

## Saudi Aramco - SOfPD

We believe in the power of energy to transform lives, enhance communities, advance human progress, and sustain our planet.



### Case Study Snapshot

<b>Industry</b>	Energy
<b>Product/Service</b>	Oil and Gas
<b>Location</b>	Safaniya, Zuluf, and Marjan Areas
<b>Energy performance improvement percentage</b> (over the improvement period)	38.9 % improvement over 1 year
<b>Total energy cost avoidance</b> (over the improvement period 12 months)	\$ 7.4 MM
<b>Cost to implement Energy Management System (EnMS)</b>	\$ 0.76 MM
<b>Total energy savings</b> (over the improvement period)	25.3 MWh
<b>Total CO<sub>2</sub>-e emission reduction</b> (over the improvement period)	227 k Metric Tons

### Organization Profile / Business Case

Safaniya Offshore Producing Department (SO<sub>f</sub>PD) falls under Saudi Aramco Company, primarily focused on oil and gas production which covers three main areas: Sadaniya, Zuluf, and Marjan. The department's main motivation for energy efforts is to meet its customers' energy demands while reducing its carbon footprint and environmental impact. SO<sub>f</sub>PD is committed to driving energy efficiency and addressing the global emissions challenge. And as the world's largest integrated oil and gas company, we believe we are uniquely qualified to make effective contributions to the overall solution.

The department's overarching goal is to achieve its production targets for oil and gas in a reliable, safe, and ecofriendly manner. To accomplish this, SO<sub>f</sub>PD is efficiently managing its financial, workforce, and asset resources in a responsible and accountable way. Energy management is critical in the organization's larger business strategy and framework on climate change, sustainability, and decarbonization. As a leading oil and gas producer, the department recognizes the importance of reducing greenhouse gas (GHG) emissions and is committed to mitigating the environmental impact of its operations. To this end, SO<sub>f</sub>PD has implemented various programs and initiatives to encourage and reward energy management actions that reduce energy related GHG emissions. Additionally, SO<sub>f</sub>PD has incorporated climate change and sustainability considerations into its overall business strategy, including its investment decisions and operational planning. The department's focus on sustainability and decarbonization aligns with Saudi Aramco Company's long-term commitment to achieving net-zero emissions by 2050.

One of the initiatives is initiating the Energy Management Program (EMP). The SOfPD Energy Management Program (EMP) addresses the measurable objectives, targets and initiatives to achieve operational excellence in the field of energy conservation within Saudi Aramco while maintaining plant safety and production targets. SOfPD Energy Management Program (EMP) emphasizes sustainable energy conservation by making energy conservation everyone's target in SOfPD. This framework is intended to be a guide for SOfPD Energy Management Team (SOfPD EMT) to plan and implement the Energy Management Program within all operating facilities in Marjan, Zuluf, and Safaniya areas. Hence, this program plays a crucial role in the sustainability and decarbonization since it manages energy consumption and improve energy efficiency in the Safaniya Offshore Producing Department (SOfPD). SOfPD has developed this EMP to assist all SOfPD operating facilities in deploying a departmental level energy management program in alignment with the Corporate Energy Management Program. Furthermore, this EMP provides guidance for operating facilities to integrate energy efficiency into the management practices, including fine-tuning production processes and improving the energy efficiency of various systems. Implementing this program allowed SOfPD to obtained the ISO 50001:2018 along with multiple awards and certificate in the energy industry.

*“ISO 50001 is an important milestone for our operating organization as it provides a framework to improve energy performance, reduce environmental impact, and cut the energy cost”*

—Hamad Alameer, Section Head

## Business Benefits

In line with ISO 50001:2018 Program, SOfPD launched around 10 initiatives to reduce the consumption of energy in Safaniya, Zuluf, and Marjan Area. These initiatives resulted in significant cost avoidance of \$ 7.4 MM and total energy savings of 25.3 MWh during 12 months from October 2021 to September 2022. In addition, there was a reduction in CO2 emissions as well. Moreover, the mothballing of the SG-4 resulted in less equipment for the maintenance to do Preventive maintenance which saved a significant amount of time.

