Case Study

Global Energy Management System Implementation:

General Motors South America

GMSA achieves 25.62% energy reduction per vehicle use in 11 years for the three certified sites in Brazil.



The unveiling of the Energy and Environmental Policy by Manufacturing Vice President for GM South America



Gravataí Site Certified in 2015 – One of the three manufacturing sites certified at in GM Brazil

"The ISO 50.001 certifications of our plants are the confirmation that the Energy Management routines are effective and deliver sustainable results."

— Luiz C. Peres, GM South America Mfg Vice President

Case Study Snapshot

Industry	General Motors
Product/Service	Automotive
Location	Brazil
Energy Management System	ISO 50001
Energy Performance Improvement Period	11
Energy Performance Improvement (%) over improvement period	25.62%
Total energy cost savings over improvement period	13,423,465.44
Cost to implement EnMS	1,404,211.88
Payback period on EnMS implementation (years)	1.15
Total Energy Savings over improvement period	702,901.47 (GJ)
Total CO_2-e emission reduction over improvement period	26,556.9 (Metric tons)

Business Case for Energy Management

Founded in 1911 in Detroit, Chevrolet is one of the largest vehicle brands in the world, with business in more than 115 countries and annual sales of more than 4.0 million vehicles. Chevrolet offers customers vehicles with high efficiency and superior performance, differentiated design and high quality.

General Motors celebrated in January 26, 2016, 92 years of activities in Brazil. The moment coincides with the beginning of execution of the largest investment plan announced by the company in the country for a five-year period: R $ 13 billion until 2019. The amount will be applied in the development of new products, update of the vehicle portfolio and in the development

of technologies linked to energy efficiency and connectivity.

Company Profile/Business Case

Since 2003, in a global commitment to the triad of sustainability (social, business and environmental), General Motors has begun monitoring its energy indicators. From then on, annual targets were established.
In 2005 the Department of Energy and Utilities for General Motors South America (GMSA), a service center comprised of multi-skilled professionals focused on meeting the region's diverse needs to ensure energy efficiency and sustainability of General Motors facilities.

Monitoring of indicators, management of energy contracts, implementation of energy efficiency projects, communication with a focus on management in the industrial and the residential environments are the initiatives developed over the years focused on reducing energy and utilities consumption. In 2011, General Motors established a commitment to reduce energy consumption per vehicle produced and CO2 emissions by 20% by 2020. By 2016, the corporation made an even more challenging commitment, which is to be supplied by 100% renewable energy by the year 2050. All this only is possible with an implementation of a strong energy management system.

"Energy Efficiency and natural resources conservation is deeply embedded in our culture."

— Alicia Boler Davis – Executive Vice President of Global Manufacturing

Business Benefits Achieved

Business Benefits

In addition to the ISO 50001 certification, São Caetano do Sul, Mogi das Cruzes and Gravataí units also received the Energy Star Challenge recognition from the US Environmental Protection Agency for achieving a minimum reduction of 10% within 5 years. In addition to the energy and financial benefits, the engagement of all employees in search of more efficient, innovative and sustainable manufacturing processes is perceived as a great achievement.

Following the tangible results achieved:
Energy Performance Improvement: 6.55%
Total Energy cost Savings (USD): 13,423,465.44
Total Energy Savings (GJ): 702,901.47
Total CO2e Reduction (metrics ton): 26,556.9

EnMS Development and Implementation

Organizational

The process of implementation of EnMS in General Motors Brazil is coordinated by the Energy and Utilities Department. Locally, each plant has a Site Utility Representative, linked directly to the Central Maintenance department, which is responsible for coordinating the implementation process on site. This professional has the support of the Internal Energy Conservation Commission (IECC) of the unit where it operates. The IECC, composed by representatives from the various internal departments, assists the management and energy efficiency processes. This professional structure was created prior to the implementation of EnMS ISO 50001 in GM units and is also present in non-certified units. In 2014, Mogi das Cruzes was certified, the Gravataí plant was certified in 2015 and in 2016 the largest industrial complex of General Motors in South America, São Caetano do Sul, was certified. This industrial complex includes four sites that were part of the scope for certification, and were certified with zero non conformance.

