

energia cria energia

galp



Operational eco-efficiency in Refineries

CONTENTS

BACKGROUND	3
STRATEGIC APPROACH	3
RELEVANCE TO STAKEHOLDERS	4
ACTIONS AND MEASURES	5
RESULTS ACHIEVED	5
RESULTS ACHIEVED	5
ECONOMIC IMPACTS	7
SOCIAL IMPACTS	8
CONCLUSIONS	8
NEXT STEPS	8
REFERENCES	9
AUTHOR(S)	9
ATTACHMENTS	10

Operational eco-efficiency in Refineries

BACKGROUND



STRATEGIC APPROACH

Our strategy

The increasing scarcity of resources puts its management and use as one of the great challenges of today. This challenge is assumed by us and, for that purpose, we are committed to eco-efficiency, to the efficient consumption of resources, the minimization of negative impacts and the maximization of environmental, technical and economic benefits.

According to our strategy, we are committed to continuously improving the sustainability of our operations with focus on operational eco-efficiency and energy efficiency in the refining system.

In this context, our strategic goals are:

- Gradually evolve towards the best market benchmarks in terms of emission intensity and energy efficiency.

Galp's Commitments:

At Galp we are committed to **ensuring the protection of people, environment and assets.**

Additionally, we are committed to help to **satisfy future energy needs** and **minimize the intensity of the carbon footprint.**

Sustainable Development Goals (SDG)

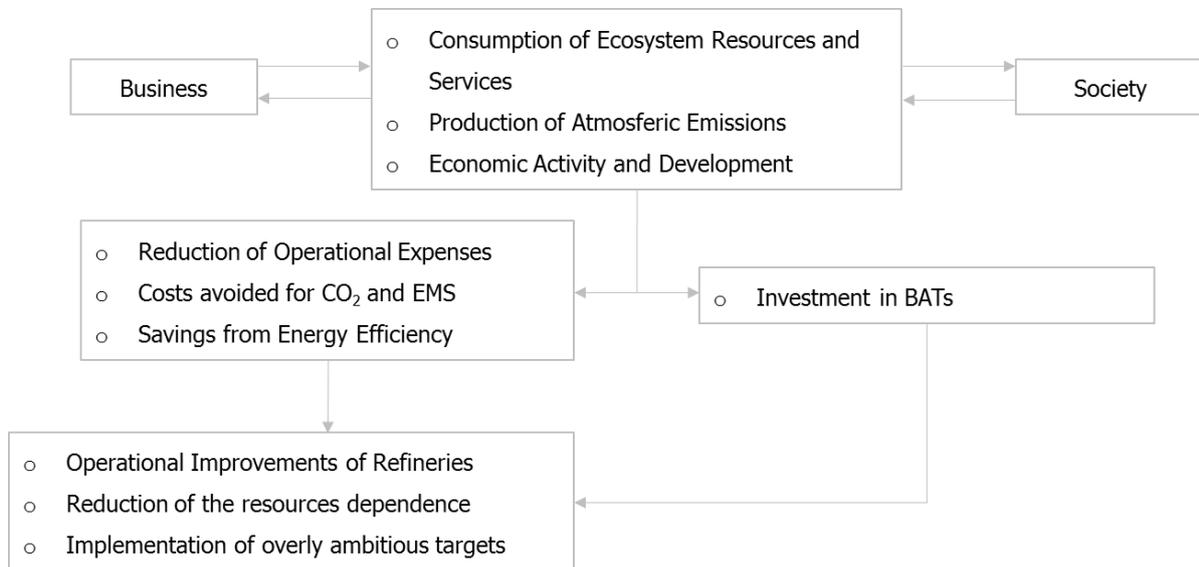
- 7** Ensure access to affordable, reliable, sustainable and modern energy for all.
- 12** Ensure sustainable consumption and production patterns.
- 13** Take urgent action to combat climate change and its impacts.
- 15** Protect, restore and promote sustainable use of terrestrial ecosystems.
- 17** Strengthen the means of implementation and revitalize the global partnership for sustainable development.

- Identify and mitigate impacts associated with trends and regulatory requirements, particularly with regard to emission limits in the refining phase.
- Identify exposure, in the medium term, to the physical risk climate change and draw up plans or adaptation measures.
- Link social responsibility programmes with Refining & Marketing and climate changes strategies.

