

ISO 50001 Energy Management System Case Study

2020

Estados Unidos Mexicanos

Audi México S.A. de C.V.

The achievements have been throughout the company.



Organization Profile & Business Case

Audi Mexico is a company dedicated to the manufacture of Premium cars, in 2013 Audi AG decided to install in Mexico and since September 2016, is assembled the Q5.

The Executive Board of Audi AG take the decision to have all the plants in the group, free of CO2 by the year 2025. In Audi Mexico since January 1, 2020, the electricity supply comes from renewable sources.

The EnMS has a very important role in the 2025 goal, with the improvement in energy performance, we can contribute to this goal, looking for alternatives to mitigate CO2 emissions, and our goal is to replace natural gas with other renewable energy.

*"Save today Use tomorrow
Every Audian makes the difference."*

—Erich Auer, responsible for environmental protection.

Case Study Snapshot

Industry	Automotive
Product/Service	Q5
Location	San Jose Chiapa, Puebla, México
Energy management system	ISO 50001:2018
Energy performance improvement period, in years	One year
Energy Performance Improvement (%) over improvement period	Electricity: 1.56 % Gas: 19.83 %
Total energy cost savings over improvement period	\$USD 534,684.45
Cost to implement EnMS	\$USD 43,000
Total Energy Savings over improvement period	Electricity: 6,649 GJ Gas: 71,195 GJ Total: 77,844 GJ
Total CO ₂ -e emission reduction over improvement period	4,967.41 Metric tons

Business Benefits

As part of the strategies of Audi Mexico to reduce the impact on the environment, consist of use and consume moderately the necessary energy in production the Q5 model. For this reason, the decision to implement the energy management system based on the International Standard ISO 50001:2018 was the best option, allowed achieving the objectives and improving energy performance and in the immediate time, the results have been tangible and rewarding. This action will help with the strategy of Audi AG 2025 to eliminate CO2 emissions in all its plants.

For the implementation of the EnMS we follow the directive of the Top Management to carry out this project, it is important to have knowledge in management systems to be able to understand the requirements of the Standard. The implementation of tasks and responsible written in an action plan, help us to visualize where we can have delays. It is important to integrate a work team, appoint a leader and define the roles of people to interact directly with the EnMS. Energy measurements should be available to review how the behaviors in the use and consumption of energy have been. A good practice is to exchange experiences with other plants, adopt the best practices implemented and thereby ensure continuous improvement in the EnMS and in energy performance.

Understanding and interpreting the data it is very important to help us detect efficiencies or deficiencies in energy consumption. To obtain reliable information is necessary: install software, acquire data automatically and ensure verification of energy meters. We must also establish the correlations with the correct variables (units produced, temperatures, occupancy, among others). To be able to anticipate when the deviation indicate a higher consumption to the baseline, alert us to take preventive actions in energy consumption. With the help of ISO 50006: 2014 and with statistical knowledge it will be easier to understand the correlations between variables. Energy consumption must be inform to Top Management at least once a month with the intention of

showing some deviation, defining the actions aimed at achieving energy goals and objectives.

It is important to identify the highest consumers, a Pareto diagram is a simple way to do it; 80% of our consumption resides in 20% of the equipment installed. The actions to improve the energy performance should focus on serving these equipment, identify the relevant variable will be the best option to implement actions in order to reduce the energy consumption of the equipment. To observe immediate results, it is very helpful to do the actions easy to implement in the short term and lower cost.

For the construction of new buildings, remodeling of buildings or modification of a production line, you must consider from the design: the energy efficiency and the installation of energy meters, the impacts on the energy consumption will visualize almost immediately. Some actions after the installation of equipment, is the analysis of the starting curves in motors, it is preferable to start with a frequency inverter, in the case of ovens define a good carburetion optimizes the use of fuel by reducing CO2 emissions For lighting it is better to have glass walls, taking advantage of solar energy.

The continuous improvement of the EnMS, is a powerful issue, derives largely from the results obtained at the end of the year, the report to the Management is crucial to establish the strategy for next year, detect the potential for improvement and present them to the Top Management define the direction of the EnMS. Compliance with legal requirements, defining an energy policy, training of personnel, correct interpretation of measurements, adaptation of processes, definition of new tasks and the incorporation of new challenges help to maintain a solid EnMS

The benefits obtained after implementation are as follows:

Electricity. The methodology “Better” was applied to calculate the energy performance, the correlation is the units produced and the electricity consumption,

achieving **1.56%** per year in the improvement of performance, equivalent to **6,649 GJ** saved.

