

ISO 50001 Energy Management System Case Study

2020

CHILE

Grupo Liguria/Química Rhenium

Plants Sulphonation and Batch.



Sulphonation Plant

Organization Profile & Business Case

Química Rhenium, the commercial arm of Grupo Liguria, is today the leader of the Chilean surfactant market, and through increasing exports in South America, has been able to position itself as a regional actor in this industrial sector.

The company, founded in the early 1980s with the objective of developing, manufacturing and marketing quality chemical products, has operated since 1996 in its industrial establishment located in Camino Lo Ruiz No. 5200, Renca, Santiago, Chile. In an almost 4 acres facilities, the company develops its manufacturing activity with two production plants: one of continuous type, where sulphonation and sulphation processes are carried out for the production of LABSA / SLES (the only plant in Chile); and another a multipurpose batch type plant, which has a variety of reactors and mixers in which betaines, amine oxides, alkanolamides, quaternary ammoniums, and various premixes are produced.

“With the EnMS implementation I feel the satisfaction to be working on a sustainable competitiveness.”

— Carina Pastore Pruzzo, CEO.

Case Study Snapshot

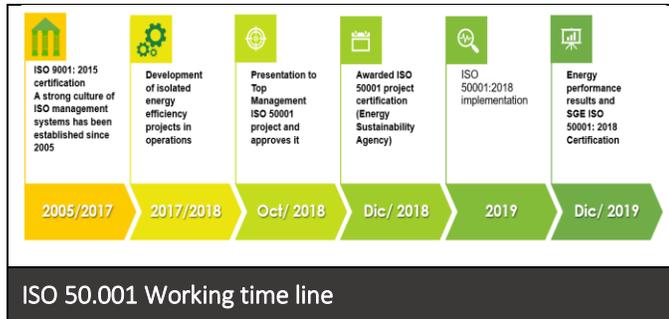
Industry	Chemical
Product/Service	Industrial chemicals manufacturing
Location	Renca, Santiago, Chile
Energy management system	ISO 50.001:2018
Energy performance improvement period, in years	2
Energy Performance Improvement (%) over improvement period	13,7%
Total energy cost savings over improvement period	USD \$216.715
Cost to implement EnMS	USD \$33.402
Total Energy Savings over improvement period	7.935 GJ
Total CO ₂ -e emission reduction over improvement period	1.689 Ton CO ₂ eq.

Between 2015 and 2016, we faced the challenge of building a new batch plant. Its development focused on improving and automating processes, considering efficiency in its design. With this milestone Grupo Liguria started the path towards sustainability, promoting the development of projects that will impact the efficiency of productive processes.

Great opportunities to improve energy efficiency in operations were detected during 2017. Several of which began to be addressed with immediate projects. However, while sizing the potential of these opportunities, in 2018 the company's Top Management, together with the Energy Sustainability Agency, decided to face a greater challenge: implementing the Energy Management System (EnMS) based on ISO 50.001: 2018.

Having the experience of implementing a robust Quality Management System, more than 15 years ago (in the pursuit of establishing quality as an important

organizational value), Top Management saw an opportunity to deepen the path already started in sustainability, with the implementation of the Energy Management System, declaring it an organizational value. We are in the permanent pursuit of sustainable competitiveness, in order to fulfill the strategic objective of projecting our industrial activity into the future. Implementing ISO 50.001 was presented as a powerful tool to meet this objective by providing a system that, integrated with Quality, allows controlling operational expenses through concrete actions that, at the same time positively impact the environment (GHG reduction).



We started with the EnMS project in October 2018, setting a main goal to Reduce at least 3% of global energy consumption. In order to achieve that goal, and knowing our inexperience about energy systems, we started to work with an external consultant (Roda Energía) which provided us with advice, guidance and training during a year. At the same time, Grupo Liguria trained the EnMS team leader and two other members of the energy team in the Industrial Energy Manager program, for considering knowledge as a fundamental axis in the successful development of this project.

Our EnMS focuses on operational controls, awareness of the efficient use of energy in daily work and of technical knowledge acquisition to develop energy efficiency projects.

