ISO 50001 Energy Management System – Case Study

2023 United Arab Emirates

Government of Ras Al Khaimah

First government in the world to achieve ISO 50001 certification across all of its entities

Ras Al Khaimah government Director Generals and Reem energy team after certificate handover ceremony.

Case Study Snapshot	
Industry	**Other - Government**
Product/Service	**Government Services**
Location	**Ras Al Khaimah, United Arab Emirates**
Energy performance improvement percentage (over the improvement period)	**24.6%** electricity savings at the end of 3 years
Total energy cost savings (over the improvement period)	**USD 926,000** (equivalent to AED 3,398,583 from electricity and water savings over 3 years)
Cost to implement Energy Management System (EnMS)	**USD 276,000**
Total energy savings (over the improvement period)	**43,140 GJ** (11,983,368 kWh of electricity over 3 years)
Total CO_2-e emission reduction (over the improvement period)	**4,865 metric tons** (from 11,983,368 kWh electricity savings over 3 years)

Organization Profile / Business Case

Ras Al Khaimah is the fourth-largest emirate in the United Arab Emirates, occupying an area of 2,478 km^2 with a population of more than 480,000 residents. The emirate is governed under the leadership and guidance of His Highness Sheikh Saud bin Saqr Al Qasimi, UAE Supreme Council Member and Ruler of Ras Al Khaimah, and His Highness Sheikh Mohammed bin Saud bin Saqr Al Qasimi, Crown Prince of Ras Al Khaimah and Chairman of the Executive Council.

Ras Al Khaimah is undergoing a remarkable transformation and growth in multiple sectors of its economy. Energy and water are central to the policy agenda of the government under Ras Al Khaimah's Vision 2030 as well as the UAE energy and sustainability strategies and wider vision. In 2018, the Energy Efficiency & Renewables (EE&R) Strategy 2040 was adopted in Ras Al Khaimah to support the competitiveness of its economy through efficient energy use and cost-competitive, available and reliable energy supply. The strategy targets 30% energy savings, 20% water savings and 20% contribution from renewables by 2040 from a 2017 baseline. It comprises nine programs, briefly described in Figure 1 and more information about it is available at www.reem.rak.ae.

The Energy Management Program of the EE&R Strategy 2040 aims to promote systematic energy management practices such as ISO 50001 across high-energy users, including industries and commercial and government entities in Ras Al Khaimah. The strategy targets implementing such energy management systems in at least 30 high-energy users by 2040.

The strategy envisages the government as a leader and champion in adopting energy efficiency solutions and so the government adoption of building retrofits and energy management was mandated through a directive. The Amiri Resolution No.15 of 2018 sets an overall target of 20% electricity and water savings by 2022 for the entire Government of Ras Al Khaimah from a 2017 baseline. The Energy Efficiency and Renewables Office (Reem) in Ras Al Khaimah Municipality was tasked to coordinate the EE&R Strategy implementation.

Program	Brief & Objectives
1. Green Building Regulations	Introduce and periodically upgrade green building regulations for new buildings. Introduce efficient community guidelines and a building rating scheme at a later stage.
2. Building Retrofits	Execute comprehensive energy efficiency improvement projects for at least 3,000 existing buildings by 2040, starting with large government and commercial buildings with high energy consumption.
3. Energy Management	Promote best practices in energy management at key energy and water users, representing >30% of the total electricity consumption.
4. Efficient Appliances	Promote adoption of energy and water efficient appliances and equipment (such as air conditioners, refrigerators and water fixtures). Implement mechanisms to enforce appliance efficiency standards.

