ISO 50001 Energy Management System
Case Study

2020 ARGENTINA

FCA AUTOMOBILES ARGENTINA S A

ARGENTINA PLANT

Case Study Snapshot	
Industry	Automotive
Product/Service	Vehicles
Location	Córdoba, Argentina
Energy management system	ISO 50.001
Energy performance improvement period, in years	4
Energy Performance Improvement (%) over improvement period	27%
Total energy cost savings over improvement period	USD 821,000
Cost to implement EnMS	USD 79,944
Total Energy Savings over improvement period	100,000 GJ
Total CO_2-e emission reduction over improvement period	556 Tn CO2

Organization Profile & Business Case

FCA AUTOMOBILES ARGENTINA S A has an automobile factory opened in 1996, located in Ferreyra, Córdoba Province, dedicated to the production, marketing and after-sales assistance of vehicles for the national and international markets.

With a production capacity of 220,000 units per year, it spreads out on 820,000 m², of which 276,000 are covered.

FCA develops all of its operations under the World Class Manufacturing (WCM) Methodology (currently Silver level) – as well as ISO 9001, ISO 14001 and OHSAS 18001 international standards, and during the last four years, under ISO 50.001.

"Certifying ISO 50.001 is a key evidence of FCA sustainability commitment".

Eng. Eduardo Borghi - Energy Pilar and SGE ISO 50.001 Leader at FCA AUTOMOBILES ARGENTINA S A

Following our commitment with continuous Improvement, by the end of 2015, FCA Group and FCA AUTOMOBILES ARGENTINA SA top management decided to certify the ISO 50.001 standard, entrusting with this challenge to the local team, which, by that time, accounted with five years of experience with WCM Energy and Environment pillars and ISO 14.001 certifications.

With this solid basis, the certification journey began at the end of 2016, when the first phase certification audit took place, and the final certification was awarded in the second audit at the beginning of 2017.

Our Environment and Energy policy was the first step taken by the company Direction, driving staff motivation with different awareness programs.
The road traveled with ISO 50.001 was very pleasant for the company, since a sound participation of all employees has been achieved, regarding good habits, suggestions and projects, resulting in important savings which contributed to the business profitability.

Business Benefits

The decision to implement ISO 50.001 at FCA AUTOMOBILES ARGENTINA SA went hand in hand with the group's global business model, aligned to the WCM

and the commitment to sustainable production. Within that framework, the FCA AUTOMOBILES ARGENTINA S A plant in Cordoba was one of the first automakers in the local market to certify ISO 50.001.

From the very beginning, corporate Direction has demonstrated its commitment by means of Environment and Energy Policy, which comprises:

- Continuous improvement of **Energy and Environmental Performance** (efficient use and consumption of energy and resources).
- Compliance with **legislation and other requirements**.
- **Awareness and training** of all employees and suppliers.
- **Availability of information and resources** to achieve the objectives.
- **Design and purchase** of products, services, facilities and systems that affect Energy and Environmental Performance.

Since the beginning of the certification process (2016 - 2019) the measured results have been:

- 27% reduction in consumption of electric energy and natural gas that means CO2 reductions.
- Saving of USD 821,000.
- Awareness of 100% of employees and suppliers.

Distribution of Use and Consumptions

The main energy vectors in our plant are Electric Energy (52%) and Natural Gas (48%), coming from the National Matrix.

The objectives assumed every year of reducing electric energy and natural gas were based on investment possibilities, but also driven by the challenge of achieving efficiencies, especially in recent years where doing it at low costs has been an extra challenge.

So the Energy Group has set up some motivating strategies to achieve these goals:

- A regional Benchmarking program has been conducted, visiting 10 local companies of various activities during 2019, from which several management concepts and ideas have been taken.
- Cross Project: It is a kind of digital benchmarking developed among all FCA group plants, exchanging ideas, technologies, projects, and outlining a Virtual Best Plant as a role model to follow.
- Energy War Room: it is an area created by the energy team where groups from different internal areas get together regularly, to whom the premise “Breaking Paradigms” is presented, to analyze opportunities for reduction or adjustments at very low costs or no cost at all, as well as "Barrilete Ideas (Kite ideas)", letting the imagination of the groups fly away to innovate.