The above represents part of our Top Management strategies in energy management, which is complemented by other programs, such as the one initiated in June 2019. Because of this 100% of the total consumption of the electrical energy of the industrial

establishment was obtained from renewable sources, and the consequent reduction of our carbon footprint.

Grupo Liguria, through its EnMS, brought together isolated measures that started in 2017 and enhanced the work already done. Thus, significantly reducing energy consumption and achieving a milestone in this regard, by falling from 294 to 254 kWh / ton of finished product, equivalent to a 25% decrease in energy costs.

Business Benefits

The application of ISO 50.001 in Grupo Liguria first allowed us to learn about the energy matrix of both plants and their uses, which provided valuable information to continuously monitor the use of energy, detect a large number of opportunities for improvement and generate an energy annual plan for short and medium term.

Energy Efficiency Achievement

With the actions performed during 2018 and 2019 we achieved a total energy decrease of 7935 GJ, which translates in a production increase of 18%. These results derive mostly from investment projects in the thermal system and the implementation of the EnMS.

The following points stand out in our experience of improving energy performance:

- Significant decrease in expenses and energy use, even when production has increased by 18%.
- 26% reduction of thermal energy, and 17% reduction of electrical energy.
- 21% Cost reduction of thermal energy, and 31% of electrical energy.
- Total energy use comes from 100% renewable sources.

Non-Energy Benefits

- Increased awareness of energy efficiency among staff at all levels, motivating employee's commitment towards the company and care for the environment.

- Increase in technical skills, improving professional development of our employees.
- Enhanced corporate image among costumers and other concerned parties.



Implementation EnMS cost \$33,404, including internal staff time spent to develop and implement the EnMS. This cost takes into consideration:

- Internal staff included 1 energy manager and a variety of supporting cross-functional staff, with total staff time estimated to be 0.7 person-years over the 1-year implementation period
- Certification Audit
- External technical assistance (consultants)
- Communications

Plan

Top Management Commitment.

The EnMS is led by our CEO, who has actively promoted our energy team since its origin, personally participating in the conception and development of our energy policy, as well as its promotion within all levels of the organization. We have made a special effort in communicating energy policy, letting all our employees know what we want to achieve and how to achieve it. Through presentations and field work, we introduced everyone to the basic concepts of energy and energy efficiency, thus preparing the cultural change required by our EnMS.

Starting the Planning

After determining the activities for this project and scheduling them in a Gantt chart, we began the work with an energy audit of our industrial facility to better understand consumption patterns and determine our gaps. We detected opportunities related to energy distribution and thus changed the matrix from the use of Liquefied Petroleum Gas (LPG) and Diesel to Natural Gas (NG), thus contributing significantly to lower emissions by fuel type. We expect to replace 100% of diesel use by 2020.

Summary of projects developed:

year	ID	Description of the improvement opportunity	Investment \$USD	Saving kWh/year	Saving \$USD/año	Payback (years)
2017	1	Steam Trap Replacement	\$3,168	35,804	\$13,300	0.2
2018	2	MAPAS reaction time optimization	\$9,036	64,707	\$14,832	1
2019	5	Change of burners in boilers, more efficient	\$20,748	986,453	\$41,357	1
2019	6	Install economizer in boiler	\$4,214	228,071	\$6,761	1
2019	7	Install automatic purges in boilers	\$4,570	505,660	\$11,164	0
2019	8 / 9	Install thermal insulation missing steam pipes	\$3,528	984	\$1,058	3
2019	11	Technical-economic study focused on energy efficiency to acquire a new main compressor of the sulfonation plant	\$94,087	364,320	\$30,168	3

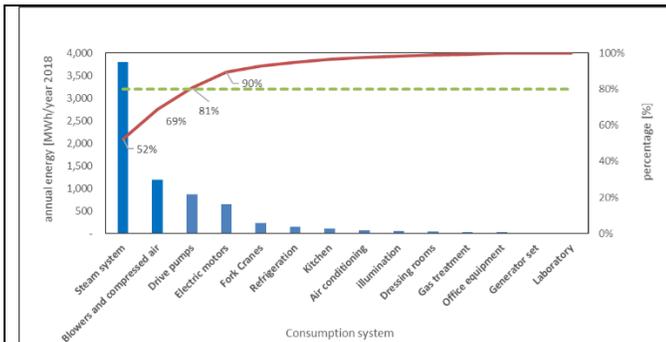
Grupo Liguria achieved savings:

- With capital investments of US \$88,472
- Without additional investment (Operational savings) of US \$128,243, which represent 59% of the total savings achieved.

