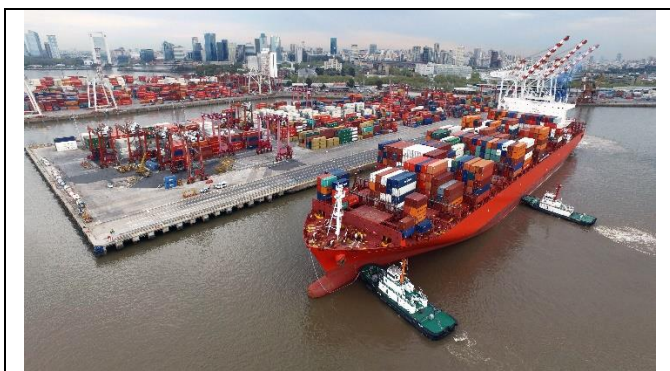


ISO 50001 Energy Management System Case Study

Argentina

Terminales Río de la Plata

19.5% Energy Performance improvement with total cumulative energy cost savings of \$2 m since baseline year 2013.



TRP - Terminals 1, 2 and 3, Buenos Aires Port - Argentina

Organization Profile & Business Case

Company Profile: Terminales Río de la Plata (TRP), is located in Puerto Nuevo, Buenos Aires, capital city of Argentina. It is formed by DP World, Latin American Infrastructure Fund and other International partners. DP World, responsible for the Management of the Terminal, is one of the main global port terminal operators, with more than 78 Terminals around the world. TRP, with an investment of at least USD 220-million, has an operation capacity of 740,000 TEUs (Twenty-foot -Equivalent Unit) and a 430,000 square metre operating area. Our mission is to make TRP the leading Container Terminal in South America, by providing the best service in a sustainable way.

“TRP decided to be part of the change focused in building sustainability, and our EnMS have become a fundamental pillar towards our mission”

—Beatriz Cabella, HSE & IMS Manager.



Solar cells and Solar heaters

Case Study Snapshot

Industry	Ports
Product/Service	Freight Container Services
Location	Buenos Aires Port - Argentina
Energy management system	ISO 50001
Energy performance improvement period	4 years
Energy Performance Improvement (%) over improvement period	19.5 %
Total energy cost savings over improvement period	2,013,300 \$USD
Cost to implement EnMS	61,600 \$USD
Total Energy Savings over improvement period	85,230 (GJ)
Total CO₂-e emission reduction over improvement period	9,278 (Metric tons)

Energy Management System (EnMS) drivers: Lined up with DP World Sustainable Development Goals, in TRP we have decided to “be part of the change taking the challenge”, focusing in building sustainability at each activity we undertake and assuming a leading position in the protection of our environment in our business activities. The Energy Management Program intends to

compliment DP World’s energy reduction strategy with focus on employee education, clear energy performance tracking, and reduction of our energy footprint up to a minimum to ensure a sustainable business model. The results achieved clearly demonstrate that even the smallest contribution makes a difference to someone, no matter who or where they are.

TRP is the first terminal in DP World to be certified (July 2014) under ISO 50001 - Energy Management Standard. The ISO 50001 program was initiated during 2012 to ensure a continuous focus and an effective proven management system was implemented to meet our goals. We aimed the program to be very innovative by identifying low cost solutions and focusing on operational controls (especially in human behaviors) to ensure maximum performance. The scope includes all freight container and associated services in Terminal processes. General cargo was insignificant during this case study period and is not included.

Business Benefits

Since the beginning, our EnMS has brought many benefits. TRP has reduced its energy footprint by 19.5 percent with low implementation capital expenditure and engineering controls, producing a total of 85,230 GJoule savings in a 4-year period, that also represents environmental and social benefits because it means 9,278 Metric tons of CO2-e emissions reduction. Total Energy Savings of 2,013,300 USD were reached, with an EnMS implementation cost of 61,600 USD.

Table below shows reductions achieved until 2017 of our energy performance indexes versus baseline period (calendar year 2013):

Reduction for indexes (*)	2017
Diesel (vs. 2013)	13.7 %
Electricity (vs. 2013)	29.2 %
Total Energy (vs. 2013)	19.5 %

(*) the Total Energy index includes gas contribution (this has a low share of 2 to 3% of the total energy). Gas has been reduced by 38.7% vs. 2013.

