Saudi Standards, Metrology and Quality Organization -SASO



Achievement Savings in electricity consumption of 39% since implementing the ISO 50001 energy management system in 2020

Case Study Snapshot	
Industry	Government Org.
Product/Service	Excellence in developing standards, conformity, metrology, and promoting product safety in the Kingdom of Saudi Arabia.
Location	Site 1: Riyadh, Saudi Arabia (11 buildings) Site 2: Jeddah, Saudi Arabia (2 buildings) Site 3: Dammam, Saudi Arabia (1 building)
Energy performance improvement percentage (2020-2023)	39 % improvement over 4 years. (Baseline 2019)
Total energy cost savings (over the improvement period)	$ 3,655,551.03
Cost to implement Energy Management System (EnMS)	$ 12,267.00
Total energy savings (over the improvement period)	40,617.23 MWh
Total CO_2-e emission reduction (over the improvement period)	20,148 Metric Tons

Organization Profile / Business Case

According to the Saudi Standards, Metrology and Quality Organization (SASO), an internationally trusted body that aims to enable quality of life and the competitiveness of the national economy, sustainable development and environmental protection are at the top of its priorities by issuing, developing, and adopting Saudi standard specifications for goods, products, services, and measuring devices. In addition, this includes issuance of conformity assessment regulations and certification activities. Many motivations made SASO adopt and implement the ISO 50001 EnMS as the body responsible for issuing energy efficiency regulations and Standards. On the other hand, EnMS Supports Saudi Initiatives such as: **Saudi Vision2030** which is a long-term strategic vision and Energy plays a crucial role in achieving these goals, with initiatives focusing on spreading renewable energy, energy efficiency, and investing in clean technologies. **The renewable energy program** aims to generate 50% of electricity from renewable sources by 2030, in addition to the **Saudi Energy Efficiency Program**, which is led by the Saudi Energy Efficiency Center(SEEC), which in turn encourages, motivates and supports the ISO 50001 EnMS for the government and industrial sectors.

ISO 50001 Energy Management System – Case Study

2024 Saudi Arabia

"Implementing the Energy Management System ISO 50001:2018 has aided in saving costs, conserving energy, and reducing greenhouse gas (GHG) emission by 38% over the past four years."

—Khaled ALAwwad, EnMS Team Leader, 50001 LA®, CCML™

—Hani ALOgaili, EnMS Team Director

Business Benefits

In 2012, the Saudi Program for Rationalizing and Raising the Efficiency of Energy Consumption was launched as a framework for a working system that coordinates energy efficiency efforts in the Kingdom. This program was led by the Saudi Center for Energy Efficiency, several competent government agencies, government institutions, companies, and the private sector, including SASO. In addition, these organization achieved success and benefits since the implementation of the ISO 50001 EnMS energy management system in 2020. These successes and benefits can be summarized as follows: reduced costs, electricity consumption bills, and fuel consumption (diesel and gasoline) of the SASO vehicles. The percentage improvement in energy performance (for electricity and fuel) was approximately 39%, which is equivalent to (40 million kWh) compared to the 2019 baseline.