Gas. Was applied the methodology “Better” to calculate the energy performance, the correlation is the average monthly temperature and the gas consumption, achieving **19.83%** per year in the improvement of the performance equivalent to **71,195 GJ** saved.

Energy savings. For economic savings, we consider the monthly rates for both gas and electricity and multiply it by consumption, obtaining **\$ 534,684.45** as a benefit.

CO2. For the calculation of metric tons, we use the emission factor of 0.527 tCO₂e / MWh for electricity and 0.0000561 tCO₂ / MJ for gas, resulting in **4,967.41** metric tons CO₂.

Investment in the implementation. \$ USD 43,000.

Renewable energy. Electricity 100% renewable energy, for gas it is still conventional energy.

Reference for natural gas: DOF.*ACUERDO que establece las particularidades técnicas y las fórmulas para la aplicación de metodologías para el cálculo de emisiones de gases o compuestos de efecto invernadero*.03.sep.2015.

Reference for electricity: CRE.*Factor de Emisión del Sistema Eléctrico Nacional*.28.feb.2019.

Plan

The planning for the implementation and certification of EnMS was the beginning of this project. We rely on the Conuee document: “Technical guide for the implementation of Energy Management Systems within the framework of a Learning Network”, version: February 2017, with focus on the ISO 50001: 2018 version. Next, we list the progress of this topic.

1. Define the work team and the necessary roles to start the project.
2. Acquire the ISO 50000 family standards.

3. Establish the energy policy, this activity carried out in conjunction with Top Management and the EnMS representatives.
4. Evaluate current energy performance by building and by energy.
5. Establish and communicate to each area the energy objective and goal.
6. Identify in each building the significant uses of energy by production line or cell, (Pareto chart).
7. Define task to improve the energy performance.
8. Prepare documents to record relevant system information (standard process, equipment registration, Pareto, and others).
9. Identify if the installed equipment has energy efficiency. Describe the characteristics for the acquisition of new equipment.
10. Perform the internal audit to review the degree of the conformity in the EnMS.
11. Develop action plans for the closure of audit findings.
12. Schedule date for review by Top Management.
13. Implement the actions defined by Top Management for the improvement in EnMS.

The commitment to EnMS certification based on the International Standard ISO 50001:2018 was a decision of the Executive Board of Audi Mexico aligned with the 2025 strategy to be a neutral CO₂ emission company. *Strategy Consequently Audi*, Bram Schot, President Audi AG (June 2018- March 2020).

With the data obtained from the energy diagnosis, it helped us to detect unnecessary consumptions during weekends. We found a great saving potential just by **turning off** the equipment on the days off, this dynamic gradually showed opportunities for improvement in startups at the beginning of the workday and allowed us to find the best conditions to turn on the equipment, reducing energy consumption.

Month by month, is reviewed the energy performance indicator reached (energy saved in kWh), to compare it against the energy baseline (kWh), the deviations in the improvement of energy performance were due to the number of units produced and the ambient temperature

of the geographical location of the company. The results obtained at the end of the month showed the behavior and tendency of the energies, warning of some possible increase in energy consumption. The results obtained each month helped us to know if our actions responded to the achievement of the energy objective and goal to improve the company's energy performance. An important recommendation is to know the amount of energy consumed each day of the week, it helps us to easily identify an over consumption.

The company since its inception, it was designed with energy efficiency, this helped a lot to maintain optimal consumption in the operation of the equipment.

Do, Check, Act

The implementation of the EnMS, it was always linked to a planning for the achievement of each task. The tasks placed in a shared file, each person in charge had to reviewed the activities and how to apply it to their area, in case of any doubt, we specifically reviewed it and if an exception was necessary, we justified it. We kept a traffic light in the action plan indicating whether the action was open or closed. A person was requested from each Area Director to perform the role of Energy Representative, the characteristics of the Representatives be defined in a role, including academic preparation and some technical requirements to fill the position.

Weekly, we had a meeting with the energy representatives to know the progress in the tasks and the determination of new activities; on the other hand, we scheduled specific meetings with each area to guide them in the implementation of the EnMS.