Program	Brief & Objectives
5. Efficient Street Lighting	Adopt efficient lighting technologies (such as LEDs) for 400+km of existing street lighting and for new roads. Apply dimming and switch-off measures.
6. Water Reuse & Efficient Irrigation	Increase wastewater collection and treatment. Reuse at least 95% of the TSE produced by 2040. Implement efficient irrigation measures to allow for expansion of public green spaces.
7. Solar Programs	Promote solar energy for on-site and utility scale applications, with an ambition to reach 1,200 MWp of total capacity by 2040.
8. Energy from Waste	Develop a range of waste-to-energy capacities to contribute at least 2% of the primary energy consumed in Ras Al Khaimah.
9. Efficient Vehicles	Promote adoption of efficient vehicles with a focus on EVs and hybrids, starting with government fleets.

Enablers				
Awareness and Capacity Building	**Financing Mechanisms**	**Research and Innovation**	**Information Systems**	**Policy and Regulation**
Development of efficiency-consciousness in RAK society, and building local skills and capacities	Ensuring adequacy of capital for energy efficiency & renewables projects in RAK	Supporting research and development of new energy efficient solutions and technologies	Creation of data processing tools to support projects and monitor strategy progress	Adoption & enforcement of regulatory measures promoting implementation of the programs

Figure 1 - EE&R Strategy Programs

The Government of Ras Al Khaimah includes 19 entities that are supported by central financing mechanisms and common HR processes. These entities cover different local government functions such as the ruler's court, municipality, public infrastructure, environmental protection, customs, museums, economic development, civil aviation, media office, local sports club and others.

"We are very excited about achieving the ISO 50001 certification, which comes as a direct result of our adherence to the vision and directives of His Highness Sheikh Saud bin Saqr Al Qasimi, UAE Supreme Council Member and Ruler of Ras Al Khaimah, to make our emirate more sustainable and set a global example in energy efficiency and renewable energy."

—H.E. Dr. Mohammed Abdullatif Khalifa, Secretary General of the Executive Council and Director General of the Department of Human Resources

Business Benefits

In becoming the first government in the world to achieve ISO 50001 certification for all of its entities, Ras Al Khaimah government showcases its leadership in the energy management field in the UAE and the world. It reinforces its position as a leading emirate striving towards its sustainable energy targets and positions itself as an attractive emirate for sustainable companies. This milestone has resulted in a more sustainable, energy-efficient and cheaper-to-operate government whose staff has the relevant expertise to lead by example, thus expanding their sustainable energy management outreach to business and society.

Ras Al Khaimah government has benefitted from the lessons learnt during the building retrofits and ISO 50001 certification of Ras Al Khaimah Municipality and used them to upgrade government assets, i.e. energy efficient equipment in buildings, as well as organizational capabilities, i.e. enhanced energy management processes and expertise.

Immediate economic benefits came from a project, started in 2019 by the government, to upgrade 46 of its buildings using a guaranteed savings energy performance contract with an Energy Services Company (ESCO), selected through a group tender. These buildings are primarily offices, but there are also accommodations, wastewater treatment plants, exhibition buildings, parks, a sports club, a heavy vehicle inspection centre and even a museum. The project was split into three phases due to COVID-19 outbreak during the contract negotiations. In December 2022, construction work was completed and all buildings are now realising savings. The total investment of AED 14.4 million is bringing annual savings of AED 3.9 million, equivalent to 25.6% savings in the utility bills with an overall payback of 3.5 years. Group sourcing (putting together multiple government entities for a scope of 46 buildings) was instrumental to maximize the scope of the project, i.e. allowing to retrofit small buildings that would not otherwise be manageable with energy performance contracting, for the high overhead that is typically involved in this type of projects. Phasing of the investment also allowed for quick savings to be realized in phase 1 to improve the overall cash flow for the government.

The upgrade of organizational capabilities was achieved as part of the objective of implementing an Energy Management System (EnMS) in all government entities following ISO 50001 by the end of 2022. Nominated Energy Principals and their teams attended monthly workshops to coordinate the EnMS implementation across the government. The workshops were led by Reem experts and leveraged the lessons learnt during the ISO 50001 certification process of Ras Al Khaimah Municipality, that was used as a testbed for the whole government.

