

ADNOC Gas Processing

Leveraged ISO 50001 Energy Management System to enable continual improvement through a structured approach and successfully achieved 12.8% energy efficiency improvement in just six years.



Case Study Snapshot

Industry	Oil and Gas
Product/Service	Natural Gas Liquids (NGL) and Sales Gas
Location	Abu Dhabi, UAE
Energy performance improvement percentage (over the improvement period)	12.8 % improvement over 6 years
Total energy cost savings (over the improvement period)	USD 64,900,000
Cost to implement Energy Management System (EnMS)	USD 498,000
Total energy savings (over the improvement period)	25,190,000 GJ
Total CO₂-e emission reduction (over the improvement period)	1,420,000 Metric Tons over 6 years

Organization Profile / Business Case

ADNOC Gas Processing plays a strategic role in the hydrocarbon value chain as a vital enabler in fueling the industrial and economic development, supporting the manufacture of aluminum, cement, steel, fertilizer, chemical feedstock, water, and electricity. ADNOC Gas Processing process natural gas from onshore and offshore sources to deliver a wide range of products from methane, ethane, propane, butane, paraffinic naphtha, condensates, and Sulphur.

At ADNOC Gas Processing we consider it our responsibility to act as trustees for future generations and are committed to sustainable development with the forecast of enlarged economic and financial development. We set our targets and objectives and align our strategies with ADNOC and UAE. Our main aim is to conserve the energy and optimize the consumption of the current operations and ensuring the selection of energy efficient processes in our future capital investments. We also strive to minimize our environmental impacts by developing roadmaps for reducing flaring and GHG emissions to optimum levels without compromising the safety and overall effectiveness of plant operations.

“I applaud the landmark achievement of 10% energy efficiency improvement in just a couple of years. Supported by our robust EnMS and empowered with our determination, I’m sure we’ll continue this legacy”

—Ahmed Mohamed Al Abri, A/CEO ADNOC Gas Processing

As pioneers in energy conservation, we were amongst the first to put in place a robust energy conservation policy with clear guidelines for energy management and conservation. Since then, great progress has been made to ensure this and other key sustainability issues are fully integrated with our business and drive everything we do. Our culture of

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environmental and social responsibility is founded on a philosophy of ‘improving on the standard’. Implementing ISO 50001:2011 took this philosophy to next level, by formalizing our approach to energy management and our approach to continuous improvement. The journey wasn't thought up on the spur of the moment, AGP started the sites certification back in 2012 where Asab, Bab, Buhasa, Habshan and Ruwais got certified. Followed up by Habshan-5

certification in 2015, pipeline and corporate certification in 2018 as per the ISO50001:2011 standards. The International organization for Standardization (ISO) issued the second edition of ISO50001 back in 2018. To meet the new demanding requirements, the company went through the transition phase and got re-certified in 2020.

UAE has announced a strategic initiative to achieve Net-Zero emissions by 2050. UAE earlier announced “UAE Energy Strategy 2050” highlighting various targets related to energy efficiency and emissions reduction. ADNOC, in alignment with the National initiatives, has set various sustainability targets in the ADNOC Sustainability Strategy 2030. One of the ambitious targets related to decarbonization is to reduce its GHG emissions intensity by 25% from Year 2019 baseline. To

boost our efforts, a specific target has been set to improve energy efficiency by 5% by Year 2025. Looking forward, a roadmap has been outlined for a more challenging target of 50% reduction in GHG emissions.

