

ISO 50001 Energy Management System Case Study

2020

Argentina

YPF LUZ

Reliable high-quality generation assets which are technologically and geographically diverse



La Plata Cogeneración (LPC) Plant, one of the three certified sites under ISO 50.001

Organization Profile & Business Case

Founded in 2013, YPF Energía Eléctrica S.A. (YPF Luz) is the power generation subsidiary of YPF. We are a leading Argentine power generation company, primarily engaged in the development and generation of electrical power from both conventional (thermal) and renewable sources.

Its mission is to be a profitable, efficient and sustainable electric energy company, focused on optimizing natural resources and contributing to the energy development of Argentina and the markets where it operates. Its vision is to become one of the leading companies in the power generation sector, a leader in renewable energy, operating under world-class technology, efficiency and quality standards.

Case Study Snapshot	
Industry	YPF Luz - LPC
Product/Service	Power Generation- from conventional and renewable sources
Location	Argentina
Energy management system	ISO 50.001
Energy performance improvement period, in years	1 year (2019)
Energy Performance Improvement (%) over improvement period	0,64%
Total energy cost savings over improvement period	\$ USD 6.837
Cost to implement EnMS	\$ USD 9.964
Total Energy Savings over improvement period	89.995 (GJ)
Total CO₂-e emission reduction over improvement period	1.407,83 (Metric tons)

At present, YPF Luz operates seven power generation sites and has a total net installed capacity of 1,819 MW. It also has multiple projects under construction totaling 637 MW of installed capacity, including wind farms and thermal power plants, that are scheduled to commence operations in 2020, and substantially all of which have signed or been awarded PPAs¹.

In line its mission, YPF Luz has established as an objective the implementation of the Energy Management System (EnMS) under ISO 50.001 in all its facilities. At the

¹ Power Purchase Agreements

moment, it has certified ISO 50.001 for six thermal power plants located in three sites as described below.

In the Province of Neuquén, Loma Campana I, Loma Campana II and Loma Campana Este power plants, operating under the same Management System, have an installed capacity of 105 MW, 107 MW and 17 MW, respectively. Loma Campana I and II operate LMS-100 General Electric open cycle aeroderivative gas turbines, one of the most efficient gas technologies available in the market.

Another certified site includes El Bracho and San Miguel de Tucumán thermal power plants, both part of the Tucumán Power Generation Complex, with an installed capacity of 267 MW (currently being upgraded to a combined cycle for an additional of 198 MW) and 382 MW, respectively. The Tucumán Complex involves a third combined cycle power plant which is planned to obtain ISO 50.001 certification in 2020.

The third certified site is La Plata Cogeneración (LPC), located in the Province of Buenos Aires and within the most important refinery in the country, Complejo Industrial La Plata (CILP), owned by YPF. This cogeneration plant, acquired by YPF Luz in February 2018, has an installed capacity of 128 MW and produces 240 tons of steam per hour. Its main objective is to provide steam for CILP's industrial processes and, as a subproduct, electrical energy to the electric wholesale market.

This document will develop in depth the implementation (since April 2019) and certification (in December 2019) of the EnMS under ISO 50.001 for LPC.

“Since we focus on improving efficiency in our power generation processes, we are committed to incorporate all our operations certified under ISO 50.001”.

—Martin Mandarano, CEO

Business Benefits

The implementation of the Energy Management System (EnMS) with ISO 50.001 standards in LPC led to an improvement of 0,64% in energy performance in 2019. The plant achieved a 0,97% reduction of the annual energy consumption, that is 89.995 GJ not consumed, representing \$USD 6,837 of energy cost savings and a reduction of 1.407,83 metric tons of CO₂eq emissions.

The EnMS implementation costs consider internal staff time to develop and implement the system and prepare for audits. Before and during the implementation, technical assistance such as external consultants' expertise was required to assure standards were being met. Moreover, training courses on the standard requirements were provided to all organization levels, including suppliers. Also, awareness campaigns were communicated internally through mail, flyers and the company's intranet. In LPC, the estimated costs to ensure a proper EnMS were of \$USD 9,964.

As an additional benefit, carrying out the EnMS led to internal staff and contractor's awareness on the importance of the rational use of energy during daily life and increased their commitment with the environment. Furthermore, by following this recognized standard, brand reputation improved, supporting directly our marketing strategy.

