

ISO 50001 Energy Management System Case Study

2021

Chile

Empresas CMPC S.A.

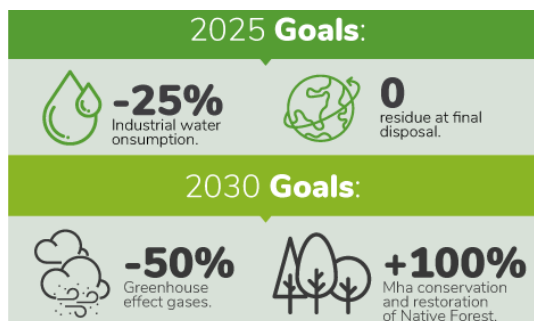
Energy management to cover the next 100 years.



Energy Excellence Seal – Chile.

Organization Profile & Business Case

CMPC is a multinational Pulp & Paper Company founded in 1920. Its business is organized in three different segments: CMPC **Celulosa**: a producer of pulpwood (CMPC Pulp) and, plywood, sawn timber and millwork (CMPC Maderas); **CMPC Biopackaging**: a producer of paper and packaging products; and **Softys**: manufacturer of tissue paper as well as other personal hygiene products. With production facilities and commercial offices in 11 countries globally, for CMPC, sustainability is an integral part of its business strategy. This is evident in the recognition in the Dow Jones Sustainability Index which categorized the Company as the third most sustainable forestry business in the world in 2020 as well as the inclusion in the CDP Water and Forest A Lists in 2020. The Company's lofty goals have driven CMPC to become increasingly efficient and led to forecasts and projections for the next 100 years:



"Our energy management system has allowed us to align our goals in efficiency, productivity and sustainability, providing us with real data on the effects of our changes to processes, and consequently, promoted continual improvements in our facilities on a daily basis".

—Enrique Donoso, Energy Manager CMPC.

Case Study Snapshot

Industry	Pulp and Paper
Product/Service	Pulp, boxboard, wood, packaging, tissue paper and personal care products.
Location	17 sites in 3 countries
Energy management system	ISO 50001:2018
Energy performance improvement period, in years	6 year (2014-2020)
Energy Performance Improvement (%) over improvement period	Pulp Chile (3 facilities): 27%; 6 years (2014-2020); Pulp Brazil (1 facility): 12%; 1 year (2020); Wood (6 facilities- CL): 7.5%, 1 year, 2020. Biopackaging (4 facilities- CL): 3.4%, 1 year, 2020 Softys Latam (3 facilities- CL-PR): 19.3%, 2020
Total energy cost savings over improvement period	\$82,241,000 USD
Cost to implement EnMS	\$23,775,184 USD
Total Energy Savings over improvement period	30,631,522 (GJ)
Total CO₂-e emission reduction over improvement period	248,795 (Metric tons)

Energy Management System

CMPC has 22 production plants certified under ISO 50001:2018; those plants manage 95% of all energy consumption, equivalent to 34.938 GWh/year. The first business unit to implement the Energy management System (EnMS) was CMPC Celulosa in 2014, and has been recertified twice since then. Originally the goal was to reduce the energy purchase per ton of pulp by 20% by the year 2020. The results were such that the goal was achieved in 2017.

Every time a new plant was integrated into the ISO 50001 implementation plan the plant as a whole was set the challenge to improve on global energy performance by a minimum of 5%, investing no more than necessary to measure progress. All the new plants surpassed the goal, fruit of their commitment and multidisciplinary teamwork.

Business Benefits

Since 2014 CMPC has continually increased benefits associated with the EnMS implementation plan, a plan in line with ISO 50001:2018. 2020 plans now consider the integration of energy management into Operational Excellence. The following are the accrued energy, financial and environmental benefits due to energy management in each of CMPC's business units from the year each was certified with ISO 50001, to the end of 2020.

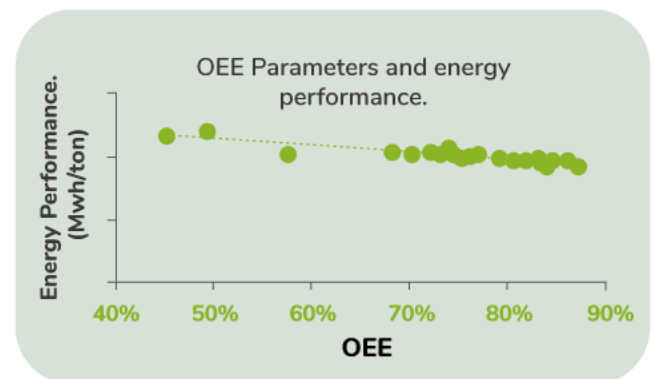
Business:	Energy Performance improvement (%)	Energy savings (GWh)	Economic savings (USD)X 1000	Estimation of avoided CO2 emissions [t CO2 e]
Celulosa	25,5%	8,415	79,111	230,379
Softys	-5,1%	56,8	1,761	16,507
Biopackaging	3,4%	36,7	1,369	1,909
TOTAL		8,509	82,241	248,795

