Coeur Rochester, Inc.: Plant-Wide Assessment of Nevada Silver Mine Finds Opportunities to Improve Process Control and Reduce Energy Consumption

Benefits

- Identified potential annual electricity savings of almost 11 million kWh
- Found opportunities to reduce total costs by $813,000 per year
- Identified measures to improve process control

Application

Identifying the primary energy-consuming equipment and associated systems helped to demonstrate and clarify how component-level changes would impact the operation and reliability of the systems. This information allowed an assessment team to identify projects that would reduce overall energy requirements at the Coeur Rochester silver mine.

Summary

A plant-wide energy efficiency assessment undertaken at the Coeur Rochester mining operations in Rochester, Nevada, identified five energy-saving opportunities. Using energy cost tracking, process system analysis, and characterization of the primary energy-consuming equipment to identify systems with the greatest savings potential, the assessment team developed and proposed five energy efficiency projects. The project proposals focused on improving the pumping systems, capturing waste heat, and upgrading lighting fixtures. If implemented, these projects would yield almost 11 million kWh in annual electricity savings. Total estimated cost savings of $813,000 per year were projected for the five projects. The required capital investment is estimated to be $260,000. The average simple payback for all five projects would be approximately 4 months.

Public-Private Partnership

The U.S. Department of Energy's (DOE) Industrial Technologies Program (ITP) cosponsored the assessment through a competitive solicitation process. DOE promotes plant-wide energy-efficiency assessments that will lead to improvements in industrial energy efficiency, productivity, and global competitiveness while reducing waste and environmental emissions. In this case, DOE contributed $26,000 of the total $58,000 assessment cost.

Plant Description

Coeur Rochester, Inc., is a subsidiary of Coeur d'Alene Mines Corporation, a worldwide producer of precious metals. The Coeur Rochester mine, which opened in 1986, is the company's largest producer and one of the largest primary silver mines in North America. It produces 60,000 ounces of gold and 6 million ounces of silver annually. The ore body is blasted, and ore is then fed into a series of crushers until it is 3/8 inch in diameter. Conveyors then transport the ore to the heap, and the facility uses a heap leaching[1] process to capture the metals from the ore.

