Case Study

The Seawater Solution

ITT Goulds Pumps makes mining operations practical and more efficient–in the driest place on Earth.

Located 2,300 meters above sea level in the Atacama Desert, the Esperanza copper and gold mine is one of Chile's largest mining operations—in one of the toughest locations. Huge amounts of water are needed daily for both processing ore and consumption by mine employees. With less than 0.01 cm of rainfall per year, the Atacama Desert is literally the driest place on the planet. Local freshwater supplies are precious and off limits, reserved for community members. The Pacific Ocean is the closest source of water, with limitless supply—but it's 145 kilometers (90 miles) away from the desert's rich copper deposits.

"Without water, we can't operate. It's needed 24 hours a day, seven days a week," said Carlos Ahumada, Operations Manager at Esperanza. "At Esperanza we determined that the most sustainable option was to use seawater. This option is a viable solution that doesn't have an impact on the underground water supply."

The Esperanza mine was a project long envisioned, but impossible to launch without a solution to the seawater problem.

The ITT Impact

With ITT, Esperanza has access to necessary water 24 hours a day—with a more reliable operation.

Bringing Water to the Desert–Uphill

To make the seawater transport a reality, mine owner Antofagasta Minerals worked with ITT in 2010 to develop a pumping solution. The company purchased 16 ITT Goulds Pumps model 3600 units, installing four each at four booster stations at the Esperanza mining complex. These pumps are powerful workhorses, propelling the seawater uphill at 11,500 gallons of water per minute, or more than 16 million gallons per day.

Of these millions of gallons, about 8 percent (more than 1.2 million gallons daily) are run through desalination systems for use in clean-water applications. Esperanza uses the raw seawater directly in the mineral crushing and concentration process. For copper, it is used to move and rinse ore as it is crushed into smaller pieces. A flotation system uses the water to separate the valuable minerals from the "gangue," or worthless material.

Twenty Goulds 3600 API pumps propel seawater 90 miles from the Pacific to the Esperanza copper mine, while 14 ITT employees are on site for daily pump inspection, ProSmart data monitoring, and implementation of other Plant Performance Services (PPS) assessment recommendations.

The ITT family of industrial brands includes:

Boosting the Seawater System

After the mine had been open for five months, Antofagasta contacted ITT again in September of 2011. The seawater pumping system (SIAM, sistema impulsion de agua de mar, or seawater pumpline system) and concentrator plant were operating, but the team wanted to improve the reliability of the seawater pumping system. In addition to reducing maintenance costs, increasing the flow of seawater to the mine's flotation plant would improve the efficiency of the copper ore processing operation.

As part of a root cause analysis engineering study, ITT Plant Performance Services (PPS) performed a physical assessment of each of the four pumping stations and associated inter-piping. The PPS team completed a detailed vibration analysis of 16 pumps and reviewed pump performance data when the pumps were in normal operating mode.

Based on the analyses, ITT recommended corrections to the check valves, control valves and pump-stopping procedure that would balance the flow between stations. A condition-based maintenance system would mitigate water-hammer effects and increase reliability. ITT also recommended the addition of a ProSmart system to give mine operators real-time data on all pumps and motors, allowing them to keep tabs on vibration levels, temperatures and more.

The mine implemented these recommendations and has since added a fifth 3600 pump to each booster station, helping to maintain system flow so that maintenance can be performed on any one pump. While only four pumps per station are currently running on a constant basis, the fifth pump will run continuously when the operation is expanded.

Adding People Power

When the mine opened, only four operators and two electrical technicians were on staff at Esperanza. That's a very small team to be fully responsible for the operation and availability of the mine's two pumping systems—without dedicated maintenance crews.

To ensure the SIAM continues to operate at optimum reliability, there are now 14 ITT employees on site at all times, in charge of daily pump inspection and ProSmart monitoring. With the ProSmart system, they can monitor the pumps over the web from any place in the world, 24 hours a day, and are using the data to create a monthly report with trends and recommendations for the ITT staff on site to implement. If a pump needs repairs that can't be made on site, it is sent to the ITT PRO Services Center in Antofagasta. From machining individual parts to complete pump overhauls, the shop services all of the mine's pumps and rotating equipment, not just products from ITT Goulds Pumps.

"ITT truly sold us more than pumps—they sold the whole service that keeps our mine running smoothly, allowing us to increase our system reliability and secure the water supply to the concentration plant at all times," said Julio Avaca, SIAM Superintendent sistema impulsion de agua de mar, or seawater pumpline system. "Now we have not only the water we need, but a dedicated partner to help us. They dug deep to identify and resolve the inefficiencies."