Using the multi-site approached enabled the organization to quickly adapt to any change and initiative to reduce both energy and CO2 reduction. It ensures the flexibility of all of our sites to implement these initiatives in timely manner. In addition, most of these initiatives were conducted in house giving the expertise of our personnel. The costs are explained in the attached excel sheet. The top major initiatives are highlighted below:

### 1. SG-4 Total Plant Shutdown for energy saving

The Safaniya GOSP-4 was identified as a high-energy consumer with low oil production. To address this issue, an energy study was conducted with support from different organization inside Saudi Aramco, which recommended mothballing SG-4 to save energy. By shutting down and mothballing GOSP-4, the Safaniya field was able to operate more efficiently, resulting in a reduction in energy consumption and environmental benefits following the guidelines of EnMS. The initiative did not affect the oil production but it dramatically reduce the energy consumption of the used energy. The oil production rate remained at 25-30MBOD, but the power consumption reduced from 5MWH to 0.89MWH, which represents a significant improvement. This initiative resulted in energy savings of 4.11MWH for one year and cost avoidance of \$1.61MM per year. Additionally, the critical mothballing of SG-4 achieved an OPEX cost avoidance of \$1.7MM per year. Furthermore, the calculated CO2 Emission Reduction was 26K Ton CO2/Year. The electrical energy consumption before the shutdown of SG-4 was 5.0MWH, and after the mothballing, it reduced to 0.89MWH, representing a remarkable reduction in energy consumption.

Cost avoidance from energy per year \$1,6 MM

## 2. Safaniya Electrical Submersible Pumps Power Optimization

The Electrical Energy Consumption data for Safaniya ESP's was analyzed and compared with production data for individual wells and platforms. It was found that some of the platforms are consuming more electrical energy while producing less oil. Where as some of the platforms are consuming less electrical energy and producing more oil. Also this was evaluated that for producing 1300MBOD the optimum energy consumption will be 29.5MWH by choosing the high efficiency platforms (Less KWH/MBOD ratio wells). Where as for same Production of 1300MBOD the energy consumption will be 39MWH by choosing the low efficiency platforms (Higher KWH/MBOD ratio wells). Electrical energy savings and cost avoidance was calculated as provided in attached spread sheet.

Cost Avoidance per year 1,719,927 \$

## 3. Zuluf Field Electrification for Electrical Submersible Pumps

The Zuluf Engineering team, in collaboration with the energy team, conducted an evaluation of the ZG-4 Power Gas Turbine's operation, which was responsible for the additional electrical load needed to upgrade wellhead platforms with ESP's in the Zuluf field. The evaluation confirmed that the Zuluf GOSP-4 power gas turbines were old, outdated, and operating at low efficiency and reliability levels. Furthermore, it was found that at 10MWH de-rated capacity, the power gas turbines would consume 6.5MMSCD fuel gas at an efficiency of approximately 18-20%. To address these issues, the team initiated the Maintain Potential project, which aimed to electrify the Zuluf field by installing an Electrical Distribution Platform (EDP) powered from the existing Safaniya TP-20. By August 2022, 95 ESP's were commissioned, which were operating at an electrical load of 8MWH. This initiative led to a saving of 4MMSCFD internal fuel gas consumption. The electrification of the Zuluf field through this initiative resulted in a significant reduction in energy consumption and increased efficiency. Additionally, the environmental benefits of this project were notable, as it significantly reduced the amount of fuel gas consumed, resulting in reduced greenhouse gas emissions.

Cost avoidance per year 2,785,680 \$

## 4. Zuluf Power Recovery for GOSP's

The Zuluf Engineering team, along with the department energy team and NATSD, evaluated the operation of ZG-4 Power Gas Turbines and determined that they were aged, obsolete, and operating at low efficiency. To address this, the team engaged the vendor for major maintenance of the gas turbines. In addition, a plan was established to hire a third party for rental power generation to meet the electrical energy requirements for Zuluf GOSP's. Diesel was used as a source of fuel for rental power generators. The daily consumption of diesel heating value was calculated, and the equivalent quantity of internal fuel gas was found to be 0.45MMSCFD. The target value for internal fuel Gas consumption was 2.5MMSCFD. Thanks to this initiative, a saving of 2.05MMSCFD internal fuel gas was realized, resulting in Energy Savings 108.48 MMBtu

Cost avoidance per year 1,609,804.00 \$

### Plan

The SOfPD Energy Management Program (EMP) addresses the measurable objectives, targets and initiatives to achieve operational excellence in the field of energy conservation within Saudi Aramco while maintaining plant safety and production targets. SOfPD Energy Management Program (EMP) emphasizes sustainable energy conservation by making energy conservation everyone's target in SOfPD.

