

Seawater Desalination System Case Study

CURRENT SITUATION ANALYSIS

Seawater has a high salinity character, with an average TDS of around 40,000 mg/L, chloride content of approximately 20,000 mg/L, and a pH value ranging between 7.8 and 8.3.

The limited availability of freshwater resources, increasing salinity in groundwater, and the continuously rising water demand make it necessary to utilize such challenging water sources. In this context, seawater becomes an alternative and sustainable option for water supply.

TECHNICAL SOLUTION APPROACH

This project is a seawater desalination (SWRO) solution specifically designed for the high salinity and water scarcity conditions of Saudi Arabia. The system is designed to achieve **more than 99.6% salt rejection** and to produce product water with a TDS value below 500 mg/L.

Thanks to the integration of multi stage pretreatment, high-pressure SWRO membranes, and an isobaric energy recovery system, the solution ensures **high operational reliability, optimized energy consumption, extended membrane lifetime, and low operating costs**. In addition, the system targets long term water security with a low chemical and carbon footprint.

During the design phase, flexible operating scenarios were developed by considering region specific conditions such as sudden increases in turbidity, seasonal variations in biological load, and fluctuations in conductivity.

The system was optimized with hydraulic equipment suitable for **operating pressures of up to 65 bar and a skid mounted construction**, ensuring mechanical strength, vibration control, and ease of maintenance.



PROJECT INFORMATION



Seawater Desalination System



1.000 m³/day



Saudi Arabia



Water Security and Sustainable Infrastructure Sector



High Salt Removal



Project Specific Design



Membrane Lifetime and Protection



Energy Efficiency



Stable and Continuous Operation



Operational Robustness

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ACHIEVED RESULTS



Post commissioning performance tests and continuous operational data confirmed that the system successfully met its design targets.

Thanks to the integrated operation of the pretreatment and membrane processes, high and variable turbidity and colloidal load in the raw seawater were effectively controlled.

Through the SWRO process, high quality product water was achieved with **low energy consumption and high operational reliability.**

Optimized process control and energy recovery applications significantly contributed to reducing environmental impact and supporting long-term sustainability.



KEY RESULTS



≥ **99.6% Salt Rejection**
<300 mg/L TDS Product Water



≈ **3,0 kWh/m³**
 Specific Energy Consumption



%95
 Stable and Continuous Operational Performance



%42
 Net Water Recovery with Low Carbon and Chemical Footprint