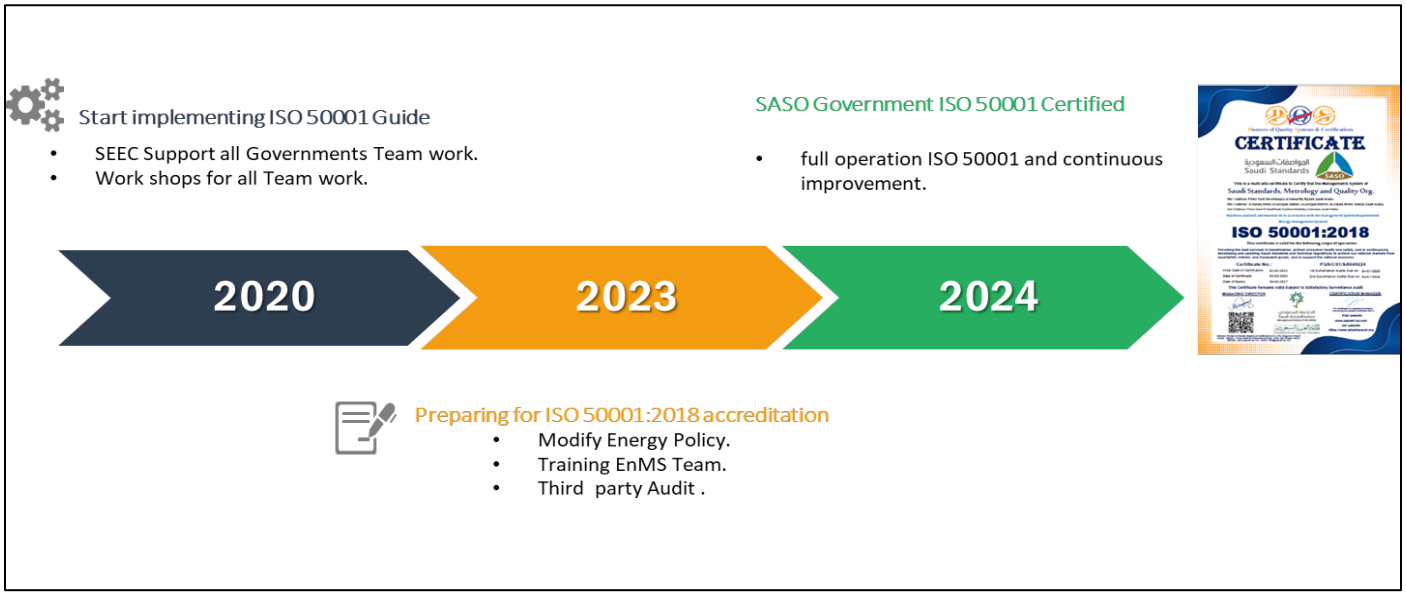


Figure 1. Energy Management System implementation stages

The Energy Management Team developed an advanced business model for team members and created a real environment to enhance communication among team members. In addition, it contributed to achieving effective communication with all SASO employees and providing them with the opportunity to share ideas and proposals that contribute to the effectiveness and performance of the Energy Management System.

Non-energy Benefits: SASO has gained several different benefits from implementing ISO 50001 EnMS. These benefits can be summarized as follows: reducing the electricity bill, optimizing the operation of energy equipment (reducing maintenance costs and extending the life of the equipment), reducing carbon emissions, following up and applying best practices in energy management and rationalizing consumption and setting a benchmark to compare performance progress. The table below shows the benefits gained due to the implementation of EnMS.

Year	Elec. Consumption kWh/y	Elec. Tariff 0.09$/kWh	Saving kWh/y	Cost Saving $/kWh	Improvement % kWh
2019(Baseline)	27,020,580.00	2,431,852.20	-	-	-
2020	16,778,313.32	1,510,048.20	10,242,266.68	921,804.00	**38%**
2021	18,262,849.00	1,643,656.41	8,757,731.00	788,195.79	**32%**
2022	15,918,000.00	1,432,620.00	11,102,580.00	999,232.20	**41%**
2023	16,505,924.00	1,485,533.16	10,514,656.00	946,319.04	**39%**

Table 1: Saving's Journey since implementing ISO 50001



Figure 2. Celebrating the ISO 50001 certificate in the presence of His Excellency the Governor of the SASO, the Vice Governor's, team members, and the team of auditors from the Certification body.

Energy cost savings: Since the SASO implemented the energy management system, it has achieved a total cost saving estimated at 3.7 million US dollars, equivalent to 30% of electricity consumption[Figure 3]. The SASO is proud that this saving did not result in any costs achieved, thanks to the support, direction of Top Management And as well as the procedures for operating and maintaining equipment in a periodic and correct manner, which had the greatest impact on achieving savings.

