

ISO 50001 Energy Management System – Case Study

2024

Kingdom of Saudi Arabia

YANPET Affiliate

Energy Efficiency Initiatives



YANPET Energy Efficiency Improvement

Case Study Snapshot	
Industry	SABIC- YANPET Affiliate
Product/Service	Petrochemical Company (HDPE Polymer, PP & Glycols)
Location	Yanbu, Saudi Arabia
Energy performance improvement percentage (over the improvement period)	2.7 % improvement for the last 2 years
Total energy cost savings (over the improvement period)	USD 1,049,359
Cost to implement Energy Management System (EnMS)	USD 16,267
Total energy savings (over the improvement period)	266,484 MWh
Total CO ₂ -e emission reduction (over the improvement period)	60,135 Metric Tons

Organization Profile / Business Case

YANPET is a joint venture petrochemical company based in Yanbu, Saudi Arabia, established by Saudi Basic Industries Corporation (SABIC) and ExxonMobil. The company plays a significant role in the petrochemical industry in the region and contributes to the economic development of Saudi Arabia.

The motivation & drivers towards energy efforts include enhancing operational efficiency, reducing costs, complying with regulatory requirements, and demonstrating corporate social responsibility. YANPET's goals include optimizing energy consumption, reducing carbon emissions, and promoting sustainable practices within its operations.

Energy management system is a crucial tool helping business strategy to achieve its operational and sustainability objectives. By effectively managing energy usage, YANPET can improve resource efficiency, lower operational costs, and minimize its environmental footprint. This aligns with the company's priorities on climate change, sustainability, and de-carbonization can promote a more sustainable approach to petrochemical production.

To connect energy management to YANPET priorities on climate change, sustainability, and de-carbonization, there are clear specific targets have been set for reducing energy consumption, Carbon Neutrality & implementing energy-efficient technologies.

YANPET over the last 2-3 years have implemented major projects & initiatives related to Energy part aiming to meet the global sustainability & regulatory compliance including Major Energy Efficiency upgrade in Glycol plant, Automated sheet for Key Energy variables starting with Crackers, & Utility Deaerator plant to optimize Steam availability

ISO 50001 Energy Management System – Case Study

2024

Kingdom of Saudi Arabia

YANPET has two Main crackers plants that Produce Ethylene, Propylene & Py-Gas, the nature of the process Consumes 80% of the Total site Energy (~40 Million GJ Per Annum), moreover Yanpet has YANPET has Glycol Plant that produce Liquid Glycol (MEG/DEG/TEG) for various applications including HVAC, Plastic mold making and Food applications

Glycol plant consumes ~7% of the Total site Energy (~3.6 Million GJ Per Annum), & 90% of the Pure CO2 Vents is only from Glycol Plants. As part of the Saudi Energy Efficiency Centre (SEEC) the performance of the plant was not able to achieve the obligations of the SEEC targets, so the need for Upgrade in the Energy Efficiency of the plant was not an option but necessity The objective of this project is to modify CO2 recovery section along with the implementation of Opportunities/ideas to reduce Energy Intensity of Yanpet EG-2 plant. The final goal is to Transform EG-2 from its present state to a plant capable of utilizing High Selectivity Catalyst HSC) with efficient heat/energy integration for the sake of valuable feedstock (i.e. Ethylene, O2) saving as well as in good compliance with SEEC and SABIC Sustainability footprint.

YANPET has 6 deaerators used to supply BFW to Boilers & downstream units like Olefins & Glycols. The deaerator’s functionality is to remove oxygen and other gases from the water that feeds into boilers for steam generation purpose. LP Steam is injected to Deaerators for removing the gases & oxygen from water avoiding rust and carbon dioxide into produced steam. As these Deaerators are major consumers of LP steam. This i targets for steam optimization & reduction without compromising the functionality of the mechanical desecration process.

The need of robust automated Energy monitoring is crucial to enable the organization to establish systematic framework in achieving continual improvement of Energy Performance and Energy Management System, though Key Energy Variable Dashboard (KEV)

“Great Results from a great team, we are aiming for more optimization and further enhancement in safe and sustainable manners.”

