

CLOSED CIRCUIT REVERSE OSMOSIS

Boosting water recovery up to 96%

LENNTECH
WATER TREATMENT SOLUTIONS

Lenntech Closed Circuit Reverse Osmosis (CCRO) is based on the most advanced reverse osmosis principles that will **conserve water**, **reduce brine waste up to 84%**, and **reduce energy consumption by 35%**, compared to traditional reverse osmosis designs.

CCRO technology works by recirculating pressurized feed water until a desired recovery is reached. At a software-based point the system automatically flushes all the brine, returning then to normal operational mode. The recovery is achieved in different steps, starting at low recovery and progressively increasing it until the end of the cycle, **achieving an average of 96% recovery**.

Succeeding where conventional RO fails

MAXIMUM RECOVERY

- ▶ Industry leading up to 96% recovery

LOWEST ENERGY CONSUMPTION

- ▶ Up to 35% less energy consumption Brine pressure is reused in the system
- ▶ System gradually increases pressure over time

SUSTAINABILITY GOALS

- ▶ Up to 84% wastewater reduction
- ▶ Up to 22% water intake reduction
- ▶ Reduction of chemical consumption

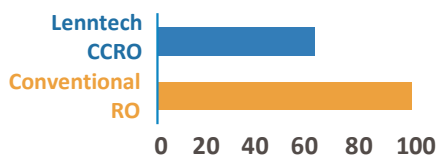
UNMATCHED FLEXIBILITY

- ▶ Recovery easily adjusted through control panel settings 75-96%
- ▶ Able to work with varying water quality and flows

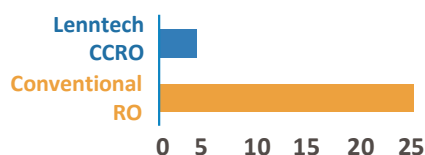
INCREASED RELIABILITY

- ▶ Reduced fouling (organic and biologic)
- ▶ Reduced scaling
- ▶ Longer membrane lifetime

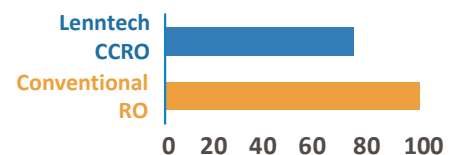
ENERGY CONSUMPTION – 35%



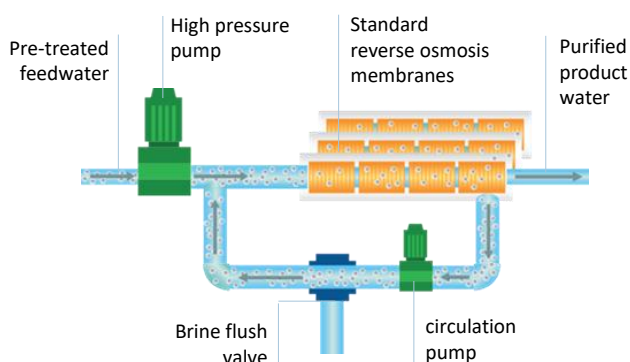
WATER DISCHARGE – 84%



WATER INTAKE – 22%



Lenntech CCRO Unique Features



- ▶ One stage, independent how high the recovery
- ▶ Semi-batch mode: Periods of 100% recovery, followed by discharge of brine
- ▶ Variable, controlled cross flow and recovery rate, independent of flux
- ▶ Fouling /scaling limited by high cross flow, good flux distribution and salinity variation
- ▶ Frequent membrane flushing - after each sequence;
- ▶ Inside out cleaning by direct osmosis.



WASTEWATER RE-USE WITH LENNTECH CCRO

Finland, 1000 m³/day

Aim of the Project

Treatment of flue-gas desulfurization blowdown to re-use as make-up water for boiler application. Wastewater minimization is of primary importance to the client due to the need of compliance with environmental goals and reduction of water discharge costs, and therefore Lenntech closed-circuit RO is used to achieve 93% recovery.

The CCRO allowed not only to work at a high recovery, but also to minimize organic fouling, resulting in less chemical cleanings, less downtime and higher membrane lifetime.

When compared to conventional RO, Closed-Circuit RO resulted in less 48% of brine discharge and a reduction in energy consumption of 35%, resulting in a return on investment <1 year.

FEED WATER QUALITY

TDS: 3500 ppm

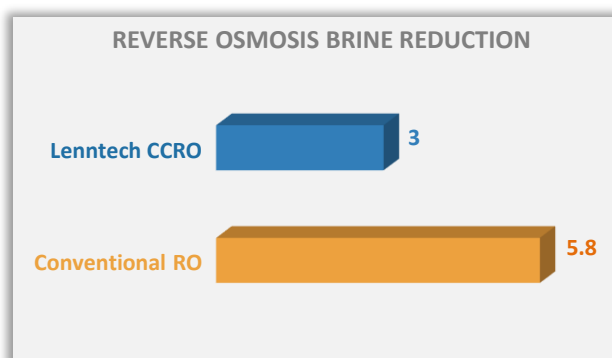
PRODUCT WATER QUALITY

TDS: < 200 ppm

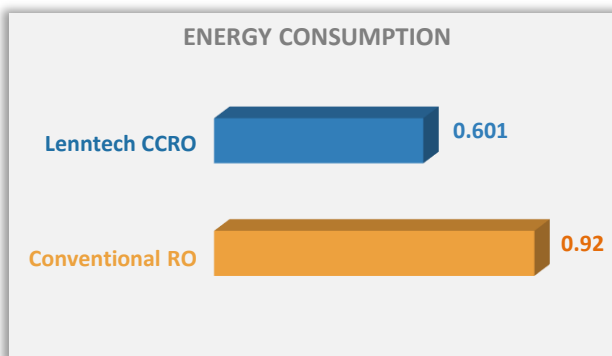
Scope of Work

- Engineering, manufacturing and assembly
- High Recovery CCRO
- Skid mounted system
- Top brand equipment
- Chemical dosing stations
- PLC controlled
- Site commissioning

WASTEWATER DISCHARGE 48% REDUCTION



ENERGY CONSUMPTION 35% REDUCTION



RETURN ON INVESTMENT < 1 YEAR

