Which are the benefits of the ZELDA project?

The objective of the ZELDA project is to implement the EDM technology coupled with a compound recovery stage to decrease the environmental impact caused by current brine management strategies in both, seawater and brackish water desalination plants, being the final aim to reach a ZLD desalination process.

- Seawater and brackish water desalination are currently considered one of the best options to face up water scarcity problem. Reducing the high environmental impact caused by brine management, will involve clear environmental benefits in the whole European area.
- The new membranes developed by Fujifilm present high permselectivity, low electrical resistance, low water permeation and a low cost compared with current monovalent selective membranes commercially available. Moreover, these novel membranes have been developed specifically for high salinity applications.
- The recovery of valuable compounds from brines will not only make the ZELDA process more economically feasible, but will also allow to obtain commercial salts from a waste. These solids are usually obtained from mining activities, which cause a high environmental impact.

How will these benefits be estimated?

The results obtained during the pilot plant operations will be analysed using standardized Life Cycle Analysis (LCA) and Life Cycle Cost (LCC) procedures. Cradle-to-grave approaches will be adopted and several impact categories will be analysed, including climate change, water depletion, freshwater eutrophication and toxicity, among others.

The environmental and economical impact of the new ZELDA technology will be compared to those from conventional brine management strategies to demonstrate that the technology is sustainable.

Project Coordinator

ctm CENTRE TECNOLÒGIC

Partners

FUJIFILM

ABENGOA WATER

WssTP The European Water Platform

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@zelda_project Zelda Project

Pictures provided by CTM, Fujifilm and Abengoa

ZELDA

Zero Liquid Discharge Desalination

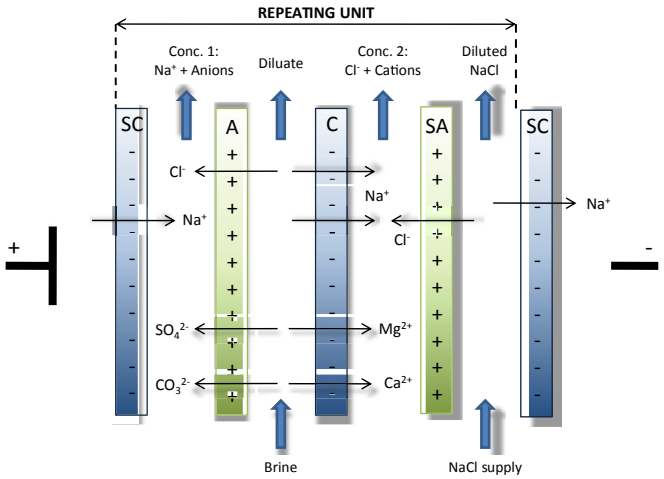
This research has received funding from the European Union's Life + Programme under the grant Life12 ENV/ES/000901

The technology behind the ZELDA project?

In the last decade an innovative electrodialysis configuration, known as electrodialysis metathesis (EDM), was developed to increase water recovery and to improve the performance of the conventional electrodialysis process.

In EDM configuration, the repeating unit comprises one ordinary anion exchange membrane (A), one ordinary cation exchange membrane (C), one monovalent selective anion exchange membrane (SA) and one monovalent selective cation exchange membrane (SC). This unique configuration permits the separation of the electrodialysis concentrate in two waste streams of highly soluble salts: one contains sodium and anions, whereas the other contains chloride and cations.

As a result, the brine can be concentrated up to higher concentrations without precipitation of salts, increasing the overall recovery of the desalination systems and opening doors to valuable compound recovery.

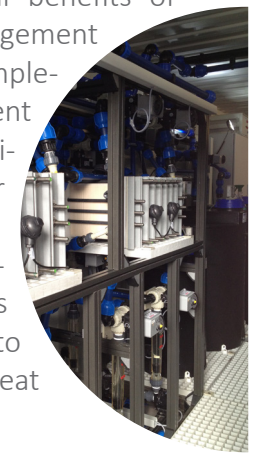


Thanks to this new EDM configuration, the sparingly soluble salts such as CaSO4, MgSO4 or CaCO3, are not produced in neither of the concentrate streams.

The key point of the EDM technology is to have good monovalent selective membranes to allow the proper separation of monovalent ions from the divalent ones, which are the most susceptible to form insoluble salts. Fujifilm will be in charge of developing and demonstrating the good performance of novel monovalent selective membranes to reach the ZELDA project objectives.

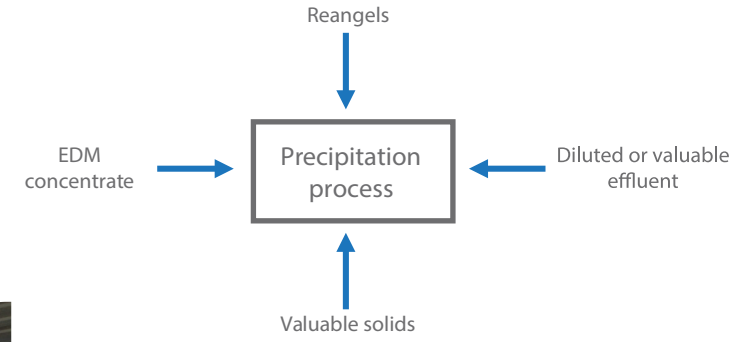
Where will this technology be tested?

To demonstrate the environmental benefits of the innovative ZELDA brine management process, the pilot plant will be implemented and operated in two different sites from Spain: one seawater desalination plant and one brackish water desalination plant.
The pilot plant will have the adequate dimensions and components, as well as a simple and versatile design to be easily scalable and adapted to treat different brines.



How to make the process economically feasible

In order to reach a Zero Liquid Discharge (ZLD) desalination, and also to make the brine management more economically feasible, the EDM process will be coupled to a second stage aimed to recover valuable compounds (Mg(OH)2, Na2SO4, NaCl, etc).



There are a number of valorization options for different salts depending on the origin of the brine. Considering the two EDM concentrate compositions when treating the brines of interest, CTM will theoretically evaluate several scenarios using specific speciation software. The best precipitation routes will be validated at bench scale and from the results obtained the most profitable recovery strategy will be adopted.
Abengoa, with a broad experience in desalination processes, will be in charge of designing and constructing a pilot plant to treat all the effluents from the EDM stage, leading to a complete and integrated system.
Coupling the EDM stage with the recovery of valuable compounds will lead to a brine management process which, not only is technically feasible, but its economics will be also sustainable.