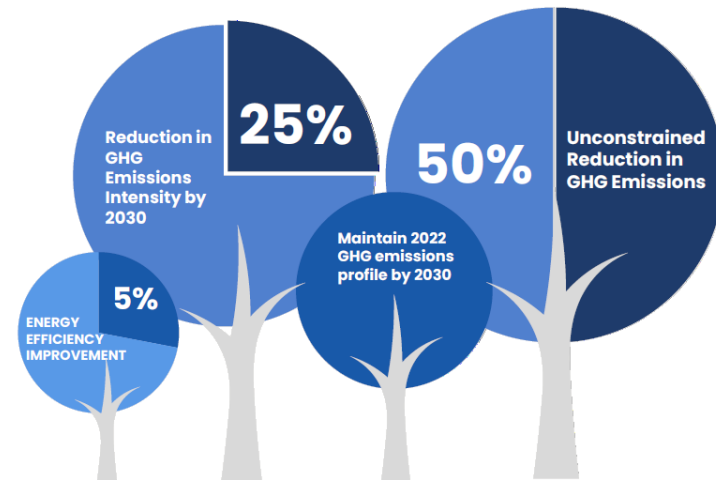


Figure 1 ADNOC Gas Processing Sustainability Targets

Business Benefits

With the early recognition of energy management importance in such an energy intensive operation, we introduced our first energy policy in 2009 indicating top management awareness and attention to the topic. Formalizing our energy management through accreditation helped us move forward on our sustainability agenda as it establish framework to monitor and continuously improve our performance. Through the journey starting from our operational sites certification with ISO 50001 to corporate level, we were able to mature our energy management system to be an integral and integrated within its business processes and positions us agile to meet future challenges. We continue our efforts in energy improvement and ensure to comply with international standards through ISO 50001 Recertification.

ADNOC Gas Processing is one of the first ADNOC Group companies to be certified for ISO 50001 in 2012. Further ISO 50001 Recertification ensured the management and shareholders that the EnMS was implemented and got confirmation through the External certification who are independent and thus avoid conflicts. This also provides confidence to management that the EnMS system will improve not only the energy performance but also the performance of EnMS. In addition, full understanding of ISO 50001 and its compliance will reap benefits by improvement in energy efficiency across the organization. ADNOC Gas Processing has implemented integrated management, which combines ISO 50001 with other standards such as ISO 9001, 14001, 45001, and 27001. ISO 50001 certification costs a small fraction of the total, about 20% of the cost of external certification.

To bring everybody along the journey, we developed a comprehensive communication and engagement plan, taking the needs of our different stakeholder groups as well as all ADNOC Gas Processing employees into consideration. Besides continuous messages through different communication channels, we conducted energy quizzes and engaged colleagues in extensive training and awareness sessions.

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In this regard, ADNOC Gas Processing was able to achieve a cumulative energy improvement of 12.8% from 2016 till 2021 in comparison to 2015 baseline as indicated in the graph below. This Improvement in energy intensity corresponds to a cumulative savings of **USD 64,900,000**. Implementation of ADNOC Gas Processing EnMS into our processes and daily operation has also helped to reduce the energy consumption by **25,190,000 GJ** which corresponds to **1,420,000 Metric Tons of CO₂** emission reduction over 6 years due to improvement in energy efficiency only.

Along with the below mentioned gains, we also realized significant benefits gained throughout our Journey with ISO 50001 including but not limited to brand enhancement, compliance with energy regulations and consideration of alternative energy sources. Therefore, the company is investing in implementing and keeping updates of the ISO requirements.

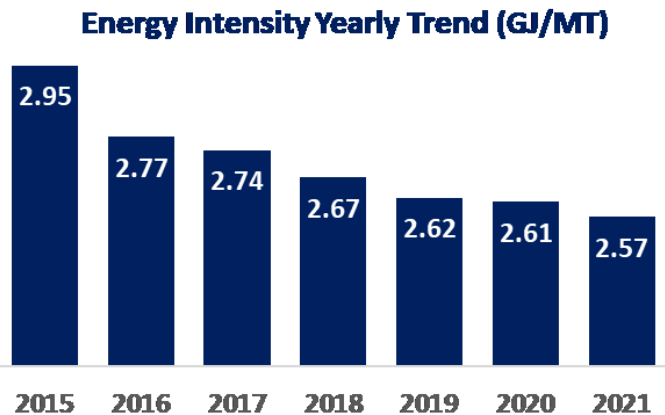


Figure 2 Energy Intensity Yearly Trend (2015-2021)

Plan

ADNOC Gas Processing Senior Management took the initiative to implement ISO 50001:2011 by the end of 2011 and mandated all of the Sites to implement. Several presentations were presented to Management on benefits of Energy Management system and its implementations, including demonstrating competitive advantage, lower GHG emissions, conservation of resources etc. and in return high profits and social and local contribution to community and the country. Moreover, Management was fully involved in defining, establishing, implementing, and maintaining an Energy Policy.

“ISO 50001 was the key enabler for AGP in successfully achieving its strategic objective of energy efficiency improvement. Now again, it will be a corner stone in shaping our decarbonization roadmap.”

