Global Energy Management System Implementation: Case Study

Quito - Ecuador

GM OBB Ecuador

GMOBB achieves 20% energy reduction per vehicle produced in 5 years for the seven certified sites in Ecuador

Ecuador team – Recognized by local authorities for "Energy efficiency program for the industry"

Recognition for GM OBB Ecuador – Delivered by the Ministry of electricity and renewable energy (MEER), for the participation in the project *"Energetic Efficiency for Ecuadorian industry"*

"Energy Efficiency is the path to sustainable manufacturing operations and driver for innovation culture"

— Fabricio Erazo, GM OBB Global Facilites Supervisor

Case Study Snapshot	
Industry	Vehicles Assembly (CKD)
Product/Service	Vehicles
Location	Quito - Ecuador
Energy Management System	ISO 50001
Energy Performance Improvement Period	5 years
Energy Performance Improvement (%) over improvement period	20.85%
Total energy cost savings over improvement period	USD 617.626,00
Cost to implement EnMS	USD 36 000,00
Payback period on EnMS implementation (years)	0.64
Total Energy Savings over improvement period	158.817,60
Total CO_2-e emission reduction over improvement period	20.463,44

Business Case for Energy Management

GM OBB is the largest vehicle assembly plant of Ecuador, and part of the world largest vehicle brands in the world.

Ecuador's GM operation started in 1981, through a joint venture between General Motors and Ómnibus BB which was the start of a new stage of automotive industry in Ecuador.

During its trajectory, GM OBB has been recognized for is commitment with social, sustainability, environmental and development programs, which have involved the participation in several government initiatives to

contribute with its development and improvement and to give impetus to these programs and its replication.

Within this framework, in 2013 GM OBB was part of the project *"Energetic Efficiency for Ecuadorian industry"* lead by the Ministry of electricity and renewable energy (MEER) with the support of the United Nations for the Industrial Development (ONUDI), with the objective of implement an Energetic Efficiency System.

Company Profile/Business Case

Since 2008, within the framework of sustainability goals (social and environmental), GM OBB began the monitoring and tracking of energy indicators. Since then, annual targets have been established for all the operation and distributed for every area to pursue continuous improvement and people involvement in energy management.

In 2011, targets related to energy performance and sustainability gained momentum when General Motors established a commitment to reduce energy consumption per vehicle produced and 20% of CO2 emissions by 2020, and then during 2016 when the corporation made even a more challenging commitment, which is to be supplied by 100% renewable energy by the year 2050.

Although energy performance constituted an achievement of sustainability itself, it has also been locally linked with several recognitions and certifications that are part of the sustainability goals of GM OBB, constituting a parallel driver for the strengthen and improvement of the energy management system. Within this aspect, the carbon footprint of the operation was positively. Also, the commitment with ONUDI that GM OBB acquired in 2013 was a strong driver not only for the energy system implementation through ISO 50001 but also due to the commitment to be part of the solution being an example for the replication of this initiatives in the Ecuadorian industrial community.

The first approach for the implementation of the Energy Management System is based in the continuous monitoring of Energy metrics, together with effective objectives determination. This allowed GM OBB to establish a base line, an appropriate program and control actions focused in areas of greatest impact and improvement opportunities which have contributed to the performance of the organization.

People involvement and energy culture development has been a critical aspect of every management system implemented, and energy was not the exception. However, since ISO 50001 implementation, all this initiatives and actions have been better addressed to reach the objectives and to be aligned with sustainability programs to move along in the same direction with focus on results and resources optimization.

Business Benefits Achieved

GM OBB was the first Ecuadorian industry to achieve ISO 50001 certification. Additional to this, the implementation of the energy system was developed as a pilot for the program developed between MEER and ONUDI, which was developed to give impulse to this programs implementation in local industries, constituting an achievement itself as GM OBB is now recognized as an important stakeholder for state entities for development and replication of programs of significant impact.

Following the ISO 50001 certification, GM OBB was recognized in the Vienna Energy Forum with the theme *"Sustainable Energy for the Future"*, due to the program that the company developed within the framework of the project *'Energy Efficiency for Industry in Ecuador'*, promoted by the Ministry of Electricity and Renewable Energy and the United Nations Organization for Industrial Development (ONUDI). Aligned to this objective, GM OBB has continuously shared good practices with its supply chain to expand the positive impacts.

GM OBB also received a recognition by MEER, ONUDI and FMAM due to its contribution to the Energy Efficiency Project for the industry, consisting of the

implementation of an EnMS to reduce environmental pollution.

The energy management system implementation and certification promoted that several projects were implemented internally. These projects are also related with sustainability and environmental aspects so they were part of the certification as "Eco-efficient" operation by the Ecuadorian Environmental Ministry which is the highest recognition submitted by this entity.