Energy consumption savings: Energy consumption savings are crucial for mitigating environmental impact and enhancing economic efficiency. This is achieved by adopting good practices and energy-saving technologies in buildings, such as building management systems (BMS) and replacing lighting units with more efficient units**.** **TARSHID*** Company, a government ESCO company that rehabilitates government buildings, rehabilitated SASO buildings in 2018, with an estimated saving of approximately 30%. Since 2020, the EnMS Team developed and updated operating procedures for all parts of the buildings, resulting in a percentage saving in electricity consumption estimated at 39%, equal to 40.6 million kWh compared to 2019 [Figure 4].

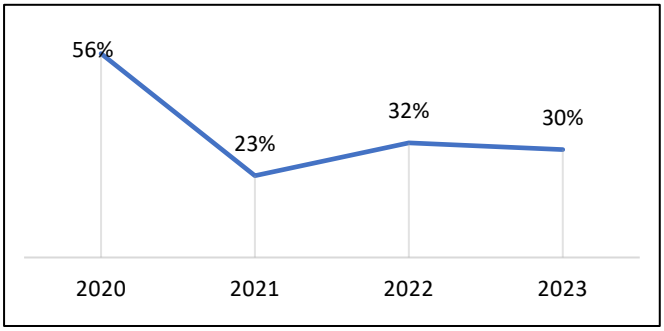


Figure 3. Electricity Cost savings for the period 2020-2023 Compared to the 2019 baseline.

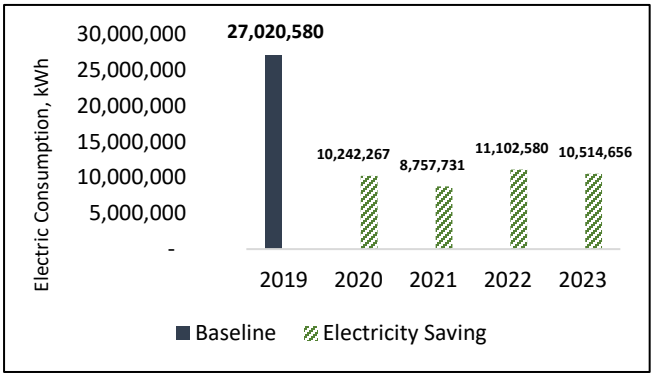


Figure 4. Electricity consumption savings for the period 2020-2023 Compared to the 2019 baseline.

Tarshid is the National Energy Services Company, established by the Public Investment Fund to catalyze the development of a more energy efficient Saudi Arabia. The launch of Tarshid is a result of a collaborative effort between the Ministry of Energy, Ministry of Finance and the Saudi Energy Efficiency Center. Tarshid aims to be a pioneer in the energy efficiency field and to build towards a more sustainable future. Tarshid has a mandate to develop, fund and manage impactful energy efficiency projects in government and commercial sectors that achieve significant energy savings for the Kingdom

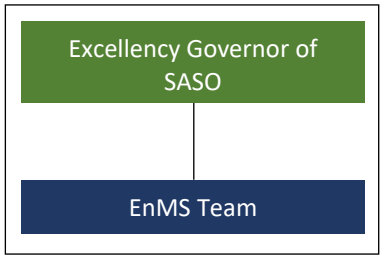
CO_2 emission reduction: SASO succeeded in gradually reducing CO_2 emissions through EnMS by 38% compared to the baseline in 2019. By 2030, the SASO aims to reach a reduction rate of approximately 60% and contribute to the Kingdom's initiative for zero-carbon neutrality by 2060. The table below displays the journey toward reducing carbon emissions since the implementation of the EnMS.

Year	2020	2021	2022	2023
Emission	9,873	10,563	9,226	9,519
Reduction(tCO_2e)	5,475	4,784	6,121	5,828
Savings %	**36%**	**31%**	**40%**	**38%**

Table 2. CO_2 Reduction Journey

Plan

Top Management Commitment: The energy management system receives significant attention from top management through the application, adoption, and dissemination of the culture and concept of energy policy. In addition to informing all employees about it annually by the Excellency Governor of SASO, Dr. Saad Al-Kasabi. In addition, the energy management team held quarterly meetings to review the energy performance indicators (Sites 1, 2, and 3) with the Governor, report on any challenges facing the team, and directly obtain all the necessary resources to remove all the challenges that hinder the implementation of the energy management system.