—Ali Al Hendi, VP Engineering & Technical Services Division

Beginning in 2012, a high-level steering committee chaired by SVP(T) was constituted to implement ISO 50001. The ISO 50001:2011 standard was used to design a plan for implementing the Energy Management System. Top management established an energy strategy and nominated a management representative who oversees the energy management system's development, implementation, and improvement and reports to top management. The

organization developed an energy management team, which involves many departments and divisions (e.g. procurement, projects, and sites) in the creation and execution of the EnMS. In addition, our management involvement was in providing adequate resources, communicating importance of energy management, ensuring that energy objectives and targets are established, considering energy performance in long-term planning and conducting management reviews regularly.

As part of ADNOC Gas Processing commitment to use natural resources legitimately, there was always thriven to improve energy use efficiently and this was the top priority of the management. The implementation process was accelerated by the formation of cross-functional energy teams and third-party resources.

The Corporate Energy Management Team is using resources like corporate process information management system (CPIMS) and Production Management System (PRISM) for effective implementation and improvement of EnMS. ADNOC Gas Processing Corporate EnMS MR based on the discussions with the Corporate Energy Team ensured that SMART (Specific, Measurable, Achievable, Realistic and Time-bound) energy objectives have been established and

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appropriate EnPI are evolved considering energy performance in long-term planning based on parameters that impact energy performance and the performance of the EnMS. These targets were fixed based on technological, financial, operational and business parameters. The performances of EnPI are closely monitored and reported monthly, for all ADNOC Gas Processing plant divisions as well as ADNOC Gas Processing overall. Top management are ensuring that monitoring reports of energy consumption, performance and efficiency are generated at appropriate intervals and are periodically reviewed during management reviews meetings. The top management of ADNOC Gas Processing Corporate is committed to implement, maintain, and ensure continual improvement in the effectiveness of the Energy Management System (EnMS) and ensure that energy performance will be considered in long term planning.

Implementing an AGP energy management system is not a goal in and of itself. What important are the system's outcomes: improved energy performance because of focusing on energy in daily practice. The desire of an organization to control energy consumption and expenses, as well as make the required adjustments to their day-to-day operations to support these improvements and cost reductions, determines whether an energy management system will work.

As part of the ADNOC Gas Processing, ADNOC set energy efficiency targets for each of its group firms. ADNOC Gas Processing must meet the set standards by its Shareholders (ADNOC). Each year, the targets were agreed upon by Performance Score Cards (PSC), which eventually cascaded down to each Operating Plant as most of the energy was used there. During top management reviews, internal audits, corporate reporting, and energy reviews, the EnMS is assessed. For each of the operational sites (Divisions), a Register of Opportunities (ROOP) is created, and these opportunities are examined and, if feasible, exploited to achieve the highest level of energy efficiency.