The achievements related to Energy Management system had a direct impact over the carbon footprint of GM OBB assembly process with a reduction of 8% of CO2e/vehicle. Based in this improvement, GM OBB developed an offsetting program with social and environmental aspects, that is currently being developed in the Ecuadorian Amazon Region through conservation and cacao agroforestry. This project obtained a Gold Conservation Certification submitted by Wildlife Habitat Council on 2017.

The EMS has allowed energy efficiency to be integrated into the culture of our people, extending its positive impact

— Fabricio Erazo, GM OBB Global Facilites Supervisor

EnMS Development and implementation

The implementation process of EnMS in GM OBB (Quito-Ecuador) originated in GM global policies lead by the Regional Direction located in Brazil. 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 person is responsible to determine local strategy and methodology for energy management creating networking inside each operation. This structure was defined prior to the EnMS implementation and allowed to build a solid baseline for the definition of a robust EnMS as a next step.

In 2013, when GM OBB was invited to participate in the project *"Energetic Efficiency for Ecuadorian industry"*, the implementation of the EnMS started, but the decision of the leadership of GM OBB was to go a step ahead of the implementation and obtain a certification that guarantees the validity of the practices implemented, being a pioneer in the implementation of Energy Management systems under ISO 50001 in Ecuador.

In 2015, GM OBB achieved the ISO 50001 certification for Quito complex which includes: Assembly operation, CKD yard, Tooling shop, Wastewater Treatment Plant, Parts Distribution Center and Polymers Plant.

Energy review and planning

The elaboration of the baseline is, the cornerstone on which all the continuous improvement of the energy management system is built. For our case, the baseline for every year was elaborated taking the data of energy consumption (electricity and diesel) of all the productive units or significant users (USE's) of the system (data of 2013 only), since as from this year the facilities were not substantially modified as it happened in previous years. Once the baseline was determined and the processes studied, the objective of annual savings was established, which in our case was 4% of the total energy consumed per year equivalent to 2309.1168 kwh / year, distributed between the energy and diesel consumption.

Our baseline relates energy consumption to the total units produced in a month; With the defined baseline, the future energy consumption can be calculated based on the volume of production scheduled per month, which at the same time is compared with the real-month consumption, creating two curves with which the management and use of energy is monitored, these curves are the Cumulative Consumption Trend (CUSUM) and the Performance Index (IDE). With the trend curve, we can verify if our strategies of use and energy saving are correct, on the other hand the performance curve allows us to know how efficient we are in the use and consumption of our energy.

Improvement actions

The improvement actions undertaken to achieve our savings objective were broad coverage, in diesel

consumption for example, the hours of ignition and shutdown of the paint facilities were standardized to avoid early starts or late shutdowns which resulted in a waste of heat in ovens. Regarding the consumption of electrical energy, which was by far the most far-reaching action, several initiatives were carried out, for example, for the lighting of interior corridors of the plant, the change was made to the type of sodium vapor lamp luminaires of 400 w was passed to 100 w led lamps, in offices buildings the lighting was migrated from T8 fluorescent luminaires to high efficiency T5 lamps; for the lighting of exterior corridors mercury vapor lamps were replaced by LED lamps powered by a photovoltaic panel system with accumulator; for water heating in the dressing areas of the personnel, a solar panels heating system was, replacing the electric resistance heating showers; to control the switching on and off of the focused lighting of the production areas, an application was developed in the man-machine interface (HMI) system that ties the lighting on and off at the start and end of the day respectively; the same was done with the supply of compressed air to the plant.

Monitoring

As a complement to the internal audits of our EnMS that were defined by the energy efficiency team and carried out by our group of auditors, there was also follow-up by ONUDI through an audit that contributed to consolidate our system and face the certification audit. The certification audit, was performed by a third-party certification (AENOR Ecuador) and consisted of two instances, the first was a documentary, and the second a floor verification in which the implementation of each of the requirements demanded by the standard were verified. After finding compliance of our system with the standard, the certification was extended.

As a conclusion, we can say that benefits related to the field of energy efficiency in the industrial sector are in fact achieved through changes in the way energy use and its consumption is managed, this is clear it is, without detriment to the benefits that are achieved with the incorporation of modern technologies based on efficient consumption of energy within the production processes that are the main energy consumers.

Cost-benefit analysis

In the last years GM spent about $USD 36,000.00 in the certification of the EMS system related to EMS implementation that includes internal labor cost and metering and monitoring equipment implemented. 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, which have also been evaluated for the determination of the baseline of each previous year. One of the most important references for the EnMS indicators determination is to work over the performance of the baseline of the previous year, ensuring continuous improvement of the system. After considering all conditions for a specific scenario, the energy per vehicle number is created. After that there is an evaluation based on historical data with fixed and variable consumption rates 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.

