ISO 50001 Energy Management System
Case Study

Argentina

Mastellone Hnos. S.A

The implementation of an EnMS at the Central Complex has achieved, in two years, an accumulative saving of more than 53.700 GJ and a reduction of emissions estimated in 3.800 tons of CO2.

Mastellone Hnos, the biggest dairy company in Argentina. General Rodriguez Industrial Complex.

Organization Profile & Business Case

Mastellone Hnos S.A. is an argentinian company, leader in the dairy sector of the country, founded in 1929 by the Mastellone family. Currently, the company has more than 3.700 direct collaborators, and under its brand "La Serenisima", produces a wide variety of dairy products: fluid and powder milks, formulated milks, butter, cream, milk caramel, ricotta and cheeses.

The company has 5 main industrial complexes, located in General Rodríguez, Trenque Lauquen, Leubucó, Canals and Villa Mercedes.

Mastellone Hnos. has the VISION of elaborating its products with an efficiency similar or higher than those in developed countries. Under this premise, the Top Management establishes in the POLICY of the company, the implementation of Management Systems which promote the continuous improvement and the training of the staff in concepts of efficiency, quality, food safety, occupational health and safety, environment care and energy efficiency.

Case Study Snapshot – General Rodríguez Industrial Complex	
Industry	Food Processing
Product/Service	Dairy Products
Location	Argentina
Energy management system	ISO 50001
Energy performance improvement period	1 year (2018)
Energy Performance Improvement (%) over improvement period	2.76 %
Total energy cost savings over improvement period	$USD 522.700
Cost to implement EnMS	$USD 41.654
Total Energy Savings over improvement period	51.200 GJ
Total CO_2-e emission reduction over improvement period	3.460 ton CO2

The enterprise counts whit the department of Management Systems, dedicated entirely to assist in the implementation, maintenance, improvement and certification of management systems. In 2016, the Top Management decided to include the ISO 50.001 Standard in order to systematically improve the energy performance of the company.

Since the very beginning of the EnMS implementation, emphasis has been placed on the awareness of all employees of rational use of energy and nonrenewable resources and their environmental impact. Thanks to this, after almost three years of general courses (with

more than 1900 attendees), many technical trainings and formation of internal auditors, a *culture* in energy efficiency has been established in all areas of the company.

After that, when in 2018 Mastellone Hnos. declared its POLICY OF SUBSTANTABILITY, the efficient use of energy was highlighted as one of the pillar for the sustainable development of the company, in conjunction with the assurance of dairy raw material, and the rational use of water. Therefore, the implementation and maintenance of ISO 50.001 has become a strategic element for the fulfilment of the goals and targets of the organization, and this is the reason it is currently working on including all its industrial complexes in the scope of the EnMS.

In particular, for the next external audit process in 2019, it will be requested to include within the certification, the Trenque Lauquen Complex (200 million liters of milk processed by year; total consumption 110.7 GWh/year), and the Leubucó plant (59 million liters of milk processed by year; total consumption 12.12 GWh/year).

Recognition and benchmarking

Mastellone Hnos. was the first dairy factory in the country to certify ISO 50.001 and one of the first food industry companies. For this reason, the implementation of the EnMS has been published as a *case of success* by the Subsecretaría de Ahorro y Eficiencia Energética del Ministerio de Energía de la Nación (National Subsecretariat of Energy Savings and Efficiency).Moreover, in 2018 the Subsecretariat established the "Redes de Aprendizaje en Eficiencia Energética (RdA)" (networks of learning in energy efficiency), in which the company has been participating actively. Luis Demicheli, as Management Representative of the EnMS, has participated in workshops of the RdA, sharing the experience in the process of implementation and certification and motivating other companies to follow this path.

"Sharing our experience in the implementation of SGE with other industries, companies and educational institutions enriched our own management system."
—Luis I. Demicheli, Management Systems Manager.

