

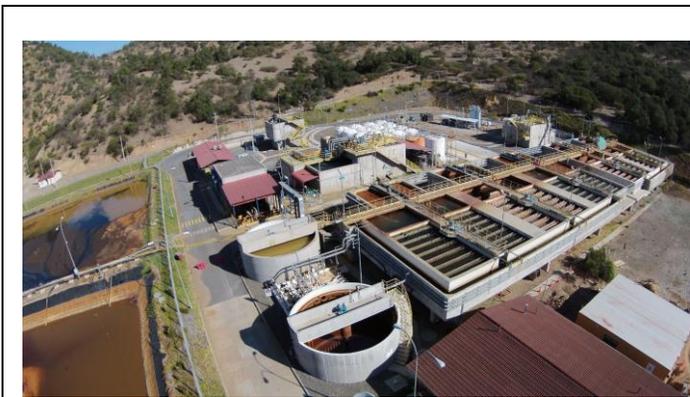
# ISO 50001 Energy Management System Case Study

2020

CHILE

## Molybdenum Removal Treatment Plant - SUEZ Chile

*Efficient O&M. One of the first certified mining plants in energy management in Chile.*



Planta de Abatimiento de Molibdeno (PAMo)

### Organization Profile & Business Case

SUEZ Chile it is a company that belongs to an international group present in more than 70 countries in the world, that delivers industrial services and solutions specialized in the protection and recovery of natural resources focusing mainly on water, recycling and waste recovery.

Within this context, it is that SUEZ participated in the design and building, start up and guaranteed operation of the Molybdenum Removal Treatment Plant (PAMo for its initials in Spanish) belongs to El Teniente Division of the Corporación Nacional Del Cobre (CODELCO), the world's main copper production mine, located in Alhué. By the end of 2019, SUEZ Chile was awarded the Complete Service of PAMo and Carén reservoir, extending for 5 more years the provided service, adding

up to 15 years of experience in the operation and maintenance to the El Teniente Division.

### Case Study Snapshot

<b>Industry</b>	Mining
<b>Product/Service</b>	Water Treatment Services
<b>Location</b>	Alhué, Región Metropolitana, Chile.
<b>Energy management system</b>	ISO 50001
<b>Energy performance improvement period, in years</b>	1 year
<b>Energy Performance Improvement (%)</b>	5.51 %
<b>Total energy cost savings</b>	4,931 USD
<b>Cost to implement EnMS</b>	18,956 USD
<b>Total Energy Savings</b>	116.8 GJ
<b>Total CO<sub>2</sub>-e emission reduction</b>	13.2 tonCO <sub>2</sub>

PAMo's purpose is to treat the evacuated waters for the Carén reservoir (tailing) in order to comply with the current environmental regulations. Its treating capacity goes up to 2.500 liters per second, being the largest of its kind worldwide with a high-tech level (Densadeg®), operational excellence and low energy consumption endorsed by the Energy Management System (EnMS) based on ISO 50001, obtained in March 2019. This initiative was driven by its dedication to the environment and sustainability. SUEZ is strengthening its climate commitments to join the 1.5 ° trajectory of the IPCC by reducing its greenhouse gas emissions by 15% and aiming to become a carbon neutral organization by 2050.

One of its main objectives is to improve energy efficiency in customer facilities and opt for sustainable energy production solutions to comply with the country's new environmental and energy regulations

Achieving the established goals, SUEZ was also awarded with the highest recognition in the subject of energy efficiency in the country, the Gold Seal of Energy

Efficiency, delivered by the Ministry of Energy: Energy Sustainability Agency, leading organizations in this matter of the country.



Figure 1: SUEZ Team receives Energy Efficiency Award – Ministry of Energy of Chile

The energy management at PAMo has become a founding pillar for its workers, creating an energetic and sustainability culture not only at site but also within the organization transversely. This is how measuring carbon footprints has been proposed in SUEZ headquarters in Las Condes and SERPRAM for the year 2020.