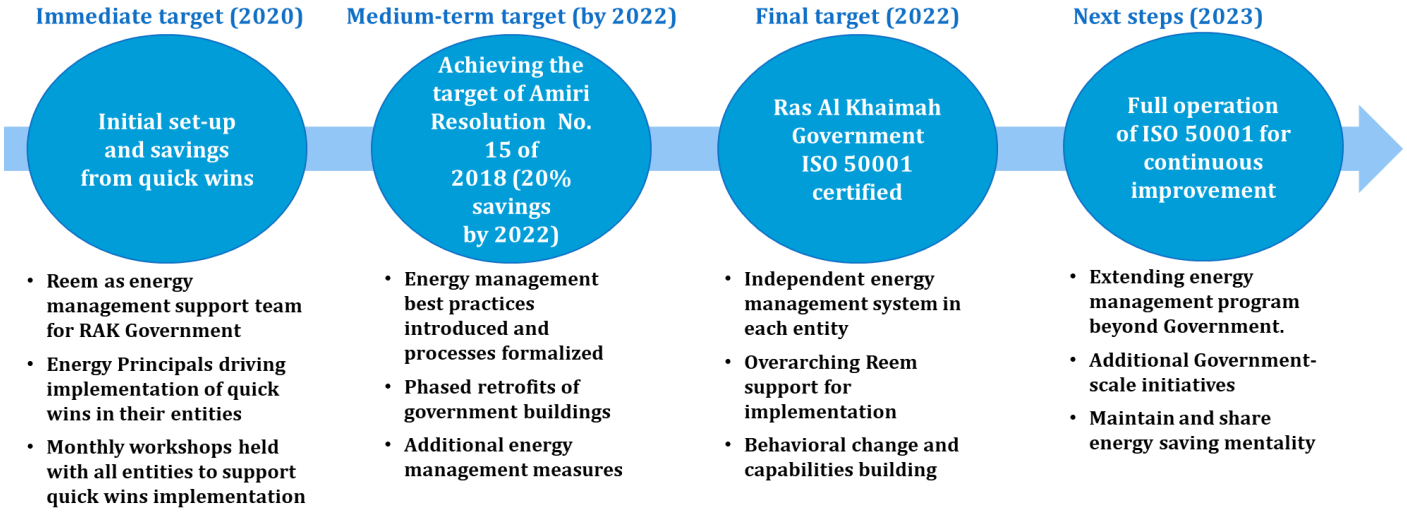


Figure 2 – Energy Management System stages' targets

A quick-wins initiative was launched to achieve immediate savings at the onset of COVID-19 because the government identified energy management as one of the tools to minimize the economic challenges caused by the pandemic. Hence, quick-wins in energy equipment, monitoring, and consumption behaviour were prioritised for immediate deployment. While achieving 8% energy savings over a few months, the quick-wins initiative was important to set some first steps in formalising the Energy Management System of the government.

Table 1 below presents the total unadjusted electricity and water consumption and costs across all Government of Ras Al Khaimah office buildings during 2019, the selected baseline year, plus 2020 to 2022. Table 1 also presents the adjusted consumption data. The adjustments included non-routine, such as the consideration of the additional HVAC

equipment in some buildings, as well as routine adjustments due to weather using linear regression of electricity and cooling degree days (CDDs).

After adjustments (Table 1), we record savings in electricity of 24.6%, partly compensated by increased use of water in buildings. Nonetheless, over 3 years, the government has achieved an overall utility cost reduction of 12.8%.