Top management commitment

The GMB certification process begins with the agreement of top management of each unit. They are responsible for assigning resources to implement the system and support the necessary actions for their full development. The first step in seeking certification is the development of energy policy, which is validated by top management. It is also the responsibility of the top management to designate the coordinators of the certification process for each unit and the deployment team, who periodically report on the development of the system. The entire process is monitored closely and the certification audit begins and ends with top management being audited. Is critical for GM, an industry with multifunctional areas, to show to all of

employees that energy efficiency is rooted at all levels of the organization.

Energy review and planning

Since the foundation of the South America Energy and Utilities Department, General Motors uses an account monitoring and processing system, called GM2100. This system allows the evaluation of all consumption indicators and the mapping of atypical behaviors. This system has an energetic map of the plants, which helps, from measurement data, the identification of the main consumer areas (Significant Uses of Energy - SUE) and the calculation of the percentage of the total energy consumption corresponding to each one of them. This control structure supports the monthly monitoring of the energy indicator, which at the end of the year composes the annual closing and is used as baseline for the following year. In addition to General Motors is implementing a monitoring system called FMS (Facility Management System), which allows real-time monitoring of the consumption of each shop and act immediately in cases of diversion, this system sends data to a second program called Energy OnStar, that makes up a database in which it is possible to evaluate the history of consumption.

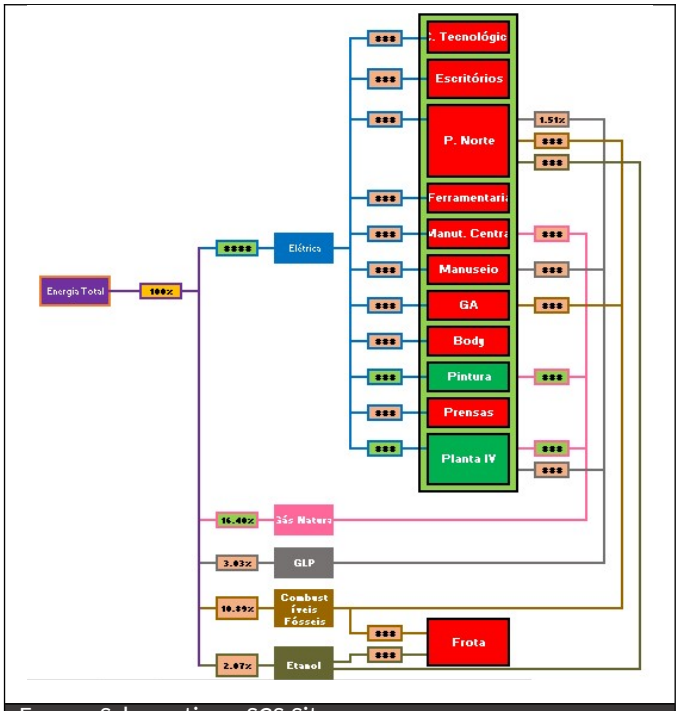
The GM2100 management system allowed us to identify also the main sources of energy used in each of the certified plants.

With the consumption and production volumes defined, it is possible to establish the energy indicator of GM, which is the energy per vehicle produced. Annually, GM performs an overall verification of the behavior of the energy consumption indicator per unit produced in the previous year and the production volumes. From this survey, the goals and targets for the period that begins are established. Each site is evaluated, the goals and targets are individual, making that each unit contribute a different percentage to the energy indicator of GM Brazil.

The evolution of the indicator is monitored on a monthly basis and in cases of deviation, action plans are established. Knowing the main consumer areas and monitoring the consumption of each area individually, it is possible to define, precisely, in which area the deviation occurred and take accurate actions for correction.

