

# ISO 50001 Energy Management System – Case Study

2024

SAUDI ARABIA

## A SABIC and Japan Saudi Arabia Methanol Co.



*ARRAZI plant achieves USD 2,353,629.48 savings 1 year post ISO-50001 certification.*

### Case Study Snapshot

<b>Industry</b>	Chemical
<b>Product/Service</b>	Methanol
<b>Location</b>	Jubail Industrial City/Saudi Arabia
<b>Energy performance improvement percentage</b> (over the improvement period)	1.67 % improvement over 1 year
<b>Total energy cost savings</b> (over the improvement period)	USD 2,353,629.48
<b>Cost to implement Energy Management System (EnMS)</b>	USD 72,444.44
<b>Total energy savings</b> (over the improvement period)	152,232.55 MWh
<b>Total CO<sub>2</sub>-e emission reduction</b> (over the improvement period)	38,000 Metric Tons

### Organization Profile / Business Case

A SABIC and Japan Saudi Arabia Methanol Co. (Ar-Razi) is one of the world’s largest methanol procedure by using natural gas as raw material and fuel.

Ar-Razi gives the highest importance to comply with all matters related to Energy & Sustainability and continual improvement. In confirming to this commitment, the company management implements the company’s policy to implement best in class technologies to improve plants sustainability footprint and energy efficiency and asset performance that will increase the use of the renewable energy and alternative fuels that support Circular Carbon Economy objectives. Taking into consideration the environment, health, safety and security requirements.

In addition, Energy management is adopted to improve Ar-Razi energy performance and energy cost index in order to meet SABIC’s sustainability strategy and regional regulatory requirement of energy efficiency improvement.

This will enable AR-RAZI to achieve the best possible energy quartile performance that will ensure achieving SABIC 2025 strategic objective of a 25% for Energy Intensity Reduction and achieving SABIC 2030 strategic objective of a 20% Carbon Emission Reduction.

As support tools to implement energy management program in Ar-Razi, Energy management Dashboard has been developed to monitor, analysis and report plants gap energy performance and plan for the corrective action.

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Finally, Flyers, quizzes and Sustainability and energy Award have been conducted in order to encourage all organization to participate in Sustainability and Energy program and enhance their awareness and ownership.

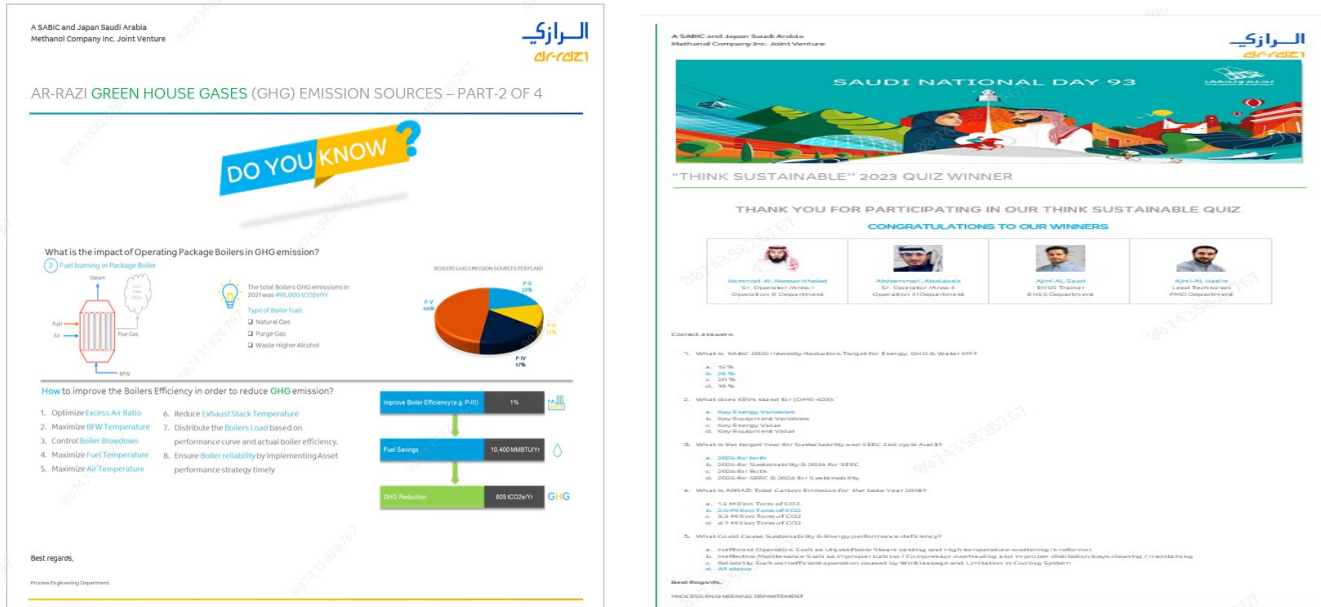


Figure 1 shows a sample of the flyers and quizzes communicated by ARRAZI Energy Team

