

ISO 50001 Energy Management System Case Study

2020

CHILE

CAP ACERO

Energy Management System (EnMS) implemented at CAP Acero reached an energy performance improvement through a reduction of 39% fossil fuel consumption.

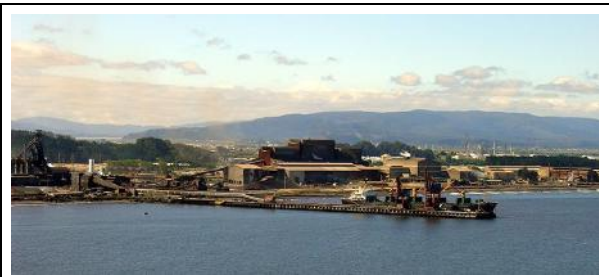


Figure 1. CAP Acero – Huachipato Facility

Organization Profile & Business Case

CAP Acero produces steel ensuring sustainable value to their Latin-American customers and markets. Their processes are continuously improved driving innovation, reaching high quality standards, ensuring environment care, health and safety conditions and improving energy performance.

Steel production process is inherently an energetic process, then energy management is key. Energy costs represents 30% of total cost. Therefore, energy management is fundamental. Reducing environmental impact is also a priority and the company is aware that using energy efficiently will provide a sustainable operation.

“Energy cost is high and depending on its source, it could also have an environmental impact. EnMS has been fundamental to implement measures that improve energy performance continuously”

—Rodrigo Briceño, General Manager

Case Study Snapshot	
Industry	Siderurgic
Product/Service	Steel Production
Location	Avenida Gran Bretaña 2910, Talcahuano, Bio Bio, CHILE
Energy management system	ISO 50001
Energy performance improvement period, in years	2.5
Energy Performance Improvement (%) over improvement period	1% Global Consumption 38% Fossil energies purchased
Total energy cost savings over improvement period	USD \$1,550,547
Cost to implement EnMS	USD \$1,352,224
Total Energy Savings over improvement period	736,773 (GJ)
Total CO ₂ -e emission reduction over improvement period	2855 (Metric tons)

Prior to 2016, energy was managed by the environmental area, were monitoring EnPIs and implementing energy improvements projects was done in a random basis. When EnMS was implemented in 2016, it did create a global awareness on how to use efficiently an expensive resource by::

- implementing EnPIs in all operational areas
- defining objectives which leverage energy performance improvement

- establishing a systematic approach for improvement ideas identification. This challenges the organization to have a critical view on resource optimization which allows to reach very demanding targets from one year to another.

Business Benefits

Company reached important economical and non-economic benefits since the system has been certified. In a global context, energy consumption was reduced by 1%. At first glance, this could be considered not significant, however total energy amount managed is high, and 1% means 736,773 GJ.

Fossil energy (Fuel Oil and Natural Gas) purchases were reduced significantly by 38%. This reduction means a 512,274 USD/ yr savings. CO₂ emissions were reduced by 2855 tons. Some investments were needed to reach these results. Projects were implemented like steam consumption reduction, in several process stages energy leaks reduction on steel storage and transportation. Other none investment improvement measures taken forward like new operational practices. Total investment made was 1,352,224 USD, including both assets improvements and EnMS implementation cost.

There were additional benefits, although none of them directly associated to energy like process stability, employees committed to improve operations, leaders supporting operational changes and supplier involvement on improvement measures.

Regarding energy management implementation costs and resources, following were considered:

1. 1 full time dedicated person for 1.5 years (internal staff).
2. Total workers: 3 training hours each person for awareness process (Company had 874 workers at the end of 2018)
3. 60 Service companies trained for awareness.
4. It was not necessary to install new measurement devices
5. Internal communication done through newsletters (paper and electronic), intranet, triptychs and physical banners.
6. Specific training provided to 20 internal auditors and 30 staff responsible for implementation
7. Software: Database from systems MES, PI and SAP
8. Technical support: Consultancy service provided by Atia Consultores Ltda.
9. Third part audit: USD \$16,500



Figure 2. Training process for auditors and implementators

“Energy Management System demands continuous improvement in our EnPIs. By doing this, we were able to reduce our fossil energies purchases.”

—Filippo Bustos, Finance Manager

Plan

EnMS was developed and planned since 2015. At that time, Company used funds from the Energy Efficiency Agency, which depends on the Chilean Energy Ministry, to develop a gap analysis allowing a deeper understanding on what was needed to implement an EnMS based on ISO 50001. An implementation plan was developed and in 2016 it was decided to implement the EnMS based on that plan. A consultancy company was hired, and internal resources were provided to support the process.

