

Latin America

Country

MEXICO

Sector

MINING AND METALS

Sector

COPPER MINE

Workstream

PLANT OPERATIONS

Keywords

- **Short Interval Control**
- **Operational SOP's improvement**
- **KPI's development**

Reduction of Plant's Energy Cost (\$) and Kw/Ton

Decreasing power intermittencies leveraging supervisory daily routines.



Driver Goal

- ▲ To efficiently manage energy consumption of the Processing Plant.
- ▲ To install an Energy Cost Management System to impact Milling Circuit and Flotation area as two of the main energy costs areas.

Results

- ▲ Monthly Energy Cost (\$) per tonne milled decreased in **37% for the milling circuit, and 41.2% for flotation area.**
- ▲ With these percentages total savings projection were estimated in \$211.5k / yr which represents a **14% of the 2015 yearly expenditure** for the two mentioned areas.
- ▲ Monthly Energy Consumption per tonne processed presented a reduction of **7.9% for the milling circuit, and 11.4% for flotation area.** (kg/ton)

Issue

Energy costs increased in 38% from December 2015 to March 2016, trending up. Plant was being managed by lowering mills tonnage as a result of low levels of ore entering to crushing circuit. Lowering tonnage of the two mills and switching mills as for different capacity needs, led in to an erratic and intermittent *on* and *off* of the equipment impacting costs. The plant was using the same amount of energy to mill less tonnes, not to mention the impact in recovery due to the lack of efficiency in TPOH.

Solution Approach

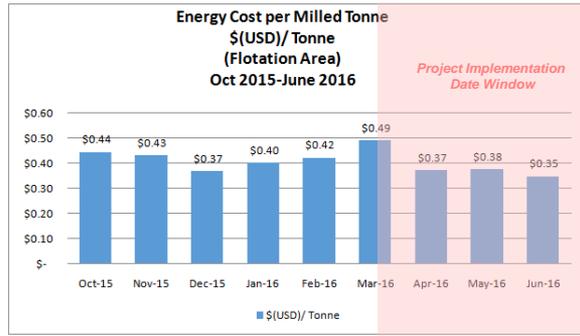
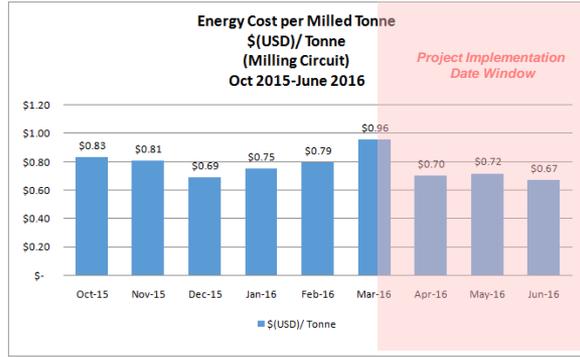
Making a call for powering *off* and *on* of a mill is normally a management call not a supervisor call. In these terms, the management consulting team worked with the client, redesigning the plant way of response for low tonnage scenarios. In this improvement, the plant would not have to adapt to the amount of ore as an input of the system, but would lead the plant into an efficient way of processing what is available.

Actions Taken

Management Team was trained to use simple MOS tools to be able to measure their weekly energy performance and improve decision making.

The system changed in to a very different scheme with the following features:

- ▲ Introduced an improved Mill shutdown schedule.
- ▲ This new schedule complied with the 93% of milling circuit required availability.
- ▲ Removed all power intermittencies, decreasing power peaks due to rebooting.
- ▲ Assured long runs by accumulation of ore due to this new shutdowns scheduling system.
- ▲ Increased milled tonnage per hour to the optimal technical limit.



Reduction of Plant's Reagents Cost (\$) and \$/Tonne

A goal achieved by leveraging supervisory level

A Short Interval Control (SIC) Approach



Driver Goal

- ▲ To implement a Plant Management System in order to impact total monthly cost per critical reagent consumed.

Results

- ▲ Monthly Energy Consumption per tonne processed achieved a reduction of **129.4% (\$USD/Tonne)**.
- ▲ With this percentage total savings projection were estimated in \$580k / yr which represents a **27% of the 2015 actual expenditure** for Plant reagents.
- ▲ Monthly Reagents Total Cost (\$) decreased in **142% from April to June equivalent to \$75,630 USD**.
- ▲ World class result achieving \$0.88/ton (less than a dollar).

Issue

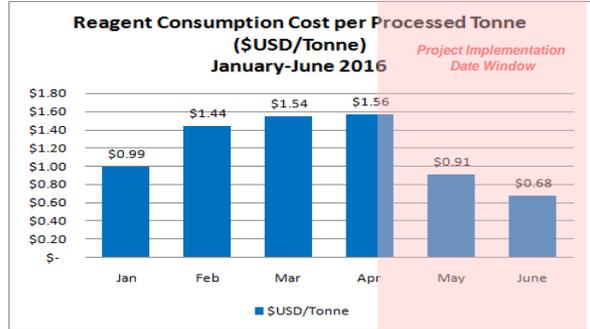
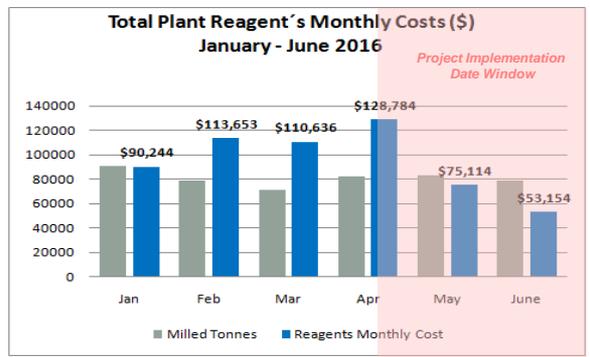
Client's plant reagents cost, increased in 38% from January 2016 to March 2016, trending up after a successful decrease due to a replacement of the collector reagent in December 2015. One of the main reasons this happened, was because the plant was receiving lower levels of ore entering to plant system; but also because a lack of supervision in terms of assuring the correct amount of concentrate mix for the process, having harmful effects on the reagents consumption control.