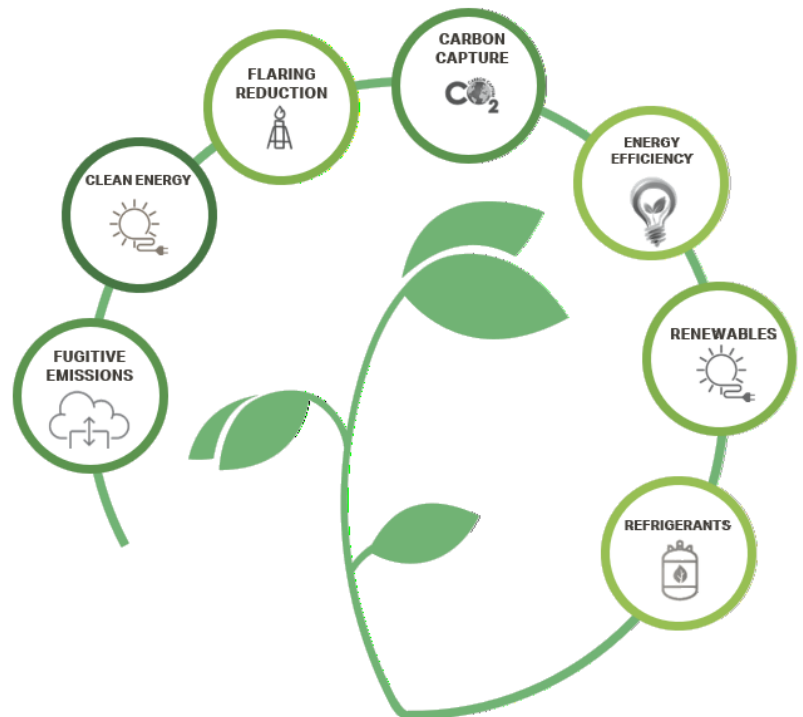


Figure 3 ADNOC Gas Processing Focus Areas for Decarbonization

The EnMS was first implemented at Habshan site and later extended to all other sites (Asab, Bab, Buhasa and Ruwais and later on for the new sites Habshan-5 and Pipelines). Once all the sites got certified a corporate ISO 50001 certificate obtained encompassing the sites as child certificates. As the Corporate EnMS is complementing sites EnMS, therefore there is distinctive domain of energy management for both the levels. Corporate EnMS (led by Corporate EnMS MR) covers overall energy performance of sites in addition to the ADNOC Gas Processing corporate level energy performance. Whereas respective sites EnMS (led by respective site EnMS MRs) covers site energy performance at all levels from individual energy uses up to the overall site level energy performance.

Initially AGP got certified to ISO 50001:2011 and later the transition audits were conducted along with re-certification audits to upgrade the certificated to ISO 50001:2018. AGP has implemented many ISO standards like ISO 9001:2015, ISO 14001:2015 and ISO 45001:2018 which are integrated into a coherent Business Management System also can be termed as Integrated Management System. The new ISO 50001:2018 is also based on ISO's High-Level Structure (HLS) which forms the basis for other mentioned standards, the implementation and transition was made much easier.

Do, Check, and Act

ADNOC Gas Processing has enforced a formal procedure for energy performance monitoring, analysis, and reporting. It sets the guidelines and cover the energy intensity: encompassing the energy boundaries and calculation, analysis, reporting, target setting, normalization, and savings estimation. The energy performance indicator (EnPI) used for corporate-level and individual site-level energy performance monitoring and reporting is referred as “Energy Intensity”.

$$\text{Energy Intensity} = \frac{\text{Energy Consumed (GJ)}}{\text{Total Production (MT)}}$$

Energy Consumed consists of all sources of primary and secondary energy consumed within the organization’s boundary. Total Production refers to all the net products leaving the respective site for transfer to other sites, export to other Group Companies or for selling. The Energy Intensity of individual sites are used in estimating the ADNOC Gas Processing Energy Intensity. With the scope of natural gas processing operation, using energy intensity as an energy performance metric allows monitoring and reducing the specific energy consumption per unit production.

The energy performance monitoring and reporting is taking place frequently and being delivered in different forms either through monthly reports, portals or excel sheets and delivered to our different stockholders within the company. This is mainly to review changes in the performance and study optimization initiatives to ensure sustainment of the energy improvement. Each year, ADNOC Gas Processing undergo target setting exercise as per the ISO50001 requirement. It involves the analysis of past energy performance, production forecast and shutdown plan to identify baseline energy performance of individual sites and corporate level. The practice of setting yearly targets of sites involves the following:

- Set the baseline where a minimum of 12 months data should be considered. This is minimum requirement to align with energy management and business objectives where it captures a full range of operating cycle and seasons.
- Arranging production and shutdown plans on a yearly basis based on business plans.
- Perform regression analysis on baseline data and updated production figures to estimate the energy consumption of the upcoming years.
- Set improvement target and include any operational or strategical strategies.
- Perform adequacy checks and set Energy Intensity target.

Any deviation with the target illustrates a change in energy performance of the site, which could be either due to operation conditions / philosophy or due to parameters outside the boundary of the site. Therefore, normalization is applicable to any deviation from expected energy performance of a site that is caused due to an external factor (factor outside the control of the site). Certain criteria are in place to classify if the different variables are applicable for normalization or not. The organization is always eager to ascertain whether the impact on energy intensity is due to internal or external factors. The following instances are a few examples that prompt normalization in ADNOC Gas Processing: production change, change in feed characteristics, change in power strategy and different gas injection rates.



