ISO 50001 Energy Management System – Case Study

2024 CHILE

EFE VALPARAÍSO

ISO 50001 Certificate and I-REC Certificate

Case Study Snapshot	
Industry	Transport
Product/Service	Railway
Location	Chile
Energy performance improvement percentage (over the improvement period)	2,24 % improvement over 2 years
Total energy cost savings (over the improvement period)	USD 31,977.00
Cost to implement Energy Management System (EnMS)	USD 15,556.00
Total energy savings (over the improvement period)	719,5 MWh
Total CO_2-e emission reduction (over the improvement period)	174,1 Metric Tons

Organization Profile / Business Case

EFE Valparaíso is a railway company committed to energy efficiency and sustainability. Our main motivation is to reduce our environmental impact and promote a more responsible business model. To achieve this, we have set clear goals that include more efficient use of energy and reducing carbon emissions.

Energy management plays a fundamental role in our business strategy, as it allows us to improve operational efficiency, reduce costs, and minimize environmental impact. By optimizing energy use in our facilities and train fleet, we can offer a more sustainable service to our customers and make a significant contribution to the fight against climate change.

"Reducing energy consumption through efficient use in all processes is imperative in the face of the climate crisis."

—Miguel Saavedra, General Manager EFE VALPARAISO

Business Benefits

The implementation of ISO 50001 has generated several additional benefits for our organization. Some of these benefits include:

Improved energy efficiency: Implementing an EnMS in accordance with ISO 50001 has helped us identify opportunities to reduce energy consumption and optimize its use, leading to greater operational efficiency and cost savings.

Enhanced corporate image and reputation: Adopting sustainable energy management practices and obtaining ISO 50001 certification has improved our image as a responsible company committed to environmental sustainability.

Regulatory compliance: Following the requirements of ISO 50001 has assisted us in complying with legal and regulatory requirements related to energy management and carbon emissions. This has allowed us to avoid potential sanctions and fines associated with non-compliance with environmental regulations.

Improved operational efficiency: Optimizing our processes and energy systems as part of ISO 50001 implementation has contributed to overall improvements in operational efficiency within our organization. This is reflected in increased productivity, waste reduction, and better management practices across all areas of our business.

Enhanced competitiveness: Energy efficiency and sustainability have helped us differentiate ourselves in the transportation market, attracting users and commercial partners who value environmental responsibility.

Reduction of Greenhouse Gas Emissions (GHG): More efficient energy management leads to reduced GHG emissions related to energy, thereby decreasing carbon footprint and contributing to the fight against climate change.

In addition to implementing the EnMS, we have obtained the I-REC (International Renewable Energy Certificate), which is a key tool in our strategy for managing energy-related GHG emissions. By obtaining the I-REC certificate, we demonstrate the renewable origin of our energy, reinforcing our commitment to reducing GHG emissions and strengthening our reputation as a sustainability-focused company.

The costs associated with EnMS implementation, including certification, amounted to USS$ 15,556. This implementation took place throughout the year 2022, with the energy management team dedicated to this task.

The savings generated thanks to the EnMS amount to 719.5 MWh over the 2 years since implementation, equivalent to USS$ 31,977.00.

In summary, the adoption of ISO 50001 has had a positive impact not only on our energy management but also on other key aspects of our operation and corporate reputation. These additional benefits further reinforce the strategic value of EnMS implementation in our organization.

Plan

For the planning and development of the Energy Management System (EMS), an approach was adopted that encompassed the following steps:

We secured commitment and involvement from top management by presenting them with the benefits associated with EMS implementation, including reduced operational costs, compliance with sustainability objectives, and decreased greenhouse gas emissions.

A significant milestone was achieved with the acquisition of the I-REC certificate, demonstrating that the energy matrix feeding EFE Valparaíso is sourced 100% from renewable sources, backed by the commitment and involvement of top management.

Furthermore, top management demonstrated their commitment by establishing a team for the energy management system and providing resources for both implementation and continuous improvement of the system.

The EMS was aligned with the organization's strategy and objectives, integrating into processes and developing an energy policy under top management supervision.

To achieve the objectives, the collection of data including energy, mileage, number of services, passengers transported, is fundamental and is carried out daily, with this information stored in a database for availability.