—Sultan Al-Otaibi, Chemical Operation Director

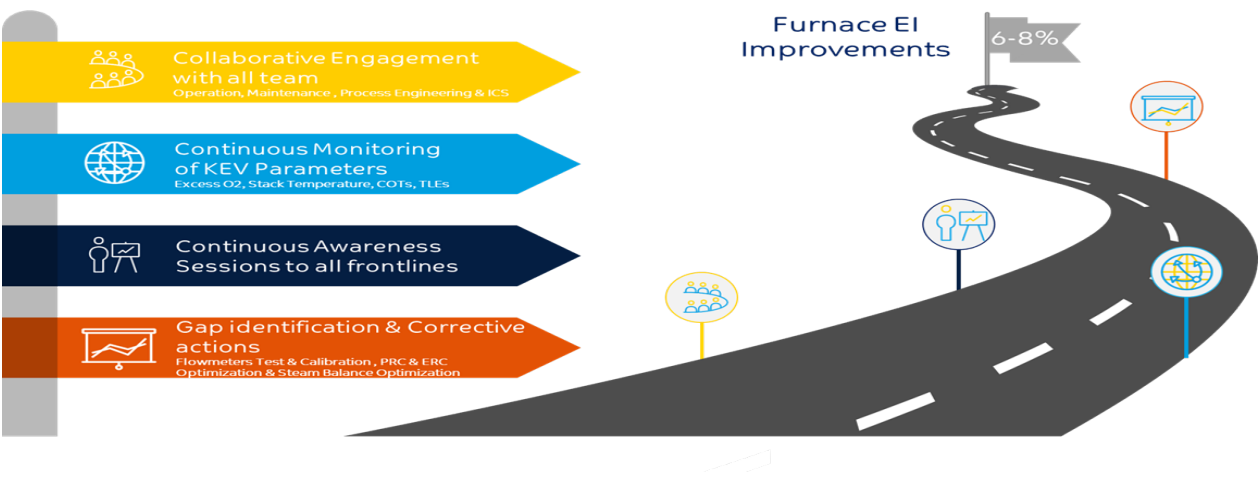


Figure 1, Key Energy Variables Roadmap

ISO 50001 Energy Management System – Case Study

2024

Kingdom of Saudi Arabia

Business Benefits

Key Energy Variables

Using Intensity based Calculation (Total Energy/Production) expected to achieve 400,000 GJ/Year of 2024 Equivalent to 1.02 MT/Hr Fuel Savings (25,861 MT CO₂ Emissions Savings per Annum) Equivalent to 440K \$/Annum

Ethylene Glycol Energy Efficiency Project

Using Intensity based Calculation (Total Energy/Production) expected to achieve 60,000 GJ/Year Equivalent to 0.15 MT/Hr Fuel Savings (0.44 MT/Hr MT CO₂ Emissions Savings) Equivalent to 65,700 \$/Annum , Additional savings in Waste KPI through reduction in CO₂ Vents from the regenerator Drum , 77,000 Ton/Annum CO₂ post the project implementation

Deaerator Energy Optimization

Energy performance improvements achieved by steam optimization along with energy cost savings, reduction in emissions (30420 MT CO₂) Optimizing Overall Steam 26.6 TPH resulted to achieve 473,982.196 MMBTU / Over 1.3 Year total Fuel Saving ~ 10942.6 tones Equivalent to 541,659 USD for overall period

Plan

YANPET Energy initiatives Optimization Milestone Summary

Through Collaborative engagement & Continuous Monitoring from all discipline, Yanpet was able to gain commitment towards achieving Energy Goals per each plant, the team consist of Operation, Maintenance, Process Engineering & Process Control, utilizing the team ability, corrective actions can easily attended, e.g. FT Calibration, Steam & Fuel Balance Optimization using internal monitoring sheet. At YANPET we have Site Sustainability Stewardship program, where the performance is monitored, Engagement from all team is activated Crackers & Glycols have major Energy Users that utilize more than 87% of the process Energy on, each crackers has its own Fuel Input flow meters that are daily monitored by the plant and Sustainability Focal personal & similar practice is being applied for the remaining plants. Towards energy & De-Carbonization savings goals, for the short & long-term period as part of SEEC & Carbon Neutrality. By Having EnMS, the organization will be able to Benchmark its performance with other peers, collect& analyze data, Potential process effectiveness & execute modification