The EnMS also brought about the following benefits:

- Profiting from a comprehensive business vision shared by all areas and structured on the Integrated

Management System that focuses on the responsible and sustainable energy resources management.

- Better understanding of our energy aspects and identification of potential efficiencies, improved data collection and thus, decision making.
- Reducing negative environmental impacts and greenhouse gas emissions.
- Improving reputation, being recognized as a committed leader in our local and global community.
- Outstanding active participation of the personnel and stakeholders.
- Competitive advantages over our local competitors and by operational efficiencies improvement and reducing our cost structure.

During 2017 TRP was awarded by the AmCham – US Chamber of Commerce of Argentina – with the "Corporate Citizenship Award" in the Sustainable Environment Initiatives’ category in the topic "Use of Energy" for our Energy Management, and during 2014 our EnMS was awarded by our global corporative Environmental Awards.

Cost-Benefits: Costs summary of EnMS implementation are detailed below.

Cost to implement - EnMS	Cost (\$USD)
Internal Staff time to develop and implement the EnMS	9500
Internal staff time to prepare for external audit	2000
Additional monitoring and metering equipment installed to meet EnMS requirem.	0
Third party audit costs	5200
Technical assistance (e.g. hired consultants to assist with EnMS implementation)	43200
Other (e.g. internal communications)	1700
Total	61600

The main costs were related to technical support for the implementation. Additionally, 1,844,000 USD were invested in equipment and infrastructure (engineering) to improve energy efficiency. Totalizing 1,905,600 USD investments with a payback period of 3.8 year. We used approx. 1 year of internal/external staff time to develop and implement EnMS. Of Overall Savings, Engineering investments represent less than 45% while EnMS actions (including operational controls) more than 55%. Thus, EnMS implementation payback was of 0.22 year.

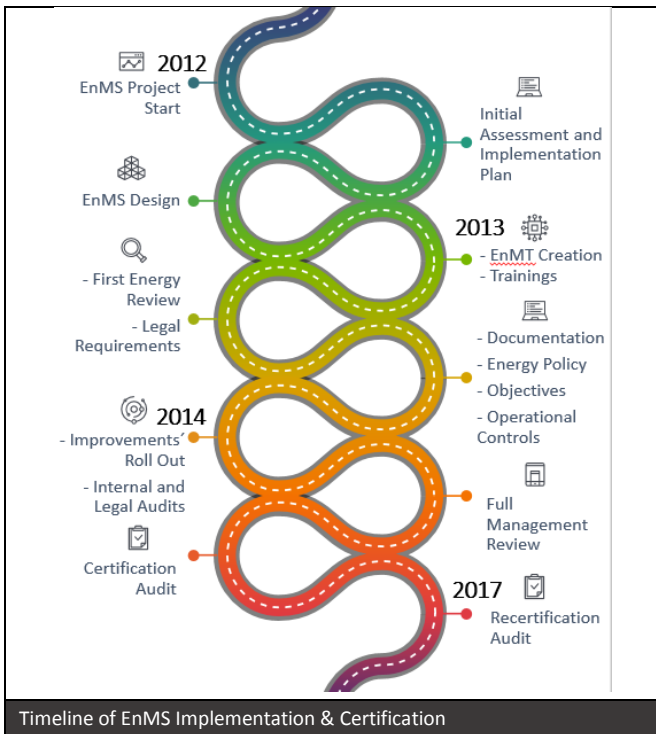
Plan

The initial decision to implement an EnMS based on ISO 50001 was taken during 2012, by the Director of Human

Resources (Management Representative for the already certified ISO Management standards), who fostered it and, in this way, established the energy management as part of the vision and the business strategy.

TRP implemented and integrated its EnMS with its Integrated Management System (IMS) of Quality, Environment, Supply Chain Security and Occupational Health & Safety, that was already certified based on ISO 9001, ISO 14001, ISO 28000 and subsequently in OHSAS 18001. The program was totally funded with company's own resources. As support for the design and implementation of the system (including trainings), an ISO 50001 implementation consultancy was hired.