Unlike other industries and organizations, at CMPC energy management is integrated into operational excellence. One of the ways the Company has approached the relationship between operational and energy performance is through management indicators. The main indicator for operational management is "Overall Equipment Effectiveness", which breaks down into the following:

$$OEE = \text{availability} \times \text{performance} \times \text{quality}$$

This indicator allows the user to assess how much of a productive advantage is achieved at a particular organization, process or asset, in other words, how efficient it is in terms of its purpose. Given the previous, monitoring this indicator is a strategic measure with goals defined at the highest echelon of the Company, in service of improving on productivity.

With the intention of making energy efficiency yet another component of process optimization, CMPC has established a mathematical relationship between energy and operational performance. The mathematics quantify, plan and predict energy savings.



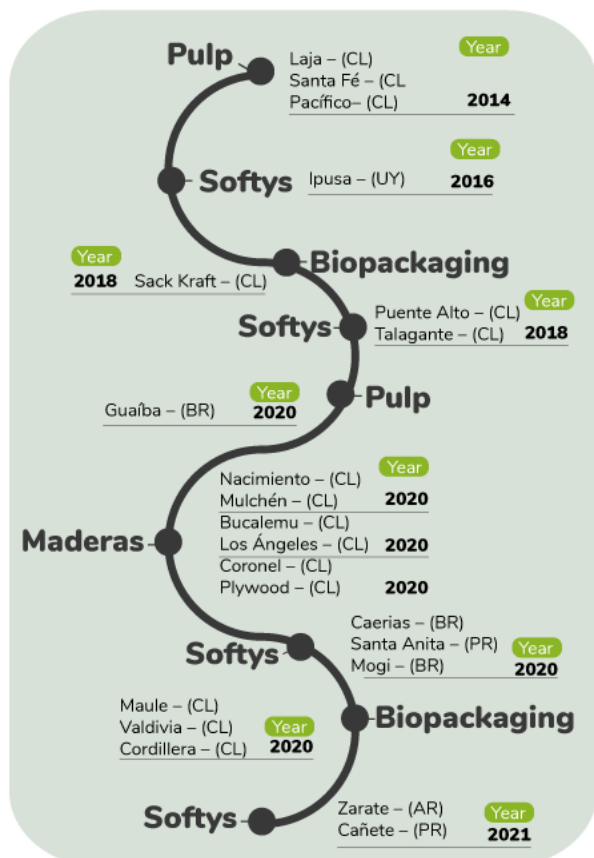
Joining operational excellence and energy performance has enabled faster understanding of how operational areas impact on energy management, assigning responsibilities and adding energy to the list of work duties. In this manner they avoid duplicity in administrative work loads at a rate of approximately 40% of all tasks associated with ISO 50001:2018.

It is under this same concept that operational variables are assessed for their impact on Significant Energy Use. Using statistical tools one determines the level of significance in the variables of a determined process, to which are assigned the responsibilities of tracking those variables. The latter has led to energy savings in 2020, product of quantifiable operational improvements, to the tune of 64,338 [MWh/year], equivalent to \$885,000 USD in the CMPC Celulosa business unit. In Celulosa integration into operational excellence has been active

for over a year. In addition, good practices are transferred to every plant when the respective corporate area managing EnMS are working on multiple sites. This maximizes the benefits obtained from replicable projects. To date, CMPC has recorded savings over MMUSD\$82, having invested MUSD\$23.8, which is in itself evidence of maximizing profit from resources.

Plan

The strategic plan for energy management at CMPC has been in effect for six years, a plan that considers and includes the following timeline and stages:



The implementation plan was designed internally at CMPC, and sets the following phases:

1. Learning

The objective driving this phase was to certify all three pulp plants in Chile under ISO 50001, which account to 55% of energy consumption. The results were so very

encouraging (over 20% improvement in energy performance over 3 years) that the initiative was then expanded to every plant in all three business units, independent of size, production and energy consumption.

Parallel to the previous, CMPC implemented the first waves of the pillars of Operational Excellence at CMPC Celulosa plants.

2. Expansion

In this stage the goal was to certify at least one plant in each business unit under ISO 50001. This was first materialized in Softys Uruguay (in 2016) and in Biopackaging – Sack Kraft Chile (in 2018). This led to the inevitable conclusion that the benefits of implementing EnMS under ISO 50001 were significant, independent of the size of the facilities or business unit. This laid the foundation for a more aggressive implementation of the plan in the next phase as an integral part of the Corporate Policy.