Energy data is categorized into two types of consumption: traction and low voltage. Having daily data enables us to estimate that traction consumption accounts for 80% of the total consumption, while 20% corresponds to low voltage (buildings, stations, fans, etc.). As a result, it was determined that the first step to follow should be to generate efficiency in the most significant use, which in this case is traction energy. Additionally, thanks to all the available data, it was determined that there are three types of differentiated workdays: weekdays (Monday to Friday), Saturday and Sunday, and holidays.

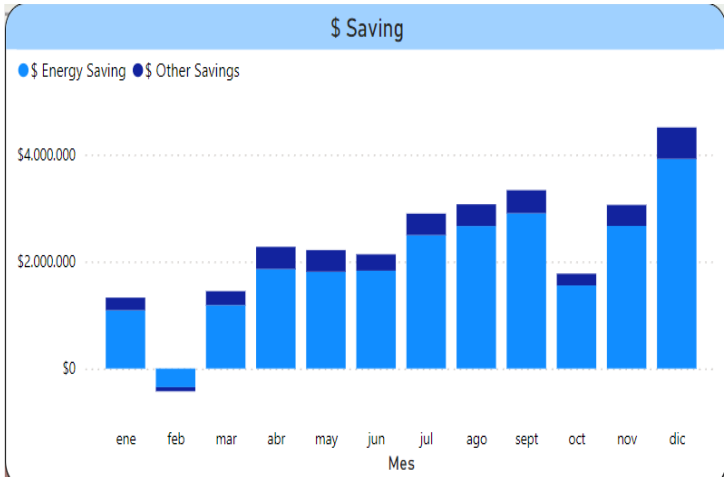
The management system team collects and analyzes data to ensure traceability and identify improvement opportunities, regularly reviewing energy usage, identifying trends, and detecting deviations from established objectives.

These analyses led to prioritizing measures for the EMS, focusing on a more efficient use of rolling stock, which does not involve projects or investment in technology.

In design projects, including modification or renovation, acquisition of equipment and services, opportunities to improve energy performance and operational control are evaluated, especially in facilities, equipment, systems, or processes that may have a significant impact on EFE - Valparaíso's energy performance.

Currently, the implementation of an electromobility project is being analyzed, which would include the installation of chargers and the necessary infrastructure for interurban buses, contributing to the reduction of greenhouse gas emissions.

"The implementation of the EnMS is a tremendously significant step for an energy-intensive company like EFE Valparaíso, which operates a fleet of electric trains and positions itself as a leader in electromobility in the Valparaíso Region, providing sustainable transportation to thousands of people every day."
— Miguel Saavedra, General Manager EFE VALPARAISO



In this graph, the monthly savings generated by the implemented initiatives are shown month by month.

Do, Check, and Act

During the implementation of the Energy Management System, various key departments of the organization were involved, including operations and rolling stock maintenance. This implementation was carried out through a multidisciplinary team coordinated by the leader of the management system appointed by top management. This team was responsible for developing and implementing specific plans for each area of the organization, ensuring consistent and effective execution across all company operations.

Top management provided strong support and commitment throughout the SGE implementation process. From the outset, they recognized the strategic importance of energy management and actively supported all related initiatives. Adequate financial resources were allocated to support the implementation. This support was crucial to the success and results of the SGE.

To demonstrate the effectiveness of the SGE, energy uses and consumption are analyzed, as well as the energy sources used in the organization. This process aims to generate a baseline scenario for projection and identify energy systems with the highest associated consumption, thus identifying potential improvement opportunities and establishing operational controls.

Through these analyses, while there are many variables (services, number of trains, passengers), the variable that directly influences energy consumption is the mileage covered by rolling stock on a daily basis, and this relationship between traction energy and mileage determines the energy performance indicator.

Energy performance indicators (EPIs) are quantitative values or measures of energy performance that allow for the comparison of performance trends over time, across different processes and/or systems, or between different locations.

The main conclusion drawn from the energy review is that the Significant Energy Use (SEU) is primarily employed in traction, i.e., in the circulation of trains for passenger transport and other movements necessary to fulfill its services.