Year	Parameter	Electricity (kWh/year)	Water (IG/year)	Cost (AED/year)
2019	Unadjusted baseline consumption	25,356,055	107,174,105	14,611,679
	Non-routine adjusted baseline	27,946,708	107,174,105	15,595,390
2020	Unadjusted consumption	25,386,273	111,051,924	13,764,655
	Routine plus non-routine adjusted baseline	28,104,367	107,174,105	14,534,753
	Savings (-)	**- 2,718,094**	**3,877,819**	**-770,098**
	% savings (-)	**-9.7 %**	**3.6 %**	**-4.9 %**
2021	Unadjusted consumption	26,613,441	110,973,646	13,916,972
	Routine plus non-routine adjusted baseline	28,997,912	107,174,105	14,547,863
	Savings (-)	**-2,384,470**	**3,799,541**	**-630,891**
	% savings (-)	**-8.5 %**	**3.5 %**	**-4.0 %**
2022	Unadjusted consumption	21,726,252	112,842,063	12,096,697
	Routine plus non-routine adjusted baseline	28,607,057	107,174,105	14,094,292
	Savings (-)	**-6,880,804**	**5,667,958**	**1,997,594**
	% savings (-)	**-24.6 %**	**5.3 %**	**-12.8 %**
2020- to 2022	**Cumulative savings (-)**	**-11,983,368**	**13,345,318**	**-3,398,583**

Table 1 – EnMS performance summary

The majority of the savings have been achieved through upgrades of buildings thanks to the EPC whose impact is more evident in the second half of 2022 as shown in Figure 4 once most of the energy conservation measures were implemented. Nonetheless, the EnMS is expected to provide significant additional business benefits to the government because it provides a broader framework for expansion of scope and continuous improvement, allowing to retain and increase energy savings even after the current EPC ends.

As a result of the electricity savings in the past three years, around 4,865 tons of CO_{2eq} have not been emitted into the atmosphere. The grid emission factor used (0.406 $kgCO_{2eq}$/kWh) is the same as the last EE&R Strategy 2040 Annual Report.

To achieve the certification and prepare for the external audit, each entity's energy principal and team dedicated an average of 0.2 full-time employees (FTEs) of their time in the last year. They were supported by the Reem team with two junior resources, with a combined commitment of 0.4 FTEs, and some more senior resources with a dedication of around 0.1 FTEs. This resulted in approximate costs of USD 211,000. No extra monitoring equipment was required. Additionally, the external auditor certification costs were circa USD 60,000 plus other costs of USD 5,000.

Multiple initiatives contribute to ISO 50001, such as the Green Public Procurement initiative, which includes procurement of efficient equipment across 13 product and service categories (e.g., efficient AC, appliances, vehicles, etc.). Similarly, Barjeel, the green building regulations require new buildings to be more efficient. There are also incentives, such as waivers in annual business license fees to support growth in the supply ecosystem, including energy auditors and ESCOs among others. This has sparked interest from manufacturers of renewable energy and energy-efficient products and solutions to establish themselves, either inland or offshore, in Ras Al Khaimah.

Plan

The Ras Al Khaimah government's plan for upgrading assets (Retrofits) and organizational capabilities (Energy management system) started in 2019 and is shown in Figure 3 below.