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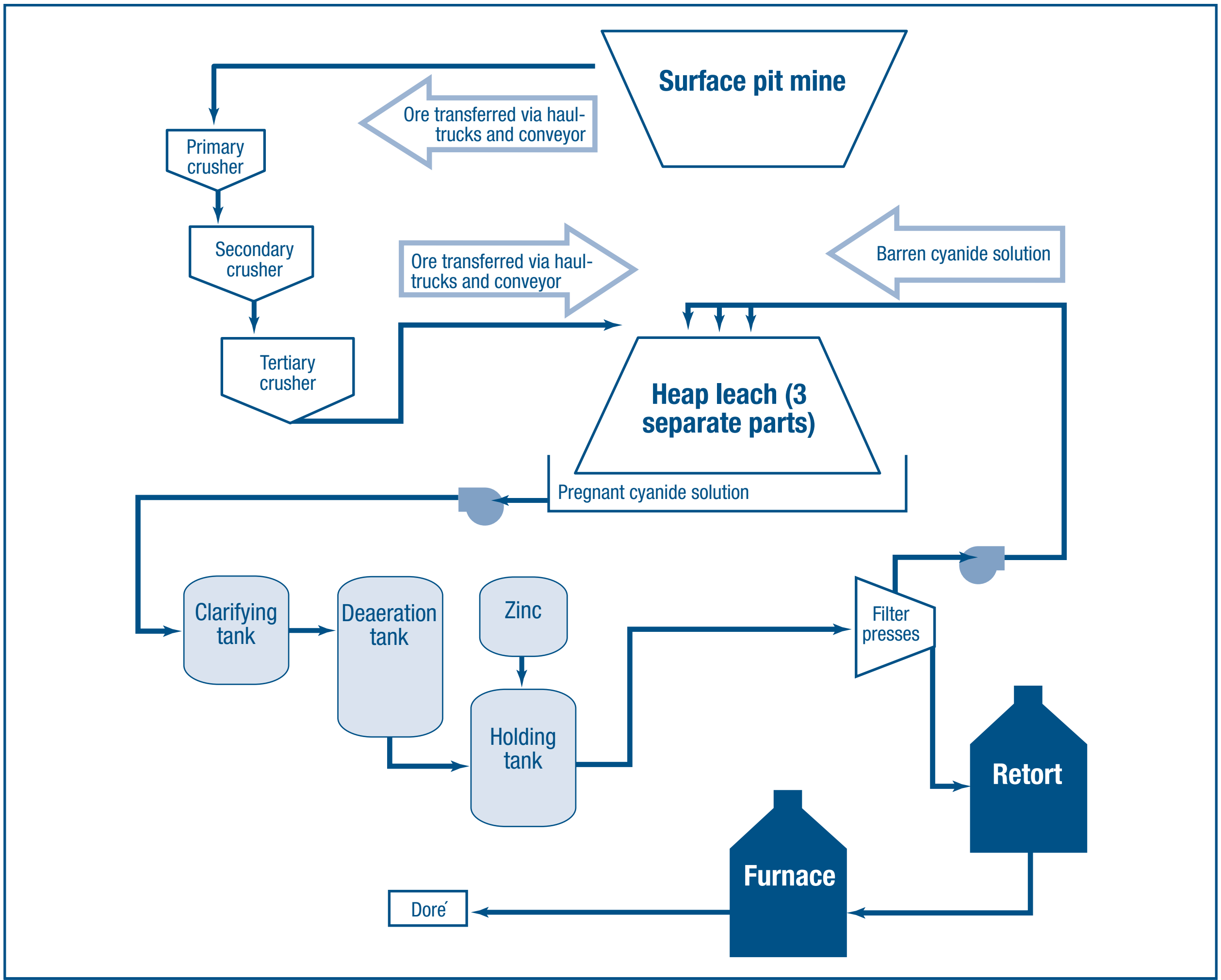
[1] Heap leaching is a process that extracts a soluble precious metal compound by dissolving the metal content from crushed ore. Ore is heaped onto open-air leach pads with a base of asphalt or plastic sheeting. A solution of dilute cyanide is sprayed onto the ore pile. The cyanide percolates down through the heap, leaching out the metal. This solution, now enriched with the desirable metal, drains off the bottom of the pad into what is known as the pregnant pond. This pregnant solution is then pumped to the recovery plant. Two steps are involved in single-stage leaching:

1. Contact of solid and solvent to transfer solute to the solvent
2. Separation of the resulting solution from the residual solid.



The Coeur Rochester mining process

In this process, a cyanide solution is pumped to the top of the heap and distributed across the ore. The cyanide solution flows down through the ore and captures the precious metals. Then, the mine uses the Merrill-Crowe process[2] to recover the metal from the cyanide solution.

Assessment Approach

Coeur Rochester formed an internal energy team and then partnered with the Energy Assessment Center at the University of Nevada, Reno, to perform the assessment. The joint team's methodology included tracking monthly energy costs, performing a process system analysis, and identifying major energy consumers. Specifically, the assessment team accomplished the following activities:

- Performed a comprehensive review of product flow through the mine, from raw materials to final product, and established production efficiency benchmarks
- Developed a database of energy-consuming equipment

[2] The Merrill-Crowe process is used to recover gold from a pregnant cyanide solution. This process involves precipitation with zinc dust and is applicable particularly to gold ores with high silver content. Before gold can be precipitated with zinc dust, all solids must be removed from the pregnant solution. The Merrill-Crowe process has three stages:

1. Deaeration to prevent the gold from dissolving again
2. Zinc dust precipitation
3. Precipitate filtration, in which zinc dust and gold are mixed with sulphuric acid to dissolve the zinc, the resulting mix is filtered, and the remaining solids are smelted into a bullion bar.

