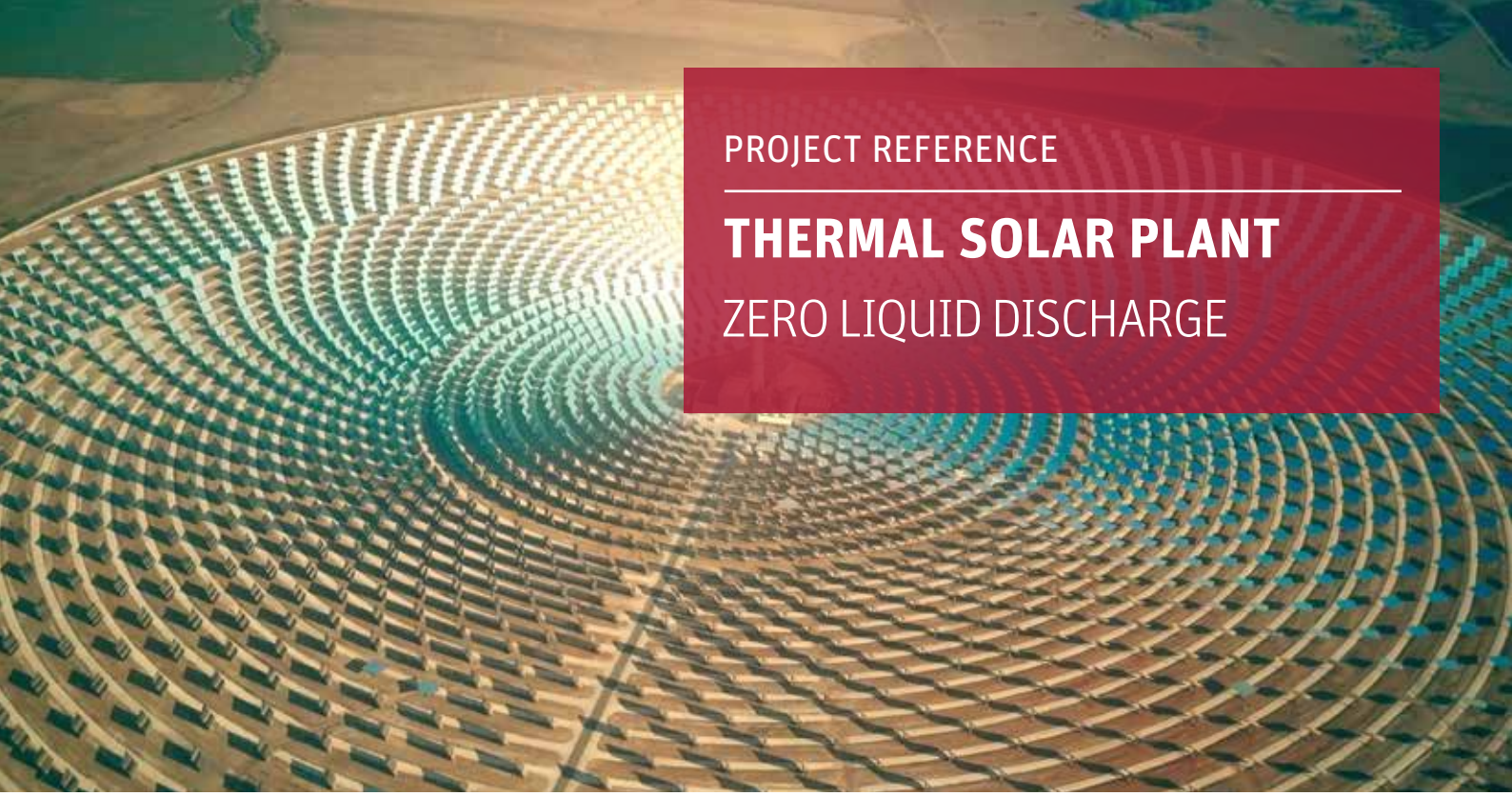

PROJECT REFERENCE

THERMAL SOLAR PLANT

ZERO LIQUID DISCHARGE

Project Details

Location:	Mojave Desert - California
Product:	External B-SMART™ Crossflow System
Produced permeate:	6.720 m^3/day
Membrane type:	5 mm PVDF, backwashable

Project overview

A large **zero discharge treatment plant** located in California's Mojave desert faces the unique challenge of treating reverse osmosis (RO) concentrate/wastewater. Due to the increasing costs of water and waste discharge, new **stringent reuse policies** are placing heavier demands on companies in regards to concentrate recovery.

The challenge

RO membrane technology is widely used for recycling and reuse of process water, and to decrease amount of ions in the process water itself. RO recovery rates typically range from 50 - 75%, therefore leaving the other 25 - 50% as concentrate to be discharged as wastewater. Although it's possible to treat the RO concentrate via a second pass, the absence of proper pretreatment in the second pass increases the potential of scaling which can result in **costly repairs and system shut-downs**.