Solution Approach

Understanding that a poly-metallic production, which has a variety of reagents necessary to control the quality of the three main concentrates (Copper, Zinc and Silver), would tend to increase the cost of use, several lab initiatives were performed, that at the end encouraged the replacement of chemical collector (Promotor) and foaming (Flottec). A solid replacement process where supervisors would have to focus their efforts in operational compliance, was also necessary to succeed. The Management team, participated in this process but also leveraged the supervisory level in terms of daily behaviours to improve in mix preparation and levels tracing.

Actions Taken

- ▲ Short Interval Control (SIC) in lab processes was installed in order to keep up with the ore changes from the mine and improve decision making.
- ▲ Behavioral Change: All supervisors had their density hydrometer and timely reported on the preparation the night shift to ensure correct concentration and / or respond if not.
- ▲ KPI introduction: Monitored most consumed reagents during the week and perform a Pareto analysis.
- ▲ Sharpen and adapted the decision tree regarding changes in ore, where parameters training shops were performed to secure operators commitment.
- ▲ Strengthen structured supervisor daily plant routes.
- ▲ Installed a weekly Reagent Consumption Monitor in Kg/ton versus an standard according to ore type.



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CASE STUDY

Increasing Copper Recovery (%)

A goal accomplished by installing daily operational routines reinforced by the use of supervisor's SIC



Driver Goal

- ▲ To achieve 95% average of Copper Recovery.

Results

- ▲ Plant: Copper Recovery **increased in 0.37%** from 94.39% to 94.76% and ramping up with 1.42% grade.
- ▲ Taking this increased percentage, savings projections were estimated in **\$241.5k / yr.** which represents a **0.32% of the annual copper value @ 95% recovery.**

New Challenges faced after an slight recovery decay

On May, achieved a big step forward on copper recovery due to technical improvements combined with the Reagents Consumption System for Management . Coming from .74% to .37% slight decrease from June to July due to technical challenges with the new ore composition that is entering to the plant.

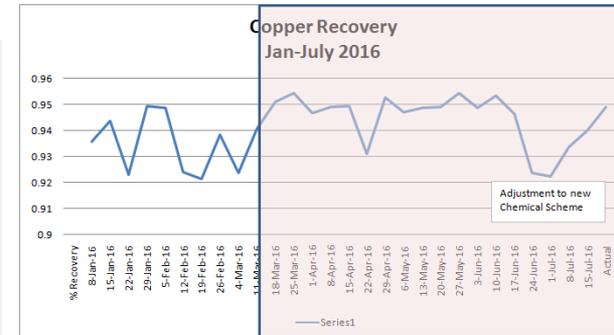
Solution Approach

The plant has been in a constant effort to make changes regarding their laboratory researches and modifying technical parameters. Likewise, the management process controlling the recovery process has been upgraded by working with the people and their behaviour. Leveraging client's flexibility in developing new chemical schemes, adapting floor decision trees, the learning curve will happen faster allowing optimal response when ore sudden changes happen.

*"Our Technical improvements have been supported with a better operational control reflected on people's behavior. **Metallurgic Laboratory Leader.***

Actions Taken

- ▲ Improved attainment delivery of samples, reducing frequency gap from 2 to 1.5 hours.
- ▲ Leveraged operators compliance in cells cleaning routines (more frequent).
- ▲ Cells breakdown reported with more sense of urgency.
- ▲ Any chemical flotation anomaly reported real time to take action.
- ▲ Developed Control Room supervisor routine to support operational control.
- ▲ Conducted parameters use training to increase sense of urgency of the people.
- ▲ Updated Flotation Macro Decision Tree, Specific Decision Tree based on new chemical scheme based on mine ore.
- ▲ Developed a daily Courier availability calculation and reporting system.
- ▲ New Schedule for Courier Calibration introduced.



Date	% Recovery
8-Jan-16	94.4
15-Jan-16	94.2
22-Jan-16	94.5
29-Jan-16	94.5
5-Feb-16	94.3
12-Feb-16	94.2
19-Feb-16	94.4
26-Feb-16	94.2
4-Mar-16	94.4
11-Mar-16	94.4
18-Mar-16	94.5
25-Mar-16	94.6
1-Apr-16	94.5
8-Apr-16	94.5
15-Apr-16	94.3
22-Apr-16	94.5
29-Apr-16	94.5
6-May-16	94.5
13-May-16	94.5
20-May-16	94.6
27-May-16	94.6
3-Jun-16	94.5
10-Jun-16	94.3
17-Jun-16	94.2
24-Jun-16	94.3
1-Jul-16	94.4
8-Jul-16	94.5
15-Jul-16	94.8

"The team has helped us to put a consistent management system in place with more sense of urgency of the people, which with our technical improvements has allow us to ramp-up our own recovery performance."
Plant Manager.