- Identified potential projects to reduce energy use and demand and developed preliminary cost estimates for those projects
- Prioritized potential projects based on probability of implementation
- Performed a detailed cost/benefit analysis for selected projects
- Developed implementation strategies for selected projects.

This approach uncovered the systems with the greatest potential for energy savings. By associating the major energy-consuming equipment with the appropriate system, the assessment team gained a better understanding of how component-level changes would impact the system's operation and reliability. The team used this information to propose ways to reduce the mine's energy requirements. They selected several projects for further analysis—specifically, those that involved major energy consumers, offered the greatest savings potential, and met a one-year simple payback criterion.

Results and Projects Identified

The assessment team developed a list of five projects with potential for significant energy and cost savings that also met the company's payback requirement. These potential projects are summarized in Table 1 on page 4, and details about them follow.

Replace 1,250-hp barren pump motor with 600-hp motor. The four-stage barren pump circulates 5,500 gallons per minute (gpm) of cyanide solution to the top of the phase 2 and phase 4 heaps. Phase 2 currently requires 1,300 gpm, and phase 4 receives 4,200 gpm. Using DOE's Pumping System Assessment Tool (PSAT) software and the manufacturer's pump curves, the assessment team determined that a 600-horsepower (hp) premium efficiency motor could replace the existing 1,250-hp barren pump motor.

Replace 1,250-hp phase 4 pregnant pump motor with 750-hp motor. The phase 4 pregnant pump transfers the metal-laden cyanide solution from the base of phase 4 to the processing plant. The actual head required is 500 feet. The team determined this head requirement by calculating the pressure loss and elevation gain and using a 25 pounds-per-square-inch (psi) pressure drop through the clarifiers in the processing plant. Using the calculated head requirement, the assessment team found that one bowl could be eliminated from the existing pump configuration. The team also determined that a 750-hp premium efficiency motor could replace the existing 1,250-hp pregnant pump motor. In addition, they recommended that an adjustable-speed drive be installed to accommodate the change in flow requirements from phase 4 to the plant.

Install a regenerative system on downhill conveyor. A downhill conveyor transfers crushed ore to the base of phase 4, at an average rate of 1,200 tons per hour. The energy created by the falling ore is currently dissipated as heat in the conveyor system's brakes; the team recommended that this energy be recovered and used to generate electricity.

Install adjustable-speed drive on 150-hp well pump no. 2. Well pump no. 2 provides water to the processing plant for use in the plant and in suppressing road dust; however, flow requirements fluctuate. Currently, a valve on the discharge line controls the flow rate. Installing an adjustable-speed drive on the 150-hp motor would allow better flow control and reduce the operating costs for this pump.

Install efficient lighting fixtures. Currently, metal halide lighting fixtures are used throughout the shop and in warehouse spaces. However, a newer, proven fluorescent lighting technology can deliver a better quality of light at a much higher efficiency than metal halide fixtures do. The assessment team therefore recommended installing T-5 high-bay fixtures with significant potential to provide savings and improve the overall performance of the lighting.

Project Description	Annual Electricity Savings (kWh/yr)	Implementation Cost ($)	Annual Cost Savings ($/yr)	Simple Payback Period (yr)
Replace 1,250-hp barren pump motor with 600-hp motor	4,520,000	41,000	339,000	0.1
Replace 1,250-hp phase 4 pregnant pump motor with 750-hp motor	3,206,000	69,000	240,000	0.3
Install a regenerative system on downhill conveyor	1,920,000	115,000	144,000	0.8
Install adjustable-speed drive on 150-hp well pump no. 2	544,000	16,000	41,000	0.4
Install efficient lighting fixtures	648,000	19,000	49,000	0.4
TOTALS	**10,838,000**	**$260,000**	**$813,000**	**0.3 (average)**

Table 1. Projects Identified During the Coeur Rochester Plant-Wide Energy Assessment

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Project Partners

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