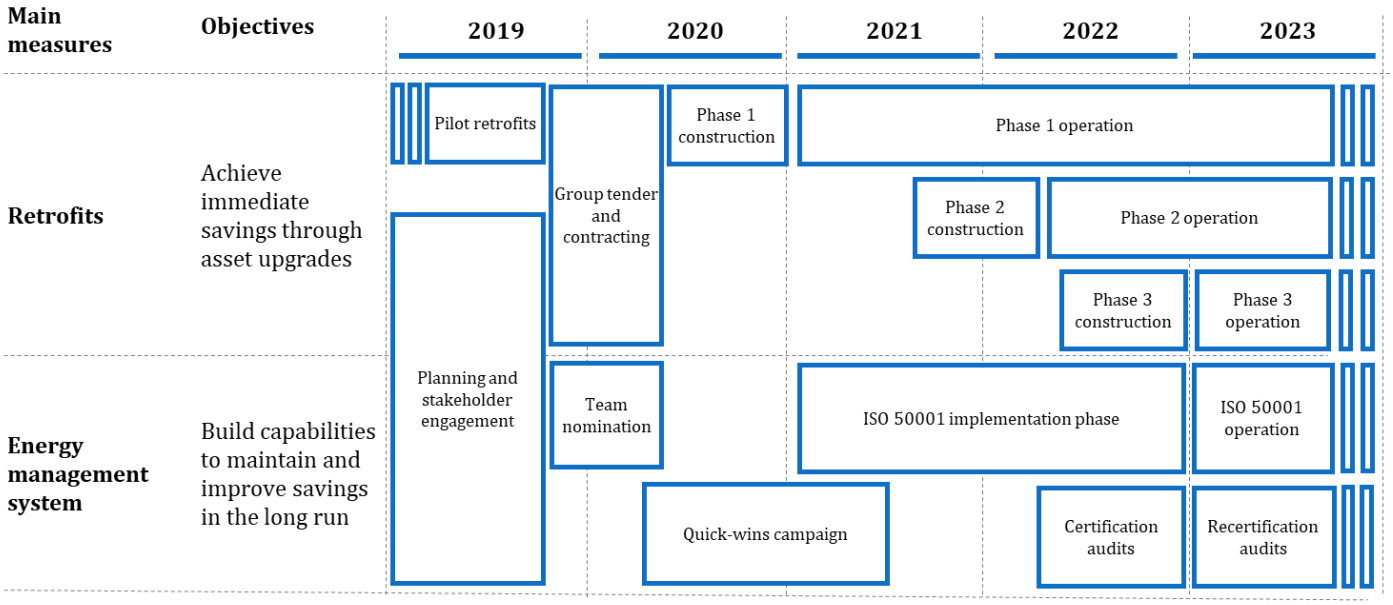


Figure 3 – Energy management system and retrofit timelines

Both projects were supported by targets established by Amiri Decree #15 of 2018. The success of the pilot retrofit project in the Municipality further strengthened both projects, which materialised in the form of commitment letters signed by all Director Generals to participate in the initiative.

With the nomination of the energy principals and teams and the approval of the energy policy in each entity by the respective Director General, the EnMS implementation started. The energy principals and teams' dedication was part-time with the centralised support of Reem. Based on the lessons learnt in the Municipality, the teams streamlined the process of identifying energy-saving measures for the retrofit as well as gaps and improvement actions for the EnMS with the support of Reem.

The energy retrofit and the EnMS scope for each entity were different. The retrofit grouped 46 selected buildings of certain entities where there was a reasonable return, whereas the EnMS scope included all the entity activities, not only the retrofitted buildings.

Amiri Decree #15 of 2018 for all entities established a target of 20% electricity and water savings costs from a baseline of 2017. However, some of the early years' utility data was inconsistent, i.e. had data gaps and adjustments by the utility company whose justification could not be retrieved by the teams retrospectively. Therefore, most accounts had to use a 2019 baseline. Also, some entities moved offices and therefore, their baseline was recreated. During the gap assessments of some entities, it was established that their Significant Energy Uses (SEUs) were, in addition to the typical electricity and water consumption, the fuel used in their corporate fleets, waste trucks, etc.

During the initial energy audit for the retrofit, it was established that the majority of the electricity consumption was for HVAC and lighting. Therefore, both the retrofit and the EnMS prioritised them.

A centralised budget was provided by the Department of Finance for the retrofit as a one-off special project after justifying that it had a good return on investment. For ISO 50001, the Municipality covered the budget for the external auditor fees for all government entities. Still, each entity had to budget for its action plan activities outside the retrofit.

Do, Check, and Act

The Energy Principals and their teams strived to implement the EnMS and facilitated the energy retrofit activities in their respective entities. This was done with the support of Reem in the form of knowledge sharing during regular workshops with all the entities as well as individual preparatory meetings for each entity ahead of the respective internal audits, management meetings and external assessments.

For the energy retrofit activities, Reem acted as a client representative managing the overall project on behalf of the government. Still, each entity was responsible for validating the activities on their premises.

