

ISO 50001 Energy Management System Case Study

China

Shenzhen Airport (Group) Co.,Ltd.

“Green Airport” is one development strategy of Shenzhen International Airport.



EnMS in Shenzhen International Airport

Organization Profile & Business Case

The first airport getting 10 Energy Management Certifications in China.

As one of the “Top 10 beautiful airports in the world”, Shenzhen International Airport is an important window of in south China for external presentation. It covers an area of 23.8 square kilometers. It received 49.3471 million passengers and delivered 1,217,900 tons of goods, in 2018. Globally, it ranks 47th in passenger throughput and 24th in cargo throughput. Its main energy consumption includes power, diesel, gasoline, and natural gas. In 2017, the energy consumption was 141.55 GJ per passenger, lower than other international airports in China.

“As the energy management action guideline of our group, ISO 50001 standardizes energy use and equipment management, improves energy efficiency based on PDCA model, and helps the construction of ‘safe, green, intelligent and humanistic’ airports.”

— Chen Jinzhu, GM

Case Study Snapshot

Industry	Airport, Public Buildings
Product/Service	Aviation business; Public service
Location	Shenzhen, China
Energy management system	ISO 50001
Energy performance improvement period	3 years
Energy Performance Improvement (%) over improvement period	13.12%
Total energy cost savings over improvement period	318530.3 USD
Cost to implement EnMS	732619.69 USD
Total Energy Savings over improvement period	89844.83 GJ
Total CO₂-e emission reduction over improvement period	14959.73 tons

Motivations: We adhere to the concept of green airport construction "resource conservation, environmentally friendly, efficient operation, people-oriented", fulfill social responsibilities and contribute to the reduction of global greenhouse gas emissions.

Goals: Build a "safe, green, intelligent and humanistic" airport. Compared with 2015, the energy intensity will be reduced by 21% and the carbon emissions will be reduced by 23% by 2020.

Role played: Energy management is an important part of enterprise management, will contribute to the sustainable development of the Airport.

The support of energy management actions

- ① To carry out the strategic planning of energy conservation and emission reduction since 2016.
- ② Build an EnMS team with 51 staff.
- ③ Organize qualification training for energy managers.

Business Benefits

Protect environment, ensure sustainable development with high-quality, and less resources and energy consumption.

Energy performance improvement

Baseline year: 2016
 Baseline period: From January to December 2016
 Reporting period: From January to December 2018

The calculation formula is:

$$\left[\frac{\text{Baseline Period Consumption} - \text{Reporting Period Energy Consumption}}{\text{Baseline Period Energy Consumption}} \right] \times 100\%$$

Over improvement period the total energy savings of Shenzhen International Airport is 89844.83 GJ.

NO.	Site Name	Energy Savings (GJ)	Improvement (%)
1	Shenzhen Airport (Group) Co.,Ltd.(Group headquarters)	377.47	3.58%
2	Shenzhen Airport Co.,Ltd	83223.21	13.39%
3	Shenzhen Airport (Group) Co.,Ltd.Prower Branch	80.58	2.48%
4	Shenzhen Airport Real Estate Co.,Ltd	0.00	0.00%
5	Shenzhen Airport Aerotropolis Operation Management Co.,Ltd	0.00	0.00%
6	Shenzhen Airport Joyee Business Development Co.,Ltd	591.04	6.55%
7	Shenzhen Airport Property Service Co.,Ltd	1790.96	9.94%
8	Shenzhen Airport Ferry Terminal Services Co.,Ltd	1169.71	34.41%
9	Shenzhen Chengyuan Aviation Co.,Ltd	1051.16	8.67%
10	Shenzhen Airport Petroleum Co.,Ltd	1560.70	23.20%
11	Total	89844.83	13.12%

Figure 1 Energy Savings of each sites

Over improvement period the total CO₂-e emission reduction of Shenzhen International Airport is 14959.73 tons.

NO.	Site Name	CO ₂ -e Emission Reduction (tons)	Improvement (%)
1	Shenzhen Airport (Group) Co.,Ltd.(Group headquarters)	125.08	4.66%
2	Shenzhen Airport Co.,Ltd	14552.87	10.75%
3	Shenzhen Airport (Group) Co.,Ltd.Prower Branch	64.89	8.48%
4	Shenzhen Airport Real Estate Co.,Ltd	0.00	0.00%
5	Shenzhen Airport Aerotropolis Operation Management Co.,Ltd	0.00	0.00%
6	Shenzhen Airport Joyee Business Development Co.,Ltd	61.22	3.56%
7	Shenzhen Airport Property Service Co.,Ltd	-295.28	-7.42%
8	Shenzhen Airport Ferry Terminal Services Co.,Ltd	163.27	22.83%
9	Shenzhen Chengyuan Aviation Co.,Ltd	-0.49	-0.03%
10	Shenzhen Airport Petroleum Co.,Ltd	288.18	23.50%
11	Total	14959.73	10.10%

Figure 2 CO₂-e Emission Reduction of each sites

Costs and energy cost savings

EnMS Costs:

	Cost to implement	Cost to implement (\$USD)
Internal Staff time to develop and implement the EnMS		98736
Internal staff time to prepare for external audit		14641.6
Additional monitoring and metering equipment installed to meet EnMS requirements		497944.3
Third party audit costs		53276.45
Technical assistance (e.g. hired consultants to assist with EnMS implementation)		66600
Other (e.g. internal communications)		1421.34
Total		732619.69

Figure 3 EnMS costs of each sides

Overall energy cost savings = Savings from the EnMS + savings from projects with capital investment

Savings from the EnMS is 104477.94 USD.
 Savings from projects with capital investment is 214052.36 USD.
 Overall energy cost savings is 318530.3 USD.