If it is necessary to apply financial resources to correct the deviations founded, a business case is presented to the company's top management, which evaluates and provides the necessary financial and human resources.

Over the years GM has identified that the deployment of EnMS is a constant process. Although it takes up on average nine months to certify a site, the energy management system needs to be constantly revisited and rectified if necessary.



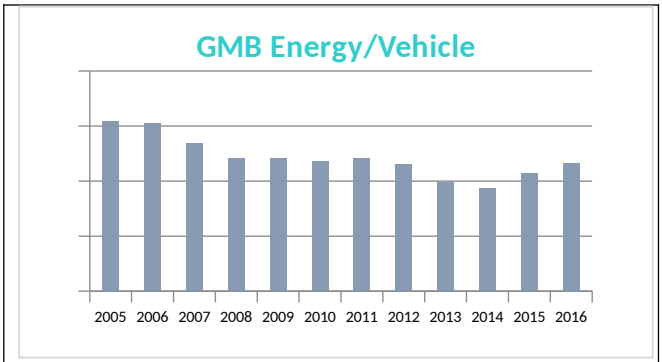
Energy Schematics – SCS Site

Cost-benefit analysis

In the last years GM spent about $USD 166,000.00 in the development of the FMS system and intends to spend more $USD 70,000.00 to complement this project. That allows us to know and control the EnMS. The direct certification costs is $USD 344,921.88, that includes internal labor cost, third parts audit cost. Further, by month, we have a cost at about $USD 8,025 regarding internal staff team of Energy & Utilities department. All communications and training for GM staff of certified sites are internally developed, reducing the implementation costs.

Approach used to determine whether energy performance improved

The energy indicators are evaluated based in some variables, such as production rates, working days and operational shifts. After considering all conditions for a specific scenario, the energy per vehicle number is created. After that there is an evaluation based in historical data with fixed and variable consumption rates in order to establish a target for those indicators and define the final number. This process is reviewed each year, in January, when the results of the previous year is closed.



Graphic of the evolution in the energy consumption per vehicle produced for all sites from GM Brazil

Approach used to validate results

Every fortnight, the Department of Energy meets with the energy representatives of each unit. On that occasion, good practices are shared and opportunities are evaluated by the group. Expected versus actual energy consumption, as well as production volumes are evaluated on a monthly basis by the energy department; all productive areas have their individual consumption evaluated, in addition to meetings with energy suppliers are carried out to ensure quality and reliability in the external supply. With the use of tools like FMS, Energy OnStar, GM2100 it is possible to measure, monitor and analyze the system by checking its effectiveness.

IECC members make efficiency rounds every week, drawing reports where deviations are pointed out. Monthly, IECC members meet to evaluate the progress of actions to improve the unit's energy performance. In addition, GM has an Innovation Team, which seeks to bring to its processes the most modern and processes and technologies, including more efficient alternatives. In addition, a group of internal auditors periodically performs an audit to ensure compliance with the requirements of the standard. Communication routines are implemented, addressing both the technical and cultural aspects of the management system. Energy metrics are tracked monthly, treating deviations with priority.

Steps taken to maintain operational control and sustain energy performance improvement

With the implementation of the ISO 50001 standard all maintenance and operation routines of the sites were reviewed, guaranteeing the reliability of the system's energy performance.

Aligned to the FMS project, in all the substations and in the main consumers were installed measuring equipment to monitor the system. In this way, a schematic of energy monitoring and consumption was elaborated. For all major consumers there is an established calibration routine for critical system equipment.

Development and use of professional expertise, training, and communications

All employees have a rigid training routine to carry out their activities. New employees perform an internal integration process where they immerse themselves in the precepts of the standard. Each General Motors employee, regardless of function, knows his responsibility to the energy efficiency process.

General Motors has an internal communication department which, together with the energy department, ensures that all its employees are aware of the energy policy and the importance of EnMS. Periodically, information about the process, energy savings tips and new technologies is released. General Motors also feels it is critical to listen to its employees and share knowledge.