## Business Benefits

Ar-Arazi started Sustainability program in 2010 with 2025 strategic objectives. Accordingly, Sustainability footprint Work Process was developed to achieve the following objectives: 25% Greenhouse Gases emission (GHG) intensity reduction, 25% Energy consumption intensity reduction, 25% Water consumption intensity reduction and 50% Material effectiveness intensity reduction. In 2016, Ar-razi Energy Management system was developed considering the best practices. Then, on 2022 Ar-Razi applied for ISO 50001 EnMs Certification in order to enhance Energy Management Implementation and ensure continual improvement.

The Energy management system establishes a cross-functional site energy team on Ar-Razi. The team defines a methodology to identify significant energy users and their key energy variables and develops a database system to track and improve the site energy performance at equipment level.

Regular tracking of Energy Performance Indicators (EnPIs) allows Ar-Razi to identify improvement opportunities, compared to base year conditions, and reduce the site energy intensity. Energy management system also defines the frequency of performance reviews, when to revise the targets, and the KPI calculation frequency.

Energy management system is driven by seven main components:

1. Establish Energy Policy, Site Energy Team & Centralized Database
2. Conduct Energy Self Audits
3. Collect and Analyze Data
4. Assess Operational Losses and Recommend Improvement
5. Monitor Energy Conservation and Execute Modification

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6. Review Energy Management Process Effectiveness
7. Plant Energy Intensity Internal Benchmark.

Ar-Razi has a significant experience and achieved numerous accomplishments as a result of implementing ISO 50001. The implementation of ISO 50001 has a profound impact on our business, leading to several benefits and improvements.

First, we have witnessed remarkable energy performance improvements across our organization. By adopting ISO 50001, we were able to identify and implement energy-saving measures (Especially through effective performance gap analysis mandated by section 9 as well as driving Energy projects), resulting in reduced energy consumption and increased energy efficiency. This, in turn, has led to substantial energy cost savings for our organization of about 2.35 Million USD. For Methanol (MeOH) process, the major contributors for energy demands are the Steam Methane Reformer as well as the steam boiler which constitute around 80% of the total plant energy consumption. The main function of the reformer is to convert the supplied natural gas into synthesis gas (CO, CO<sub>2</sub> and H<sub>2</sub>). Thus, by introducing imported CO<sub>2</sub> into the synthesis gas, the load on the reformer will be reduced achieving a significant natural gas (energy) savings. The above mentioned savings can be calculated as follows:

Comparing with 2022 Plant performance, 2023 Performance after implementing several project driven by ISO-50001 Energy Management Standard such as CO<sub>2</sub> injection and Advanced Process Control (APC), Plant energy intensity improved by 0.57 MMBTU/MT Product and Plant CO<sub>2</sub> emission intensity improved by around 0.0417 tCO<sub>2</sub>e/MT product.

During the reported base period of 2022 (12 consecutive months starting from January) the Energy consumption and CO<sub>2</sub> emission were reported about 30.23 Million MMBTU and 485,000 tCO<sub>2</sub>e respectively. While, Ar-Razi in 2023 (12 consecutive months) was able to reduce its consumption by 0.52 Million MMBTU and 38,000 tCO<sub>2</sub>e after normalization.

This saving was estimated after subtracting actual consumption from the expected consumption (Projected by the reported period). To illustrate, this was summarized as shown in the below equation:

$$\text{Energy Savings} = \text{Expected Energy Consumption} - \text{Actual Energy Consumption}$$

$$\text{Energy performance improvement percentage} = \text{Energy Savings} / \text{Expected Energy Consumption} \times 100$$

Where

$$\text{Expected Energy Consumption} = \text{Base Year Energy Intensity} \times \text{Base Year Production}$$

$$\text{Actual Energy Consumption} = \text{Base Year Energy Intensity} \times \text{Reported Year Production}$$

As another example for business benefits, regulator offer 33.3% reduction in electricity tariff taking in consideration key selection criteria need to be met. Implementation of ISO 50001 or equivalent energy management system is one of key selection criteria. ISO certificate support Ar-razi to obtain such cost reduction.

