling:
 - New fouling indicators that allow quantifying, and especially early identification of fouling episodes in membranes, both low and high pressure.
 - These indicators can be based on new measurements, combinations of existing parameters, or new sensors and virtual sensors .
- Improved pre-treatment.
- Alternative chemicals.



- Increased water recovery.
- Raw materials recovery / reagents production.

Source: Panagopoulos et al. (2019), Science of the Total Environment

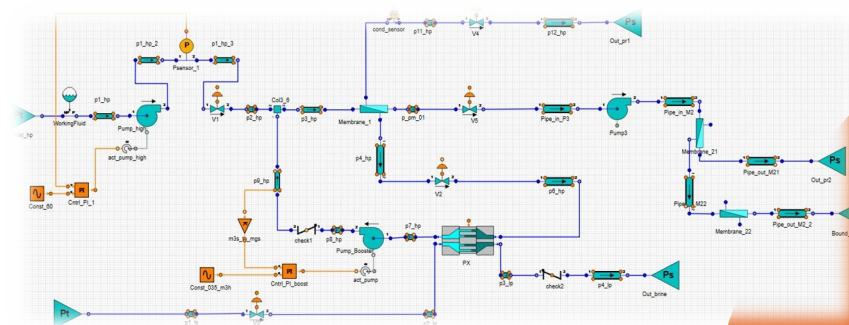
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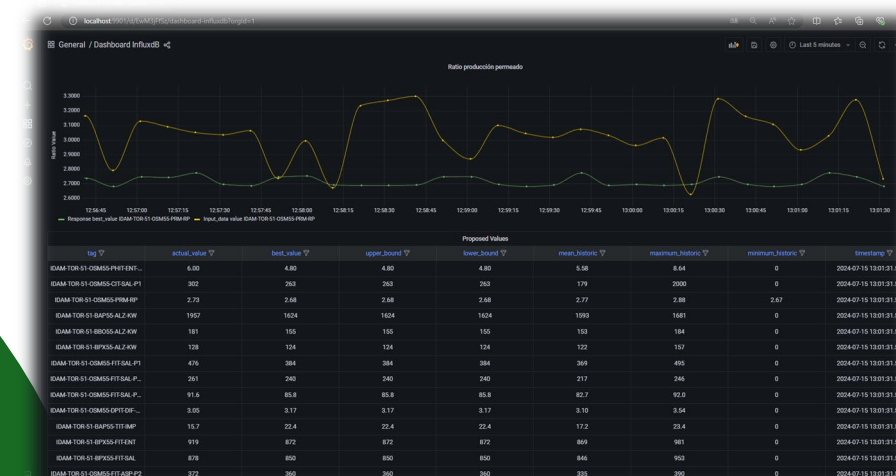
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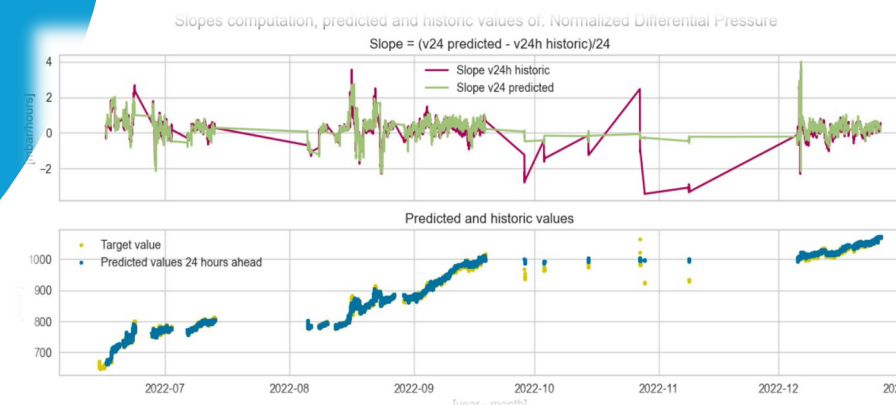
Model combining Physics-based of elements of a RO rack with AI model based on historical data.

Algorithm for identifying the best operation set-points for the reverse osmosis than minimizes the specific consumption based on historical data.



Decision support system managing technologies for removing Contaminants of Emerging Concern (CECs).

AI models for predicting the RO membrane fouling with anticipation of a few days.





*Thank
you!*

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