Plan

Since LPC had already experienced the certification of ISO 9.001, ISO 14.001 and ISO 45.001 standards, the team realized that ISO 50.001 could be successfully incorporated into its Integrated Management System allowing significant improvement opportunities in energy use and performance in general due to synergy.



LPC Energy Team on 5 November 2019, during phase 2 of ISO 50.001 certification audit.

Organization Strategy

The business objectives regarding energy efficiency arise from YPF Luz's vision and mission, its Operational Excellence Performance Policy and from YPF's Climate Action and Energy Efficiency Policy. Within this framework YPF Luz developed its energy commitment for the whole organization and appointed the CMASS and Operations teams as implementation leaders. Consequently, Energy Management were defined and participation of operations, maintenance, engineering was achieved together with other sectors involved as needed.

Climate Change Committees meet at least twice a year with the participation of CMASS teams from all assets and main office. In these meetings, ways to improve energy efficiency and consequently reduce GHG emissions are discussed.

In LPC, a FODA analysis is carried out annually. Two main results appeared at the 2018 strategic plan revision:

- 1) In December 2018, the Cogeneration Plant of YPF Luz entered into an agreement with GE Digital Energy to pilot test Predix, a digitization system which helps make the maintenance of power plants more efficient.
- 2) Certifying the Cogeneration Plant with ISO 50.001 was identified as an interesting opportunity.

Identifying Opportunities

To define an adequate action plan, it was necessary to get to know the LPC energy context in depth, by identifying activities and actors involved in the use and

consumption of energy. Variables that indicated Significant Energy Uses (SEUs) were defined and allowed the prioritization of activities to improve processes and equipment. Hence, objectives, targets and Energy Performance Indicators (EnPIs) were developed for the entire LPC complex.

In LPC, a scenario analysis was developed using information that LPC CMASS team received from the operations sector with data recorded daily from gauges, together with historic trends for particular cases like machine starts and stops.

During the external consultancy prior to the EnMS implementation, certain observations were brought up such as: lighting in sectors where there was no staff developing activities, operational actions that did not contemplate energy efficiency, the purchase processes did not consider the energy class of equipment.

La Plata Cogeneration Plant's main machines involved in the energy generation process are around 20 years old. This aged technology implies that to enhance the process efficiency significantly, a large investment would be necessary. Therefore, Base Line 1 (BL1) was defined to cover the whole energy process in the cogeneration plant by considering total energy outputs (steam and electricity) in relation with the total energy input (natural gas and electricity).

On the other hand, Base Line 2 (BL2) comprises electric energy consumed for auxiliary services to the whole plant. This allowed the team to focus on the improvement of secondary processes (compressors, pumps and engines) that could be easily reflected in the indicator.

“The ISO 50.001 has been an intensive learning process that has transformed the way we analyze energy use and performance. It has allowed us to incorporate new documentation processes and systems.”

—Emiliano Sanchez, LPC operations Team

Staff Commitment

YPF Luz’ corporate values are Commitment, Sustainability, Agility, Passion, Teamwork and Focus on Results. YPF Luz assures its members are aligned to these principles and apply them in their day to day activities. An example of this is the encouragement of top management (CEO and InSite Managers) to be actively involved and participate at energy team meetings. This way motivation and support can be provided as needed.

Internal staff and supplier’s motivation and awareness is achieved mainly by the fluid communication between the Energy Team and the rest of the organization.

It is estimated that more than 430 hours were dedicated to trainings and courses during the EnMS implementation, including:

- Engine management
- GE equipment management and operation
- Post technical program provided by UTN (Universidad Tecnológica Nacional de Argentina)
- Graduate Degree in Energy In Company (Instituto Tecnológico de Buenos Aires)
- Energy Use Awareness Talks and Campaigns

Moreover, energy efficiency online courses are provided to the entire business personnel by YPF Foundation for both organizations YPF Luz and YPF.

In LPC, as in the entire organization, there is conviction that energy efficiency awareness, commitment and promotion is everyone’s duty. Energy Performance Improvement is achieved through the collaboration of all staff on site. Therefore, suggestions, ideas or observations from everyone are encouraged to be sent to the energy team’s email.

Social Commitment

YPF Luz has developed a social investment program focused on education, energy efficiency and environmental improvement of the communities where we operate.

Our social investment strategy is aligned with the following Sustainable Development Goals:



In 2019 the company implemented 23 social investment activities, which included forestation activities, recycling workshops, and renewable energy and energy efficiency talks. These activities were implemented with the

involvement and active participation of the company employees through the company’s volunteering program. In 2019 more than 90 employees participated in the program, contributing more than 320 hours of volunteer work.

