ISO 50001 Energy Management System
Case Study

United Arab Emirates

Dubai Electricity and Water Authority (DEWA)

Certification of DEWA's Head Office to the ISO 50001 Standard was the ideal flagship project to further showcase DEWA's pioneering role towards effective and economical management of our energy use.

DEWA receives ISO 50001 Certification for its Head Office

Case Study Snapshot	
Industry	Power Generation
Product/Service	Generation, Transmission and Distribution of Electricity and Water
Location	Dubai, United Arab Emirates
Energy management system	ISO 50001:2011
Energy performance improvement period	3 years (Baseline 2014)
Energy Performance Improvement (%) over improvement period	58%
Total energy cost savings over improvement period	$25,249/annum
Cost to implement EnMS	$1,811,172
Total Energy Savings over improvement period	877.86 GJ
Total CO_2-e emission reduction over improvement period	105.66 Metric tons

Organization Profile & Business Case

Dubai Electricity and Water Authority (DEWA) is a Dubai government owned utility with the responsibility for supplying electricity and water to the Emirate of Dubai. DEWA owns, operates and maintains power stations and desalination plants, aquifers, power and water transmission lines and power and water distribution networks in Dubai. DEWA is strategically driven, continuously aligning itself to national and international strategies and goals. With new trends emerging in innovation & technology, customer service and excellence, sustainability remains at the heart of our business. It is the core of our strategy, vision and mission. The Climate Change & Sustainability (CC&S) Department under the Business Development & Excellence Division manages DEWA's corporate sustainability programme. As a leading Power and Utility company, DEWA continuously strives for excellence in energy management. In 2018, DEWA launched the "My Sustainable Living Programme", which is a new, innovative tool that applies behavioral science principles to nudge the customers into reducing their consumption, through a standard peer analysis and benchmarking methodology. Moreover, and regards to the energy consumption of DEWA's own premises, DEWA has taken the decision to construct and certify its new buildings as

LEED Green Buildings. One example is the Sustainable Building in the Dubai Al Qouz area. This building holds the record to be the largest government building in the world to receive a Platinum Rating. However this will soon be superseded by the new headquarters in Dubai AlJaddaf area, which is planned to be the largest LEED Platinum, net Zero Energy Building in the world. Such efforts are not only restricted to the new buildings for DEWA. However, most of the existing buildings are very old, and it was challenge to understand how energy is being consumed in order to determine effective conservation measures. To resolve this, in 2018, DEWA decided to design, develop and implement an Energy Management System, starting with the current Head Office building. Given initiatives like "My Sustainable Living Programme" which encourages customers to reduce their energy consumption, the DEWA Head Office was the ideal flagship project to further showcase DEWA's pioneering role towards effective and economical management of our energy use. The energy management system is also in line with DEWA's strategic objectives of 1) adopting global governance and management standards, and 2) reducing our carbon footprint and environmental impact by decreasing greenhouse gas emissions through the efficient use of energy. DEWA succeeded in operating this system by adopting a systematic approach, improving its energy performance, and achieving the highest possible level of energy efficiency and sustainability.

"We are delighted to receive this important energy management system certificate. It supports our vision to become a leading sustainable innovative global corporation, and a role model for all public and private organisations in Dubai in the fields of sustainability, environmental and natural resource conservation, as per the UAE Vision 2021 and Dubai Plan 2021. It enables us to explore further opportunities for improvement and reducing operating costs in energy consumption."

—His Excellency Saeed Mohammed Al Tayer, Managing Director & CEO of DEWA

Business Benefits

To measure the benefits of the Energy Mnagament System, Energy Performance Indicators (EnPIs) were developed at the installation level for the entire building (Level 1 EnPI). The Level 1 EnPI is normalized considering the cooling degree days, occupancy (full time equivalent) and area of the building.

The energy management system resulted in several measurable benefits, such as:

- 58% reduction in the Head Office premises consumption from 2.95 kJ/m^2/FTE/^oC in 2014 to 1.23 kJ/m^2/FTE/^oC in 2017.
- Approximately USD $25,249/annum in cost savings
- 105.66 metric tons of CO_2e reduced from 2014 to 2017

These figures were verified according to IMVP by Engineer Hassan Zulfikar, a CMVP (4609) from the Power and Water Planning division of DEWA. The percentage of operational savings to overall savings was less than 25%, meaning that the majority of savings was achieved through savings from capital investments, and estimated staff time was over a year. The energy management system not only resulted in improved energy performance, emission reductions, and cost savings but also stronger commitment from DEWA's Top Management, increased awareness among employees on energy management, more indicative metrics, clearer objectives, targets and KPIs, and more robust monitoring and verification processes and procedures. The energy management system also helped identify and correct discrepancies in meter labels, and identify opportunities for improvement.