3. Consolidation

This stage consisted in consolidating energy management as a corporate policy for the organization. The goal was to certify under ISO 50001:2018 at least 90% of all energy consumption for CMPC in 2020. This meant certifying the EnMS for 19 plants over the course of a 2-year period, and updating to the 2018 version of ISO 50001 for all the plants that had been certified under the 2011 issuance of the standard.

Parallel to the previous, implementation of operational excellence was also expanded to other CMPC Biopackaging and Softys plants.

4. Integration

As a byproduct of the maturity of EnMS, great potential for integration was detected between the organization's model for operational excellence and EnMS.

That is why this particular phase is centered on analyzing and structuring the integration process between both management models at CMPC Celulosa. To that end, **the**

Corporate Energy Efficiency team was in charge of leading the previously described integration process.

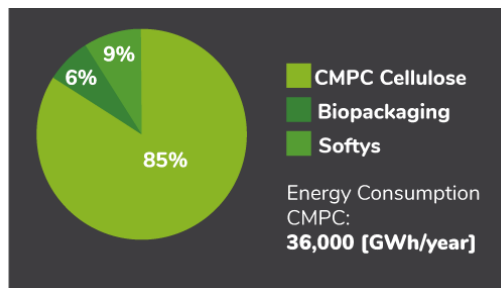
The plan also considered support from advising consultancies to train personnel, develop plans, establish energy performance indicators, develop energy revision and balance and launch improvement projects.

The team also has a leader placed in each of the plants, which is responsible for energy management at the facility and reliant on varying operational and transversal areas. These positions act as change agents backed by top-tier management.

An important part of the success is due to the transfer of knowledge from the lessons learned. These lessons are perennially transmitted onward to the teams and leaders at each facility, ensuring permanent evolution towards continuous improvement.

Context for Energy at CMPC

As described earlier, the implementation of EnMS was made a priority according to the organization's energy consumption at their respective business units.



For pulp, the main energy sources are: fuel oil, biomass and black liquor, all used to generate steam for cogeneration and other processes. For Biopackaging, the main energy sources are natural gas and electricity, used in the steam boilers and paper machines. This is similar to what happens in Softys, another core business that shares the same prioritized energy needs for boilers and paper machines, with the majority of steam channeled through yankee cylinders.

During the implementation of each EnMS, the larger part of traceability of energy consumption is done through

measuring, which had to be reinforced in improvement cycles. This was reflected in the result of energy and operational management over shorter terms, which meant being able to rely on fast reaction times when faced with divergence from the norm. On the other hand, the plants have a control center for critical operational variables, among which are those of significant impact such as: lime kiln temperature (Pulp), excess air in boilers (Transversal), paper machine speed and hood air pressure, (Softys).

Improvement measures that impact on Significant Uses must be a priority within action plans for goals and objectives. This considers both projects and measures taken with and without investment, implemented for the main purpose of improving on energy and efficiency, or rather to improve on productivity or operational continuity, but that, regardless, still have a significant impact on energy performance; meaning they should be analyzed taking that trait into consideration. To date, we have observed that half of energy savings were accumulated from process optimizations and operational performance, both of which typically don't require large investments. However, at a global level in CMPC, close to 23.7 MMUSD have already been invested to improve on measuring, technologically updating equipment and processes, consulting and engineering.

In the case of CMPC Celulosa, 2 MMUSD were approved for 2021, and will be exclusively assigned to energy efficiency projects. These projects are intended to encourage plants to propose ideas for improvements on energy performance, and materialize those plans without having to compete with projects of another nature or with regulatory commitments. We have proof that the experience has been adopted enthusiastically in different plants.

"Our proven model for operational excellence ensures support for business results and helps improve on them continually via cultural change. Therefore, I am convinced of the value of integrating EnMS to boost the demanding challenges of sustainability the company has committed to."

—Francisco Ruiz Tagle, CEO CMPC

Do, Check, Act

To implement EnMS the Company has put together multidisciplinary management teams from the areas of processes, maintenance, production, operational excellence, among others. The Corporate Energy Efficiency team coordinates activities with the plant Energy team and cross-sectional areas, such as the departments of communication, acquisitions, engineering, legal, risk and human resources. Every Energy Management team has a highly trained leader on site at the plant, which belongs to a key area for energy consumption in an effort to bridge the gap between EnMS and processes. The Energy Management team is trained in ISO 50001, energy audits and internal audits and to date, CMPC has over 40 collaborators trained as leading or internal auditors in ISO 50001 IRCA.

