

Lenntech is introducing the innovative **Closed Circuit Reverse Osmosis (CCRO)** technology to the water and process industry in Europe. CCRO is revolutionizing the purification and recovery of water across a variety of industries.

While traditional RO systems create excess brine waste, do not use water supplies efficiently and consume too much energy - CCRO systems will conserve water, reduce brine waste up to 75% and energy consumption up to 35%, compared to traditional reverse osmosis designs. CCRO systems are also drastically reducing fouling and scaling on membranes which results in less maintenance and down time.

Side-by-side comparisons between traditional reverse osmosis and CCRO have demonstrated breakthrough improvements in fouling and scaling resistance — most notably at Padre Dam where water recovery rates of 96% with no requirements for Clean-In-Place have been obtained; outpacing the industry's highest recovery rates of 85% (and numerous CIPs) for comparable water.

CCRO systems work by recirculating pressurized feedwater until a desired recovery level is reached. Brine is replaced with fresh feed without stopping the flow of pressurized feed or permeate. CCRO systems achieve recovery by recirculation, not with multiple membrane elements and stages in series, and can therefore reach any desired recovery percentage in a single stage. This patented semi-batch reverse osmosis process has demonstrated recovery rates of up to 98% in single stage brackish systems, saving more water and reducing more waste than traditional one-, two- and three-stage reverse osmosis systems. Recovery is adjustable, providing unmatched flexibility. Cross flow supplied by a circulation pump washes the membrane and salinity cycling disrupts and greatly reduces scaling and fouling. Cycle times are shorter than the induction time for scale deposition and frequent and complete brine rejection can stop and even reverse precipitation, making very high recovery rates possible even from difficult source waters. Furthermore, massive fluctuations in salinity and pressure within the feed-brine side of the reverse osmosis membranes prevents biological growth.



The low initial pressure of each CCRO sequence means a lower operating pressure and less pump energy than required in traditional RO systems. When treating seawater, it uses just enough power to overcome the water's osmotic pressure, resulting in a record low energy consumption of 1.45 kWh/m³.

Short membrane arrays and high cross flow also allow CCRO systems to operate at higher average fluxes without exceeding conventional reverse osmosis membranes manufacturer's flow or recovery specifications. CCRO systems can be used for anything traditional reverse osmosis is used for, including but not limited to:

- industrial process water
- food, beverage, and pharmaceutical ingredient water
- boiler water pretreatment
- irrigation water desalination
- brine concentration
- municipal wastewater treatment

Because of their record-setting water recovery rates and unmatched operational flexibility, CCRO systems are especially valuable when handling sites with:

- Variable feedwater
- High silica concentrations
- Expensive liquid waste disposal
- Strict liquid waste volume limits

This is a clear paradigm shift in water efficiency and reliability. CCRO systems minimize the largest cost associated with reverse osmosis system operation, wastewater disposal, which can be reduced by 50% to 75% and provide paybacks of under a year. CCRO systems come with an industry-leading maximum recovery guarantee, operating at up to 98% recovery and allowing you to achieve your sustainability goals. Closed Circuit Reverse Osmosis is boosting our customer's financial, environmental and operational competitiveness.



For more information or quotation, please contact us:



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