This approach will allow Galp to contribute to the protection of the ecosystem services and reduce the carbon footprint resulting from the activity, thus ensuring the protection of the people, environment and assets.



Operational eco-efficiency in Refineries



Approach according to the methodology of the Natural Capital Coalition Protocol

Relevance to Stakeholders

The Refining business segment processes raw materials in two refineries, Matosinhos and Sines. These refineries have a total refining capacity of 330 thousand barrels of crude oil a day, i.e. 20% of Iberian Peninsula's refining capacity.

One of Galp's strategic objectives for Refining business is the "Focus on energy efficiency and process optimization of the refining system, both on reductions in cost and in capital employed". Under that driver, we take operational eco-efficiency as a strategic issue incorporating the risks and opportunities inherent to its management.

The operational eco-efficiency was identified, by Galp's top managers and by our stakeholders, as a material issue for our activity. Taking into account the indicators related to operational eco-efficiency, the refineries represent, in general terms, the greatest materiality (over 90%) in the universe of our facilities.

Operational eco-efficiency in Refineries

ACTIONS AND MEASURES

Our approach

At Galp, we continue to invest in the implementation of new energy efficiency measures in our refining equipment, even after the upgrade project for Matosinhos and Sines refineries, the most ambitious industrial project developed in Portugal.

This project had as objectives to adapt the refining system to new trends in demand in fuel markets and improve refineries' performance, in order to enable them to achieve benchmark levels in terms of energy efficiency, through the modernization of facilities and processes. The implementation of these measures involved an energy efficiency plan for each refinery, with the ambitious objective of making them into benchmarks for the industry in the short-term.

Taking into account the control and reduction of atmospheric emissions measures are taken to reduce the atmospheric emissions in the refining operations, making these operations and products increasingly sustainable, through the implementation of the best available technologies.

Measures to Improve Eco-efficiency

- Optimization of the combustion systems;
- Adjustment of the fuel portfolio, giving preference to fuels with lower carbon and sulphur content;
- Introduction of nitrogen oxides reduction additive into the fluid catalytic cracking (FCC) catalyst;
- Integration of the new fuel specifications, minimizing environmental impacts from commercialized products utilization;
- Establishment of objectives and targets based on key performance indicators (KPIs).

All the action related to the operational eco-efficiency improvement have as common denominator the maximisation of the efficiency of the use of resources and the minimisation of the environmental impacts.

RESULTS ACHIEVED



In the last three years, we have reduced the consumption of direct energy by primary sources and raw water per feedstock processed. On the other hand, there has been an increase in the production of waste and wastewater per feedstock processed.

This increase is the result of situations outside normal refining activity, such as maintenance works on certain units or the variation in rainfall levels.

Refinery indicators	2013	2014	2015	2016	Δ 2013 - 2016
Direct energy consumption by primary sources per feedstock processed (TJ/mmboe)	397	373	377	376	-5%
Consumption of raw water per feedstock processed (10 ³ m ³ /mmboe)	87	84	73	75	-14%
Wastewater per feedstock processed (10 ³ m ³ /mmboe)	44	47	46	48	+9%
Waste produced per feedstock processed (t/mmboe)	131	150	159	196	+50%

Moreover, there is also an increase of activity, especially the start-up of Fabrication III at the Sines Refinery.

Operational eco-efficiency in Refineries

ENERGY EFFICIENCY

Sines Refinery performance

Indicator	2013	2014	2015	2016	Δ 2013 - 2016
CO ₂ /CWT	37.7	32.9	32.1	31.8	-16%
EII (%)	101.0	92.7	94.6	92.9	-9%

Matosinhos Refinery performance

Indicator	2013	2014	2015	2016	Δ 2013 - 2016
CO ₂ /CWT	31.7	28.2	26.6	28.9	-9%
EII (%)	84.4	82.7	80.9	81.0	-5%

Sines Refinery continues to pursue the established objective, to achieve leadership in Availability and Energy Efficiency in Western Europe as well, setting the objective of achieving the first quartile in 2019. It has been launched also in Sines the project for the implementation of Reliability Centered Maintenance (RCM) methodology, which yielded visible outcomes resulting in a positive trend throughout the second quartile.