"The commitment and engagement of our teams is one of the main enablers of the significant improvement in energy efficiency at our process."

— João Sidney Fernandes, South America Facilities Director

Employee engagement: At least once a year an internal energy efficiency campaign is held, where quizzes and contests are carried out in a way that motivates the participation of all. The most engaged employees are recognized and rewarded for top direction. The whole process of training and communication encompasses not only GM employees but anyone who works directly or indirectly for organization.



Examples of graphical communications directed at GM internal employees

Professional expertise: Before the certification audit, a gap analysis is contracted to evaluate the implementation and maintenance of the EnMS and thus to have an external view of the process and to correct possible deviations.

Tools & resources

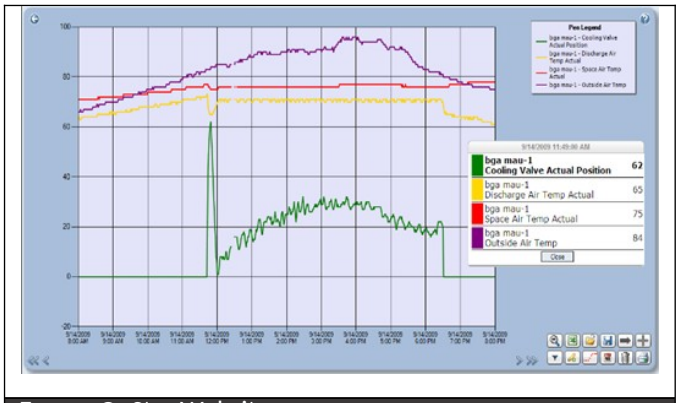
ISO 50001 certification process is coordinated by the Energy & Utilities department, which has professionals with solid experience, ensuring implementation supported by the company's sustainability pillars. All the certification process is supported by the top management of the company, based on the experience acquired of ISO 9.001 and 14.001.

GM has a systematic monitoring of energy indicators since 2003, in 2005, with the creation of the energy department a structured energy management was implemented, being supported by technological tools such as:

GM2100: System of monitoring of accounts and metrics that allows to identify deviations in the consumption and KPIs.

FMS: System of implementation of measurement and control on line of consumption.

Energy OnStar: Database of FMS system consumptions, which allows us to prepare reports and evaluate the historic of the measured points.



Energy OnStar Website

IECC: Committee composed of representatives of all internal departments that assist in the maintenance and control of the management system

Quality meetings: Meetings are held periodically with Utility Company to ensure the reliability and quality of the power supply.

Energy procurement and deregulated market management: Energy and Utility department has authority to negotiate and execute contracts for energy supply, which allows capturing the market dynamics opportunity and maximize savings and flexibility.

Advocacy groups: GM is an active player in advocacy groups to propose new and modify existing regulations to foster energy efficiency and industrial competitiveness.

Lessons Learned

The search for improved energy performance is a constant and ongoing activity that demands, above all, awareness and engagement. Industrial equipment technology has advanced rapidly and monitoring the market for knowledge is critical so the company is prepared to keep up with the changes and identify the opportunities that come up on a daily basis.

Lessons Learned

The main difficulty in the certification process was to shape the existing management system to the requirements of the standard. Therefore, General Motors chose Mogi das Cruzes as a pilot plant and after success in certification comes gradually sharing the experience with other sites, ensuring that in 2016 it would be possible to certify its largest complex in South America, the plant of São Caetano do Sul.

Synergy and commitment were the fundamental points to allow the certification process, but also are great challenges to be maintained.

Keys to Success

- Existence of an energy department focused on energy efficiency.
- Participation of 100% of the company's employees in maintaining the system.
- Synergy and Commitment.
- Top leadership support.
- Existence of technological tools to monitoring and control system.
- Financial support to implement new technologies.
- GM global support in energy and sustainability.

"Focused and resilient teamwork is essential to achieve a successful Energy Efficiency Culture."

— Glaucia Roveri, South America Energy &Utilities Manager

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.