Electric Energy

In the case of electric energy, some improvements coming from the ISO 50.001 management are:

- **Technological projects:** efficient engines, LED conversion, robotics, inmotics, etc.
- **Good practices:** transferred to all areas through awareness programs and other active programs such as "The Energy Captain Plan", to be explained later on.
- **Process standards:** the standards of the productive processes were analyzed, achieving adjustments that allowed great savings with no investment (for instance: adjustments of painting cabin temperature and product temperature, start-up time optimization, electrical transformers configuration, stand-by setup, etc.).
- **Service contracts - legislation:** PHI cosine control, hired power demand reduction according to electric energy consumption.

Natural gas

Under the same paradigm used with that of electrical energy and with the same efficiency objective, the following improvements have been conducted:

- Base conditions optimization and equipment maintenance standards - operational controls: the same as for electrical equipment, the role

of preventive maintenance and autonomous management (WCM PM and AM Pillars) is very important, being able to define together with the Energy Pillar, the efficiency criteria: calibrations, vibration measurements and thermographs, etc.

- Optimization of process standards: start-up reduction, temperatures, set-up times, etc.
- Technological improvements: automations, start-up adjustments, insulation improvements.
- Logistics improvements: productive programming designed according energy efficiency.
- Service contracts: tenders and re-contracts according to tax optimization.

In conclusion, although FCA AUTOMOBILES ARGENTINA S A has been working with the Energy pillar for more than 10 years, identifying losses and opportunities, carrying out projects and investments, the implementation of ISO 50.001 contributed mainly to the concept of efficiency, from use and consumption of energy, involving the entire FCA AUTOMOBILES ARGENTINA S A population, unlike the WCM criterion that analyzes from the concept of losses.

The general benefits for the implementation of ISO 50.001 at the corporate level are:

- Optimization of measurement systems and relationship with services accounting management (number of measurers, digital systems, calibrations, etc.) and Key Performance Indicators management.
- Improvement of public image: FCA AUTOMOBILES ARGENTINA S A is a local reference for its energy performance, participating as exhibitors in different centers such as the National University of Architecture, CONICET, ISO 50.001 Learning Network, etc. This also grants the company with some benefits in terms of relations with service supplier.
- Positive impact on the environment: resources and CO2 emissions reductions.
- Reduction of hidden losses: especially linked to preventive maintenance.
- Social impact: awareness of internal staff, involved suppliers and its behavioral transferred to their homes.

Plan

The path began with a Master plan, whose first phase was the definition of methodologies for regulatory requirements compliance, legal requirements evaluation, measurements, management team awareness, as well as operators and internal suppliers, specific job training, among others.

A very successful top-down strategy in this regard has been conducted by the "Energy responsible", who delivered the necessary information and commitment (spreading it out to their teams and area coworkers).

This strategy has been one of the cornerstones for the success of the energy management system, achieving active participation and spreading out downstream the necessary management tools. One of the very successful improvements of this strategy has been the implementation of the "Energy Captain Plan" (2017), whose purpose has been leadership assignment to operators (different from the Energy responsible) who take it in turns during a certain period of time, guaranteeing in this way the participation of everyone with simple activities and transmissible habits in terms of energy (breakdown alerts, lamp changes, ideas of online projects, etc.). This year 2020 the plan has been improved again, moving towards the “Energy Multiplier”, whose objective is to multiply in three months, transmitting the role to two partners (new multipliers) and, in addition, to add two new projects through an app, which also allows each multiplier to load “identified losses” to be resolved by maintenance quickly.

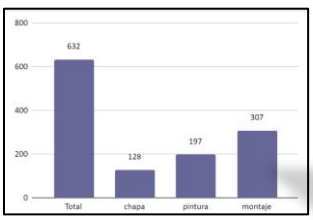

Fig: 1: Energy Captains 2019

The energy area knew how to find its own personality always with ambitious and

challenging objectives, but especially with great efficiencies".
Eng. Pamela Zanel, Energy Team

Returning to the first planning stage, our methodology for the ISO energy revision 2011 was that each "Energy Responsible" together with its team performs periodically, or according to major changes, an initial analysis of its uses and energy consumptions, to develop a "MAP" of all the existing equipment in the facilities of their area, identifying power and time of use, PHASE 1, to obtain this way energy consumptions and costs.

