

# Water Reuse: Datong Power Plant



## Overview

Shanxi Province is challenged by an arid climate during most of the year, and a harsh monsoon season that concentrates 60 percent of annual rainfall between June and August. The region suffers from a lack of water resources, resulting in poor economic development and dire conditions for the area's farmers.

The government and the major industries in Shanxi have attempted to address the situation by implementing large-scale initiatives to conserve water and utilize alternative water resources.

One of these initiatives concerns the Datong Power Plant. Located in the historic city of Datong, this enormous coal-fired plant supplies electricity to the sprawling city of Beijing, 160 miles to the east.

The facility's eight cooling towers circulate 6300 m<sup>3</sup>/hr (39 MGD) of water. One-seventh of the water is continually blown down to prevent buildup of harmful solids, resulting in a continuous outflow of 900 m<sup>3</sup>/hr (5.6 MGD).

In a different part of the facility, high pressure boilers for the steam turbines in the electrical generation process consume makeup water at a continual rate of 600 m<sup>3</sup>/hr (3.7 MGD). Since the construction of the plant in 1978, this large volume of boiler makeup water has been purchased from the municipal water utility, straining its ability to satisfy the water needs of its other residential, agricultural and industrial customers.

## The Challenge

To conserve the municipal water supply by building a water treatment system to purify blow-down water and reuse it as a source for boiler makeup water.

## Solution

Engineers at the Datong Power Plant selected Koch Separation Solutions (KSS) to supply FLUID SYSTEMS<sup>®</sup> reverse osmosis (RO) technology to purify the cooling tower blow-down to make it suitable as a source for the boiler makeup water.

To optimize the performance of RO systems and protect the membranes from fouling, an effective pretreatment system is required. Pretreatment for the RO system is especially critical at the Datong plant because of unusually high concentrations of silicate in the cooling tower blow-down water.

Based on the results of pilot studies to evaluate UF membranes from three suppliers, the Datong plant chose TARGA<sup>®</sup> UF cartridges, the only membranes able to meet the rigorous specifications of the project.



This pilot system also proved TARGA® cartridges to be the most energy efficient, consuming less energy per cubic meter of permeate. The high reliability and resistance to fouling of the TARGA cartridges were important factors that weighed heavily in the selection process.

### The Treatment Plant

The RO system installed in the Datong plant is arranged into four trains, each containing 252 eight-inch diameter elements. The UF pretreatment system, with 138 TARGA-10 cartridges, is configured into six separate trains arranged in parallel, and includes an extra train to ensure that five trains will operate continuously, even when a train is taken out of service for cleaning or maintenance.

The plant installed TARGA-10 cartridges because they deliver 60 percent more product water than the more conventional 8-inch cartridges. This reduced the number of cartridges needed and resulted in significant savings in equipment cost for the Datong plant. Moreover, the larger diameter cartridges significantly reduced the overall system size enabling a significant savings in building costs.

The UF membranes take the feed of 900 m<sup>3</sup>/hr from the cooling tower blow-down operation and produce a permeate of 800 m<sup>3</sup>/hr. The RO system recovers 75 percent of this flow, producing 600 m<sup>3</sup>/hr of high quality water – completely replacing municipal water as the source for boiler makeup water. No water is wasted, as the concentrate from the UF and RO processes is used to wash coal.

The UF pretreatment system reduces the cleaning frequency of the RO system and extends membrane life. The UF system also permits an increase in the recovery rate of the RO system due to the reduced concentration of silica in the feed water.

The Datong Power Plant now has the largest UF/RO system used for cooling tower blow-down recovery in China.

“We are very happy with the performance of the UF and RO products from Koch Separation Solutions,” says Mr. Guo Zhiyuan, the plant manager. “The system has performed as expected, allowing us to recover more than five million cubic meters of water per year, which we would otherwise need to purchase from the municipal water utility.”

### Product Overview

KSS UF membranes result in more effective and reliable pretreatment procedures for reverse osmosis and ion exchange operations. Membranes such as the TARGA-10 and the newly-launched TARGA II provide an advanced, highly efficient alternative to standard methods for removing contaminants from boiler makeup water.

Primary advantages of KSS UF membranes for boiler feed water include:

- Ability to quickly start-up the water plant, for example, in peaking power operations
- Consistent high quality water from ultrafiltration leads to improved operation of downstream processes.
- Small footprint for power plants with limited space for expansion of existing water treatment systems.
- Highly automated operation for minimal operator attention.
- Minimal chemical use resulting in less need to purchase, store and handle chemicals.
- Minimal waste production and disposal.



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