The timeline with the most important milestones is describe below.



Energy Review: comprehensive identifying of Significant Energy Uses (SEUs) and consumptions, related EnPIs, Baselines (EnBs) and personnel, and Improvement Opportunities.

Energy Objectives and Goals, linked to an **Energy Management Plan (EnMP)** establishing actions and improvement goals in line with the **Energy Policy**, that address technology changes and improvements but also a review of processes in terms of their behavioral aspects. In this EnMP we separate Technological from Operational Control actions and subsequently we can estimate its specific impacts and savings.

Operational control definition: Process settings, measurements, maintenance task controls, purchasing specifications, monitoring controls.

Energy Management Review: revision and decision making of the whole EnMS.

Energy Management Team (EnMT): proved to be an essential support towards the implementation and the continuous review of the system.



EnMS Design Strategy, Implementation and Monitoring: The design strategy used in the EnMS implementation was based on three key pillars:

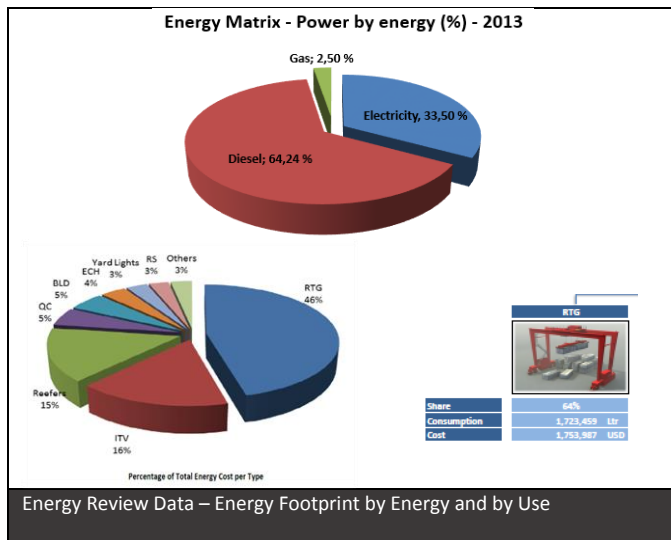
1. Planning, development and monitoring of technical issues: The EnMS and associated tools set the foundations for a proper energy reduction planning. Most important tools are:

2. Personnel and stakeholder awareness: The participation and commitment of personnel and other stakeholders were considered essential for the successful implementation of the EnMS and getting support and buy-in from our employees, their families, and the local community. This type of contributions creates a positive and multiplier effect on the society. We resorted to a range of communication strategies that included tips for the workplace and home.

3. Technological Improvements: Ensure, through hard controls, a sustainable performance despite the behavior and operational changes. These include the installation of alternative and renewable energies, more efficient

equipment and devices to avoid misuse of energy in the processes and services.

Energy Review: The first Energy Review was carried out through a Corporate Energy Audit during April 2013. Main consumptions and uses (SEUs), were identified and a plan of actions and recommendations was defined. Subsequent local energy reviews, periodically done by EnMT, incorporating more details and information on aspects focused on personnel’s behavior and their rational use of energy, and the analysis of various processes. The review became a fundamental tool to complete the planning, improve measuring and data collection, define suitable EnPIs and related baselines, objectives, improvement opportunities and potential saving topics.



Energy Review Data – Energy Footprint by Energy and by Use

Using data collected taken from our meters of electricity (2 meters, and 15 sub-meters), diesel (2 meters) and gas (1 meter) we were able to identify and quantify several uses and define the significant ones. No additional meter’s installation was needed.

Opportunities are compared using a scored matrix which follows several criteria (saving potential, paybacks, etc.).

Reduce RTG Idling					Opportunity Evaluation	
1	2	6	10	15	Score	Comments
2	5	9	14	19	Savings	2 \$ 150,987/Annum
4	8	13	18	23	Cost	0 No Cost
7	12	17	21	26	Payback	0 Immediate
11	16	20	24	28	Time	1 Less than 6 months to plan and implement improvement programme
					Project Mgmt	2 Terminal Working Group
					TOTAL	5 IMMEDIATE

Energy Review - Opportunities Assessment

“ISO 50001 allowed us to clearly identify uses and its potential improvements, track performance and efficiently gather human energies to reach our energy goals.”