Business Benefits

The implementation of the EnMS emerged from the need of reducing operating costs, facing the continuous increase of electricity and fuel rates. Then, two energy objectives have been set:

- OBJECTIVE 1: Improve systematically the energy performance of the plant.
- OBJECTIVE 2: Raise staff awareness of energy efficiency.

Electrical Energy

Since 2016, when the implementation of the EnMS started, the energy performance is being monthly monitored, comparing Energy Performance Indicators (EnPI) and the Energy Baselines (EnB). This enable to quantify directly the savings achieved and also to detect early deviations in consumption levels.

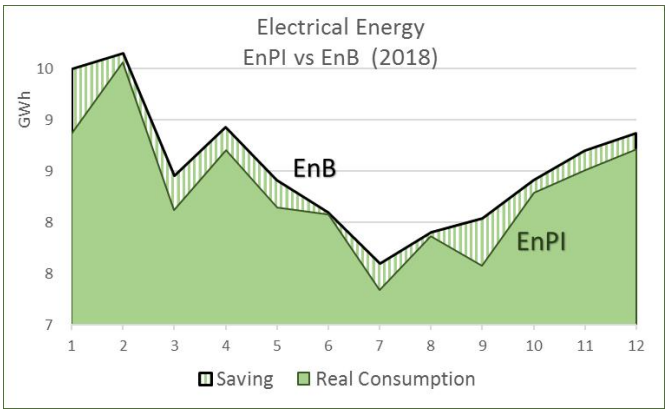

Fig. 01: Energy performance improvement - Period 2018

From the time when the EnPI started to be measured, the recorded accumulative saving rises over 12.600 GJ, only electrical energy, which is equivalent to a reduction of 1.750 ton CO2.

Natural Gas

The execution of 3 energy efficiency projects, associated with the use of industrial steam, allowed a reduction in the consumption of natural gas of 1.057.000 m3/year (equivalent to 41.157 GJ/year) representing 4% of the annual consumption and a reduction in the emissions of CO2 of 2.063 tons/year. These projects were the following:

- Heat recovery from the purges of the two main boilers, using a revaporizing tank (saving 2457 GJ/month).
- Optimization of the operation and cleaning of pasteurizers; better operational control (saving 882 GJ/month).
- Isolation of large steam valves, to avoid heat loss (saving 90 GJ/month).

It is important to mark, that the projects also have others associated benefits, such as saving a significant amount of water, reduction of running hours of equipment, and the consequent decrease in the frequency of preventive maintenances.

Implementation Costs

Cost of implementation process was composed by staff-time spent (12.632 $USD), training courses (4.882 $USD), equipment acquired (20.000 $USD) and third-party audits (4.140 $USD). Total cost: 41.654 $USD.

Implementation across multiple sites

Working with an integrated management system, centralized by the area of Management Systems, has been a great advantage when implementing the EnMS across the multiple sites of the company.

The plants of Trenque Lauquen and Leubucó, despite being more than 400 km from the headquarters, have been incorporated into the EnMS, adapting the pre-existent procedures and related documented information. In these cases, the EnMTs meetings were held through a video call platform (Skype), and frequent visits to the plant were made, in order to train the staff.

As all the improvement projects are recorded and shared, a data base has been built and it is available to all plants and sectors of the company, in order to find ideas and new opportunities.

Plan

Gradual implementation

At the beginning of 2016, a plan was established to progressively implement ISO 50.001 Standard. The preexistence of other management systems, according to international standards, has significantly simplified the inclusion of the EnMS. In fact, many requirements were already accomplished, as they were common with the other ISO Standards, including Corrective and Preventive Actions, Internal Audits, Top Management Review, Statutory and Regulatory Requirements Compliance, Documented Information Control, Staff Training and Control and Testing of Equipment.

In the first instance, only the industrial plant Armonía was included in the scope of the EnMS. This first experience was successful, obtaining the certification in March 2017, and reaching the proposed energy target (improvement of 3% in energy performance).

After that, the goal was to include the entire General Rodríguez Industrial Complex (Processed Milk: 1.2 billion liters/year; total energy consumption: 400 GWh/year) with December 2017 as deadline.