In PHASE 2 the evaluation of energy uses and consumptions is carried out to determine significance. In this instance we detect and plan:

- The greatest uses and consumption of energy (significant).
- The necessary operational controls to make efficiency.
- Existing measurements and improvement possibilities.
- The baseline compared to the previous year's consumption (remembering that FCA AUTOMOBILES ARGENTINA S A has been managing energy vectors since 2009) and objectives and goals for the first year.

Thanks to these first steps, the economic benefits for the business could be demonstrated to top management, who found an attractive opportunity, being able to invest in resources with concrete and short-term returns.

"The implementation of ISO 50.001 helped us to achieve great savings with low investments providing more business efficiency".
Eng. Daniel Alonso, Manufacturing Engineering and General Services FCA AUTOMOBILES ARGENTINA S A.

Do, Check, Act

The commitment assumed by all the FCA AUTOMOBILES ARGENTINA SA Directions (HR, Purchasing, Commercial, ICT, Logistics, Finance, Product Development, etc.) with the ISO 50.001 management, resulted in achieving our first objectives, being the main one of the Industrial Direction, to reduce the use and consumption of energy, measured by Gj/veh (Gigajoule/vehicle) indicator:

Year	*KPI*	*KAI*
2016	- 15%	60
2017	- 15%	83
2018	-13,5%	150
2019	- 10%	200

Table 1. Objective

References: KAI: activity indicator (number of projects / year) / KPI: Performance indicator (GJ/veh).

To achieve these performance objectives, resources and projects were assigned, being directed mainly in the first years to achieve facilities base conditions and to improve staff habits. Then the evolution in projects was towards inventiveness and innovation, crossed by an economic crisis in recent years, where the premise continued to be the energy performance improvement but, as mentioned early, with lower investments (EWR, Benchmarking, Cross Projects, Captain Plan), adding interaction programs with advanced students from local universities (supervised practices and internships).

On the other hand, each Direction proposed its own specific objectives on training, induction and awareness programs, communication campaigns, number of projects per area, and so on.

Based on the objectives of each Direction, an annual action plan is made, summarizing the projects, resources / costs, actions, deadlines and responsibilities, as well as the measurement methodology. In the following paragraph, some examples of projects carried out year after year are presented:

Year	*Project*
2016	New technology of boiler burners.
	Replacement of pneumatic tools by electric ones.
	Improvement of physical insulations.
	Cylinder changes in extraction equipment.
2017	Transformer Reconfiguration.
	Set point reduction in boiler temperatures.
	Compressed air pressure reduction.
2018	Startup reduction in paint ovens.

	Energy power demand reduction.
	LED lighting replacement.
2019	Set point reduction of cabins, processes and boilers.
	Readjustment of coordinated ignitions.
	Lighting switch-off automation.
	High efficiency motor replacement (IE3).
	Peripheral solar lighting.
	Digitalization of switch-on/off of process booths.

Table 2: Energy project

Energy Performance Improvement

The improvement in energy efficiency was calculated based in the last 4 years of work of ISO 50.001 (2016 - 2019). The calculation was performed as follows:

$$\left[\frac{\text{Baseline Period (2016) Energy Consumption/ vehicle - Last Period (2019) Energy Consumption/ vehicle}}{\text{Baseline Period (2016) Energy Consumption / vehicle (2016)}}\right] \text{X } 100$$

This calculation was made in GJ / Vehicles and the resulted was 27%.

Baseline: initially, a baseline was developed that related GJ / veh in a linear regression (Y= A.X + B) according to consumption (gas + electric energy) and vehicle. Then it evolved into two baselines normalized for each vector, gas natural and electric energy. The baseline analysis period is a closed year.

Subsequent steps for the new version of the ISO 50.001 standard are the normalization of the baselines with new relevant variables.