The above, thanks to the international organization guidelines, consisting in a firm commitment with the circular economy principles as a model to boots energy efficiency and help the environment.

***“To have accomplished with ISO 50001 and to achieve energy savings of over 30,000 kWh revitalizes out environmental commitment and the energy sustainability of the country”***

— Juan Rafael Espinoza, Head of Plant.

## Business Benefits

The Energy Management System implementation in PAMo actively begins in 2018 with the purpose of stand out as a company based on its strong commitment to sustainability, in that line is that despite not owning the plant, SUEZ believes that operation and maintenance are the fundamental pillars for the country's future energy policy.

This had a cost of \$USD 18,309 and implemented through an external energy efficiency expert consultant with vast experience that concluded with the awarded certification in March 2019.

In terms of the time associated with the critical staff involved in the EnMS, this was from half a year to a year. This did not consider an extra cost because the development of the activities of energy management were described in their respective job profiles as well as in their roles and responsibilities.

The benefits gained in terms of energetic performance reached 5.51% that translates in savings of 32,449 kWh within a year that equals to \$USD 4,931. All of this meant a carbon footprint reduction of 13 tons of CO<sub>2</sub> associated with energy consumption.

On the other hand, it is worth mentioning that 18 workers, which are the pillar of the EMS, operate PAMo. One of the benefits brought by the energy management is to create an energy reality awareness that can be transferred to each family. SUEZ has verified a notorious commitment of the workers with energy efficiency, which is demonstrated in the constant concern for improvements in their work environment and personal life. This has also translated into the interest of other professionals to become members of the SUEZ team and apply for job offers in the company that include energy efficiency as a hallmark in the profiles of each relevant position.

In addition, certification has proven to be a benefit of utility when it comes to attracting customers and / or renewing contracts with clients, such as the recent renewal of the contract for a period of 5 years in PAMo. Thus, a factor of differentiation or competitive advantage has been established, which highlights SUEZ over its competitors

## Plan

PAMo's energy management begins in the year 2016, with an external energy audit in order to identify as a diagnosis, which are the gaps that could be considered for an EnMS implementation based on ISO 50001. Since

then, the process begins and it is intensely executed during 2018.

To accomplish this process, Senior Management of the company, the Operation and Maintenance Director of SUEZ Chile, forms an energy management committee. Within this context, ISO 50001 certification became one of the main objectives for management, so enough resources are committed in order to achieve the main goal, thus aligning with the main guidelines of the group that in 2014, Spain has already certified over 20 sites of different areas associated with water treatment. Therefore, PAMo's certification becomes a milestone and an initiative for SUEZ in Latin America and the world.

The energy management system made it possible to reinforce SUEZ's compliance associated with its proposed sustainability guidelines and goals, contributing to the reduction of the carbon footprint associated with energy consumption and to its organizational strategy of becoming carbon neutral.

### Energy Planning

After making a strong commitment with the implementation and the commitment shown by Operation and Maintenance Management as senior management of a supporting team associated with Energy Management, an Energy Policy is enforced that guards SUEZ Chile's guidelines in relation with Energy Efficiency (EE) and operational excellence of its services. Meanwhile, thanks to the resources provided, the Energetic Review process begins executed by the EE specialists hired for this purpose. In order to obtain concrete information of the energy consumption, data was gathered in site from the electric cabinets since PAMo only had general energy meters (for billing) and an unclear distribution of their main consumers through boards.

The results indicate that, the plant is the major electricity consumer, and that 90% of the energy is used in the treatment process. This consists of three main areas: Sludge line that pumps and dehydrates the sludge; water line associated to the mixers and drainage; and chemicals for the pretreatment and neutralization.

A 61% of the total consumption being used by the sludge line, plus the water line adds up to 90% of the total energy consumption, pinpointing them as the priority to find improvement opportunities given their consumption significance.