The first step was to create the Energy Management Teams (EnMT), for each sector of the Complex. The Top Management had a key role in this stage, as it was responsible for providing the necessary internal resources, particularly human resources. Then, an organizational structure was built, in which 6 EnMT were created; this structure involved more than 80 people.

No external assistance was used for the implementation process.

Multidisciplinary Teams

In order to have an effective EnMT, the key aspect was to establish an interdisciplinary work team: Maintenance and Industrial Services contributed the technical knowledge of facilities; Production Areas had the experience in productive processes and how changes in operational variables could affect them; Coordination of Management Systems, ensured the monitoring of tasks and the recording of actions carried out, and established the procedures for the Energy Review, Energy Baseline and EnPI analysis; Training area was responsible for giving the energy efficiency course to the whole staff, providing specific technical courses, and coordinating training for internal auditors. On the other hand, other sectors, such as Process Improvement and Environment, served as support providing

knowledge and experience regarding the environmental impact of projects. Higher Management levels contributed to decision making and budgeting.

"We have learned to take into account the energy efficiency in every maintenance work we do."

—Gabriel Markow; Maintenance Manager

Staff Engagement

Internal staff motivation was achieved mainly by a fluid communication between the EnMT and the rest of the organization. Three main communication channels were used: the energy efficiency course, communication boards with suggestions boxes and "transfer trainings" (i.e. focused on staff who operate the Significant Energy Uses).

"The energy efficiency training, given every year by internal instructors, allowed to transmit the culture and commitment that Mastellone have with the rational use of energy."

—Mariano Alba; Head of Training Department.

Commitment with society

Many academic institutions and colleges have been invited to participate in the Energy Efficiency Courses, along with training in Good Manufacturing Practices and Quality Management Systems. More than 790 students and teachers have participated, from 24 institutions.

Fig 02: Students receiving the Energy Efficiency Course

Do, Check, Act

Energy Review

One of the first challenges that showed up, was the identification of energy uses, which is necessary for the Energy Review. This required a lot of staff-time, as it was necessary to identify and register all the equipment, and measure or estimate their consumptions, to then process the information and determine which were the Energy Significant Uses.

At the beginning there were very little capacity of energy measurement, so the first step was to prepare a documented procedure, which detailed the methodology for the data upload, measurement techniques or formulas to estimate consumptions when necessary. Meanwhile, *Energy Tables* were published into the system, in order to unify values of conversion factors, calorific values of fuels, steam enthalpies, losses in electrical transformers and cables, efficiencies and power factors of electric motors.

A data sheet was filled with the following information: Equipment ID, location, Rated Power, Current Measurement and Running hours. Then, with this basic data electricity consumption was calculated.

The consumption of steam and fuel was estimated by calculus of the exchanged heat, measuring generated steam condensate or by nominal values provided by manufacturers.

More than 16.000 energy uses were registered. In order to do this extensive work, "Energy Use Groups" were identified in the different sectors, and each of them had a responsible for its data uploading. A timetable was set up with dates for the meetings of EnMTs, where progresses and doubts were shared.

The Energy Review process is the most tedious and difficult stage, but it is certainly the most enriching aspect for the organization, since it gives lot of information about the characteristics of facilities and equipment, information about energy consumption and, what is particularly important, many deviations and improvement opportunities were detected during this phase. Some of those improvements are mentioned on the following chart.

Deviations	Corrective actions
Compressed-air losses	Programmed routes for loss detection and repair; ultrasonic equipment was purchased
Excessive compressed-air pressure at generation	The set-point pressure of air compressors was lowered, according to needs
Heat loss in valves and steam pipes	Missing isolations were gradually placed
Areas permanently illuminated, without need	Sectorisation of lighting, placement of interrupters, photocells and motion sensors.
Utilization of mercury, sodium and halogen lamps	Gradual replacement to LED technology
Oversized electric motors	Installation of speed switches
Low power factors in electric transformers	Placement of capacitors
Heat loss at loading docks and cold chambers	Placement of plastic curtains or air curtains.