Plan

In line with the Emirate of Dubai's vision to become a leader in energy efficiency and security, the Dubai Supreme Council of Energy developed the Dubai Demand Side Management (DSM) 2030 Strategy. This ambitious strategy aims at improving energy efficiency, reducing

energy consumption and contributing to the sustainable development of Dubai, with a target to reduce electricity and water demand in Dubai by 30% in 2030, compared to the business as usual scenario. In order to support this strategy, DEWA established a Committee for Energy Management of DEWA Premises in 2012. The Committee was guided by an Energy Policy that was approved by our Top Management. Since then, this Committee had continually monitored and tracked energy performance, followed by a review by the Management. The Committee also undertook an energy audit for our buildings, considering 2014 as a baseline for consumption, which resulted in the identification of improvement opportunities, energy efficiency initiatives within our premises, including conservation measures, retrofits, and light replacements. Following these findings, DEWA contracted an energy services company (ESCO) to execute retrofits within the Head Office. This includes:

- Implementation of variable chilled water flow with VFD for the chilled water pumps in 2017
- Retrofit of chiller plant by replacing air cooled chillers by high efficiency water cooled chillers in 2017

Additionally, as a form of operational improvement, power metering and monitoring systems were installed.

In 2018, and following meetings of the Committee, DEWA embarked on the development of a more robust and structured energy management system, in line with the ISO 50001:2011 standard, starting with its Head Office building. The idea was to have this Energy Management System monitor the effective implementation of the energy conservation measures identified before and to also perform data analytics based on the energy measurements captured by the additional meters installed in the premises. Furthermore, the existing Committee for Energy Management of DEWA Premises was replaced by an Energy Team, and a Top Management Committee was formed, chaired by the MD&CEO of DEWA, HE Saeed Al Tayer, and with the membership of the top management members overseeing DEWA's operations, such as Generation, Transmission, Distribution, Buildings, and Fleet, in line with the guidance of the ISO 50001 Standard. DEWA's existing Energy Policy, which had been developed in 2012, was reviewed and revised in March 2018, and endorsed by the MD&CEO, emphasizing the commitment of DEWA's leadership towards energy management.

To ensure the continual and successful implementation of the Energy Management System, the Chief Officer - Climate Change and Sustainability (CC&S) was appointed as the Management Representative (MR), supported by two Assistant Management Representatives from the Climate Change & Sustainability department, under the Business Development & Excellence division. Key stakeholder divisions involved in the operation and maintenance of the Head Office facilities were identified, and employees from each division were nominated to support in the data collection and review of the energy performance.

Energy Review

An energy review procedure was developed for the Head Office, setting the guidance for assessing the energy performance, consumption and efficiency of the building, assigning the roles and responsible departments, and identifying opportunities for improved energy performance. The Head Office is equipped with 8 main billing grade meters. After reviewing consumption data, it was determined that 7 meters would be considered in the system, since the 8th meter recorded the consumption of the small on-site Imam house, which is negligible in comparison to the other Head Office facilities. The energy baseline year was set as 2014, in line with the directive from the directive from the Dubai Supreme Council of Energy.

SR.NO.	TYPE	Total Consumption (kWh)	CRITERION A	CRITERION B	SIGNIFICANT ENERGY USE
			Energy consumption	Energy Saving Potential	
			Refer to Energy Review Procedure section 6.2		
SEUs - Electrical Energy					
1	Lights and Plug Loads	2,114,923.60	74%	Medium	SEU
2	Chilled water pumps	146,366.74	5%	Medium	SEU
3	Extract Fans	-		Medium	Not an SEU
4	Chillers	587,088.99	21%	High	SEU
5	Air Handling Units	Not Available		Medium	Not an SEU
	Sub Total	2,848,379			-
SEUs - Thermal Energy					

Snapshot of SEU selection methodology

The figure above represents the energy review that was conducted to identify the Significant Energy Uses (SEUs).

Considering energy consumption and saving potential, 3 SEUs were identified:

1- Chillers
2- Chilled water pumps
3- Lighting and plug loads

The variables that affect the SEU operations were identified and recorded. Accordingly, objectives, targets, Energy Performance Indicators (EnPIs) were developed at the installation level for the entire building (Level 1 EnPI). Prior to the establishment of the EnMS, data from the submeters was not tracked. As part of the EnMS, we have collected the submeter data, and after analysis, identified additional tiers of indicators on the process and equipment level (Level 2 EnPIs).

As part of the EnMS Improvement Program Procedure was developed as guidance to rank and prioritize energy improvement opportunities, weighing the complexity of implementation of each improvement opportunity, and the economic assessment of its payback period. The Head Office retrofit program was integrated into the EnMS, which allowed for regular monitoring, measurement and review of actual energy savings.

The energy efficiency (EE) measures were implemented within the designated time. Therefore the primary target to implement the EE measures were achieved. The data that was captured and the calculation of the EnPIs performed demonstrates that there has been reduction in energy use and consumption by significant amount. However, we expect further reduction in energy use and therefore the full realization of the energy reduction will happen in coming years. As a part of the EnMS the EnPIs are in place to constantly track the continual improvement in the energy use and consumption.