EnMS Team Structure

What is not measured cannot be monitored or developed

The team collects and documents all data, which is reviewed periodically and identifies opportunities for improvement.

Recently, the team concluded that there was a waste of energy about 2% in site2. The reason was due to some employees randomly attending the workplace outside the official working hours, and then it was circulated to all employees about the necessity of adhering to the official working hours (we obtained the support of Top management in this regard).

The goals and objectives in SASO are set based on the outputs of the energy review report, where a detailed report on energy performance is presented to senior management at the end of each year. SASO's business strategy objectives revolve around the lowest energy cost, improving energy performance, saving energy, reducing energy consumption, reducing carbon emissions and raising the Energy efficiency of buildings.

Energy Review: The electrical energy consumption (HVAC, pumps, motors, and cooling towers) was measured using devices that were regularly calibrated by a third party. In addition, an energy simulation model [Figure 5] was used through one of the most famous simulation programs, the TRNSYS program, to measure the electrical consumption in the SASO, and compared the simulation results with the actual consumption. The relative error between the

simulation and actual results was approximately 2.5%. The simulation program helped us determine the percentage of HVAC and lighting consumption for all buildings and sites [Figure 6].

Energy Baseline (EnBI) and Energy Performance Indicators (EnPI): As Shown on Figure [7], an energy baseline was developed based on a statistical regression analysis that has the highest relationship between energy consumption and cooling degree day (CDD)@24°C. In addition, it as compared with simulation results to reach the highest possible data accuracy, and 2019 was set as the baseline year.

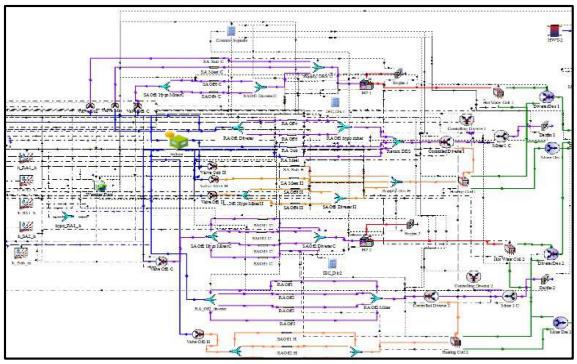


Figure 5. Energy model

Development for multiple site: One of the most important practices that the energy management team worked on developing was the design of an interactive performance dashboard that includes more than 20 performance measurement indicators and indicative indicators through which the presence of energy waste/conservation can be predicted at some sites and buildings [Figure 8]. Due to the large number of buildings, their varying geographically locations, the number of end users, the building areas for each site, and to ensure accurate and continuous monitoring of performance, an interactive dashboard that helped the team identify points of energy waste and conservation, was developed in addition to presenting it to the decision-maker to know the performance indicator for each site and building.

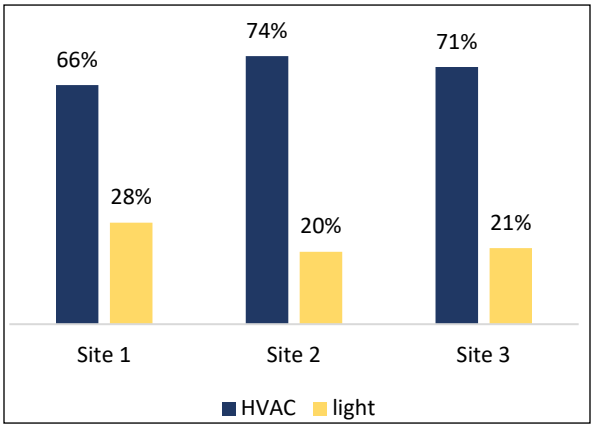


Figure 6. Significant Energy Use (SEU)

"EnMS guides SASO to a systematic approach to continually improve energy performance, reduce costs, sustainability, enhance energy efficiency, and meet regulatory requirements in the Kingdom of Saudi Arabia."