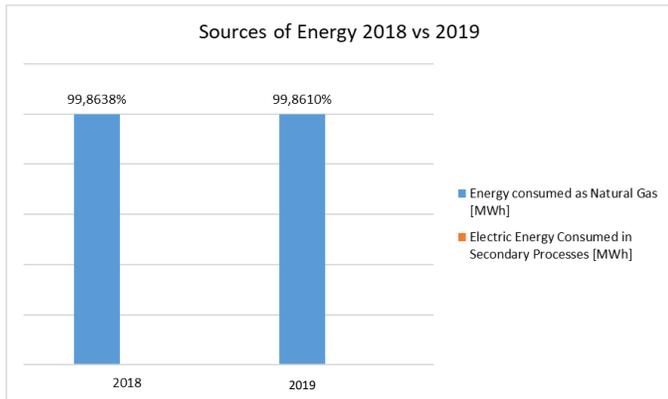
YPF Luz has adapted workshops for primary school children based on the Program “Vos y la Energía” developed by Fundación YPF which seeks to inspire children to learn about energy and use it more efficiently. These workshops will be implemented by company volunteers in the communities close to its operations as of 2020.

Do, Check, Act

Top Management established the EnMS objectives. For the project monitoring, LPC defined an action plan “Programa de Objetivos y Metas SGen 2019” (see table below) in which different actions with their corresponding target, owner, deadline and KPIs were defined and progress in % was tracked.

Programa de Objetivos y Metas SGen 2019																	
Codigo	Objetivo	Meta	Medios	Indicador Asociado	Sector/ Involucrados	Responsable	Valor Objetivo	2019			2020			2021			Resultado VTG
								1	2	3	1	2	3	1	2	3	
LPC-01	Eliminar el consumo de agua para reducción de NOx	Reducir 10 TWh reducción de consumo de gas por reducción de producción de agua	Capex Mantenimiento 2022	Optim	Mantenimiento	Pradri Embiano	0 TWh de agua para reducción de NOx										0,00%
LPC-02	Mejorar de la relación técnica e	Eliminar parámetros que impliquen reducción del sistema de gas	Capex Mantenimiento 2020-2021	Cantidad de lugares a visitar. Cumplimiento del 100% del programa de mantenimientos	Mantenimiento	Pradri Embiano	A saber										0,00%
LPC-03	Reducción de consumo de energía eléctrica por iluminación	Eliminar el consumo eléctrico de iluminación en exterior de la planta.	Eliminar todos los artefactos de iluminación con lámparas LED de tubo en lugar de tubos de fluorescencia	Infraestructura	Mantenimiento		Mejora de eficiencia energética de 4%										30,00%
LPC-04	Reducción de consumo de energía eléctrica por iluminación	Eliminar el consumo eléctrico de iluminación en CCM de caldera, sala de bombas, PEECC.	Colocar sensores de movimiento para apagar que están prendidos.	Infraestructura	Mantenimiento	Pradri Embiano	Mejora de eficiencia energética de 4%										
LPC-05	Estimación de pérdida de calor en la caldera por medio de termografía	NA	Capex Mantenimiento 2019-2020-2020	NA	Mantenimiento	Di Ianni Nicolas	Cumplimiento del objetivo										100,00%
LPC-06	Reducción del consumo de agua de alimentación por purgas del Domo	Reducir el consumo de agua de alimentación	Implementar sistema de control de agua que controla	Tech	Operaciones	Sergio Larrosa	Basé de las 20 TWh										0,00%
	Nombre, Apellido	Firma	Fecha														

Natural gas and electrical energy consumption as well as the electrical energy and steam production, are recorded daily by the operations team.



These parameters, among others, are incorporated into data sheets, published into the system. Table 2 contains information with unified values of conversion factors, calorific values of fuels, steam enthalpies, etc. The report is sent by email to the plant staff.

Table 2.

The information related to energy performance and its management system is periodically communicated internally to the staff, also via email.

For the program implementation, Key Performance Indicators (KPIs) are required to evaluate the business' energy performance and its efficiency.