YANPET has 6 Deaerators , the aim was to reduce the deaerator pressure as per the steam balance demand & availability in LP pressure in 2 stages (300 Kpag- 250 Kpag) Considering impacting Deaerator Dissolved Oxygen (DO) Residual Oxygen Scavenger was maintained at the Required range (800 – 1500 ppb)through DO analyzers, FT verification for the LP Steam Flow, ensuring the quality of the BFW is within the specification , in addition Online Steam optimization , Water Treatment Validation program were utilized

Yanpet has designated internal sheet that monitors all Sustainability & SEEC related performance then it is circulated to all organization on frequent basis, Daily, Weekly Monthly & Quarterly, beside timely awareness sessions to all frontlines, Responsible engineers to ensure full understanding of EnMs, Gap Identification & Closure plans.

ISO 50001 Energy Management System – Case Study

2024

Kingdom of Saudi Arabia

“It requires the organization to establish, implement and maintain documented energy objectives target and action plans specified outcome.”
—ISO-50001 Energy Objectives Standards

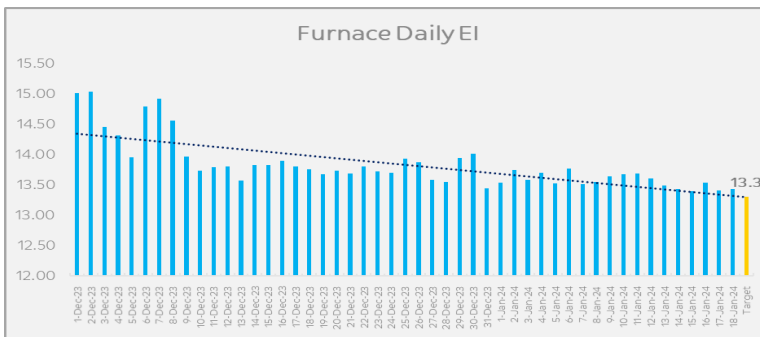
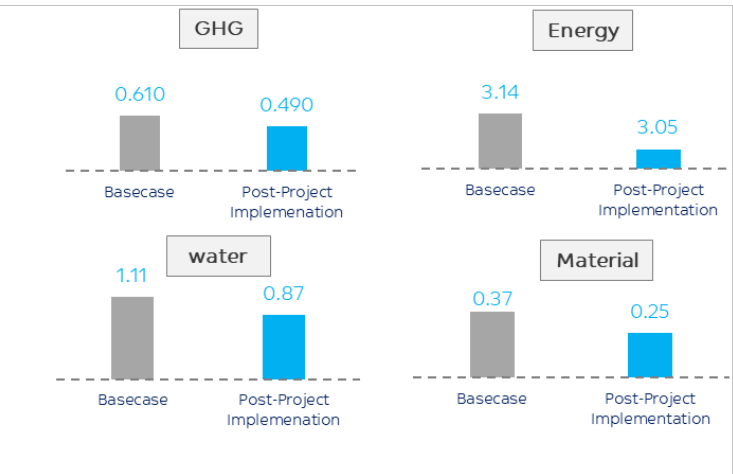