Commitment from top decision makers

Gap analysis mentioned above was requested by the Sustainability Manager. It was a common understanding that energy was a high cost resource which needs to be managed. This fact is also clearly understood by top decisions makers from the very beginning. They were committed to invest resources for EnMS implementation. Company was already certified in ISO 9001, ISO 14001 and OHSAS 18001. Therefore, there was a culture in place which understand the value of having a certified ISO system. Once the implementation started in 2016, a multidisciplinary team was responsible to lead this process, then every manager had to approve a part time resource from its own area to perform this task.



Figure 3. Decision makers meeting

Understanding energy consumption and use

Since many years, company calculates a monthly energy balance and reports its results to the management team. Some areas had their own EnPIs which are typical for steel making processes like Coke rate. With EnMS implementation, the energy balance was analyzed following a wider view, separating sources of energies (primary and secondary sources), including the use of those consumptions and adding a detailed quantification of energy losses. By these new understanding, company determined, once EnMS were in place, that every area

should have at least one significant use of energy to manage.

EnMS as a support of strategy and targets

Energy reduction consumptions was always a target for the company. Since many years ago, annual targets have been set up. Then, EnMS officialized a process that was already in place. In a very demanding market, one of the most important corporate strategies is to reduce cost. Therefore, EnMS was seen as a direct contribution to the Company Strategy.

Energy review

Energy review was developed from the energy balance. Implementation team had several meetings to analyze results and determine the criteria to select significant energy use. One important consideration from the top management was to ensure that every operational area has at least one significant energy use to manage. By doing this, awareness should be developed. Finally, a Pareto Criteria based on consumption was selected for electricity uses and fuel uses separately. Nowadays, this criterion will be updated and a multivariable decision matrix which considers costs and feasibility to implement improvement measures is included.

“We have reached a high awareness from all stakeholders on the EnMS. This is key to ensure the energy performance continuous improvement. Everyone understands how to contribute with their own work”

—Andrés Saldaña, Change Management Chief

Do, Check, Act

Leading the Implementation

The implementation strategy defined at the beginning was to integrate this new ISO to the existing certified management system. Implementation process was performed during 2016 and 2017 and it was certified in 2018. Currently, first follow up audit has been performed and in 2021 the system will need to be recertificated. An

energy committee was already in place when the implementation started. It was formed by the top management team, including the General Manager. EnMS implementation changed this committee including every Area Chief who had a significant use of energy. An EnMS representative was nominated as well as an Energy Committee Leader. Following positions are part of the Committee: Operation Manager, Finance Manager, Innovation Manager, Environmental Manager, Certified Systems Responsible and Area Chiefs.

Energy Planning

Energy review is performed in annual basis, where all uses, and consumptions are evaluated. New energy sources and energy losses have been included to be managed. Therefore, EnPIs has been updated considering energy losses management. Energy baseline was established for 2016, but currently it's under review due to static factors changes. Then, in 2020 EnMS will have new normalized base lines.

Currently, there are 19 EnPIs and each of them has their own base line to determine expected values and evaluate performance improvement. Most relevant EnPI is Global Energy Consumption per produced steel ton. In order to improve energy performance, objectives have been established and implemented. Most important objectives performed have been: Reduction on global steam consumption, Torpedo ladle modification to reduce heat losses during hot metal transport to Steel Shop and Energy efficiency lightning replacement. In addition to that, there were operational criteria changes like hot load between Steel Shop and Bar Mill and Electric energy consumption reduction at Metallurgic Adjustment Station due to heat losses reduction. All investments have been provided by the company.

EnMS implementation lasts 1.5 years due to organization size y process complexity.

Cost-Benefit Analysis

EnMS savings comes mainly from energy performance improvement opportunities implementation like: Steam consumption reduction, Process heat losses reduction and Operational criteria changes.

Steam consumption reduction: Since 2017, several initiatives have been taken forward to reduce steam consumption like:

- Driving system change at Coke Plant: In May 2017, ammoniacal liquor pumps drives in Coke Plant were changed from steam turbine drive to an electrical drive.
- Distribution line reduction (hot sanitary water and offices). From September 2017 steam used to warm up water and to heat up offices were gradually replaced for more efficient electrical systems. Main objective was to reduce size of steam distribution system avoiding losses.
- Change in Fuel Oil spray system: From March 2018, steam was replaced by air as spray system from Fuel Oil at Talcahuano Bar mill Furnace.

Process heat losses reduction: Hot metal transport generated from Blast Furnace to Steel Shop is done through torpedos ladle. Main objective is to reduce heat losses, therefore covers where installed to these torpedos ladles.

Operational criteria changes – Electric energy consumption reduction at Metallurgic Adjustment Station: Metallurgic Adjustment Station heats up and homogenizes liquid steel using an electric arc which demands a high level of electric energy. In order to reduce electric energy consumption, several practices were modified like reducing temperature drop from previous stage due to less waiting time.