— Khaled ALAwwad, EnMS Team Leader, 50001 LA®, CCML™

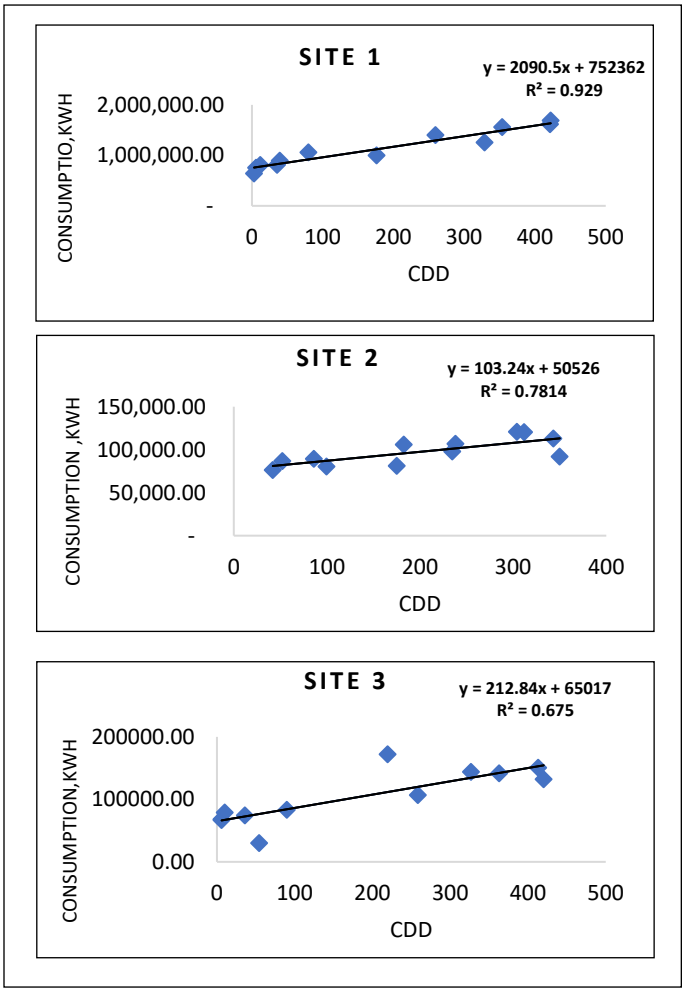


Figure 7. Energy Baseline Equations

•***Economic indicators:*** Energy cost index (ECI- S.R/m^2/y), electricity cost (S. R/kWh/y), and fuel cost index (S. R/liter/y).

•***Energy performance indicators:*** Barrel equivalent oil consumption index (Boe/kWh/y), CO_2 emissions index (ton/y), carbon footprint(ton/y), energy use index (EUI- kWh/m^2/y), and electricity consumption per person index (kWh/P/y).

•***Indicative performance indicators:*** Reactive power, peak demand, power factor, and load factor.