Figure 4 EnMS Implementation Approach

Initially, a steering committee comprised of representatives from Energy Compliance (EC), Corporate Excellence Quality (CEQ) and sites was established. Implementation plans were presented to top management and the project was approved and sponsored. As the Corporate EnMS is complementing sites EnMS, therefore there is distinctive domain

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	Key Activities	Responsibility			2012							
		EC	Sites	CEO	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
1	Appointment of MR and Energy Team		P									
2	Conducting ISO50001 Awareness Sessions and Lead Auditor Courses			P								
3	Conducting Energy Review	S	P									
4	Establishing Energy Baseline	S	P									
5	Setting of Energy Objectives, Targets and KPIs	S	P									
6	Preparation of Documentation		P	S								
7	Development of Operational Controls	S	P									
8	Performing Internal Audits & Management Review Meetings		P	S								
9	Performing GAP Analysis	S		P								
10	Creating Awareness through publicity with help of Posters and technical training	P										
11	Engagement of Certification body			P								
12	Perform Document Review and Initial Visit	S	P									
13	Perform Certification Audit		P	S								

Figure 5 EnMS Implementation Plan

Top Management demonstrated effective leadership through involvement and engagement with meeting the standard as opposed to just a commitment to developing an energy management system. The project was sponsored by the senior management, who conducted regular meetings until the initial certification. Later, it was replaced by an Energy Management Team for each site with members from Legal Counsel and Corporate Excellence Departments, coordinated by the corporate Energy Efficiency team that drives implementation.

ADNOC Gas Processing Corporate EnMS MR, in coordination with Corporate Energy Team, plans for energy use by discussing and re-assessing ADNOC Gas Processing Corporate energy inputs and outputs, past and present energy uses, and legal and other requirements related to energy. The Corporate Core Energy Team analyzes energy use and consumption, defines corporate energy performance indicators (EnPIs), defines an energy baseline based on available historical energy data, selects and updates significant energy uses, identifies objectives and targets for continuous energy performance improvement and support plants EnMS MR to define site specific energy performance indicators ,targets & objective, and implement action plans to reach the corporate and site specific performance targets. The outputs from this assessment are discussed and validated in the Energy Review meetings. The procurement process slightly changed after implementation ISO 50001; Company inform suppliers of energy services, products, equipment and energy through the ADNOC Gas Processing Procurement Division (PD) that the procurement is partially dependent on the energy and environmental evaluation wherever the products or services have an impact on SEUs and environment.

Any of the plant division use the criteria’s developed by the ADNOC Gas Processing Projects and Procurement Division team for assessing energy use, consumption and efficiency and environmental issues over the planned or expected operating lifetime when procuring energy using products, equipment and services which are expected to have significant impact on energy and environmental performance. Various plant divisions follow ADNOC Gas Processing Design General Specifications (DGS) through ADNOC Gas Processing HQ Technical Services. Energy considerations are captured in the following documents: Rotating Equipment – System Integration and Electric Motors Cage Induction and Synchronous. The latest includes Life Cycle assessment, which considers energy unit cost as one of the parameters.

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We exposed the implemented system to an internal EnMS audit to verify compliance with ISO 50001 and to identify opportunities for improvement. The findings raised were subsequently addressed through root cause analysis. Later, the system was reviewed during a planned Management Review Meeting before the third-party audit. As a result of getting integrated audits, all ISO standards were reviewed by external auditors as integrated audits to reduce the cost and effort involved.

The energy savings estimation refers to comparison of performance between two periods or scenarios (hereby referred as References). Reference 1 is generally called Baseline. ADNOC Gas Processing methodology in calculating Energy savings is directly estimated by comparison of energy intensities. First “Business-As-Usual” energy consumption is estimated by multiplying the Reference 1 energy intensity with the Reference 2 production rate. Subsequently, difference of Reference 2 energy consumption and “Business-As-Usual” energy consumption directly gives the energy savings. Following diagram shows the high-level calculations methodology for savings estimation. All individual years values are normalized for other variables, where applicable.

Table 1 Energy Savings Estimation

	Reference 1 (Year 2015 Baseline)			Reference 2 (like Year 2021)			Business As Usual	Savings	
	Energy Cons.	Production	Energy Intensity	Energy Cons.	Production	Energy Intensity	Energy Cons.	Absolute	Percent
	GJ	MT	GJ/MT	GJ	MT	GJ/MT	GJ	GJ	%
	EC1	P1	$EI1=EC1/P1$	EC2	P2	$EI2=EC2/P2$	$EC3=EI1*P2$	$ES=EC3-EC2$	$ES\%=ES/EC3$
2015 vs 2021	188,265,150	63,908,732	2.95	169,219,956	65,856,312	2.57	194,002,417	25,190,000 *sum of 6 individual years rows	12.8%