Initiatives mentioned above generates a reduction on electric energy consumption and less fuel oil and natural gas purchases.

EnMS savings reached from period 2017-2018 were USD \$ 1,550,547. Investment spent were USD \$ 1,352,224. Investment payback period was approximately 0.87 years.

Methodology for energy performance improvement evaluation

Energy performance improvement is followed up in a monthly base through EnPIs. These EnPIs are calculated using data from control process systems like DCS or ERP

systems like SAP. A significant deviation on energy performance is evaluated through a comparison between real and expected performance. I.e. Global energy consumption EnPI base line was determined with a multivariable regression considering as relevant variables: hot metal production, coal load at Coke Plant, Oxygen production, Bar Mill load and Liquid steel production. In addition to that, monthly follow up is performed by each area and every three months, top management and energy committee analyzes performance y defines corrective actions to improve EnPIs.

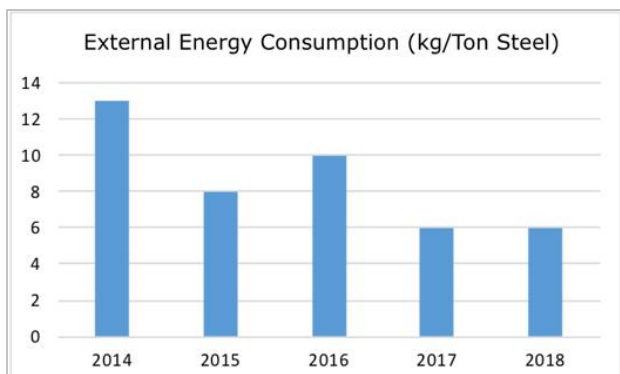


Figure 4. Global external energy reduction

Results validation focus

Follow up and analysis of objectives, targets, plans and EnPIs is done in a monthly base through standardized reports and meetings. Once an EnPI exceeds 5% base line, a deviation analysis occurs, then causes and corrective actions are established and implemented. At longer term level, an annual review is performed by top management level to evaluate the complete EnMS.

Operational control to ensure energy performance improvement

Operational control has been established through manuals and procedures by every area. These operational criteria were established during the implementation process and every time a process changes, these documents are updated. Performance evaluation is done by EnPIs. Currently, it’s estimated around 30 documents with operational control criteria.

Competence, training and communications

There are 30 internal auditors developed to perform internal reviews and audits. As mentioned before, awareness trainings were performed to the whole organization and service companies. Policy, EnMS, Objectives and how to achieve them were topics communicated during these sessions. In communication, a specific channel was implemented to ensure that everybody can detect and report energy improvement opportunities. Printed copies and videos were also used as communication mechanisms. Company was rewarded in 2017 by the Energy Efficiency Agency with the “Sello Silver” (Silver seal) and in 2019 with the “Sello Gold” (Gold seal). These two awards were communicated to increase motivation and improve workers commitment towards energy management. For awareness and competence development, a consultancy company was hired, Atia Consultores, which also supported the implementation process.



Figure 5. Gold Energy Efficiency Seal

Tools and resources

For implementing EnMS, develop the energy review, EnPIs and Baselines, existing databases were used called MES, PI and SAP. Initial baselines were determined with Minitab following Six Sigma tools. EnMS was developed under the basis of integrating with the existing ISO

management system. To perform the gap analysis, Energy Efficiency Agency provided funds so accredited consultants as Atia Consultores could developed this activity.

Transparency

Company decided to not communicate its EnMS externally. However, this information can be seen at its annual sustainability reports and web page. Authorities were also communicated like Energy Ministry to apply the awards mentioned above.

Lessons Learned

Main lessons learnt are the following:

- It's important to include key stakeholders from the very beginning of the implementation, not only directly related to energy use, but support areas like contract, purchase, engineering and human resources to create awareness. In Huachipato, they were included, but only at the beginning and not during the whole process, this should have been done differently.
- To implement systematic follow up meetings where key participant, at least from areas which have a significant use of energy. This meeting were done systematic at the beginning, but not during the whole process generating delays.
- To establish a responsible per area for energy management implementation. There were areas like production planning which were not included and they should have been part of the process.

- Avoid high rotation of implementation team members, this could lead to project delays. This is something that occurred during the implementation.
- Awareness is a continuous process and not one step process. It's needs to be done until a minimum maturity level is reached. A punctual awareness exercise is not enough to enable people understands how their work influences energy performance. This was noticed during the audit process.
- Update EnPIs after being operating the EnMS to ensure that they are adding value.
- A complex challenge was to determine efficiency criteria for purchase. It's frequent that competences to determine these criteria are not in place, then it's important to build up enough technical competence on those that are establishing technical specifications for purchases as well as design. This is something that the company is still working on.



Figure 6. EnMS Communication Tool

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.