The energy baseline and respective performance indicators are built on the basis of lineal regression analysis to guarantee accurate energy projections. Indicators are monitored constantly and are reported to top-management on a monthly basis. However, variables for operational control are monitored on a day-to-day basis for the purpose of maintaining operational standards. To that effect, CMPC uses the SDCA cycle (Standard, Do, Check, Act) which for every critical action determines which are the process variables that significantly impact on energy performance. The data is obtained from monitoring systems and controls such as DCS, SCADA and PI; these measurements are planned and include maintenance and calibration to ensure precision and accuracy.

Each one of these variables must have a Standard Operational Procedure which must indicate the way in which to operate, an acceptable range of operation and how to act when the variables stray out of range. The previous allows, at the same time, for greater operational and energy control. The behavior of those variables is the responsibility of each associated area.

In the event of indicators deviating beyond the expected, it activates Root Cause Analysis using the “5 whys” or

Ishikawa, depending on how critical the variable is. New projects may arise from these analyses and be considered as part of the PDCA (Plan, Do, Check, Act) improvement cycle.

In this manner, energy performance improves thanks to operational control, asset management and improvement projects. As mentioned earlier, each facility with an EnMS plan was oriented towards the goal of improving on energy performance by 5% in the first year, which was fulfilled by 100% of the 22 EnMS facilities to date. After this, goals are established in accordance with energy revisions and planned improvement projects. These objectives are monitored on a monthly basis in management meetings, which promotes maintaining updated energy action plans where projected energy consumption is compared using the baseline with real consumption. The goal is to cover savings generated by improvement projects and current state of progress.

The elements related to context, risk analysis, identification and assessment of legal requirements are all executed in coordination with cross-section areas and the Corporate Energy Efficiency team, in conjunction with energy management teams. Processes audits are exhaustive and implemented by independent third parties via international accreditation agencies.

The keys to improving energy performance.

In the over 6 years of experience in energy management with certified EnMS, certain key elements have come to the forefront to guarantee success in effective energy performance. These key aspects are recommended for companies taking their first steps in energy management. One of the main aspects is to **maintain corporate leadership**, with long-term commitments and resources in line with ambition. In addition, having a specialized area also allows knowledge transfer and good practices between facilities, mitigating knowledge management risks and increasing efficiency in resources and duplicability. This also provides an extra measure of reliability to sites that start their own experience in energy efficiency within their own organizations. On the

other hand, clear and easily assessable communication and commitments must be established at each facility, as well as comprehensive integration of existing methodologies and structures that allows the quick adoption of the management model. Last, and by no means least, one must always align indicators' goals and strategic objectives. To that end it is key to invest in measuring equipment, specialized consulting, and to rely on service providers and specialist technicians that will impact on Significant Energy Use.

Transparency

CMPC, over the course of 2020, has been acknowledged for leadership in sustainability by the prestigious international organization Carbon Disclosure Project, "CDP", a non-profit organization that promotes data disclosure from companies and governments on climate change. Parallel to that, CMPC has also been given the recognition of the third most sustainable forestry company in the world, granted through the Dow Jones Sustainability Index, organization to which CMPC has been reporting voluntarily for the last 5 years.

In matters specific to energy efficiency, CMPC is the most recognized company in Chile, having been awarded with the Gold Energy Excellence Seal, the maximum distinction in all matters related to energy management as evaluated by the Ministry of Energy and the Agency for Sustainable Energy. The Company currently has 15 facilities in Chile classified as Gold.

What We Would Have Done Differently

One of CMPC's outstanding characteristics in energy management is that the company has a specialized corporate area in energy management, an area with extensive experience in implementing and maintaining

EnMS. This has allowed the Company to consistently transfer good practices, which in turn has strengthened efforts in permanent continuous improvement.

Conversely, integrating energy management into operational excellence has been particularly relevant in 2020, especially within the context of the COVID-19 pandemic. Sanitary restrictions have impacted on the number of plant operators, whom as a result have mainly focused on operational continuity to ensure the manufacture of essential products. However, the context of the pandemic has not been an obstacle to execute on energy efficiency, given that strategic focus on operational reliability has also had repercussions on managed energy performance. The plants were able to fulfill goals, and even managed to certify 13 EnMS in 2020, and another 4 in 2021.

Other aspects that make a relevant difference have been the resilience and capacity to adapt to the country's new reality, accelerating the digital transformation. These elements have become part of the lessons learned that have ultimately led to significant improvement.

The Energy Management Leadership Awards is an international competition that recognizes leading organizations for sharing high-quality, replicable descriptions of their ISO 50001 implementation and certification experiences. The Clean Energy Ministerial (CEM) began offering these Awards in 2016. For more information, please visit www.cleanenergyministerial.org/EMAwards.