The significant and continual energy efficiency improvement achieved at ADNOC Gas Processing primarily shows the credibility and success of the approach adopted. The robust energy performance monitoring and reporting system is at the core of overall energy management. It has a major contribution in identifying gaps and realizing the opportunities on regular basis through the Register of Opportunities (ROOP). The achievement of ADNOC Gas Processing, being one of the major energy consumers in the ADNOC Group, also enabled ADNOC to achieve its energy efficiency improvement and sustainability targets. Energy efficiency improvement has not only reduced the operating cost and increased plant profitability but also helped to reduce the GHG emissions, thereby contributed towards sustainability. Additionally, we have developed our own Project Energy Optimization framework in line with ADNOC Value Assurance Program to define the energy management considerations in projects during the different stages of ASSES, SELECT, DEFINE and EXECUTE.

Transparency

Since the ISO 50001 is a voluntary standard for organizations to implement and get certified, AGP also adopted this standard as a well-known approach. The fact that we were one of the first ADNOC Group companies to be ISO 50001 certified in 2012, during which few companies within the UAE got certified to ISO 50001, prompted us to announce this in our internal news bulletins and to inform ADNOC. As part of sharing and collaborating with other entities within UAE, we shared our success story with ADNOC LNG and Borouge on special focus on how to integrate the ISO management systems. AGP also shared the ISO 50001 Certification news and its success in various forums/conferences like ADIPEC, GASTECH etc. The ISO 50001 certification helped our employees to excel in promoting the adoption of renewable, green, or other innovative energy technologies and been main motivator for achieving the prestigious “ENERGY INNOVATOR OF THE YEAR” Award for AGP employee. This international award from the U.S. based

Association of Energy Engineers (AEE), is a non-profit organization that recognizes advances in the industry for practices and principles in energy engineering and energy management. We are participating in publishing ADNOC group level Sustainability Report in accordance with GRI standards that provide a snapshot of our energy and environmental performance including status of our actions towards achieving GHG emission reduction targets 2030 in alignment to UAE NET ZERO 2050 pledge. We are sharing our energy performance with our International Shareholders on yearly basis.

What We Can Do Differently

With our current experience of ISO 50001 EnMS, we are able to reflect back and Identify what can be done differently to improve EnMS even further:

- Integrating the energy management system for all operating sites to address all key aspects under one umbrella and aim:
 - Objectives & targets alignment
 - Standardization
 - Centralization in terms of documentation
- Introduce KPIs for EnMS performance tracking and improvement instead of focus on energy performance only.
- Dedicate more resources for ISO 50001 EnMS awareness and training among employees.
- Engage and ensure operations frontline knowledge and cascade their role in EnMS through daily operational controls.
- Employ some good software based application or tool with enhanced analytics, graphics and statistical techniques instead of using spreadsheets.
- Apply regression based concept of dynamic baseline while setting targets.
- Identify the variables affecting energy performance and correlate actual energy performance with these variables. Apply normalization through the use of statistical and / or thermodynamic models.
- Emphasize on developing competent internal auditors and design a comprehensive auditing plan in initial implementation stage.
- Give ISO 50001 awareness to consultants, contractors and suppliers.

“The real strength of ISO 50001 EnMS lies in addressing all the pertinent aspects and dimensions for continual energy efficiency improvement, ranging from soft skills like awareness and competencies to all the way to a structured framework for energy performance monitoring, analysis and reporting.”

—Eisa Al Jenaibi, Manager Research & Energy and Corporate MR EnMS,
ADNOC Gas Processing

In AGP we will be leveraging our ISO 50001 based EnMS as one of the most cost-effective ways to reduce operating expenses, help control costs, optimize resources and contribute towards sustainability by emissions abatement. As part of future plans, we will be focusing on:

- Procurement aspects with a better developed criteria in which our focus will be on life cycle costing and energy efficiency rating (including those based on labelling programmes).
- Mapping our decarbonization and GHG emissions abatement strategy with an ISO 50001 dynamic register of opportunities (ROOP).
- Integrating the audit plans of multiple sites and management systems under umbrella of the overall Business Management System (comprising ISO50001, ISO14001 and ISO9001 etc.).
- Transferring the workflow management of audit findings to the SAP based ERM system.
- Enhancing the energy performance monitoring, analysis and reporting, including energy review, through utilization of automated system with powerful analytics and graphics. An “Energy Manager” module as part of our iRTO project is being developed and will be commissioned soon.