Consequently, EPIs are constructed to relate the electric traction energy consumption to the number of kilometers traveled as follows:

$$EPI = \frac{Traction\ Energy\ [kWh]}{kilometerage}$$

A significant milestone within the EnMS is the baseline analysis (LBE) as it allows obtaining a projection of energy consumption over a specific period. This is achieved by relating electricity consumption to independent variables that directly influence energy performance.

With the developed projection, it is possible to compare the analyzed time periods before and after the implementation of energy efficiency measures and/or EnMS execution. This should demonstrate energy savings after their implementation under the same conditions.

Significant energy use (SEU) is directly associated with traction, related to train circulation. From this, 3 baseline lines were developed according to the type of workdays: workday, Saturdays, Sundays, and holidays. Each equation is carried out through regression with 2022 traction energy and kilometerage data, according to the type of workday:

Workday baseline line:

$$EPI = \frac{Traction\ Energy\ [kWh]}{kilometerage} = 3{,}91$$

Saturday baseline line:

$$EPI = \frac{Traction\ Energy\ [kWh]}{kilometerage} = 4{,}15$$

Sunday and holiday baseline line:

$$EPI = \frac{Traction\ Energy\ [kWh]}{kilometerage} = 4{,}49$$

The energy goals established should be associated with objectives and, to the extent possible, should have feasible measurement indicators to evaluate their achievement.

At the end of the period (annually), a comprehensive review of the energy objectives and goals and their fulfillment is conducted. This information will be incorporated into the presentation prepared for the periodic review of the Energy Management System (EnMS).

In addition to regular reviews, extraordinary reviews may occur whenever it is deemed necessary to make changes to the energy objectives and/or goals, whether due to changes in legislation, third-party requirements, infeasibility with what is proposed, the incorporation of new technologies or production processes, or organizational restructuring, among others.

To achieve the expected results, different initiatives are proposed to reduce traction energy consumption, including:

Traction at 75% for weekdays and 50% for Saturdays, Sundays, and holidays: To achieve the traction effort reduction objectives, a mechanical device was implemented in the train manipulator. This device allows reducing the maximum traction effort by 75% on weekdays and by 50% on weekends.

Fleet Management: This measure consists of carrying out scheduled train circulation but with efficient use of rolling stock (UMR), i.e., all scheduled services are performed, implementing measures that involve savings in circulated mileage without failing to provide transportation services. In the case of services planned to run in double units (2 units) from Limache, with low passenger load density, they start as a single unit from Limache, and at El Belloto or Sargento Aldea station, they can couple with another unit of Rolling Stock to run in double composition to Puerto. This management is called coupling. And for trains leaving Puerto station in double composition, whenever their load density is low, they can switch to single composition at El Belloto or Sargento Aldea station, this is called cutting or uncoupling. To determine the energy savings resulting from this measure, the number of services that coupled or cut is calculated, and the kilometers not traveled are added. This mileage has an energy consumption associated with the EPI of the day the couplings and cuts were made.

The goals established for the year 2023 were exceeded, as observed in the following table:

Aim	Goal	% Saving
Work Traction Energy	0,3%	0,77%
Traction Energy Saturday	1,0%	3,79%
Traction Energy Sunday and Holidays	1,0%	5,58%
Fleet Management	0,5%	0,57%

To determine the baseline and calculate savings resulting from fleet management, we only use the Excel and Power BI tools for data consolidation and review.

Knowing that the annual energy consumption is approximately 16 [GWh/year], we obtain the I-REC certificate for all the organization's energy consumption, ensuring that any energy consumed comes from a Renewable Energy Source (ERNC), resulting in a greenhouse gas effect of 0.

To implement operational control in our Energy Management System, we followed a structured approach that involved the following steps:

Identification of significant energy aspects

Establishment of energy objectives and targets

Development of procedures

Monitoring and follow-up

Staff training and awareness

Review and continuous improvement

In summary, through a systematic and proactive approach, we successfully implemented operational control in our EnMS, allowing us to effectively manage our energy consumption and continuously improve our energy efficiency.

To ensure continuous improvement, a series of procedures supporting the EnMS have been developed. Among these procedures is the design and acquisition, which allows establishing energy considerations for designing new facilities, modifications, and renovations of systems, equipment, and energy-consuming devices, considering the expected operational life. Additionally, energy criteria are established for the acquisition of goods and services related to Significant Energy Use (SEUs), and if necessary, these criteria can be applied to other energy-consuming equipment.