The EnMS documentation was standardised as much as possible across all entities and was structured as per the ISO 50001 clauses. Reem prepared templates for all standard documents such as the energy policy, legal registers etc. and trained each team on how to fill them. All these files were stored in a central web repository, SharePoint, with restricted access for each team to their entity folder. Reem retained access to all entities' folders for support. This facilitated the auditors' work and streamlined the certification across multiple entities since all the documentation was named and located in similar folders, with just its content customised for each entity.

The team of each entity regularly updated the progress and details of the retrofit and EnMS implementation to the top management. The Executive Director of Reem met with each Director General to discuss the overall improvement of both projects and identify opportunities to maximise savings. These meetings resulted in tangible actions for the energy teams to reinforce internal communication and awareness campaigns to maintain the indoor temperature at no less than 23 ^{o}C during working hours, turn off unnecessary equipment, monitor energy consumption and adopt Green Public Procurement and constant energy consumption monitoring.

Reem created an Excel-based utility tracker for energy teams to input utility information, e.g. kWh, imperial gallons and AED per month and account from 2017 onwards. CDDs were identified to be the only variable to have a significant impact on the electricity consumption. This was confirmed in the energy audits that found that air conditioning represented around 60% of the total electricity consumption.

The Excel file allows for the normalization of the baseline electricity consumption with CDDs. This is done using a regression of the electricity consumption against the CDDs of the baseline year which is then used to calculated the adjusted baseline from which the actual consumption is deducted to calculate the savings. The Excel file also allows for the normalization of non-routine adjustments, e.g. changes in operation hours, set points, and installation of new equipment, and even forecasts future performance by estimating the possible retrofit impact. Overall, the tracker facilitates comprehensive analysis of the energy performance of each entity and the Government as a whole.

Considering the quality of the utility data and any major modification in operations, e.g. change in staff accommodation occupancy during COVID-19, the baseline year was selected. An adjusted baseline was created based on the correlation of the baseline year monthly consumption and CDDs. This allowed calculating the electricity savings as the difference between the adjusted baseline and the actual consumption. No regression was made for water, so savings are a direct bill-to-bill comparison. The energy performance is calculated using the last 12 months rolling savings as per the equation below. Cost savings are calculated by multiplying the electricity and water savings at their respective monthly rates. The reporting period considered is the entire of 2022.

$$\boldsymbol{EnPI}\ (\%) = \frac{\boldsymbol{Ann.\ Actual\ Consumption - Ann.\ Adjusted\ Baseline\ Consumption}}{\boldsymbol{Annualised\ Actual\ Consumption}}$$

The ESCO reports the savings on the 46 retrofitted buildings periodically following the contractually agreed measurement and verification plan as per the IPMVP. For the broader energy management scope, the energy performance is calculated using the utility trackers of each entity and the evolution of the performance is presented in Figure 4.

Regarding training, in addition to the regular workshops, Reem delivered a 1-hour presentation to all teams on "Introduction to energy management" that was attended by more than 50 staff. Furthermore, 13 selected entities nominated one representative to attend an internal auditor training delivered by TUV Rheinland over two days. Reem also organises "Energy days", gatherings of all Ras Al Khaimah government energy teams to exchange experiences and share knowledge. The first energy day was held in January 2022 and the second in March 2023. In addition to discussing progress and next steps, energy days have seen invitees from other entities contributing their best practices in energy management.

