ENERGY RECOVERY'S PX Q400 HELPS ACHIEVE UNPRECEDENTED ENERGY EFFICIENCY IN SWRO

LOCATION
Canary Islands, Spain

PROJECT
DESALRO 2.0

SYSTEM CAPACITY
2,500 m^3/day

ENERGY SAVINGS
18% Improvement

SPECIFIC ENERGY CONSUMPTION (SEC)
1.861 kWh/m^3

THE CHALLENGE

Across the globe, the challenge of securing clean water while reducing energy consumption has pushed the boundaries of desalination technology. Spain's Canary Islands Institute of Technology (ITC) set out to confront this challenge head-on with the launch of the DESALRO 2.0 project—a bold initiative designed to redefine energy efficiency in seawater reverse osmosis (SWRO).

The goal was as ambitious as it was clear: develop a modular, scalable desalination system that could produce 2,500 cubic meters of potable water per day with a Specific Energy Consumption (SEC) below 2 kWh/m^3 — a significant achievement in energy efficiency.

But this wasn't just a laboratory test. The plant would operate under real-world conditions typical of the Canary Islands, including seawater with 37 g/L salinity and it had to do so inside a highly compact footprint—two 40-foot shipping containers, designed for rapid deployment and replication.

Meeting this combination of efficiency, scalability, and space constraints would require the use of the most advanced technologies available.

THE SOLUTION

To achieve the aggressive performance targets of DESALRO 2.0, ITC turned to Energy Recovery, Inc. and its Q400 PX® Pressure Exchanger®, a proven solution for reducing energy consumption in desalination plants.

The PX Q400 was a strategic fit, combining high capacity with high efficiency. Designed to handle flow rates of 2,619 m^3/d, the PX Q400 enabled the plant to achieve a recovery rate of 40.4%, extracting more freshwater from seawater while minimizing waste. Equally important, its proven reliability makes it ideal for mobile, rapidly deployable systems like DESALRO 2.0, where consistent performance and minimal maintenance are critical for success in remote or resource-constrained environments. In addition to the PX Q400, the plant also integrated Energy Recovery's VPXP pump, a compact and high-efficiency high-pressure pump designed to work seamlessly with the PX, further optimizing energy use and enhancing overall system performance.

Crucially, the device achieved an estimated 98% energy recovery efficiency, producing only 1% of salinity increase at membrane feed. This level of performance was better than estimations and proved instrumental in helping the plant stay below its energy consumption targets, achieving a Specific Energy Consumption of only 1.861 kWh per cubic meter.

The Q400's robust ceramic parts offered outstanding durability in the face of corrosive seawater conditions, while its 30-year design life, industry leading up-time and maintenance-free requirements made it a sound investment for both short- and long-term operation.

Because of the PX Q400's high throughput, fewer units were needed, which helped optimize the containerized plant's compact layout and reduced upfront capital costs—a critical benefit for a system designed to be modular and easily deployable worldwide.

THE RESULT

The DESALRO 2.0 plant was successfully commissioned—and the results exceeded the high expectations for the project.

The plant achieved a Specific Energy Consumption of just 1.861 kWh per cubic meter, an incredible result for SWRO energy efficiency, marking a breakthrough moment in desalination technology.

Beyond setting a new benchmark, the PX Q400 helped the DESALRO 2.0 team realize several key outcomes:

- An 18% improvement in energy efficiency over the previously known highest efficiency in the industry.
- Significant cost savings through reduced energy consumption and minimized operational maintenance.
- Full containerization, proving that high-performance desalination can be achieved in compact, mobile formats.

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