Furthermore, ISO 50001 has not only brought energy-related benefits but also non-energy benefits to our organization. The systematic approach provided by the ISO 50001 EnMS has allowed us to optimize our operational processes, improve productivity, and enhance overall performance. This has resulted in increased competitiveness and improved reputation in the market.

In terms of costs, while there were initial investments required to implement the EnMS, we have experienced significant energy cost savings in the long run. The estimated staff time dedicated to implementing and maintaining the EnMS has also been worthwhile considering the substantial benefits and improvements achieved. In detail, the estimated internal Staff time to develop and implement the EnMS was \$63,555 (Less than a half year of equivalent

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staff time) and the internal staff time to prepare for external audit was \$8,889 with all other costs being ~ \$0 (Total \$72,444 were spent ). It is worth saying that the majority of savings was due to operational savings which makes up about 25-50% (Specifically 39% as calculated).

Our organization has extensively utilized the EnMS to manage and control energy-related GHG emissions. By leveraging the EnMS framework, we have been able to set targets, track performance, and implement measures to reduce our carbon footprint. This aligns with our commitment to sustainability and has resulted in significant environmental benefits.

The business drivers for using the EnMS to manage energy-related GHG emissions are multi-fold. Firstly, it helps us comply with environmental regulations and meet our corporate social responsibility goals. Additionally, adopting sustainable practices and reducing emissions enhance our brand image and reputation, attracting environmentally conscious customers and investors.

Lastly, we recognize the value of using ISO 50001 in supply chain engagements. By extending the EnMS beyond our operational boundaries, we can collaborate with our service and material suppliers to improve their energy performance. This not only contributes to our sustainability objectives but also fosters stronger relationships with our suppliers, promoting a shared commitment to energy efficiency.

In conclusion, the implementation of ISO 50001 has been instrumental in driving energy performance improvements, achieving energy cost savings, and reducing emissions within our organization. The EnMS has provided us with a systematic approach to energy management, resulting in various non-energy benefits and improved operational efficiency. The costs associated with implementing the EnMS have been outweighed by the substantial energy cost savings. Furthermore, extending the EnMS to multiple sites and engaging with our supply chain has enhanced the overall effectiveness and impact of ISO 50001 on our organization.

## Plan

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Developing and planning the implementation of our EnMS involved a strategic and systematic approach. We took the following steps to ensure a successful implementation:

1. Gaining the commitment of top decision-makers: To gain the commitment of top decision-makers in Ar-Razi, we emphasized on the importance and benefits of implementing an EnMS. We presented the business case for ISO 50001, highlighting the potential energy cost savings, improved operational efficiency, and enhanced sustainability. We also emphasized the alignment of ISO 50001 with our organizational goals and values. By showcasing the potential return on investment and the positive impact on our reputation, we were able to secure the commitment of top management.
2. Involvement of top management: Top management played a crucial role in the implementation process. They provided visible leadership and support throughout the entire journey. They actively participated in the development of the EnMS, setting the strategic direction, and defining the energy management policy. Their involvement ensured that the EnMS received the necessary resources, including financial commitments and dedicated staff time.
3. Obtaining financial commitments and resources: We obtained financial commitments by demonstrating the potential cost savings and return on investment associated with implementing the EnMS. We conducted a thorough analysis of our energy consumption and identified areas of improvement. This data-driven approach helped us quantify the potential energy cost savings and justify the financial investments required. We also engaged with our finance department to secure the necessary budget for the implementation, including training, equipment, and software.
4. Using data to develop an appropriate approach: We used data to develop an appropriate approach by conducting a comprehensive energy audit and analysis. This involved understanding our energy consumption patterns, identifying

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energy-intensive processes, and assessing energy performance indicators. We collected data on energy usage, including electricity, gas, and other fuel sources. This data helped us identify areas of high energy consumption and prioritize our efforts for improvement.

5. Reviewing and analyzing energy use: Our process for reviewing and analyzing energy use involved regular monitoring and measurement of energy consumption. We used energy management Excel Macro-built in tracking sheet to track and analyze energy data, allowing us to identify trends, anomalies, and potential areas for improvement. We established energy performance indicators and set targets to drive continuous improvement. Regular energy reviews and analysis helped us identify energy-saving opportunities and validate the effectiveness of implemented measures.