# ISO 50001 Energy Management System – Case Study

2023

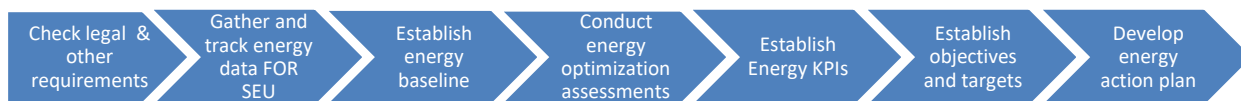
Saudi Arabia

SOfPD has developed a well-defined manual that contain the details of Energy Management Team, Energy Action Plan, Roles & Responsibility, Related KPI, Benchmarking, and Energy Management Review in line with requirements of ISO50001:2018 and Saudi Aramco Operation Excellence Program Process 5.3 “Energy Efficiency”. SOfPD Energy Management Team (SOfPD EMT), which is chaired by the director of the department, is responsible planning, budgeting, required resources, and implementation of the Energy Management Program.

In SOfPD, the data are monitored through multiple data collection system. These data are analyzed by our energy team to identify the major energy contributions (highest energy consumptions). These data were used to find a ratio of the energy consumption and the importance of this specific equipment to produce oil and gas to sort these equipment on a list. This approach was followed after receiving the ISO50001 and it’s an appropriate approach to analyze the data received from all the sources in the field. Analyzing these data further provide in-depth understanding of where the organization can improve. Hence, this list will provide a clear idea to the team on which equipment the resources should focus on. Moreover, it helps the team to poetize actions based on these equipment by recommending new initiatives to reduce energy consumption periodizing on equipment based on the established list.

EMT prepares the baseline and set the targets of the next three years based on the gathered previous data and future forecasting.

The below flowchart explains and shows SOfPD EMS Implementation Plan.



A vital contribution towards the success of SOfPD energy conservation initiative comes through spreading the energy conservation knowledge and awareness. In order to achieve this purpose, SOfPD EMT will be using the available methods and techniques such as forums, campaigns, workshops, seminars, conferences, exhibitions, video films, training, as well as posters at all operating facilities.

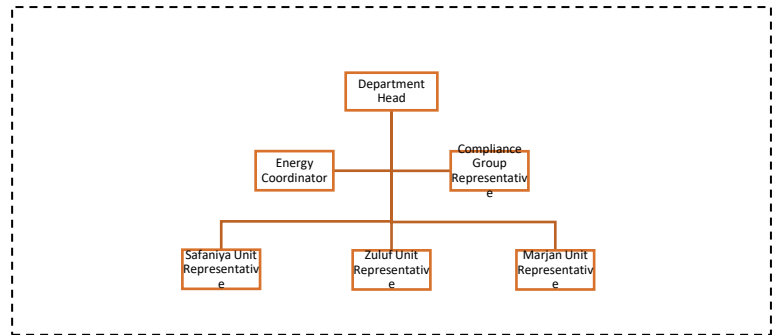
Energy efficiency forums are a very important platform for direct publicity to a vast number of SOfPD employees within a short period of time. The energy conservation forums could present samples of new energy efficient equipment, such as variable speed drives, turbochargers and others. Energy education seminars may include basic energy principles, consumption loads and relevant environmental effects.

Organizing and actively participating in conferences, seminars, symposia, meetings and workshops could create awareness among SOfPD employees by mutual interaction and exchange of latest information in the specialized fields of knowledge related to energy conservation.