Matosinhos Refinery accomplished its commitment: to sustain the positioning in Availability and Energy Efficiency while maintaining its leadership in Western Europe in terms of these indicators (CO₂/CWT e EII) in the past years.

THE REFINERIES' ATMOSPHERIC EMISSIONS CONTROL AND REDUCTION

The measures that have been continuously implemented had led to a better performance of our refining system through reductions in atmospheric emissions expressed in the numbers below when comparing 2016 to 2006.

-76%	-73%	-87%
NO _x emissions	SO ₂ emissions	Particulate matter emissions

These results show that Galp's refineries have followed the EU atmospheric reduction trends.

Such performance is compared below with the data available at the European Environment Agency (at EEA website) for the period from 2005 to 2013, particularly in the context of the refinery industry average in the 28 Member States. Comparing the values, it is perceptible that our company is in line or exceeds industry trends in the geography in which it operates.

(2005-2013)	UE	Galp
NO _x	-65%	-71%
SO ₂	-59%	-58%
Partículas	-33%	-70%

Operational eco-efficiency in Refineries

ECONOMIC IMPACTS



Since 2013, the use of eco-efficiency measures has led to savings of more than € 125 million.

Expenses, investments and savings/ cost avoidance

(M€/year)	2013	2014	2015	2016
Investments	9.99	3.45	8.33	11.17
Operational expenses	9.51	7.77	5.34	4.61
Total expenses	19.51	11.23	13.68	15.79

(M€/year)	2013	2014	2015	2016
Total expenses	19.51	11.23	13.68	15.79
Savings and cost avoidance	31.13	39.61	30.37	24.06
% of operations covered	100	100	100	100

The savings and cost avoided have remained at levels considerably above the total expenses (in capital investment and operational expenses) in improving the operational ecoefficiency. This means that the investments have been effective and generated return, which confirms the success of the strategic decisions taken, enabling medium and long-term benefits.

The operational expenses related to the environmental management systems at the refineries have been reduced since 2012, because of the improvements resulting from the eco-efficiency strategy.

The investments made in 2012 and 2013 were based on the BATs, as part of the refinery conversion project. The investments made since 2013 are essentially related to energy efficiency.

The saving and costs avoidance include: annual savings related to environmental management; CO2 cost avoidance (2012 - 2016); Energy efficiency savings (2013-2016); Water reuse benefits; Savings from electricity purchased by the refineries (2013-2016).

Operational eco-efficiency in Refineries

SOCIAL IMPACTS

The social impacts resulting from the operational eco-efficiency improvement of the refining activity are in line with the already mentioned Sustainable Development Goals (SDG). The measures taken, mainly in terms of energy efficiency and the control of atmospheric emissions will, at the end, produce the following benefits for the society:

- Access to affordable, reliable, sustainable and modern energy for all;
- Promotion of responsible patterns of consumption and production;
- Implementation of measures to combat climate change and associated impacts;
- Protection, restoration and promotion of the sustainable use of terrestrial ecosystems;
- Implementation and revitalisation of a global partnership for sustainable development.

Galp intends to contribute to the pursuit of these objectives for society in general by promoting the actions, measures and goals already mentioned, besides to the plans outside the scope of refining. If at the global level we want to contribute to the social welfare, namely through the SDG, at local and regional level the benefits from the eco-efficiency impacts may be more significant.

The measures regarding the energy efficiency and the responsible consumption and production will reduce the pressure on local resources, and in the future, they may also contribute to a reduction in the production of waste and wastewater. The atmospheric emissions decrease from direct emissions control measures, besides the energy efficiency measures, will also produce benefits for the local population, namely air quality.

In summary, the results achieved minimize the negative impacts of the refining activity and optimize the environmental, technical and economic benefits, as well as reinforce the trust of the several stakeholders, both at the social and corporate level.

CONCLUSIONS

In 2016, Galp improved its performance in operational eco-efficiency indicators, namely in energy and water consumption, as well as in carbon and energy intensity, since 2013.

To achieve this performance, the consistency of goals and targets definition for the most material facilities is essential, as well as top management commitment.

Once operational eco-efficiency is a strategic and material issue, we identify improvement opportunities and establish a plan of measures leading to reduction of water consumption, wastewater production, energy consumption and waste production, with positive effects on the associated management costs.