6. Selecting projects and prioritizing action: We adopted a systematic approach to select projects and prioritize action. After we had quantified our performance gap and initiated a closure plan along with its required projects (CAPEX) we conducted a thorough cost-benefit analysis for each potential project, considering factors such as energy savings, payback period, and feasibility. We also involved relevant stakeholders, including employees and department heads, to gather input and ensure alignment with organizational goals. Projects were selected based on their potential impact on energy efficiency, cost savings, CO<sub>2</sub> emission forecasted price and alignment with our strategic objectives.

7. Ensuring EnMS alignment with organizational strategy and targets: We ensured that the EnMS supported the strategy and targets of our organization by aligning it with our overall business objectives. We integrated the EnMS into our existing management systems, such as quality and environmental management systems. We established energy performance targets that were in line with our sustainability goals and communicated them throughout the organization. Regular reviews and updates of the EnMS ensured its continuous alignment with our evolving strategy and targets.

8. Certification announcements: We updated our company website to include dedicated section highlighting our ISO 50001 certification. This section provided information about the certification process, the benefits of ISO 50001, and our commitment to continuous improvement in energy performance. Also, we communicated the ISO 50001 certification internally to all employees. This was done through company-wide emails, newsletters, and internal announcements. We emphasized the role of employees in achieving the certification and encouraged their continued participation and engagement in energy management initiatives.

In conclusion, our EnMS implementation was developed and planned through the commitment of top decision-makers, involvement of top management, financial commitments, and a data-driven approach. We used data to understand energy consumption, reviewed and analyzed energy use, and selected projects based on prioritization and alignment with organizational goals. The EnMS was developed to support our organization's strategy as well as targets and a collaborative approach was adopted to ensure consistency and flexibility.

## Do, Check, and Act

Implementing our EnMS involved a systematic approach based on the Plan-Do-Check-Act (PDCA) cycle. The implementation process included the following steps:

1. Implementation process and involvement: The implementation process involved a cross-functional team consisting of representatives from various departments, including operations, maintenance, finance, and sustainability. This team was responsible for executing the activities outlined in the plan, monitoring progress, and ensuring the successful implementation of the EnMS.

2. Motivation and support from top management: Top management provided motivation and support throughout the EnMS implementation. They communicated the importance of energy management to all levels of the organization, highlighting the benefits and linking it to the overall business strategy. They allocated necessary resources, including

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budget, personnel, and technology, to support the implementation process. Top management also actively participated in regular management reviews, providing guidance, setting targets, and ensuring the EnMS remained aligned with the organization's objectives.

3. Key activities to improve energy performance: The plan identified and implemented several key activities to improve energy performance. These included conducting energy audits, implementing energy-saving projects, optimizing equipment and processes, training employees on energy management practices, and establishing energy monitoring and reporting systems. These activities were prioritized based on their potential impact on energy efficiency, cost savings, and alignment with organizational goals.

4. Achievement of targets: The targets set for energy performance improvement were monitored and evaluated regularly. Through continuous monitoring and measurement, we determined whether the targets were achieved. Any deviations or gaps were addressed through corrective actions, such as process optimization, equipment upgrades, or behavior change initiatives. The achievement of targets was assessed against predefined metrics, including energy intensity, energy cost savings, and reduction in greenhouse gas emissions.

5. Validation and verification of results: To validate and verify the results of energy performance improvement, we followed a rigorous methodology. We established timeframes for baseline and reporting periods, considering factors such as seasonality and operational changes. The energy baseline was determined using historical energy consumption data and taking into account any energy baseload. We used indicators such as energy intensity, energy use per unit of production, and energy cost savings to monitor and assess energy performance improvements. Key equations and calculations were used to estimate energy savings and performance improvement, considering relevant variables affecting energy consumption, such as production output, weather conditions, and occupancy levels. Normalization techniques were used to ensure accurate comparison and evaluation of energy performance over time, considering factors such as production volume, weather, or occupancy.

6. Tools and resources used: We utilized various tools and resources to support the implementation and monitoring of our EnMS. These included energy management Tracking Dashboard for data collection, analysis, and reporting; energy monitoring equipment to track real-time energy consumption; energy audit tools and methodologies; and training materials and resources to enhance employee knowledge and engagement. We also engaged with external experts and consultants to provide specialized support and guidance throughout the implementation process.

In addition to the above:

- Energy-related GHGs: Our EnMS implementation activities addressed energy-related greenhouse gas (GHG) emissions by focusing on energy efficiency measures and plan for renewable energy utilization. We considered the carbon intensity of energy sources and implemented projects to reduce energy consumption and switch to cleaner energy sources, thereby reducing GHG emissions associated with energy use.

