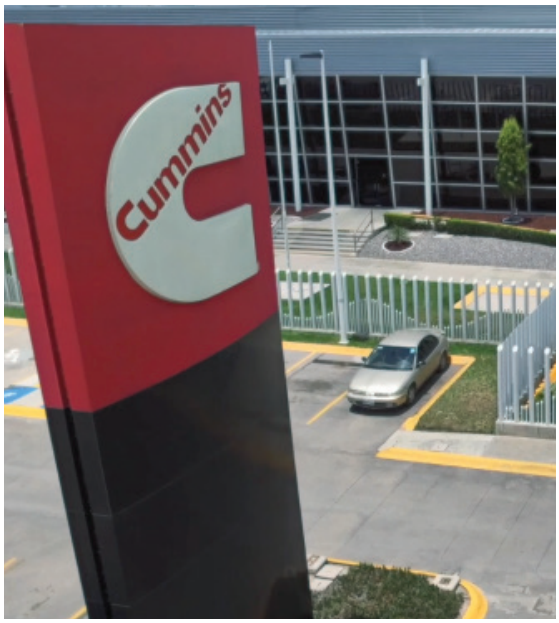
Case Study

Cummins Filtración SLP: Implementation of an Energy Management System

San Luis Potosí (SLP), Mexico

After implementing an energy management system (EMS) at its facility in accordance with the processes and criteria of the Superior Energy Performance (SEP) certification program, the Cummins Filtración SLP manufacturing plant in San Luis Potosí, México, improved its energy performance (natural gas and electricity consumption) by 9.2% over three years.



Cummins Filtración SLP plant, San Luis Potosí, Mexico.

Financial justification of the implementation of an energy management system

Organizational profile

The Cummins Filtración SLP plant located in San Luis Potosí, Mexico, which manufactures filters and filtration products for motor vehicles, is—by virtue of its level of primary energy consumption—a priority facility for the Cummins Inc. industrial group, in terms of energy performance improvement.

For a number of years now, Cummins Inc. has had a strategy for improving the energy efficiency of its plants around the world. In this context, and as part of its own energy plan, Cummins Filtración SLP has taken the steps necessary to adopt an energy management system (EMS) in its facilities that includes ISO 50001 certification, as well as certification under the Superior Energy Performance (SEP) program of the US Department of Energy (DOE).

Financial justification

Along with other projects that have also helped realize major energy savings, **the implementation of the processes and criteria of the SEP program and ISO 50001 enabled Cummins Filtración SLP to reduce electricity consumption alone by more than 2 million kWh between 2016 and 2018**.

The initiative

Putting the EMS in place at Cummins Filtración SLP has entailed the implementation of various measures, such as installation of LED lighting in various controlled areas, together with occupancy or light sensors; upgrading or replacing compressors with high-efficiency, variable-speed drive equipment; replacement of electrical resistance furnaces with others using infrared technology; replacing energy-inefficient motors with higher-efficiency ones; developing and implementing a program for ultrasonic testing and correction of compressed air leaks; implementing a thermography-based prediction program to detect electrical current "brownouts" and facilitate their

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correction; and installation of a detailed monitoring and measurement system for better control of energy use. Together, all these measures have made it possible to produce a minutely detailed analysis of energy use in the plant. In addition, a multidisciplinary environment and energy committee was formed for the purpose of identifying needs and opportunities to formulate new projects aimed at improving the plant's energy performance, specifically focusing on its different production areas.

Incentives

On a worldwide scale, the goal of the Cummins Inc. industrial group is to create a high-impact program for improved energy performance at its facilities, as well as to reduce its carbon footprint. This corporate goal involves the following objectives:

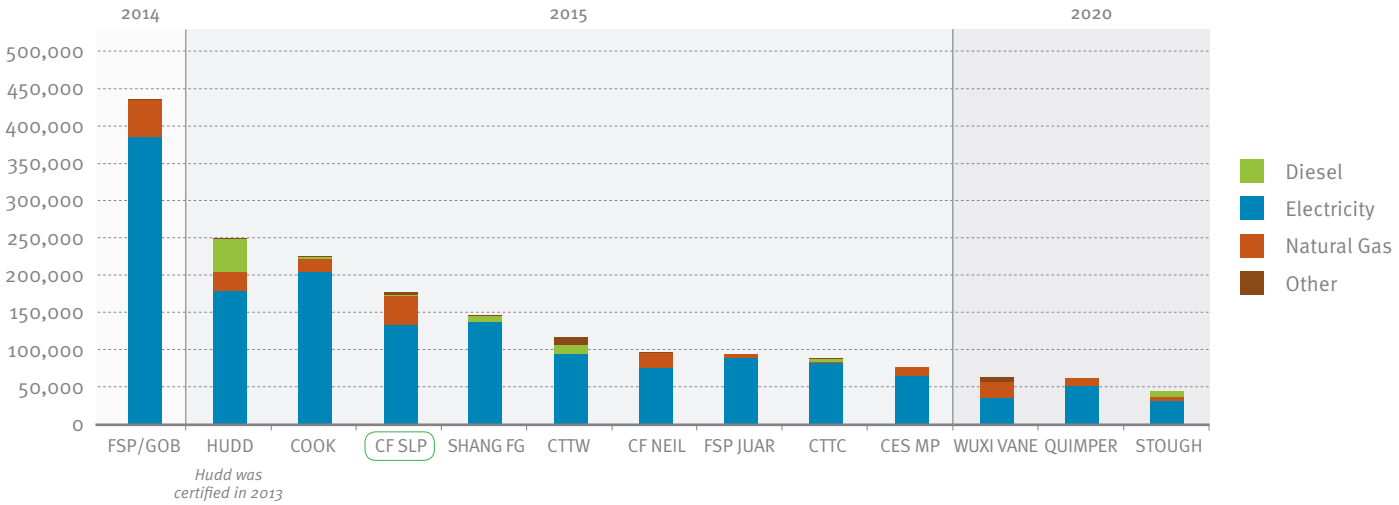
- Achieving a 32% reduction in energy consumption and greenhouse gas generation (2010–2020)
- US$60 million capital investment in energy efficiency projects (2016–2020)
- US$10 million capital investment in renewable energy (2017–2020)
- Annual primary energy savings of 344,709 MMBtu

An important incentive for the implementation of the energy management system at Cummins Filtración SLP was guaranteeing compliance with the legal requirements and other provisions relating to energy efficiency in Mexico applicable to the company.

Focus on reducing energy consumption

The methods employed in the implementation of the energy performance improvement programs at Cummins Filtración SLP were based on an inventory of the plant's equipment and machinery as well as a review of its significant energy uses (SEU). The review of equipment SEUs relied on projected energy (natural gas and electricity) consumption and energy performance indicators (EPI)—stated in "finished product per unit of measurement" or "hours worked per unit of measurement"—in order to standardize the objectives and goals as well as the review itself. Other tools used included Six Sigma, value stream transformation (VST), and Kaizen continuous or progressive improvement events (e.g., "energy treasure hunts.").

Cummins Priority Sites for ISO 50001 Certification Based on Primary Energy Consumption, 2012 (MMBtu/yr)



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Business benefits obtained

The following are some of the benefits obtained by the plant:

- Review of processes with focus on energy performance
- Incorporation of a "finished product per energy unit" metric into quality measurement
- Value created through improvement of energy performance during production processes
- Shorter payback period for EMS implementation, thanks to markedly lower energy consumption and avoided costs because of the improvements implemented
- Renewed vision of the importance of energy efficiency and the implementation of the corresponding systems at our facility

"Cummins will continue to be a catalyst for environmental action. Our vision and mission demand it, our business success depends on it, and the ingenuity and energy of our employees can make it happen."

Tom Linebarger, Chairman and CEO, Cummins Inc.

Preparation and implementation of the EMS

Several years ago, the Cummins Inc. industrial group devised a comprehensive strategy for the adoption of energy management and certification systems in all its plants around the world, with a corresponding projection of global energy performance improvement for the 2010–2020 period.