EnMS Implementation Costs:

Year	Items	\$ USD
2018-2019	Consulting, energy audit, training and certification	\$19,591
2018-2019	Training of the EnMS leader in projects and energy	\$701
2019	Working time Internal staff for implementation	\$11,994
2019	Installation of additional monitoring equipment	\$1,116
	Total	\$33,402

We then developed an energy balance to identify Significant Energy Uses (SUEs), which is the basis for identifying our opportunities for improvement. (See Pareto chart below).

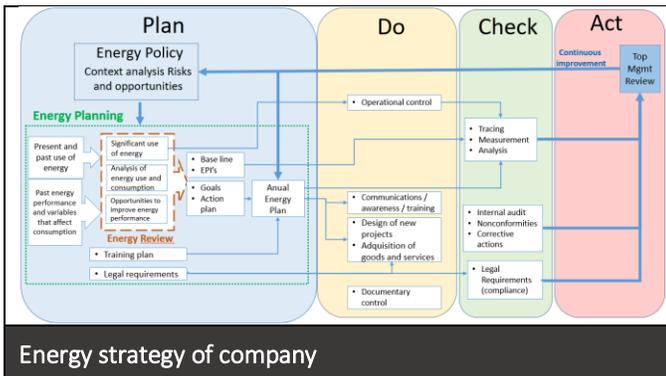


Significant energy uses (SEUs). Identification help us prioritize saving efforts

We found that steam as thermal energy use is the most significant (52%), followed by electricity (48%). With this information, top management determined that efforts to improve energy performance would be initially focused on thermal system and later the electrical system.

Developing an Energy Strategy

Our energy strategy is based on the ISO 50.001 systematic approach (plan-do-check and act), as seen in the figure below:



Energy strategy of company

Setting Objectives

The first objective proposed in order to improve our EnMS was to determine the standardization of the baseline of our plants. Unfortunately, representative linear correlations were initially found. However, once this was detected, and in order to have reliable data, we invested in new monitoring systems for energy reading, mainly electricity consumption; and an investigation was

opened to determine the cause of the deviations detected in the thermal system.

Another important objective was to develop the technical skills needed to deepen the work of the EnMS and energy efficiency projects by training the energy team as energy managers. In addition, the work of previous years was continued in order to improve the indicators of Kgv (kilogram of steam) and kWh used per ton of finished product.

Implementing the Strategy

After visualizing the improvement opportunities detected in the energy audit, these were evaluated and prioritized according to scores obtained in: investment, implementation, impact on energy efficiency and payback. In prioritizing the opportunities, top management established an annual energy plan for the next 12 months, with the required budget allocation.

“The implementation of the EnMS today is a direct contribution to the organization, not only in saving energy and promoting energy efficiency, but also in highlighting Grupo Liguria as a sustainable chemical manufacturer.”

—Joselyn Ramirez Espejo, EnMS leader

Do, Check, Act

Top management established a multi-functional energy management team, with carefully selected members to represent different departments of the organization, but with a focus on operations. This team worked together with the EnMS leader, who led the planning and implementation of this project.

The team's functions are to review and coordinate the work among departments, analyze consumption trends and evaluate new improvement opportunities identified by any person in Grupo Liguria. Top Management actively participates to motivate the team and provide the necessary support and resources to achieve the goals.



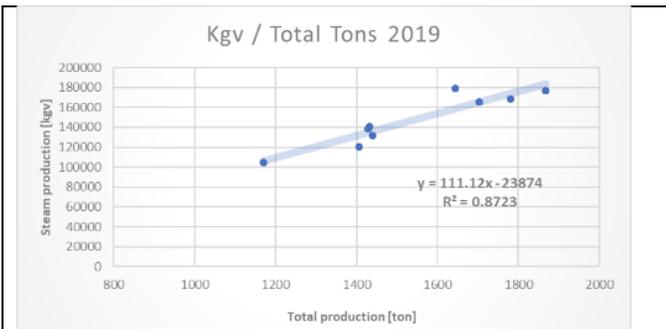
Energy Management team

We focus on developing knowledge and operational controls, in order to encourage good practices of energy use, carrying out various trainings in basic, intermediate and

advanced categories. What is fundamental, is to build the culture of energy management, which must be reflected on daily routines within the company. Thus, energy management is not only responsibility of the energy team, but of each member of the organization.