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2023

Saudi Arabia

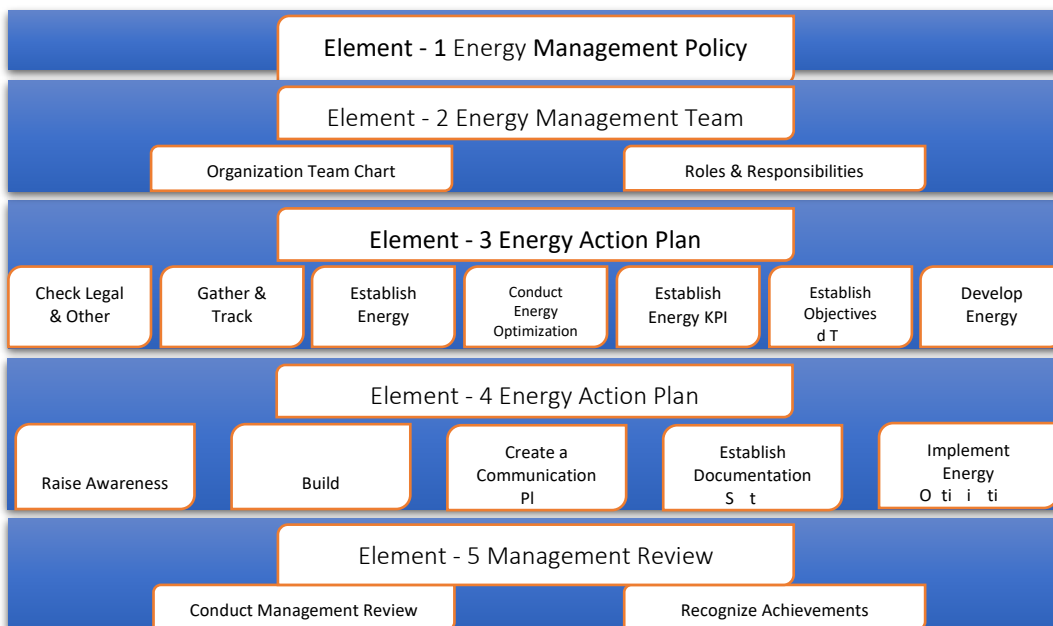


"Implementing an EnMS based on ISO 50001 provides the framework and tools to help organizations setting energy performance targets to continuously improve their consumptions"

—Hamad Alameer, Safniya SectionHead

## Do, Check, and Act

SOPD Energy Management Team follows a structured method to implement and improve the Energy Management Program in line with ISO 50001 & Saudi Aramco Operational Excellence Process 5.3 Requirements which consists of five elements which are described in the below chart:



For every initiative, the energy team will identify the all the stakeholders along with the team to conduct such initiative. For instances, for the mentioned initiatives, a multi-discipline team was created from maintenance, operation, and engineers. If the initiative is going to be conducted in multiple sites, then there will an assigned coordinator to coordinate between the multi- discipline team in all the sites.

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2023

Saudi Arabia

EMT is setting the targets for the next three years based on the gathered previous years data along with the forecasted production plan. This process is being monitored by the Energy Management Dashboard. In addition to that, three Key Performance Indicators (KPI) are being updated on monthly basis to reflect the current progress of the Energy Intensity (EI). Moreover, EMT conducts a quarterly management review with the SOfPD director to update the progress, initiative, project approval, budgeting, and obtain any required support. Moreover, EMT is conducting the yearly internal audit and share the result with the corporate Energy team. Moreover, SOfPD is conducting an external audit every three years for the energy program.

The following table shows the used KPI to monitor the progress of the Energy Intensity and Energy Performance as shown below:

Performance Measures	Formula
*Energy Intensity (EI) KPI	EI KPI = E/P, where: E = Total energy consumption in 1,000 (MBTU) P = Total production in barrels of oil equivalent except for several organizations using other type of dominator i.e. water etc.)
*Energy Performance Indicators (EnPIs) for identified Significant Energy Users (SEUs)	Energy Performance Indicators (EnPIs) for specific SEUs

As a result of all the support from the management, SOfPD was able to achieve all the targets in the targeted period. Hence, SOfPD has achieved a significant energy improvement of 38.9% which resulted in a reduction of 25.3 MWH during a span of 12 months. These number were verified using the data collectors which recorded the energy consumption of these locations before the initiatives and after the initiatives. This resulted in a major cost avoidance of \$ 7.4 MM. The team is setting a timeframe of three years and all the numbers and figures are reported on a quarterly basis and the improvement are verified using the data collected from the field through special and accurate sensors.

Using all the collected data, we can identify relevant variables affecting our energy consumption such as rate of produced oil, size of the motor, location since most of our platforms are in offshore area, dust, etc.

In addition, these data helped the organization to identify a baseline of energy consumption which helped us to ensure normalization through all platforms in multiple sites across the organization.

Another way to verify the data is that EMT is conducting the yearly internal audit and share the result with the corporate Energy team. Moreover, SOfPD is conducting an external audit every three years for the energy program.

## Transparency

Once the organization received the ISO50001 certificate, we promoted this in multiple ways such highlighting to the Saudi Aramco, Admin Areas, and conducted multiple reports and announcement to be published publicly.

In addition, the energy dashboard is available with all organizations inside Saudi Aramco where everyone can see the performance of the department.

Moreover, SOfPD conducting benchmarking with other organizations inside and outside Saudi Aramco to improve the energy reduction and CO2 emissions in the Kingdom of Saudi Arabia.

## What We Can Do Differently

The below points include the activities that can be enhanced:

- To establish Benchmarking for the processes.
- Conduct more Seminars and Training to enhance the awareness.
- Participate in energy conferences and expand the collaborations with external parties.
- Deployment of new technologies.

SOfPD next step is to implement more initiative to reduce energy consumption along with reducing CO2 emissions