A number of the corporation's facilities in different countries embarked on a corresponding process and have reached different stages. In the case of the Cummins Filtración SLP plant, the implementation

Cummins Filtración SLP, México

Industry	Manufacturing
Product or service	Automotive filters and antifreeze
Place	San Luis Potosí, Mexico
Energy management system (EMS)	ISO 50001 / ANSI/MSE 50021 (SEP)
Energy performance improvement period	3 years
Energy performance improvement throughout the EMS implementation period	9.2%
Total energy cost savings throughout the improvement period	US$346,691.80
Cost of EMS implementation	US$103,648.21
Payback period for EMS implementation	0.29 years
Total energy savings throughout the improvement period	21,647.63 (GJ); 6,013,232 kW
Total CO_2 emissions reduction throughout the improvement period	2,778 tons

and documentation of an energy management system (EMS) commenced in 2015, when it was decided to participate in the **North American Energy Management Pilot Program, an initiative of the Commission for Environmental Cooperation (CEC), in collaboration with the various Canadian, US, and Mexican energy agencies, with the aim of joining forces for improved energy performance and sustainability**. Two years later, in December 2017, Cummins Filtración SLP received its certification under the SEP (ANSI/MSE 50021) program and ISO 50001, effective for the period 2018–2021.

Organizational aspects

Thanks to the implementation of its EMS, Cummins Filtración SLP obtained its first certification for energy management systems and improved energy performance.

Among the members of the leadership team in charge of implementing the energy efficiency standards are:

- Erika M. González, environment, health, safety, and energy management leader
- Miguel E. Jasso, maintenance manager
- Gustavo Córdova, environmental engineering coordinator
- Jesús Castillo, plant services coordinator
- Raúl Castillo, maintenance coordinator

As of today, Cummins Filtración SLP holds the following certifications:

- ISO 14001:2015
- Clean Industry
- OHSAS 18001:2007
- IATF 16949:2016
- AEO (authorized economic operator)
- C-TPAT
- ISO 50001:2011
- ANSI/MSE 50021 (SEP):2012

Members of the EMS implementation team.

Energy review, analysis, and planning

Based on the SEP program and ISO 50001 processes and criteria, guidelines were drafted for Cummins Filtración SLP's energy review, analysis, and planning.

The scope of the EMS was marked out as a function of the predominant types and uses of energy at the facility, and based on documentation of energy consumption in previous years. In this way, robust background data were compiled to better interpret the plant's energy consumption and performance trends.

In addition, an inventory or record was made of all instruments and machinery, based on their "nameplate data," and, with the support of multifunctional teams (composed of personnel in charge of maintenance, production, manufacturing, finances, and operational excellence), the operation of this equipment was reviewed in terms of use and hours of operation in order to ascertain the plant's significant energy uses (SEU).

In parallel, to define the plant's energy mix, a measurement system was implemented to monitor and control energy consumption in each specific area and SEU.

Once the scope of the system and the significant energy uses at the Cummins Filtración SLP facility were identified, a number of analyses were performed, using cause-and-

effect matrices and other tools—including Six Sigma and VST process improvement methodologies—in order to document and standardize the weighting of the variables associated with the SEU.

One of the primary measures adopted as part of the implementation of the energy efficiency standards consisted of installing a real-time energy consumption meter to obtain valuable information for monitoring and measurement of equipment and machinery.

Financing

For its worldwide operations, the Cummins Inc. industrial group has a capital fund to promote impactful environmental and energy efficiency projects that will achieve timely fulfillment of the objectives set out in the company's global strategy.

This fund has supported important projects relating to water, waste management, and energy in facilities operated by the organization around the world. It was the source of the capital needed to implement the EMS at Cummins Filtración SLP, once the relevant projects had been identified and assessed to ensure that they met the established sustainability objectives and requirements.

Duration

The period allotted for the documentation and implementation of the EMS at Cummins Filtración SLP ran from May 2015 to November 2017.

Improved energy performance

Cost-benefit analysis

The calculation of the savings associated with the implementation of the EMS at Cummins Filtración SLP took into consideration the average electricity (kWh) and natural gas (GJ) costs in 2018.

"Promoting a cleaner, healthier, safer environment in every community where our employees live and work is a fundamental commitment of Cummins Inc."

Tom Linebarger, Chairman and CEO, Cummins Inc.

The energy performance trends were estimated based on data recorded between March 2013 and February 2014 (baseline), using an implementation period of March 2014–February 2017. The values obtained were assessed by a certified external auditor in December 2017.

Cummins Filtración SLP's energy performance was assessed from prior documentation and measurement of the plant's energy performance indicators (EPI), stated as "finished product per unit of measurement" or "hours worked per unit of measurement," in accordance with the key objectives and EPI set out in the global strategy of Cummins Inc. for its facilities around the world.