—Pablo Baseggio, Head of IMS.

Do, Check, Act

The top responsibility to watch over the EnMS was assumed by the Human Resources Director (Management Representative) along with IMS Department. Every manager provided support and collaborated with the EnMT (Management Team). The EnMT, led by the Head of IMS and comprising representatives from different areas (HR, Operations, Engineering & Maintenance, Purchasing, HSE, IT and EnMS consultant), carried out and boosted the EnMS requirements implementation and improvements, and fostered the participation of different stakeholders.

A key towards implementation and maintenance is Top management motivation and support. Different actions, recognition to the members of the EnMT, acknowledgments and prizes to those who present concerns, suggestions and participate in campaigns and contests are carried out. Also, Energy Objectives are linked to an annual bonus. All achievements and performance are communicated.

ELECTRICITY SAVED: From 2013 to 2017	DIESEL AHORRADO: Desde 2013 hasta 2017
<p>ELECTRICITY CONSUMPTION OF 3900 HOMES</p>	<p>CONSUMO DE DIESEL DE 650 AUTOS</p>

Energy performance improvement communication examples.

All cost-benefits resources are assured and included in a year basis budget.

EnMS implementation was structured on data gathering and calculation using Excel spread sheets.

The targets are focused in the improvement of performance of the three types of energy we use, Diesel, Electricity, and Natural Gas and its related SEUs. In general, the goals were achieved.

Key activities identified and implemented:

a. Communication/awareness/training:

- Training and outreach activities, toolbox meetings.
- Internal Auditors training in an accredited entity.
- Induction activities and Energy Efficiency Video.
- Campaigns, Energy efficiency week, participation with improvement recommendations and Trivia Games with raffles and prizes.
- Labeling on light keys, equipment and signage.
- Periodic communications to our stakeholders.

b. Operational Controls:

- Standardized procedures. (Settings: 24 °C-AC, PC in Energy mode, water heaters, Lighting ON /OFF, etc.)
- Reducing idle times. Turning off equipment between shifts (especially Diesel RTG -blocks cranes).
- Improving allocation of equipment for each operation through streamlining of planning.
- Energetic analysis of specific processes, monitoring performance through general and specific EnPIs.
- Energy Snapshots (Work interaction visits).

c. Technological Improvements:

- Renewables: Facilities power-assisted by an onsite solar panel system and solar energy water preheaters reducing gas usage.
- Ten new (fuel saving tech.) internal tractors (ITV).
- Fuel-saving Engine Variable Speed Control System (EVSC) in RTGs.
- Automatic idle time reduction in Diesel Cranes (RTG).
- Low consumption light fixtures in Yard, Quay cranes and Buildings.
- Skylights (improving use of natural light) in Buildings.
- Efficient Equipment Purchases (e.g. Inverter AC).
- Switches and automatic lighting turn off systems for each quay crane, reefer racks, Office-Restrooms).

In addition to this, new procedures were generated, all operational controls were listed in a document and

communicated to each area using an extract as applicable. Purchasing and acquisitions, Supplier Evaluation and Management of Change (Projects and processes) processes were modified, including a must of considering energy efficiency aspects.

Energy Performance improvement: We define our **Total Energy Intensity Index** (of our site/scope): measures the amount of energy consumed by all type of energies (expressed in MJoule) and the term Total Terminal Movements (TTM) is used as a normalization factor:

$$= \frac{\text{Diesel (l)} * \text{DECF} + \text{Electricity (kWh)} * \text{EECF} + \text{Gas (m}^3\text{)} * \text{GECF}}{\text{Total Terminal Movements}} \left(\frac{\text{MJ}}{\text{TTM}} \right)$$

Where,

Energy Conversion Factors to M/Joule		
Diesel (ltr.)	Electricity (kwh)	Gas (m3-9300 kcal)
DECF	EECF	GECF
38,7	3,6	38,9