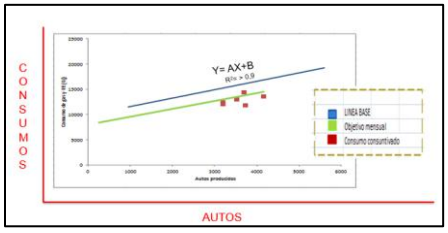

Fig 2.Example of Baseline (GJ/ Veh)

It is important to keep in mind that improvements in energy efficiency are followed through the GJ / vehicle.

Conversion Gas Natural	Conversion energy electrical
1 Sm3 = 0,0355GJ	1KWh = 0,0036GJ

Table 3: Conversion Gj

The validation of consumption data is through the measurement system with calibrated equipment and digital monitoring.

Each week an analysis of the consumption trend and the planning of activities is carried out, quantifying their consumption versus planned objectives in order to plan tasks.

To monitor consumption, FCA AUTOMOBILES ARGENTINA S A has a series of internal gas, electricity and compressed air meters, which are tracked digitally and backed up manually.

Operational Control - Corrective and Preventive Actions

As regards to operational controls, the PM (Professional Maintenance) pillar is present in each operating unit and in all common services (quality of energy, PHI cosine, etc.). Its controls are applied through SAP system (preventive, programmed and corrective cycles) and SMP (Standard Maintenance Process). Some of its controls are thermographs, vibrations, detection of compressed air losses, number of machine running hours, spare parts and fluids management, calibrations, and so on. On the environmental and safety side, CO2 VOCs are monitored on the shop floor and in chimneys, shop floor lux measurements and standards according to quality and legal regulations. Production area also carries out its own operational controls relative to the defined standards, for instance: product temperatures, booth temperature and humidity, booth speed, line speed, etc.

Proactivity and base conditions maintenance are key concepts to avoid overconsumption and/or production line stoppages.

In case of standards deviations or requirements that may put the Energy Performance at risk, a root cause analysis and an action plan are carried out: ERCA can be used (ENVIRONMENT AND ENERGY ROOT CAUSE ANALYSIS).

"The ISO 50.001 allowed us a vision for the future with attitudes of prevention that

generate great economic and environmental advantages".
Lic. Natalia Vicens. Energy Team

Management Review

Initially SGE Management Reviews were carried out together with the Environmental Management System (ISO 14.001). Then in 2018, SGE generated an exclusive area to follow-up the managing Direction periodically, having biweekly meetings complementary to Management Reviews.

These reviews mainly analyze the objectives and goals, the projected and achieved energy performance, establish new objectives, define future projects and resources, business strategies (electricity market, service contracts, etc.).

It's also the moment where the environment and energy policy is reviewed (to see if any change is necessary) as well as the indicators and baseline, the needs of internal and external communications, skills development, as well as corrective actions, risks and other context opportunities.

"Our commitment to the environment and energy is revealed day after day in each member of our community, and the measured results are proof of it".
Eng. Marcel Aun. Industrial Director

Transparency

FCA AUTOMOBILES ARGENTINA S A generates a sustainability report globally in order to communicate environmental and social performance. The published information includes the ISO 50.001 certification.

In turn, FCA AUTOMOBILES ARGENTINA S A participates in different external institutions such as the Industrial Union of Córdoba, energy committees, CIECS CONICET Learning Network, National University of Córdoba, among others, where experiences and indicators of energy management are shared.

Learned lessons

If we had to start again the process of implementing ISO 50001 in FCA AUTOMOBILES ARGENTINA SA, we would launch the energy captain and multiplier plan from the beginning, because the key to success is the involvement and commitment of people from the beginning.

It is also important to highlight management through ISO 50.001 has multiple benefits for organizations and society in general, since it:

- Involves the entire community of the organization
- Collaborates in caring for the environment and sustainability.
- Collaborates with improving the comfort of national energy services (quality of gas availability, etc.).
- Helps to find opportunities of low or zero investment and still obtain great savings.
- Helps to have the processes under control and aligned with the transversal areas of the company.
- Motivates innovation and research.