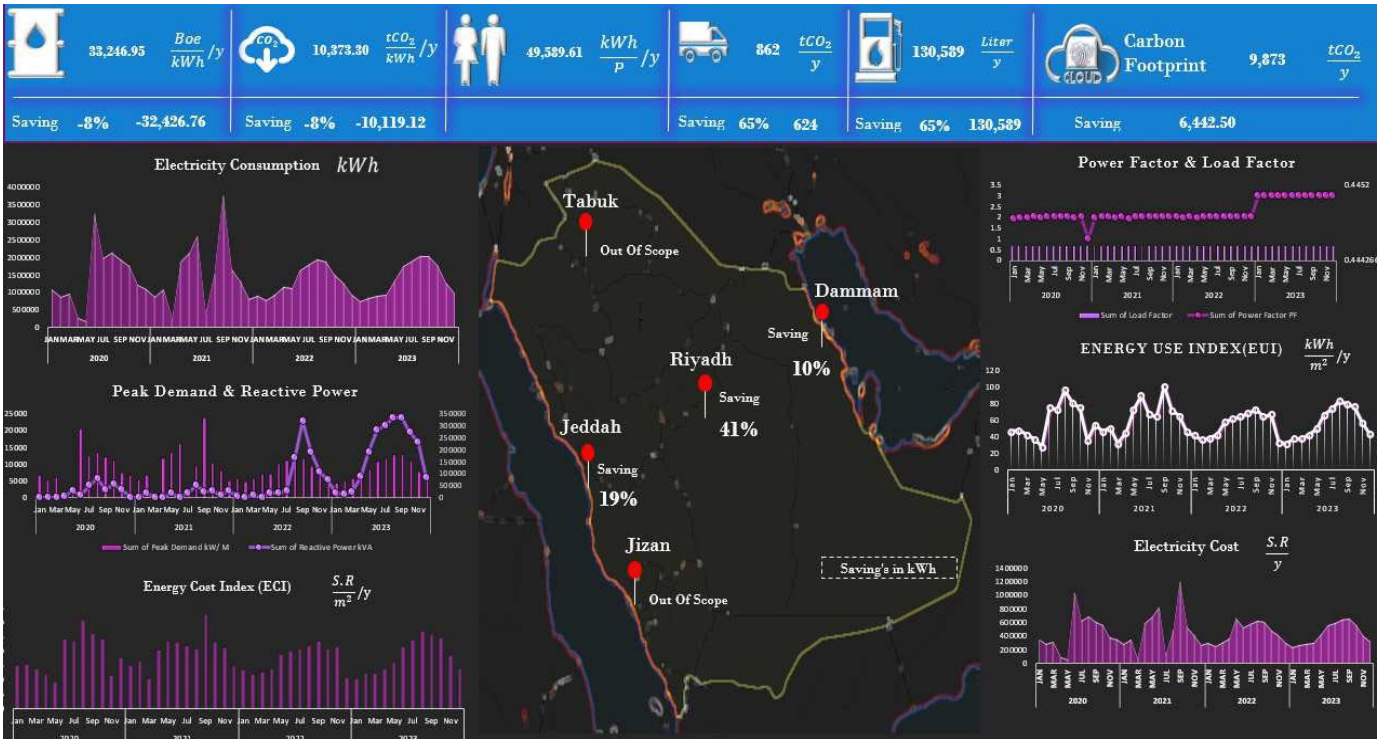


Figure 8. Energy interactive performance dashboard for all sites and buildings

Awareness: Awareness: We believe awareness to be one of the most important pillars of energy management. The EnMS team disseminates awareness messages using internal emails to all employees. The impact of awareness was measured at the end of the year using a survey sent to all employees. After analyzing all the answers, the incorrectly answered questions were targeted to increase awareness in the following year. Employee behavior was found to have improved by 40% compared to previous years before implementation.

Do, Check, and Act

Operational planning and control: The SASO has established, implemented, controlled, and maintained the processes related to its significant energy usage required to meet energy management system requirements. The actions identified were implemented to address risks and opportunities and energy objectives and planning to achieve them by:

- The EnMS documentation was standardized across all sites and structured according to the ISO 50001 clauses.
- Monthly meetings, according to the Excel tracker, discuss the progress of the team plan and follow up on the recommendations of the top management (Excellency Governor).
- All buildings (Sites 1,2, and 3) at an indoor temperature of 24°C during business hours and shutting down the entire facility at all locations at 5:00 pm.

- Identified the independent and fixed variables that had a significant impact on electricity consumption. This has been confirmed by energy audits (twice a year) and simulation results, which prove that HVAC represented about70% of the total electricity consumption.
- Several variables were monitored during the data collection and analysis process, we found that outdoor conditions (CDD) play a major role in increasing consumption, especially in the summer period (May - September), in addition, other variables such as: the number of operating hours for buildings and equipment, the number of end users of the buildings, but these The variables did not have a strong effect (R^2 = .40), such as outdoor conditions, so they were excluded from among the variables affecting the increase in consumption.
- To measure the energy performance indicator improvement (EnPI)& saving of energy we are used this equation (*Total Consumption of Electricity in 2019(KWh) minus the* ***Total Consumption of Electricity in reporting year*** *(KWh) then Dividing the Result by the Total Consumption of Electricity in 2019 in (KWh) and Multiply the Final Result by 100 %)*.