To prepare for the EnMS audit, a series of planned and coordinated activities were carried out, including:

Internal review: A thorough review of our internal EnMS was conducted to ensure compliance with all established requirements and standards. This included a detailed assessment of our documentation, procedures, and records related to energy management.

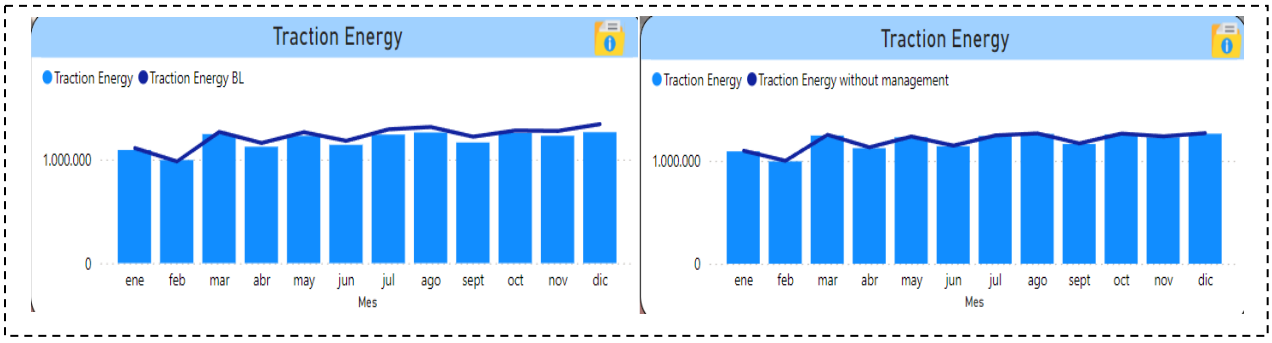
Staff training: Additional training was provided to staff involved in the EnMS to ensure their full understanding of processes and procedures. This included informative sessions on the requirements of ISO 50001, as well as any specific training needed for particular areas of the EnMS.

Document preparation: All relevant EnMS documents, such as manuals, policies, procedures, and records, were reviewed and updated to ensure they were complete, accurate, and aligned with the requirements of ISO 50001.

Internal Audit: Internal audits were conducted to assess our readiness and identify potential areas for improvement. This involved conducting simulated audits using the same procedures and criteria that would be used during the external audit.

Final review: A final review of all relevant documents and records was conducted to ensure they were in order and ready for review by external auditors.

In summary, our preparation for the EnMS audit focused on ensuring that our system was fully aligned with the requirements of ISO 50001 and that we were fully prepared to demonstrate our compliance during the audit.



The first graph shows the actual traction energy consumption (bars) compared with the traction energy provided by the generated baseline (line). The second graph shows the actual traction energy consumption (bars) and compares it with the traction energy if fleet management had not been carried out.

Transparency

To publicly announce our organization's ISO 50001 certification, we conducted strategic actions to communicate this significant achievement:

Press Release: We issued an official press release announcing our ISO 50001 certification. In this release, we highlighted relevant details about the scope of the certification and the benefits it represents for our organization. Additionally, we expressed our ongoing commitment to improving our energy processes and practices.

Social Media Posts: We utilized our social media platforms to share the news with our followers and passengers. We posted messages emphasizing the benefits of ISO 50001 certification and our commitment to sustainability and energy efficiency, such as reducing environmental impact and contributing to the fight against climate change.

Corporate Website: We updated our corporate website to include detailed information about our ISO 50001 certification. Procedures, manuals, and instructions were also added to make them accessible to the organization.

What We Can Do Differently

Even though the implementation process was successful, areas were identified that presented difficulties due to EFE Valparaíso's direct dependence on EFE Headquarters. This situation has hindered the dissemination of the EnMS to all areas of the organization. To address this challenge, it would have been beneficial to involve these areas more in the process of designing procedures and raising awareness about the importance of the EnMS.

Regarding the next steps of the EnMS, in addition to maintaining all current processes, training sessions, awareness campaigns, follow-ups, and measurements will continue to be carried out. Furthermore, active exploration is underway for the implementation of new technologies, such as solar panels, which can help us further improve our energy efficiency and contribute to the reduction of greenhouse gas emissions.