Since initially we could not find an acceptable correlation for our baselines, we decided to work with the performance indicators that the organization already had available: kWh and Kgv (kilogram of steam) per ton of manufactured product. Then, we continued the path by implementing records to facilitate the energy data collection process and thus improve the regression models developed to analyze and monitor Grupo Liguria's energy performance.

Once changes in good operational practices were made, and operational control was established, a surprising correlation of our baselines was obtained, as shown in the below chart:



Thermic baseline obtained by improving measurements and projects of energy efficient

This method currently allows us to monitor and understand our performance trends and gives us the ability to react quickly if a deviation is detected. It is essential to have a thorough knowledge of the processes and the use of energy in them, so as not to cover up

systematic problems and lose opportunities for improvement. All operations personnel were trained, raising awareness to maintain good usage practices and contributing to improve energy performance. To ensure that savings are maintained and constantly improved, each plant manager has the responsibility over operational control procedure of the SUEs. The energy team is responsible for ensuring that these controls are maintained over time. This is how we achieve our first energy policy objective: changes in habits towards good energy use and awareness.

For the second objective of our policy, we are working on technological replacement aiming at more efficient equipment. To this end, we have redesigned our acquisition process. When purchasing new equipment, all proposals are evaluated using an established methodology that has energy efficiency as an important criteria to ensure that the most efficient equipment is acquired.

Grupo Liguria also analyzed proficiency gaps and developed a training plan. A proficiency matrix was also developed to identify the gaps within the staff. This is used to organize the necessary training according to the requirements or the level of participation in the EnMS.

The mentioned above, provides us with a powerful tool that guarantees continuity of the EnMS. With the knowledge acquired, the staff identifies more easily, in an online form, every improvement opportunity in our plants. Then, the energy team analyses the proposals, determines the course of action and, finally, Top Management defines the resources needed to develop the opportunities approved by the team.

Due to this working methodology, we established projects that aimed to improve energy performance, such as:

- Inspection and change of steam traps.
- Replacement of burners in boilers, installation of economizer for hot water heat recovery.
- Heat loss mitigation, insulation of various equipment.

- Optimization of chemical reactions in batch plant (reduction of heating timing).

The above described allowed us to overcome the main goal of EnMS, reaching a 13,7% reduction of global energy consumption.

Finally, to validate the performance and status of the EnMS, we perform scheduled internal and external audits. Then we carry out the Review by Top Management, with a meeting where the information compiled by the EnMS Leader and the energy team is presented, the new objectives are established, and we start the PDCA cycle every year.

Transparency

Grupo Liguria publishes its achievements for the knowledge of its stakeholders. We want to set an example so that other companies will be motivated to benefit and benefit the planet with energy savings and environmental care

To this end, we publish our Energy Management Certificate on our website and social networks. We also make our experience available in order to share good practices achieved and provide information to be used as success stories.

Recognition to energy management.

Energy Efficiency Seal GOLD and additional recognition Sustainable Energy.



[Awards given by the Ministry of Energy and the Energy Sustainability Agency.](#)

Lessons Learned

- Monitoring and measurements on the initial phase of EnMS implementation is a critical issue to achieve the objectives of the project. In our case, it would have helped us to obtain an early diagnosis of our improvement opportunities.
- An intelligent energy monitoring system would allow to be more efficient in the data processing for analysis. In our case, the Sulphonation plant only has basic monitoring systems which is a big and actual improvement opportunity.
- Advice and continuous training for energy managers are key to maximizing savings and guaranteed the success of energy systems. However, a middle level of training and knowledge is necessary to operational and maintenance staff. Grupo Liguria considers this in our continuous improvement path.

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.