$$\text{Elec. Saving \& EnPI (\%)} = \frac{Baseline - Annual\ Actual\ Consumption}{Baseline} * 100\%$$

Top Management Support: Top management had a very big role in supporting and encouraging us since the beginning of the implementation of the ISO 50001 EnMS implementation work. The top management supported us and provided all resources to ensure the implementation of this initiative in the required manner, as it provided the team with the necessary financial resources to ensure implementation in the required manner within the work plan that the team developed and was approved by Excellency Governor of SASO, and the monthly report is submitted to His Excellency Governor regarding the work done and updating the progress status.

EnMS Team: The responsibilities of the Energy Management System (EnMS) team include a range of tasks aimed at the effective implementation of the ISO 50001 standard in the SASO and the development of methodologies to monitor and improve energy performance. In 2021, the team monitored the energy performance quarterly, leading to the discovery of significant energy waste at some sites and buildings. In 2022, the team decided to monitor energy performance every month, and established performance indicators that are measured every month and monitored daily, the result was savings for the first quarter exceeding 500 K kWh of electricity consumption.

The team continued with this methodology and achieved significant savings that exceeded the targets during the implementation plan. In addition, among the tools that contributed to achieving these savings, the team includes professional members who obtained accreditations as EnMS lead auditors (50001 LA) and certified carbon management leaders (CCML), who have the ability to deal with complex data analysis and transform it into measurable and monitorable performance indicators. Internal audits were conducted at each site by certified team members to monitor the effectiveness of the energy management system.

- Stages 1 and 2 audits of all sites were scheduled for January 2024. All audits resulted in zero non-conformities and the SASO was awarded ISO 50001 certification.

Procurement: The EnMS Team has established and implemented the criteria for assessing energy use, consumption and efficiency over the planned or expected operating lifetime, when procuring energy-using products, equipment and services which are expected to have a significant impact on the organization energy performance. The EnMS Coordinator maintains the complete records for the same and discusses in the energy management team meetings as well as in the management review meetings.

Advanced Control for Purchases: Recently, the EnMS team developed and approved a customized model for energy purchase that was announced to all department in all sites, so that no electrical devices or equipment is purchased expect after studying the operation hours and power input of the device to ensure more accurate control and monitoring of consumption, especially in the laboratory sector.

Transparency



Handing over the accreditation certificate to His Excellency Governor of SASO and the golden shield.



Announcement via Twitter platform to all the SASO's partners.

The SASO announced to all partners that it had obtained the ISO 50001 certificate through social media such as Twitter and LinkedIn.

1. https://www.linkedin.com/posts/sasogov_aepaesaetaewaepaedaepaepaesabraepaesaebaehaewaexaeyaer-activity-7164906977117126656-30MX?utm_source=share&utm_medium=member_desktop

What We Can Do Differently

1. We will not be satisfied with raising awareness via email only, but we will hold many workshops and open the way more for employees' initiatives and ideas.
2. Linking energy targets to the SASO's main indicators.
3. Applying training courses for team members well before the start of the implementation process and ensuring that all members are ready to experience the implementation of ISO 50001.
4. We looked at other international experiences (which were inconsistent with the nature of the SASO's work i.e. industrial sector, retail sector etc). **The Next Steps and future vision for ISO 50001 EnMS are:** The SASO aims to make the successful experience of obtaining the ISO 50001 certificate a helpful and motivating factor for all government sectors and to transfer the expertise and experiences it went through during the implementation and preparation for obtaining accreditation. In addition, it aims to integrate the ISO 50001 energy management system with the ISO 14001 and ISO 41001 environmental management systems for facility management by the third quarter of 2024. We are proud that the SASO is the first government sector to obtain ISO 50001 accreditation in the Kingdom of Saudi Arabia.