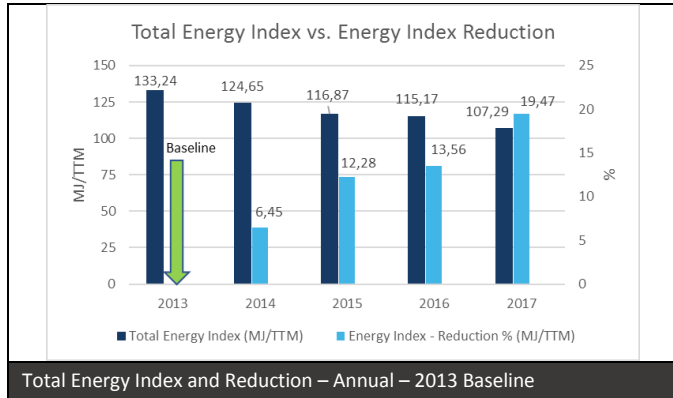
Thus, energy consumption is based on the actual movements within the terminals (Ship-Dock + Yard equipment). This index has been defined at a corporate level and allows the comparison between business units. To determine performance improvements, as well as, baselines, annual periods, which consider seasonality, are used. Other driving/governing factors and normalization methods were analyzed to define other Energy Indexes-Performance EnPIs being some factors used for specific process EnPIs, and to analyze its performance.

We define 2013 as baseline given that the saving actions had not been rolled out yet at that time, during that year the data was clearly verified guaranteeing its accuracy. Thus, Total energy performance improvement is determined by comparing Total Energy Index of Reporting Period (R) against Total Energy Index of Baseline period (B) (2013):

$$\text{Percent change} = \left(\frac{\text{R} - \text{B}}{\text{B}} \right) * 100$$

During this period (2013-2017), there have not been changes in factors that justified a baseline adjustment.

Energy Index by type of Energy: An EnPI of each type of energy (Diesel, EE, and Gas) is generated in MJoule/TTM, and its specific performance improvement is determined in the same way as Total Energy Index. In complement to that, each process related to the SEUs has its specific EnPIs and operational controls (e.g., RTG fuel consumption per box moved or per hour of using).



Effectiveness of the EMS and results driven focus: Based on the monitoring of Total and each energy EnPI's results, we are able to verify that the actions implemented towards a better management of energy have been effective, according to their proven reduction. Reliable data of measurement is ensured calibrating and contrasting periodically (month and yearly) our own meters against the energy suppliers' bills data, with the support of a specialized consultancy in measurement and billing. These are regularly audited.

EnMS Maintenance - Monitoring performance: During EnMT monthly meetings performance and recommendations are monitored and analyzed, EnMP and compliance with legal requirements follow-up is made, and corrective measures are carried out. We have implemented Energy Snapshots (Work interaction with

people to enhance awareness and detect findings). Complementary to that, periodic internal and external audits, as well as, EnReview and EnMReview ensure its continual improvement.

Transparency

TRP has announced its ISO 50001 certification through different means of internal and external communication (web page). The commitment with this standard is communicated periodically. Information of energy management and reductions in CO2 emissions is reported periodically to our Head Office, used for corporate reports and part of the information for the Global CDP (Carbon Disclosure Project). Annually, the data is verified by Bureau Veritas Cert (Certification Body) external audits and validated by external experts of ISO 26000, sustainability reports, and GRI (Global Reporting Initiatives).

Lessons Learned

- Low cost changes can produce large savings, especially those related to energy use behavior.
- Operational controls and process efficiency can drive best results than technological change.
- Motivation is a key factor, as well as, the active participation and commitment of all personnel and stakeholders. Each one makes the difference and change comes about among all.
- Importance of acknowledge and reward energy accomplishments and personnel empowerment.
- Top management involvement.
- The EnMTeam work and support relevance.

If we did it again, we would take personnel awareness and motivation actions as soon as possible, and would

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.



emphasize on monitoring with an earlier periodic Snapshots implementation. Also, we would get in contact with other organizations that have gone through an EnMS implementation to exchange experiences and approaching strategies.