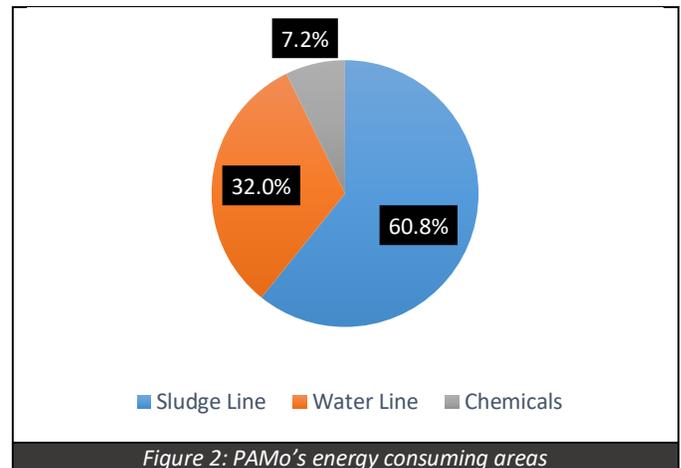
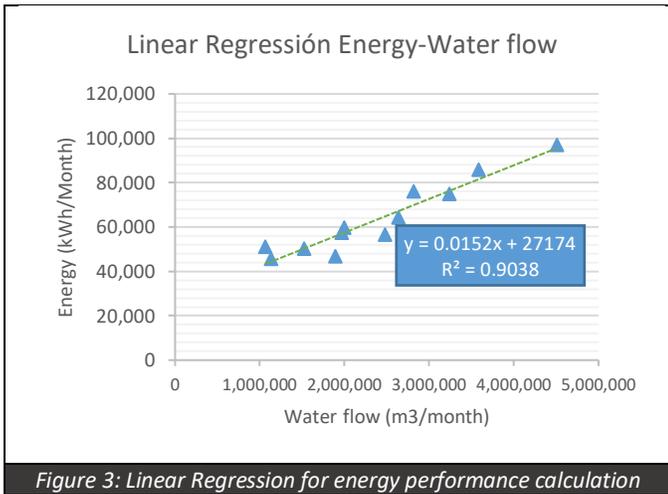


Figure 2: PAMo's energy consuming areas

Since this data was taken spot on measurement from the cabinets, for 2019 it was established as an objective to install power meters that will allow making a more broken down and precise measurements in order to refine the energy management through a well-defined line.

Likewise, to obtain the energetic base line, several critical variables that could affect the energy performance were analyzed. The main one being the treated water flow that when a lineal correlation is made with the energy consumption, we obtain an un  $R^2$  of 0,9, indicating a relevant impact according to the international Performance Measurement and Verification (IPMVP):



Regarding the base line calculates the performance improvement to the year 2019 comes into a 5.51% according to the energy indicator.

**Do, Check, Act**

Once identified the most relevant energy consumptions, key activities were performed that allowed the energetic performance improvement, mainly associated to:

- Staff training both in site and managerial (30 people)
- Search for energy efficiency opportunities
- Follow up meetings of the SUEZ Chile Energy Management committee

This committee is formed by a high range level of Directors and Managers such as HR, Building, Engineering, Occupational Health and Safety, Purchase and SERPRAM. This allows to give a true varied support to the energetic objectives proposed and to speed up the resource allocation in order to achieve them.

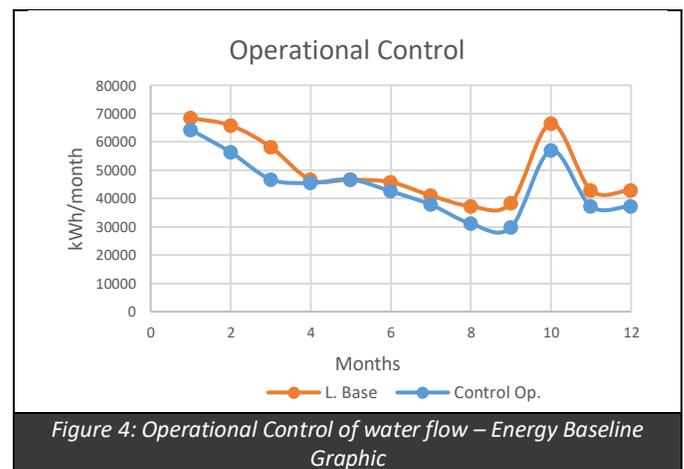
Furthermore, a key member of the committee is conformed by in site staff led by the head of plant. In this manner, decisions made are both validated by in site staff and high managerial staff.