Figure 2, KEV Credit

Sustainability KPIs/ SEEC Performance



SEEC Performance

MMBTU/T EOE

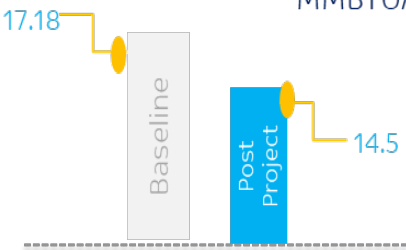


Figure 3, EG-II EIP Savings

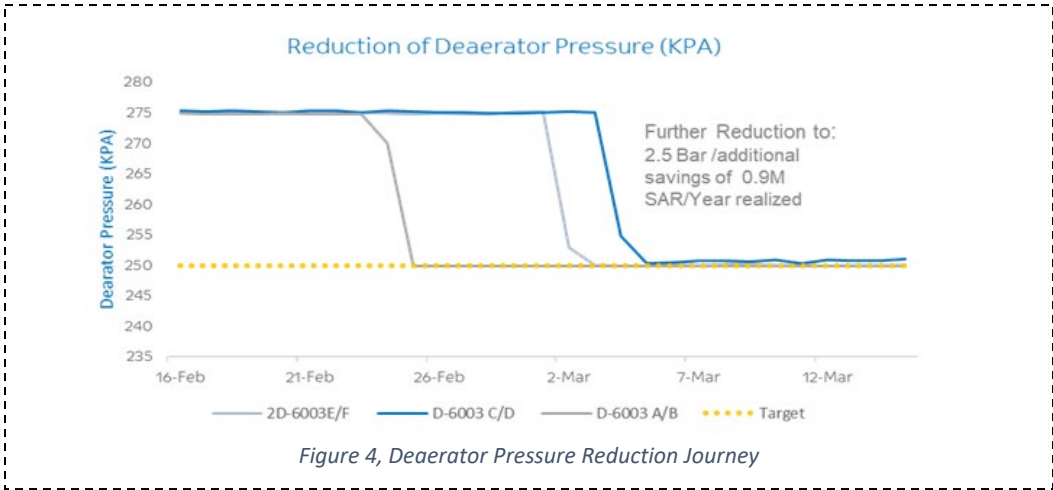


Figure 4, Deaerator Pressure Reduction Journey

ISO 50001 Energy Management System – Case Study

2024Kingdom of Saudi Arabia

Do, Check, and Act

YANPET Energy initiatives implement process

Energy Internal Audits were conducted for further recommendation & enhancement as well as Unit Internal Benchmarking, Stewardship to assess losses and generate potential area of improvement, and execute modifications if required e.g. EG-II EIP as Saudi Energy Efficiency Compliance , moreover by applying the crackers KEV Plants actual performance were positively improved towards the targets. Through continues monitoring of KEV Excel sheet (Including Excess O2, COT & Stack Temperature indication) on Daily basis, significant energy users (ENPI) assessment by plant engineers e.g. Furnace & Compressors, all through automated monitoring sheets & enhancing Steam optimization (ASPEN Utility Planner tool), and apply quick wins enablers for Deaerator pressure reduction. Performance improvement is monitored through internal monitoring sheet for each plant that has data inputs from the plant focal on Monthly basis, which provide both Absolute & Intensity performance; At SABIC this practice was initiated to Target reduction of 25% for Energy Intensity KPI by 2025 from 2010 baseline as strategic goals to enhance the climate change. Below Graphs show, Savings post implementation of the KEV, Ethylene Glycol Energy efficiency project

Equation Used to estimate Savings:

Energy Used/Production as intensity where Production is obtained through online Tag flow meter /Hour
Energy Consumed= LHV of Fuel Used (Online Analyzer Reading for Fuel Comp %)*Fuel Gas Rate (Online Flow Meter) / Hour at almost the same condition of production