Approach used to validate results

The results related to energy performance are validated monthly through the review of the proposed indicators in the Business Plan Deployment, which is established at all levels with indicators determined for each area and type of operation.

Additionally, the results are reviewed by the Utilities Regional Team monthly.

In both cases, if a deviation is identified, action plans are proposed which are monitored in each monthly review along with their managers and execution deadlines.

Another tool implemented for the validation of results consists of the review of indicators by the Internal Committee for Energy Control (CICE), which is a multidisciplinary and technical team that has the objective of finding and implementing new energy efficiency projects as well as contributing to the

definition of indicators, determination of action plans, identification of opportunities for improvement, etc.

Finally, according to ISO 50001 requirements, an annual review is performed with the Management Representative.

Steps taken to maintain operational control and sustain energy performance improvement

Elaboration of operation and maintenance criteria:

The Manager Representative of the EnMS, together with the Operations, Production and Maintenance Headquarters and area Coordinators, reviewed and determined the operation and maintenance criteria in the USEs annually, for this various sources such as manufacturers recommendations, manuals of Systems and equipment, operational and maintenance configurations suggested by the technical service personnel or by experts in energy systems, comparative evaluations of performance in similar equipment or experiences and previously solved problems were used.

Document criteria:

The operating and maintenance criteria of the USEs that have been established are registered in a matrix where their respective operational adjustment points, measurement and calibration intervals, maintenance intervals required and those who must be informed are specified.

Communication of control criteria:

To communicate the operation and maintenance criteria to the personnel involved, various tools are used such as work instructions, on-the-job training, record books, etc.

The controls are based on the procedures, training of the employees and contractors, technology: control systems, alarm / alert, electronic records.

In case of identifying a contingency that affects the energy performance of an USE, the necessary changes in the operational control criteria are determined to establish the required controls

Operational controls, follow up and measurement:

Monitoring through the passive collection of data in supply and panel meters is complemented by active measurement in individual meters and data recorders. This information is used to determine the performance of USEs to evaluate the effectiveness of Operational Control and its improvement opportunities.

Calibration of measurement equipment:

The Area Coordinators identify the instruments and control equipment that requires calibration, coordinates the periodic maintenance and calibration of the measurement equipment and keeps the records of the activity. The management representative contracts external suppliers for the installation, maintenance and calibration of measuring equipment.

Development and use of professional expertise, training, and communications

All GM OBB employees are governed by a training plan, developed by their direct leaders and leaders of areas of interest with the support of talent development specialist. This plan, assures technical and personal capacities for all the business needs which includes EnMS performance and improvement.

Regarding EnMS system, specific and certified training is provided to the energy staff and its cross functional team, to promote a proper integration.

"At General Motors, we are working to create a company that all stakeholders value, people aspire to work for and communities are proud to embrace, creating sustainable solutions to improve the communities in which we live and work"

— Mary Barra, General Motors Chairman & CEO

All trained employees obtained a function related to the Energy Management System additional to its normal activities. This promotes that the EnMS is fully engaged and adapted to all the operations, which strengthens the system and the career development of people involved.

To promote internal communication GM OBB has a department specifically focused on this aspect. Since the implementation of the EnMS and the certification of ISO 50001, the Energy staff has worked together with them

to develop innovative and effective communication of energy policy, Energy culture, permanent reception of suggestions, internal audits planning/ schedule, internal audit reports, best practices and other topics of interest of the EnMS and its improvement.

Tools & resources

ISO 50001 certification process is coordinated by the Energy & Utilities department, which has professionals with solid experience and specific training ensuring implementation supported by the sustainability pillars and leadership commitment. All the certification process is also supported by the integrated management system staff, 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, supported by management tools such as:

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

BPD: Business Plan Deployment, which determines effective energy indicators based on Business needs and specific nature or each operation.

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

Manufacturing staff review: Meetings are held periodically with manufacturing leadership to validate the energy performance of the operation.

Lessons Learned

Any organization, regardless of its size, structure or nature that decides to manage its use and consumption of energy with or without the objective of achieving a certification, must consider three substantial aspects: energy planning in accordance with its reality, a strong operational control, a monitoring that includes the measurement of the consumption and the analysis of the results.

The implementation of a EnMS improves the strategic visibility of a sustainable company.

The commitment of the leadership and the proper resources assignment is fundamental pillar for the EnMS implementation.

A parallel benefit of the certification of the ISO 50001, was the training of a strong work team which is directly linked with people engagement and development, aligned with GM OBB corporative policy.

The EnMS is strongly related with other Management systems such as 14001 and 9001. Therefore, a previous implementation of other management systems is a contribution that facilitates the implementation and certification of EnMS.

Keys to Success

- Leadership commitment
- Strategic resources assignment
- People training and involvement
- CICE conformance
- Support of Integrated management systems department and specialists.