The energy performance upgrades show a challenge for the workers at PAMo since the plant is built under energy consumption optimization criteria through very efficient technologies such as the Densadegs®, high-rate solids

contact clarifier, a high efficiency technology developed by SUEZ. The Densadeg Clarifier, Softener and Thickener is the water and wastewater industry’s most robust, versatile process on the market. This high-rate system combines optimized flocculation, internal and external solids recirculation, thickening in two conjoined vessels to maximize hydraulic loading and treatment efficiencies. The proprietary blend of energy input and high volume solids recirculation reduces waste volumes and results in rapid settling operation and high quality treated water.

On the other hand, the SUEZ plant design incorporated the gravity force for the water conduction, what eliminated many pump stations at the molybdenum removal plant, reducing, in this way, the energy consumption in the whole process

Nevertheless, efforts during the implementation were focused on specific measures, such as, operational control on the flow of the reservoir to accomplish a better equipment performance thus, energy savings. This is due to water flow being the main variable affecting energy consumption, demonstrated above. To achieve this, Codelco’s key personnel in charge of managing the treatment flows according to environmental conditions, so effective communication is key to successfully accomplish the goal.

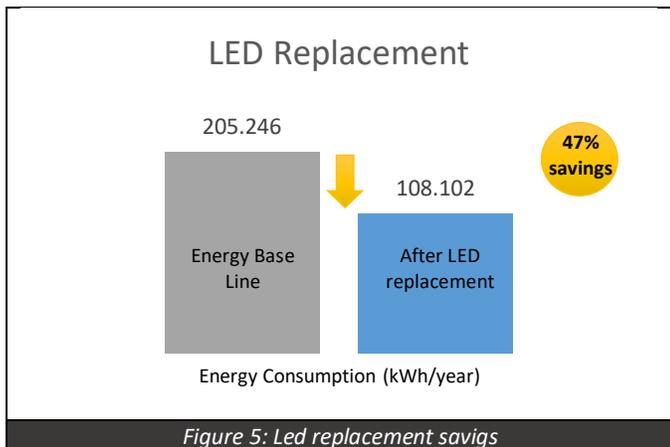


The above, allows calculating and validating energy savings associated to the optimization of the inlet flow and the equipment operation depending on it.

As well, it was noticed an opportunity to perform a technological upgrade in the exterior lightings. They had a metal halide technology, which represented approximately a 10% energy loss, increasing the energy consumption.

This was clear to the staff as an obsolete technology in terms of energy efficiency. The upgrade was to replace the lightings to LED types and their base line information was obtained in the execution of the project (3 years) and a field survey of the substituted lightings. In this way, it was obtained the amount of useful lightings, power and using time, which allowed calculating their base line and the consumed energy after the upgrade.

The energy consumption difference of the base line and the calculation of the LED luminaries translates in savings up to 47% through the past 3 years.



**Resources and validation tools**

The energy savings are validated through mathematical models or estimations from field data or with data obtained from the plant and SCADA system records. To improve the data quality, it was set as an objective for 2019, the incorporation of power meters that can register energy consumption of each defined area, such as the sludge line, water line and chemical line. In order

to achieve a more accurate energy management through defined energy performance indicators such as consumed energy of an area and the variables involved (outlet flow). By the year 2020, it is expected to establish more complex models associated to sludge production that can only be validated after a significant period of the plant’s normal operation registered by this meters installed by the end of 2019, the investment for this project is abut \$USD 8,600.