These steps enabled us to quantify and establish realized benefits based on our energy performance in 2017. Thus, when undertaking the external certification audit in 2018, we were able to achieve the certification of our Head Office building based on demonstrated real savings.

Do, Check, Act

Integration with Integrated Management System

DEWA already has in place an Integrated Management System (IMS), which includes ISO 9001, 14001, and OHSAS 18001. The energy management system was aligned with the existing IMS, and elements such as document and record control procedures, operational procedures, methods for training and awareness were borrowed from the IMS. This saved time and streamlined the development of the EnMS, avoided a duplication of efforts, and set a common language that is understood across the different operations of the Authority.

Operational Control

In line with the Energy Policy, objectives, targets and action plan, an annual maintenance program is established for SEUs to sustain energy performance over time. Quality procedures and criteria for the efficient operation and maintenance of the SEUs have been set and communicated to the concerned personnel.

The calibration of energy meters is also regularly requested by the Billing Services division on a regular basis to ensure the accuracy of the readings.

Monitoring, Review, Verification and Corrective Action

The raw consumption data of the Head Office building is collected on a quarterly basis from the meters by our Billing Services Division, and a consistency check is performed on the data since it is also used for billing purposes. The data is then communicated to the Energy Team representatives from the Power & Water Planning Division, who verify the data and feed it into the energy tools to generate the energy records. The Energy Management System has been designed following a detailed energy analysis using ASHARE Level 2 audit principles. The ESCO project for replacing the chillers, installing VFDs for the chilled water pumps and other energy efficiency measures implemented are monitored and verified using the International Performance Measurement and Verification Protocol (IPMVP). Following the IPMVP guidelines, the CMVP performs the calculation of the EnPIs based on the data captured by duly calibrated energy meters. The records are then submitted to the Management Representative and his team for analysis through tracking and measuring the actual performance of the SEUs against the energy baseline and EnPIs.

Through this review, nonconformities are immediately identified, raised to the Top Management Committee, and addressed with the appropriate corrective action

Internal audit exercises also assist in identifying any nonconformities and discrepancies, so that the appropriate corrective action can be taken prior to external audits. Examples of corrective actions taken include:

- Old meter identification numbers being used in energy consumption records. Meter identification numbers have since been updated.
- Outdated/old calibration certificates for Head Office meters. Meters have since been re-calibrated.

Training and Awareness

To ensure successful implementation of the energy management system, awareness sessions and trainings were conducted across the different employee levels. The Climate Change & Sustainability team, led by the Management Representative, coordinated with each division to identify the roles and responsibilities in regards to energy management. In 2018, an implementation training was held to prepare the energy teams and concerned Operations & Maintenance managers and technicians of the Head Office facilities by detailing the new requirements of the energy management system, the relevant procedures and concepts of SEUs and EnPIs. Forty-five employees attended this training. The workshop also explained the communication protocols and monitoring and reporting guidelines that should be followed to maintain the system. Two general awareness sessions were conducted in 2018 to train the general staff audience to familiarize them with the updated Energy Policy and highlight the benefits of Energy Management, which were attended by a combined total of 142 employees.

Implementation Training conducted for Employees

Third Party Audit

In order to prepare for the external certification audit, the Management Representative and his team conducted a workshop with the Head Office building Operations and Maintenance teams to ensure the availability of records, documentation, maintenance schedules, reports, and calibration certificates. Finally a third Party audit was organized and was carried out by professionals from a reputed certification body. The audit resulted in DEWA's Head Office premises receiving

an Energy Management System certification in line with ISO 50001:2011 without any non-conformity (neither major nor minor).

Transparency

Upon receipt of the ISO 50001 certification, DEWA issued a press release which was published in the local news outlets, DEWA's website, and social media account. The press release was also circulated to all its employees through its internal mailing communications. This achievement will further be highlighted in DEWA Sustainability Report 2018, to be published in 2019.

Lessons Learned

Top management support was key in the successful implementation of the energy management system. The creation of a clear governance structure and identification of the roles of concerned employees helped overcome the reluctance of taking additional responsibilities under a new system. Furthermore, aligning the EnMS with DEWA's existing IMS smoothed the implementation process, as most staff are familiar with the IMS, and were able to draw from their experiences and the existing systems such as ISO 9001 and 14001.

- Early training and awareness of larger employee audience. It is important to communicate to and train the operations and maintenance teams early on to ensure full awareness and understanding. While we engaged with representatives from each concerned division, we did not approach the operations and maintenance teams, who oversee the day-to-day management of the building facilities, until later in the implementation phase. This created a gap in the flow of information. Once the teams were trained, they were made aware of the communication flow, which resulted in smoother data collection, reporting and implementation of corrective actions.
- Integration with existing Integrated Management System enabled a quick implementation of the EnMS and established a common language among staff.