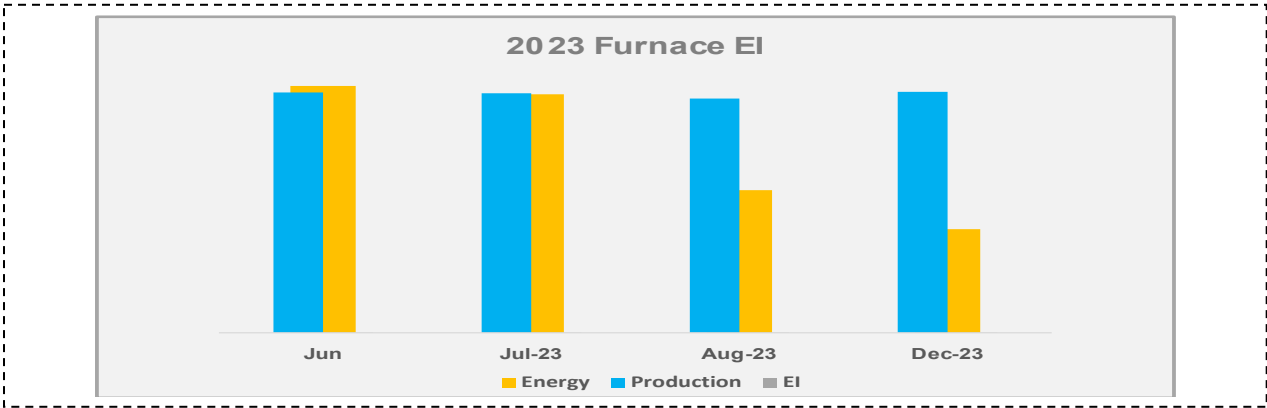


Figure 5, KEV Energy Intensity Comparison Utilizing Online Flow Meters

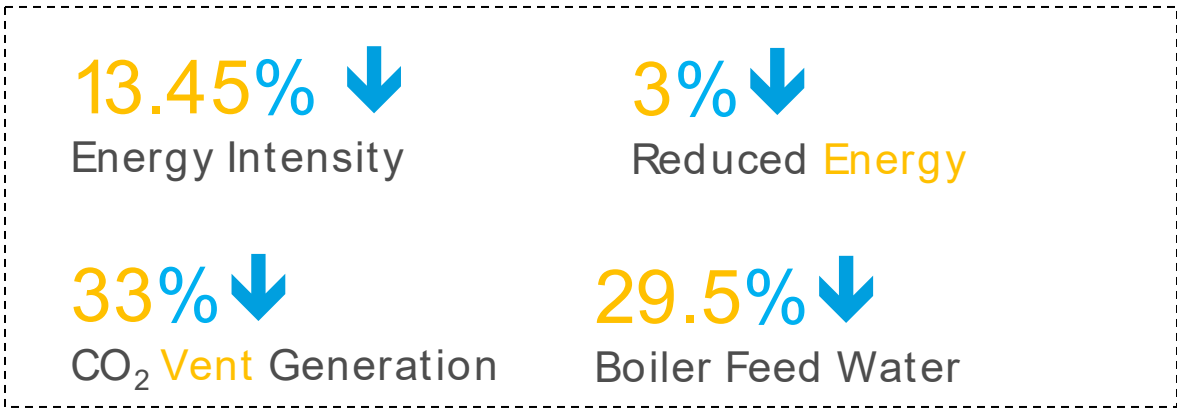


Figure 6, EG-II EIP KPI Improvement through external calculation sheet Pre & post Project Figures 2022-2023 at same Production

ISO 50001 Energy Management System – Case Study

2024

Kingdom of Saudi Arabia

Transparency

ISO-50001 Certification

YANPET Organization is always thriving to enhance its EnMS not only its EnMS not only internally but through external engagement and best practice sharing among SABIC and externally e.g. Saudi Energy Efficiency Center networking exchange, Also YANPET has also participated in MEPEC (Middle East Process Engineering Conference & Exhibition) sharing best practice & Energy transition opportunities to optimize our resources

What We Can Do Differently

Area of Improvement

In order to improve our Plant performance , continues monitoring of the performance of the plant, deploying Digitization including KEV monitoring Automated integrated system has to be introduced e.g. AI to ease taking proper actions without impacting the process To ensure proper training & expectations of the ISO-50001 to all frontlines has been delivered to elevate the level of understanding

As forecasted plan, YANPET is focusing on continues improvement, as well as elevating the level of ISO-50001 understanding through frequent awareness sessions, moreover, since YANPET granted the ISO-50001 Certification additional savings are potential since YANPET has improved the power factor and reduced the reactive power to meet the standards



The Energy Management Leadership Awards is an international competition that recognizes leading organizations for sharing high-quality, replicable descriptions of their ISO 50001 implementation and certification experiences. The Clean Energy Ministerial (CEM) began offering these Awards in 2016. For more information, please visit www.cleanenergyministerial.org/EMAwards.