The Top Management facilitated the training for the implementation of the EnMS, was a job objective of each member: achieve in 2019, the certification in the International Standard ISO 50001: 2018. This allowed the necessary time to be invested it, without diverting Representatives from the activities already assigned by their place of work.

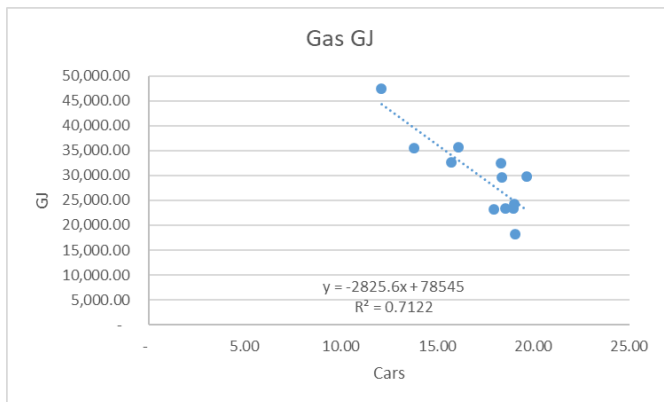
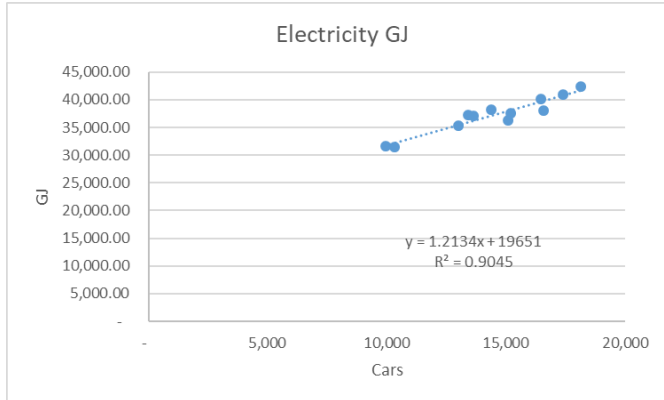
The energy performance improvement, were focused it on the next activities:

- The detection of significant uses of energy.
- Determine the relevant variables for energy consumption.
- Assign measures to save energy, in this case, only the shutdown of equipment was implemented it during hours and days off. The company since its design was integrated it with energy efficiency in the installed equipment. Daily energy consumption was measured it, with the support of the Janitza energy meters of each substation, with this information we can observe the variations in energy consumption.
- Measure the effectiveness of the actions implemented, observing decrease in monthly energy consumption. Otherwise, identify the root cause of the deviation.
- Report to Top Management the achievement of energy goals and objectives.
- Implement operational controls such as: effective maintenance, control of energy variables in production processes, dissemination of visual aids for EnMS awareness, creation of a slogan and logo of the system.

At the end of the year, the energy goals and targets were achieved it and even exceeded in both: electricity and gas. Achieving reduce more than 3% in energy consumption. The energy objective and goal defined by Top Management for the corresponding year was the 3% reduction in kWh consumption in electricity and gas.

The energy performance improvement can be visualized it throughout the company or by specific area. In our case, we will only talk about the performance at the company level. To determine the energy performance improvement, a single-variable linear regression mathematical model was used it. In the case of electricity, the correlation was between the amounts of energy consumed with respect to the cars production, obtaining an R^2 equal to 0.9045. In terms of gas, the correlation was based it on the amount of gas consumed against the ambient temperature, resulting R^2 equal to

0.7122, the temperature data were obtained from the company's weather station. Energy consumption data was acquired from energy bills.



Month by month, the results were compared against the projection of total energy according to the established mathematical model. A quick way to observe the improvement was if the value of real energy consumption was less than the projection value, the most effective way to corroborate it was based on the “Better” methodology of CEM, the results are verifying, if the value obtained is positive. At the end of the year, we apply the same methodology and observe the total value of the improvement in energy performance, again the value obtained must be a positive number.

The baseline was considered it the consumption of electricity and gas for one year. The reporting periods were monthly, monitoring the energy performance.

The operational control was exclusive to each area; we only approved the criteria for the registration of information, in each area the energies are used it in

different processes and in different ways. Only the maintenance records are registered it in the SAP platform, the electric energy meters are free of verification, for our part with an energy analyzer we verify the measurements are equal between both measuring equipment (one active and one passive). The data obtained from the installed meters report to several platforms: Legato, ECOemus, ICONAG, Janitza and Webfactory, each area according to your needs has one of these measurement platforms.