Energy Improvement Opportunities, Suggestions and Projects

Another key aspect of the EnMS is that it establishes a methodology for receiving and analyzing suggestions or improvement opportunities, identified by any member of the company, and leading them to their implementation, if feasible. Suggestion boxes have been installed, so that all personnel, anonymously or not, can communicate their suggestion, and then receive an answer from the EnMT. Each team has an electronic record, where all the Improvement Opportunities and Suggestions are listed and studied to determine its priority, depending on the feasibility of implementation, and the potential savings it would generate.

Fig. 03: Suggestion Box

Since 2016, there have been more than 320 improvement opportunities and suggestions, which have led to the management of 131 projects.

For the project monitoring, a software was internally developed, using Visual Basic, which constitutes the Action Plan: the different tasks are uploaded, with its responsible, dates of implementation and estimated savings.

"People usually have great ideas to save energy, but they do nott have the means to communicate them; an EnMS solves that."

—Matías A. Degiorgio; Analyst at Management Systems.

Energy Performance Indicators (EnPIs)

The only reliable energy measurement equipment for both electrical and natural gas, were those provided by the supplying companies. Therefore, the EnPIs defined were the total consumption of both, gas and electricity, as measured in the bill.

Energy Baselines (EnB)

Dairy production behaves with an annual cycle in which milk production falls from January to June, and rises from July to December. Then, the baseline period was established as 12 months. The same criteria were used to establish the reporting period for the EnPIs and deadlines for the objectives and targets. The relevant variables identified were:

- Cooling degree days (CDD); significant for electricity consumption
- Heating degree days (HDD); significant for gas consumption
- Total production level; significant for both gas and electricity
- Production level of powder milk plants; significant for gas consumption.

Afterwards, to create the EnBs a regression analysis was made, comparing real energy consumption with the relevant variables for both electricity and gas; Microsoft Excel data analysis tool was used. The timeframe considered for EnBs was Nov-16 to Oct-17, and the reporting period was Dic-17 to Nov-18.

EnPIs and EnBs monitoring

Energy Performance Indicators and Energy Baselines were monitored using a Microsoft Excel workbook. Monthly, every relevant variable measured was uploaded to calculate the EnB value (estimated consumption), and compared with the EnPI (real consumption). The energy development improvement was calculated as the difference between the total estimated consumption and the real measured consumption, divided for the estimated amount.

In case of any deviation of the EnPI, the EnMT would have been forced to treat it as non-conformity, identifying root causes and corrective actions to find a solution. In fact, in April 2018 the EnPI for gas consumption showed no improvement in the performance of the plant, and the tendency indicated that the target would not be accomplished. This situation led to the generation of a "Preventive Action" into the Management System.

It was then encouraged the prioritization of projects related to steam consumption. On the other hand, a review of energy uses identification and calculated consumption was made, and some important errors were detected; this led to the generation of the corresponded non-conformities.

Measurement equipment

As explained, the company did not count with much energy measuring equipment. A portable energy analyser was used to measure the improvement in energy consumption. This equipment has its own specific applications, and its accuracy is tested periodically to ensure results.

Transparency

The company has published in its web site and social networks (LinkedIn), the achievement in ISO 50.001 certification. It was also published the Sustainability Report for 2017, describing the implementation process and improvements obtained thanks to the implementation of the EnMS.

Lessons Learned

During the first two years of working with the ENMS, it was placed much more emphasis on the consumption of electrical energy than gas, due to the fact that the staff were more familiar with this type of energy and its technology. This headed to no significant improvement in gas consumption performance.

Taking into account that consumption costs of both energy sources are similar, it would have been sensible to work equally for both types of energy. Facing this situation, training courses on the use of industrial steam, and variables affecting its performance, are being planned for this year.

Keys to Success

- Leadership, support and decision making of Top Management.
- Team working among the different areas which are involved.
- Achieving employee awareness and motivation.
- Integrated and mature Management System with an ISO 9.001 base.
- Training on ISO 50.001 for the EnMT members
- Interdisciplinary EnMT