This are just a few of the efforts that reflect the main changes in energy performance accordingly to the goals and targets proposed and accomplished throughout the year. Besides these efforts, other important activities are taking place, such as, awareness campaigns and trainings. Energy efficiency trainings and Management System took place in site to all of PAMo’s operating personnel, but also in the headquarters in Santiago, to each member of the management committee within their different levels. The above was considered as a key element to accomplish a commitment level of every worker of every level. Due to the acquired knowledge, they felt motivation to discover new improvement opportunities.

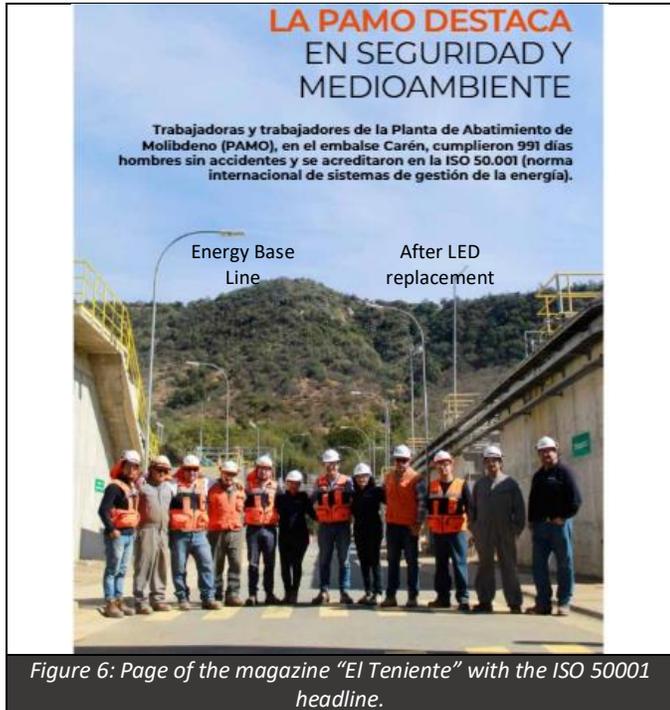
Another key point accomplished by the EnMS was the workers awareness through purchases with energy efficiency criteria. This not only applies to critical equipment of the process itself, but also smaller equipment such as domestic appliances, lab equipment and such that were evaluated considering lifespan or asking for more guidance of the product provider.

**Transparency**

SUEZ’s transparency is a fundamental pillar due to the results of the energy performance reported to each worker of PAMo through an information board located in the control room and are communicated to the management committee through reports and presentations.

On the other hand, SUEZ Latin America’s website <https://www.SUEZ-america-latina.com/> actively publishes news related to the accomplishments of all

their sites. So does Codelco that published in their El Teniente magazine a piece regarding the ISO 50001 certification.



### Lessons Learned

For SUEZ Chile, specifically for PAMo’s workers, the EMS certification represents a big milestone as an organization with worldwide presence that adjusts to each countries requirements. Nonetheless, the main difficulties showing along the way corresponds to the fact that SUEZ only operate and maintain the plant, is not its owner, which comes along with some restrictions.

If an energy management system had to be implemented again in another plant operated by SUEZ, it would be considered mainly:

- To establish an early and more fluid communication with the owners of the plant (clients) to find solutions together with the possible restrictions that could be found.
- To establish early support from a specialized company, so that implementation times become shorter than just using internal staff.

*“We are proud to be one of the main mining plants in Chile to accomplish this certification, it is an important achievement as a company that goes along with the future energy efficiency regulations to be implemented in the country”*

— Heliodoro Hurtado, Operation and Maintenance Director.

Through the Energy Management Working Group (EMWG), government officials worldwide share best practices and leverage their collective knowledge and experience to create high-impact national programs that accelerate the use of energy management systems in industry and commercial buildings. The EMWG was launched in 2010 by the Clean Energy Ministerial (CEM) and International Partnership for Energy Efficiency Cooperation (IPEEC).

For more information, please visit [www.cleanenergyministerial.org/energymanagement](http://www.cleanenergyministerial.org/energymanagement).