The awareness is carried out through a talk; we explain the benefits of EnMS and what are the negative impacts in case of lacking an implemented system. Every two years, the importance of the EnMS is imparted it to each person and prior to any audit the concepts of the EnMS are communicated to all employees, in addition the information boards are installed visual aids regarding energy issues.

For the issue of acquisition, there is a catalog with the technical specifications to acquire some production or measurement equipment. This extract is disseminated it to all suppliers, who must consider energy efficiency as a starting point for the purchase of assets.

For the certification audit, several actions were implemented it, including generating cross audits between areas, benchmarking with the best areas and even visiting other companies to identify weaknesses in our system. Some weaknesses detected in other management systems, considered and analyzed it to strengthen them.

Transparency

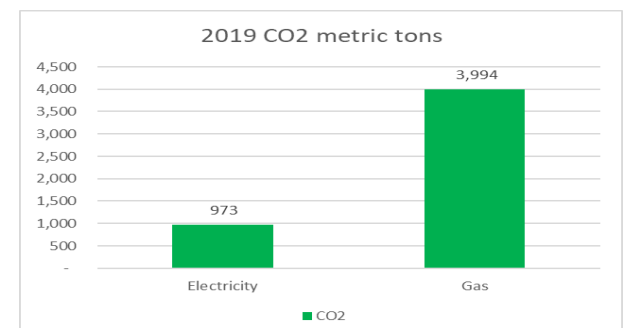
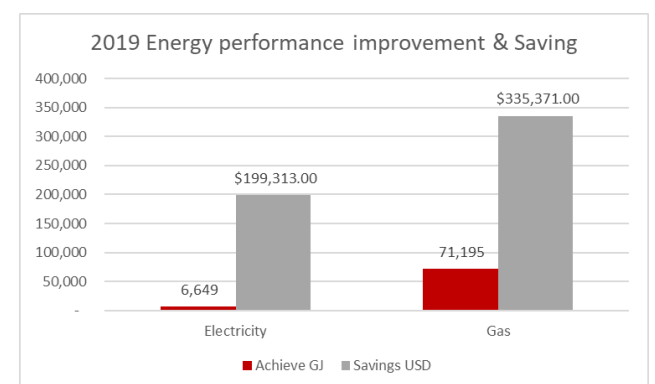
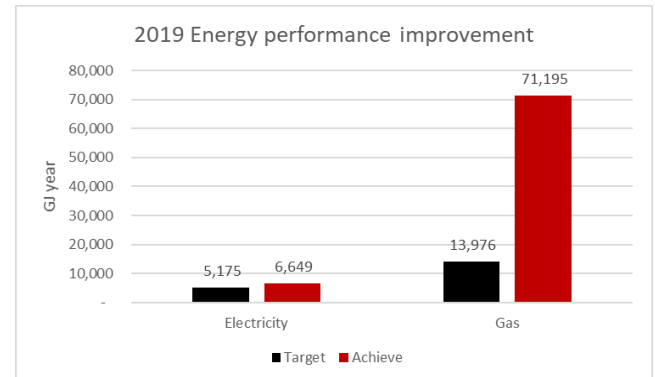
After obtaining the certification, through an email we inform the National Commission for the Efficient Use of Energy (Conuee), on November 28, 2019 the Conuee invited us to participate in the “7th International Forum on EnMS”. Carried out in the training center of the Ministry of Energy.

In February 2020, with the participation of: Conuee and the Ministry of the Environment of the State of Puebla,

an event will be held to announce publicly: the ISO 50001:2018 certification and the acquisition of 100% of electrical energy from renewable sources.

Lessons Learned

- A. The energy review was initially very complicated and data was identified which lacked importance for the system. It would improve the way to identify the equipment installed in the company, with a document that is simpler and easier to interpret.
- B. The training for energy representatives was only based it on the interpretation of the Standard. The technical part generated many doubts. Training on all energy concepts is a way of strengthening the system, transmitting knowledge of statistics will help to better interpret the results, to limit the search for measures to improve energy performance.
- C. Using the structure of other management systems also helps to make a lean system, use documents and tools implemented.
- D. Opportunities for improvement, are another area where our system is weak, we focus on addressing risks and forgot improving existing implementations.



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.