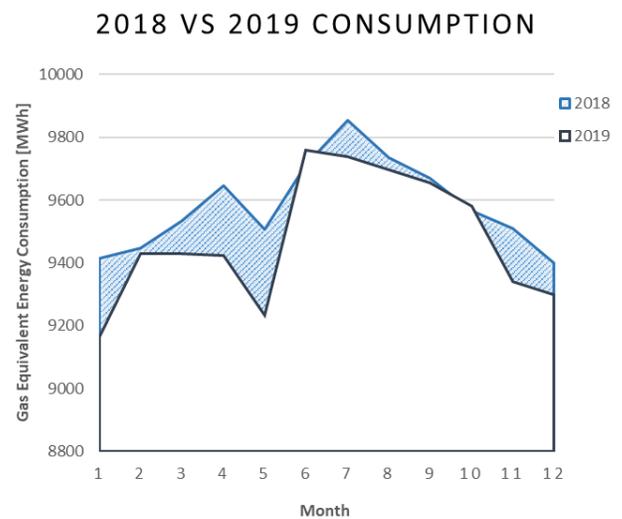
² Consuming at least 9000MWh implies engine is synchronized. These values are considered for the data analysis.
³ Energy intensity= Energy consumption [MWh]/ Energy produced as steam and electricity [MWh].

In LPC, tracking and analyzing KPIs is a monthly task and the results are presented to the rest of the Energy Team semiannually at the programmed Energy Committees. This follow up meetings involve different company levels and areas. The compliance with the program is monitored and progressively reinforced.

The EnMS performance was evaluated for 12 consecutive months, with 2018 as the baseline period. Since the EnMS implementation started on April 2019, to estimate Energy Performance Improvement over the period Jan-Mar 2019, a “2019 performance equation/model” was built using the data of the period Apr-Dec 2019. From the “2019 with EnMS equation” the energy production for the period Jan-Mar 2019 can be estimated considering relevant actual values². Based on this, the Energy Performance Improvement (0,64%) is calculated with the following formula³:

$$\left(\frac{\text{baseline period energy intensity} - \text{reporting period energy intensity}}{\text{baseline period energy intensity}} \right) \times 100$$

The graph below shows the equivalent energy of natural gas consumed [MWh]. Blue area between curves represents the energy savings (24.999MWh) as a result of the EnMS implementation. The CO₂eq emissions for each year are obtained from APA⁴. Assuming a linear



⁴ Corporate platform where environmental parameters are recorded and data is processed.

correlation ($R^2 \approx 0,9$) between total energy consumption and total CO₂eq emissions for LPC, CO₂eq emissions were calculated for the synchronized engine. Results show a decrease of 1.407,83 metric tons when comparing 2018 and 2019 CO₂eq emissions, a reduction of 1%.

In addition to certification audits, internal periodical audits are carried out to promote continuous improvement in the system and methods.

LPC 2018 vs 2019 Results:

- Energy Production improvement due to compressor maintenance with an increase of 1,5 MWh per day
- Replacement of traditional lighting to LED allowed to save 1% of the total energy consumed.
- A 4% decrease in steam loss at production lines was achieved.
- BL 1= IDE 1 – Total output / total input: 63.048,9 MWh/ 83.053,6 MWh – in 2019: Improvement of 5% versus 2018.
- BL 2= IDE 2 – Average Electrical Energy Consumed for auxiliary services/ Average Electrical Energy Provided: 3.169 MWh / 21991,7MWh. Improvement of 2% versus 2018.

Transparency

The company has communicated externally the achievement of the ISO 50.001 certifications through a press release, social media posts (LinkedIn) and its official website. Internally, it has been communicated

through Workplace, a social network to which all employees access, and other internal communication means such as an institutional email to all employees, digital signage and the company's intranet. In addition, the certifications were proudly announced in the 2018 Sustainability Report.

Furthermore, the company has included the certification information in financial reports since it is aware of the importance given by investors to sustainability issued.

Lessons Learned

- Energy management should be always considered at early stages of decision making, from design of buildings to processes of the industrial activity. From now on, equipment's and lights efficiency will be considered since purchase processes.
- It is important to communicate and train operations and maintenance teams on an early stage to ensure full awareness and understanding of the standards and energy efficiency. This led to an improve in the implementation of EnMS and overall energy performance.
- Count with necessary documentation and records and ensure their availability and use Project Procedure.
- New relevant variables in machines performance were detected: IGV (Inlet Guide Vanes) angles of engines that affect air flow needed in the process.
- Being able to access to historic data (since 1997) allowed a detailed energy overhaul to establish precise objectives, targets and actions in line with the power plant's reality.

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.