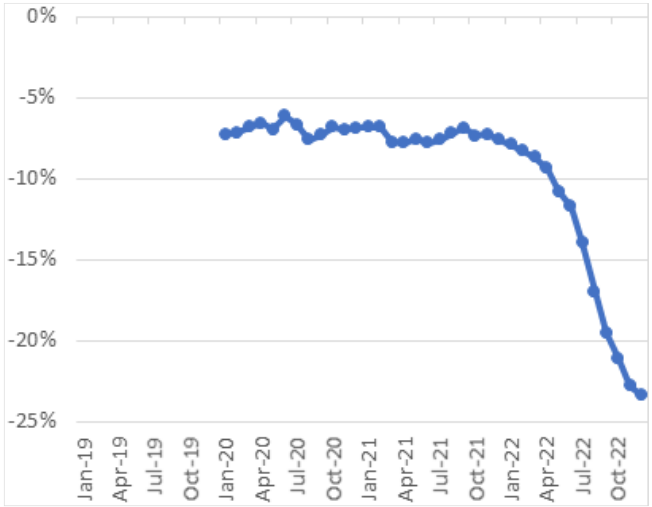


Figure 4 – Electricity cumulative % monthly savings

The internal audits of each entity were done by the trained auditors, with support from Reem where needed, to identify non-conformities in preparation for the energy management meetings.

Stage 1 and 2 audits were scheduled sequentially for all 19 entities from April to December 2022. All audits resulted in zero non-conformities and the ISO 50001 certificates were awarded.

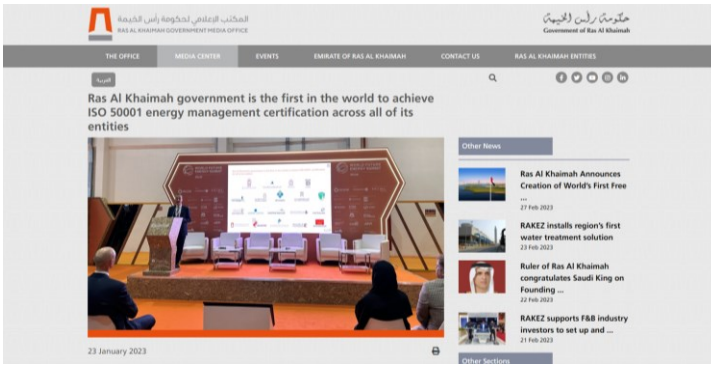
Transparency

TUV Rheinland representatives handed the certificates to the respective Director Generals in two separate events, the first during the RAK Energy Summit in October 2022 and the second during the second energy day in March 2023.

The achievement of becoming the first government in the world to achieve ISO 50001 certification across all of its entities has been announced in public events such as the World Future Energy Summit in Abu Dhabi in January 2023, the Retrofitech MENA Summit in February 2023 and the Middle East Energy Dubai in March 2023.

Regarding external communications, press releases were circulated to local and national generalist media and specialised technical publications with the support of Ras Al Khaimah Government Media Office. The external outreach was further amplified by the publication of the certification news and pictures through the Municipality's social media channels, e.g. LinkedIn, Instagram and Facebook.

"Achieving the ISO 50001 certification is a recognition of Ras Al Khaimah government's commitment to the energy transition. The energy management systems that we have implemented will support government entities in initiating many new projects and developments that will contribute to the net-zero ambitions of the UAE."
— H.E. Munther Mohammed bin Shekar, Director General of Ras Al Khaimah Municipality



Press release by Ras Al Khaimah Government Media Office, announcing a presentation with picture of the initiative by Mr. Andrea Di Gregorio, Executive Director, Reem, presenting at World Future Energy Summit 2023.

What We Can Do Differently

Retrospectively, the ISO 50001 certification could have been extended to some non government entities. Although not directly government, some entities work closely with the government and are essential to Ras Al Khaimah activities. The extra effort to include them would have been minimal and a more significant number of entities would mean a wider pool of best practices and knowledge to be shared. This would have further enhanced the position of Ras Al Khaimah government as a leading example of best practices in sustainable energy in the world.

The next steps of the EnMS project include plans to certify these other Ras Al Khaimah entities and encourage a higher degree of ownership of the EnMS by each entity. Furthermore, the lessons learnt and best practices will be shared beyond the government thanks to an energy manual that Reem is preparing to support organizations in their journey to improve their energy management practices. This manual will include general information, e.g. identification of significant energy uses, performance indicators and baselines, and detailed guidelines on implementing a full-fledged ISO 50001 compliant EnMS.