The Berghof Membranes solution

In the Mojave plant, raw water to be treated is transferred from sources like cooling towers and wells. A RO unit treats the well water to produce drinking water and the concentrate is then transferred, along with the effluent from the cooling towers, to a large tank where it is stored until its sent to a reaction tank. Once there, water is added with chemicals such as soda, sodium hypochlorite, Ferric sulphate and magnesium chloride. At a 8,5 pH, the precipitation of silica and calcium carbonate begins to take place.

Effluent overflow from the first reaction tank is channeled into the second reaction tank, where soda and lime are added in order to increase the pH value to 10,5 - 11,0 pH in order to further precipitate silica and calcium carbonate. This second tank overflows into yet a third tank that collects the different concentrates or rejections, including the one generated by the **Berghof Membranes B-SMART ultrafiltration system**. Precipitated and chemically-saturated solids are collected in this concentration tank where the concentration increases by up to 5%. This results in sludge that is then transferred to a sludge-thickener tank which feeds the filter press. From the filter press, the dewatered solids are then carried to a landfill, or similar, while the liquid is transferred back to the concentration tank.

On the other hand, the slurry from the saturated solids in the concentration tank is transferred to the Berghof Membranes ultrafiltration unit in order to completely remove the solids.

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The permeate flow from the Berghof Membranes B-SMART™ ultrafiltration unit goes into a pH adjustment tank. There, sodium bisulphite for chlorine neutralization is added to the permeate, as well as hydrochloric acid for lowering the pH down to 6,3 pH.

The UF permeate from the pH adjustment tank is treated through RO technology, and the flow from the first-stage permeate returns to the cooling tower and to a polishing unit. The produced permeate from the polisher is transferred to a continuous deionization system in order to produce the water that will feed the boiler.

Picture 1. Berghof Membranes B-SMART self-regulating UF Skid

Conversely, the concentrate from the first-stage RO is passed through a second-stage RO, and the resulting permeate is directed to the cooling tower while the concentrate flow is treated by a crystallizer. The final solids are transported to a landfill and the condensate produced by the crystallizer is used to feed the cooling tower.

The level of pollutants drastically increases in the blowdown water while water evaporates in the cooling tower. The technologies employed in this system (RO, continuous deionization, etc.) are not only subjected to challenging suspended solids, but they must also handle soluble salts which precipitate upon concentration. With the exception of seawater, practically all water supplies are deeply saturated with magnesium and calcium carbonate, not to mention potentially high silica concentrations and sulphate salts.

Lime softening is the traditional and most commonly-used water softening process for large volumes. This process includes the addition of lime and soda ash, and the increased pH level resulting from the lime leads to the precipitation of calcium carbonate, magnesium carbonate and magnesium hydroxide. Lastly, silica that precipitates is absorbed by the magnesium hydroxide.

Customer Benefits

Berghof Membranes, with its long-standing experience in treating industrial effluent using its innovative PVDF LE tubular membranes, developed the compact Berghof Membrane B-SMART™ self-regulating filtration system to achieve complete retention of solids, deliver automated fouling control and provide consistently high permeate quality.

- **Simple-to-use filtration process;**
- **Robust and compact solution;**
- **Consistently high quality permeate water;**
- **Operational cost-savings;**
- **Excellent control of inorganic & organic incrustations;**
- **Easy maintenance with remote control access;**
- **Adaptability and flexibility;**
- **Self-regulating, fully-automated operation;**
- **Small footprint;**
- **Low energy consumption of 0,3 - 0,5 kWh/m³**

The B-SMART System

Based on a side-stream ultrafiltration system located outside the feed tank **(the external principle)**, the Berghof Membranes B-SMART self-regulating system uses high-quality tubular membrane modules. The system is self-regulating and therefore **consumes less energy**. The proprietary built-in software system **analyses data in real time** using advanced algorithms based on transmembrane pressure (TMP) to control pump speed, backwash and cleaning frequency. The filtration system automatically monitors the individual TMP and automatically initiates the cleaning procedure if it exceeds defined limits as a result of fouling. Depending on the need, the system selects one of the cleaning modes to eliminate fouling: **(1) increased cross-flow velocity**, **(2) backwash with- or without chemicals**, or **(3) flushing or cleaning-in-place (CIP)**. Once cleaning is completed, the **system automatically checks the TMP values** again and applies additional cleaning protocols if the set-point value is not reached. Additionally, the unit can continue to produce a fixed amount of permeate even during the backwash process.

The Berghof Membranes B-SMART self-regulating external filtration sytem treats wastewater streams at a cross-flow velocity of 1,5 – 2,5 m/s and a flux range of 50 – 100 LMH. All this combined **ensures less energy, reduced maintenance time and improved OPEX**.

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Agora 4
8934 CJ Leeuwarden
The Netherlands

Phone: +31 588 100 110
E-mail: info@berghofmembranes.com
Web: www.berghofmembranes.com