NEXT STEPS

Our objective is to minimize the impacts of our operations, sustainably reducing the carbon intensity of our activity. We aim to be Western Europe's energy efficiency leaders, reaching the first quartile of the refining industry in 2019 in both refineries (Matosinhos has already reached it).

Major challenges faced and Lessons learned

- The daily challenge of achieving operational excellence;
- Data quality, monitoring and improvement in reporting;
- The benefits of target definition in order to improve.

We will continue to ensure that eco-efficiency targets and objectives are set in accordance with the materiality and nature of the operation.

Operational eco-efficiency in Refineries

References

Galp Energia Sustainability Reports, since 2013 to 2015.

Galp Energia Refineries Data Books, since 2013 to 2015.

Galp Energia Quarterly Performance Report and Environmental Indicators

Galp Energia website: www.galp.com

Author(s)

Galp's Environment, Quality, Safety and Sustainability Department

Operational eco-efficiency in Refineries

ATTACHMENTS

Assessment mechanisms

Assessment and monitoring procedures

The Board establishes challenging goals and targets for all levels of the Company/Business Unit (BU) with the purpose of encouraging continuous improvement in Sustainability management, aligned with the corporate Vision and Mission. These goals and targets are part of the business and strategic plan of the Company/BU.

Key performance indicators (KPI) are established and monitored within the scorecard (SC), to assess BU performance and define action plans according to the goals and targets to be achieved. KPIs related to operational eco-efficient are part of this SC, and are monitored quarterly by senior management.

KPIs targets

Sines Refinery

KPI	Target for 2013	Target for 2014	Target for 2015	Target for 2016	Target for 2017
Water consumption per feedstock processed (m ³ /t)	0.64	0.68	0.67	0.62	0.6
Water consumption per feedstock processed (10 ³ m ³ /mmboe)	87.7	93.1	91.8	84.9	82.2
Wastewater per feedstock processed (m ³ /t)	0.36	0.33	0.35	0.34	0.31
Wastewater per feedstock processed (10 ³ m ³ /mmboe)	49.3	45.2	48.0	46.6	42.5
Carbon Intensity - CO ₂ /CWT	-	40.0	32.0	31.9	31.3
Energy Intensity - EII (%)	-	-	87.5	93.4	92.2
NO _x emissions per feedstock processed (g/t)	110	73	93*	92	94
SO ₂ emissions per feedstock processed (g/t)	1410	826	500	520	460
Particles per feedstock processed (g/t)	40	22	18	17	15

* In 2015, the NO_x emission-measuring device was replaced leading to a change in the target previously set.

Matosinhos Refinery

KPI	Target for 2013	Target for 2014	Target for 2015	Target for 2016	Target for 2017
Water consumption per feedstock processed (m ³ /t)	0.55	0.52	0.57	0.51	0.51
Water consumption per feedstock processed (10 ³ m ³ /mmboe)	75.3	71.2	78.1	69.9	69.9
Carbon Intensity - CO ₂ /CWT	-	31.7	27.3	27.3	28.1
Energy Intensity - EII (%)	-	84.4	79.5	79.5	79.7
NO _x emissions per feedstock processed (g/t)	230	185	127	125	90
SO ₂ emissions per feedstock processed (g/t)	450	230	63	30	30
Particles per feedstock processed (g/t)	15	15	15	15	10

Note: The Energy Intensity Index (EII) is an index of energy intensity drawn up by Solomon Associates, which compares the consumption of primary energy sources at a refinery with a benchmark refinery of similar complexity, measuring its energy performance. The reduction in EII implies less energy is consumed for the same production level and directly represents a relative reduction in GHG and regulated pollutants. The Complexity Weighted Tonne (CWT) is an indicator drawn up by Solomon in partnership with CONCAWE that compares different refineries according to European Commission decision 2011/278/CE, of 27 April. The CWT characterizes refineries of different sizes and complexity through a means of comparing CO₂ emissions. The CWT can be applied to all EU28 refineries and takes into consideration the production mix of each refinery, reducing complexity by using various assessment parameters.

Refineries established performance targets in order to guarantee improvement of the operational eco-efficiency. These targets seek to meet the various requirements and standards made by the company management and materialized in an Environmental Management System based on ISO 14001.

We have defined ambitious objectives and goals for our refineries: we intend to achieve benchmark levels in terms of energy efficiency and carbon intensity of the industry.