To this end, a statistical model based on the Six Sigma methodology was applied, along with regressions and projections of production, stated in terms of both finished product and hours of operation of the production lines for each business area. In addition, key energy performance characteristics were considered: cooling degree days, heating degree days, subassemblies, hours worked, planned downtime, and holidays.

The payback period was calculated with the following simple formula:

$$\text{Payback period} = \frac{\text{EMS implementation cost}}{\text{Annual energy-related oper. savings}}$$

$$\text{Payback period} = \frac{\text{US\$103,648.20}}{\text{US\$346,691.80}}$$

$$\text{Payback period} = 0.29 \text{ years}$$

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Method used to validate results

The energy performance results of the process were validated with the statistical model used by the SEP program.

Measures to maintain control over operations and prolong energy performance improvements

With a view to prolonging the improvements implemented and bolstering the energy performance of the Cummins Filtración SLP plant, it was decided to carry on with continuous monitoring and measurement of significant energy uses. The following practices were adopted:

- Documentation and standardization of procedures as part of the plant's quality system
- Monitoring and measurement of SEU for real-time detection of possible equipment operation anomalies
- Portable measurement of equipment or machinery (additional to the monitoring performed with the installed meter) with a view to generating new projects
- Application of engineering and administrative controls to the SEU
- Training of plant personnel responsible for machinery and equipment handling or administration (e.g., maintenance technicians, calibration technicians)
- Training of energy leaders and environmental champions

Members of the EMS implementation team.

- Use of SEU-related visual and graphic media to facilitate interpretation of energy consumption, controls, performance, and trends as well as the economic costs due to energy consumption
- Use of predictive maintenance tools for detection of further opportunities for reducing energy consumption

Promoting participation and dissemination of the experience

The EMS implementation period for the Cummins Filtración SLP plant has now concluded, and after evaluation, observation, and validation of the significant energy efficiency improvements achieved at the plant, initiatives have been taken to promote participation and disseminate the experience acquired. The relevant activities include exposure at environmental and energy forums as well as presentations to managers and visitors and in the context of corporate reviews of performance and compliance with the goals of Cummins Inc. in the area of reduced energy consumption. Furthermore, support has been offered to other business units in their certification processes, taking advantage of the experience and knowledge acquired in the field of energy efficiency.

Tools and resources

A range of equipment (including energy meters), tools, and resources were used, including:

- Portable energy and power analyzer (Fluke 435-II)
- Rockwell FactoryTalk EnergyMetrix software and web application
- SEP assessment model for energy consumption monitoring, measurement, and projections;
- Energy reviews
- Six Sigma and VST methodologies
- ISO 14001, for reference and basic considerations regarding the processes and criteria of the SEP program and ISO 50001

What we have learned

Lessons learned

Throughout the EMS implementation, the management of Cummins Filtración SLP was involved in the process and offered the necessary support for the energy efficiency initiatives and certification process. At all times throughout the process, full recognition was given to key actors:

- Corporate involvement and decisive commitment by senior management are of vital importance.
- The formation of multidisciplinary teams for project assessment and identification, as well as the promotion of participatory activities, proved to be a good strategy for the success of the EMS.
- The formation of a leadership team for implementation of the EMS is essential.
- Projects forming a part of the EMS must be carried out at all levels of the organization.
- Relying on the support of external and internal experts improved the EMS implementation.
- Various types of training were created for better dissemination and understanding of the EMS.

Keys to success

- Work as a team at all levels of the organization and obtain the full commitment of senior management.
- Have a strategy for monitoring and detection of significant energy uses.
- Train personnel at all levels to achieve objectives and goals.
- Have a capital fund to allow for implementation of energy-saving projects.

This case study was prepared for the Commission for Environmental Cooperation (CEC) as part of the 2017–2018 project, *Increasing Industrial Energy Efficiency through ISO 50001*, implemented in partnership with Mexico's ***Comisión Nacional para el Uso Eficiente de la Energía***, Natural Resources Canada, and the US Department of Energy. The CEC facilitates collaboration and public participation to foster conservation, protection and enhancement of the North American environment for the benefit of present and future generations, in the context of increasing economic, trade, and social links among Canada, Mexico, and the United States. To date, the CEC has published over 400 reports, maps, tools and resources related to the North American environment, all accessible at **www.cec.org**.