

Innovative testbed for desalination brine valorisation: circular economy and NF-OARO synergies from Desal+ Living Lab

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Water reuse, including brine valorisation from desalination plants, is a key pillar of Circular Economy policies across Europe. Within this context, the Canary Islands Institute of Technology (ITC) has established a Brine valorisation open testbed, integrated into the DESAL+ Living Lab platform in Pozo Izquierdo, Gran Canaria (Spain). This initiative not only aims to provide a space for ITC's research work, using innovative pilot plants, but also offers external companies with a unique opportunity to test disruptive technologies in a real-world environment with diverse brine inputs.

This work presents new developments in ITC's research. The Nanofiltration (NF) pilot plant features a new energy recovery device, an in-line hardness analyser, and the usage of a 2-stage RO brine as feed. Long-term evaluation tests have also been conducted. Similarly, the Osmotically Assisted Reverse Osmosis (OARO) pilot plant also incorporates an energy recovery device and a new heat exchanger, which enables extended performance assessments. A comparative study between these pilot systems and a large-scale plant underscore the critical role of pilot-scale validations in optimizing operational reliability, cost-effectiveness and scalability.

In parallel, two new initiatives are underway in collaboration with innovative start-ups to test brine valorisation processes. These companies focus on electrochemical brine treatment coupled with CO₂ capture, contributing to sustainable advancements in the sector. These developments and synergies underscore the critical role of public-private cooperation in driving innovation and highlighting the potential for disruptive technologies to reshape the desalination industry.

ITC's findings and collaborations reaffirm the vital role of pilot scale research and cooperative frameworks in overcoming the challenges of brine valorisation. This work positions the open testbed as a pioneering hub for innovation, integrating scientific excellence with industry engagement, aiming to shape a sustainable future for desalination and brine valorisation systems.

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