



PX Pressure Exchanger Reduces Barriers to Achieving ZLD in CTX Wastewater Treatment



THE CHALLENGE

The Qingxu Hongbo wastewater treatment plant is part of the Shanxi Qingxu fine chemical circular economic industrial park in Shanxi Province, China. The plant is designed to treat multiple wastewater streams from coking and coal to chemical plants, totaling 30,000 m³ per day. The wastewater created by these industrial processes is one of the most difficult types of wastewater to treat, as it contains high levels of salinity, hardness, silicon content, and organic content, and requires multiple processes and treatment stages.

When designing the facility, Beijing BeiJieTe's goal was to reach zero liquid discharge (ZLD) and produce freshwater that could be reused through the industrial park, creating a closed loop water system. They also sought to minimize costs by reducing energy consumption and mining the reject brine for valuable minerals that could be sold.

THE SOLUTION

Beijing BeiJieTe used a combination of internal recirculation high-pressure reverse osmosis (HPRO), nanofiltration, and their own industry-leading salt separation technology to treat the wastewater. The combination of these three processes resulted in true ZLD, where there is no wastewater remaining at the end of the treatment process, and effectively separated and purified the salt present in the water.

The HPRO stages incorporated Energy Recovery's PX Q300 pressure exchanger technology, which is able to capture pressure energy as wastewater moves through the HPRO process and recycle it back into the system, significantly reducing the amount of energy needed to pressurize the wastewater feed stream. The PX Q300 is able to significantly reduce the work of a high-pressure pump in an HPRO system; because Beijing BeiJieTe incorporated the PX into their original system design, they were able to purchase a smaller capacity high-pressure pump, resulting in CAPEX savings in addition to OPEX reduction.



LOCATION

Shanxi Province, China

PROJECT

Qingxu Hongbo Plant

CUSTOMER/ OPERATOR:

Beijing BeiJieTe

FACILITY CAPACITY

30,000 m³/day

ESTIMATED ENERGY SAVINGS

3,300,000 kWh/year

ESTIMATED COST SAVINGS

\$333,000 USD per year



THE RESULT

In the first two years of operation, the Qingxu Hongbo wastewater treatment plant has been operated reliably and successfully achieved ZLD and is recirculating the resulting freshwater back into the industrial park in which it is located, creating a closed loop water system that produces no wastewater discharge.

The PX has recorded an efficiency of over 95% and has reduced the HPRO system's operating expenses by 45%. Thanks to these reductions in energy consumption and the associated costs, the payback period for the system's PX devices was well below one year.

In addition to the success of the ZLD system, the facility's salt separation technology is able to produce a salt that is 99% pure and satisfies industrial salt standards, meaning it can be sold for other industrial purposes. The facility has reached full sales of its industrial salt byproduct, effectively creating two usable and valuable resources from the industrial park's wastewater: salt and freshwater.



A Simpler System For Internal Recirculation with the PX

In wastewater treatment, concentrate recirculation is often employed in order to boost system recovery and concentration level; as the wastewater moves through the RO stages, a portion of the flow is redirected back to the feed side and mixed with the feed stream. This process requires a larger high-pressure pump (HPP) to pressurize the concentrate flow.

However, as the PX is already utilizing the concentrate flow to pressurize the feedwater, a system with the PX can incorporate a bypass line to run in parallel with the PX loop to more easily achieve the desired concentrate recirculation with extra flow capacity from the recirculation pump, alleviating the work of the the HPP and further reducing the system's energy consumption.

TESTIMONIAL

“By integrating the PX into our high-pressure concentration process, we were able to reduce energy consumption in that process by 45%, making PX payback less than one year. The PX's ceramic design has also proven to be reliable even in the challenging coking and coal-to-chemicals wastewater treatment process, and provides operational flexibility in recirculation.”

– Mr. Wu Yong Dong, QingXu Plant Manager