- Operational control: We implemented operational controls by establishing standard operating procedures (SOPs) for energy-relevant processes and equipment. These SOPs outlined best practices to optimize energy performance, including equipment maintenance, shutdown procedures, and energy-efficient operation. Regular inspections and audits were conducted to ensure compliance with the SOPs and identify areas for improvement.

- Employee engagement and training: We actively engaged employees in energy management by providing training programs and awareness campaigns. New training was provided to enhance employees' knowledge and skills related to energy management practices, energy-saving behaviors, and the operation of energy-efficient equipment. We encouraged employee feedback and suggestions for energy-saving opportunities, fostering a culture of continuous improvement.

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- Procurement processes: The EnMS data influenced our procurement processes by considering energy efficiency criteria when selecting new equipment or suppliers. We incorporated energy performance requirements into procurement specifications and evaluated suppliers based on their commitment to energy management and sustainability. This helped us source energy-efficient equipment and materials, further supporting our energy performance improvement goals.

- Preparation for third-party EnMS audit: To prepare for the third-party EnMS audit, we conducted internal audits to ensure compliance with the requirements of ISO 50001. We established a robust documentation system, including energy management policies, procedures, and records. We conducted internal audits to identify any non-conformities or areas for improvement, addressing them proactively. This prepared us for a successful third-party audit, demonstrating the effectiveness of our EnMS.

- Additional monitoring and measurement: In addition to energy and costs, we monitored and measured other key performance indicators (KPIs) relevant to our EnMS such as number of awareness sessions, brainstorming sessions, closing Audit findings/operations timely and level of EnMS implementation.

## Transparency

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We publicly announced our organization's ISO 50001 certification to demonstrate our commitment to energy management and sustainability. The announcement was made through various channels, including:

1. In October 2022, Ar-Razi Journey toward Sustainability & Energy excellence was presented in Saudi Energy Efficiency Center (regulator) Technical Workshop for energy efficiency in industrial sector where ISO 50001 was highlighted as one of the important Success Pillars and governance for Ar-Razi energy and sustainability program.
2. As another example, Implementation of ISO 50001 energy management system is supporting Ar-Razi to obtain regulator offer reduction in electricity tariff since having energy management system is key selection criteria need to be met.
3. ISO 50001 energy management certificate shared with marketers/Customers shows Ar-Razi efforts toward responsible care and utilizing the energy resources efficiently which is supporting Ar-Razi business continuity.

By publicly announcing our ISO 50001 certification we aimed to showcase our commitment to responsible energy management, inspire other organizations to adopt similar practices, and contribute to the wider sustainability and climate change mitigation efforts.

## What We Can Do Differently

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If we were to do it all over again, there are several things we would do differently to further improve our ISO 50001 EnMS implementation:

1. Enhanced employee engagement: While we communicated the ISO 50001 certification internally, we would have placed a stronger emphasis on employee engagement from the early stages of the implementation. We would have encouraged more active participation, solicited employee feedback, and organized training and awareness programs to ensure that everyone in the organization understands the importance of energy management and their role in achieving our energy goals.
2. Utilizing advanced monitoring and data analytics tools: In hindsight, we would have invested in advanced monitoring and data analytics tools to better track and analyze our energy consumption patterns. These tools would have provided

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real-time insights into energy usage, identified areas of improvement, and helped us make data-driven decisions for optimizing energy performance.

3. Integration with other management systems: While implementing ISO 50001, we would have integrated it more seamlessly with other management systems, such as ISO 14001 for environmental management and ISO 9001 for quality management. This integration would have allowed for a more holistic approach to sustainability and improved coordination between different departments.

4. Collaboration with external stakeholders: In the future, we plan to enhance our collaboration with external stakeholders, such as suppliers, customers, and industry associations. By sharing best practices, knowledge, and resources, we can collectively drive energy efficiency improvements across the value chain and contribute to a more sustainable industry as a whole.

5. Continuous improvement and innovation: Our next steps involve continuous improvement and innovation in our EnMS. We plan to regularly review and update our energy objectives and targets, conduct energy audits, and explore innovative technologies and practices to further enhance our energy management performance. We will also stay updated with the latest developments and advancements in energy management standards and incorporate them into our EnMS.

In summary, our future plans for our ISO 50001 EnMS include enhancing employee engagement, utilizing advanced monitoring tools, integrating with other management systems, collaborating with external stakeholders, and continuously improving our energy management practices. These steps will help us further optimize our energy performance and contribute to our sustainability goals.



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](http://www.cleanenergyministerial.org/EMAwards).