Estimated staff time: one half year to one year

Percent of overall cost savings that was due to operational savings: 32.8%

Any non-energy or other benefits

- ① Strengthen the communication and training to raise employees' awareness of energy conservation.
- ② Promote the clean energy sources, build 14.5MW solar photovoltaic power stations, use 145 electric automobiles and build charging piles over 1000.
- ② Install digital energy management system to ensure real-time statistics and energy use analysis, monitor the operation of energy equipment, and improve energy management efficiency.
- ③ Use advanced energy-saving technologies to upgrade energy-using systems, such as improve the energy efficiency of lighting and central air conditioning.



Figure 4 The charging piles

Plan

Investigate the energy utilization and establish an energy management plan.

Decision

① **The social responsibility:** No country or economy is immune from the consequences of climate change. It is our bounden duty to reducing GHG emissions.

② **Legal requirement:** Key energy-using enterprises shall establish a sound energy management system and make it operate effectively in accordance with the requirements of ISO 50001(GB/T 23331).

③ **Enterprise development needs:** ISO 50001 can improve energy management, reduce energy costs, and create a green image.

Data collection and analysis

Data collection includes but is not limited to the following three aspects:

- ① The total energy consumption of each sites.
- ② Relevant variables: passenger throughput, cargo throughput, aircraft take-off and landing sorties, mileage of vehicle, building area etc.
- ③ Equipment influence parameters: the refrigerating capacity of the central air conditioning , turn on the light of time etc.

The data statistics department has collected and analyzed the energy data of relevant variables and equipment influence parameters according to the digital energy management system.

Each sites has collected and analyzed the total energy consumption.

Set energy performance and energy targets

According to different situations, we set the energy performance parameters as below : Energy consumption per passenger throughput, Energy consumption per unite of output value Energy consumption per unit area Energy consumption per unite of cooling capacity, Unite time energy consumption etc.

Establish, implement and maintain energy targets, including:

- ① **Overall goal:** reflecting the overall level of energy use at the group level (e.g.Comprehensive Energy Consumption, Unit Passenger Comprehensive Energy Consumption).
- ② **Sub-objectives:** reflecting energy use levels by sector/unit (e.g.Comprehensive Energy Consumption for Unit Output Value).

③ **Indicators:** reflecting the energy efficiency of key energy-using systems and equipment (e.g. Comprehensive Cooling power consumption).

Prioritizing action

The following factors shall be considered in the evaluation and ranking: conformity of laws, regulations, policies, standards and other requirements; the impact of energy performance; technology maturity, system matching degree and other technical feasibility; economic rationality such as payback period, internal rate of return and other income; construction period, safety and environmental impact; requirements of relevant parties, etc.

“Under the framework of ISO 50001 , the group leaderships begin to focus on energy management policy and EnPI, and give strong supports in the capital, technology and human resources. At present, we have formed an all staff participation situation where the group takes the lead and subsidiaries implement in coordination. To further improve efficiency, we have already started to implement the whole process digital and networking of EnMS based on the platform of energy monitoring.”

— Zhang Yu, Director of Ecological Environment Office



Figure 5 Energy digital management system

Do, Check, Act

Continuous improvement.

Organizational

Shenzhen Airport (group) Co., Ltd. has set up an energy management team which is multi-level interconnected. It is structure as "Leading group + Ecological environment office + Ecological liaison team". The management team consists 51 people.

Leading group headed by the Group's chairman, 12 people. Who will be responsible on major matters decisions making of energy management, convenes an annual special working meeting, and study and discuss the direction of annual energy management work.

Ecological environment office is the daily management office under the leading group, with 6 full-time managers. Who will be responsible for the overall planning of the annual energy management work, and through the guidance, inspection, supervision, assessment and other means to promote the implementation of measures.

Ecological liaison team consists of 33 energy management technicians. Who will be responsible for monitoring energy usage, analyzing energy consumption, maintaining energy equipment, etc.

Training

The group shall hold no less than 4 training sessions on energy management knowledge each year, and each branch shall hold no less than 6 training sessions each year.

In 2019, Shenzhen Airport (group) Co., Ltd. will also organize managers to attend the training of registered energy managers in the United States.



Figure 6 Energy technology exchange conference

Drive and support

Shenzhen Airport (group) Co., Ltd. has established an

incentive mechanism for energy management, formulated *Measures for The Administration of Energy Conservation and Emission Reduction*, and awarded advanced branches/ for energy conservation and emission reduction, prize for exceeding targets and prize for outstanding projects.

Key actions

Over the past 3 years, Shenzhen International Airport has launched 12 energy-saving and environmental protection projects with an investment of 21 million dollars, including the EPC project. Several key projects shown in the table below:

No.	Projects	Energy cost savings USD/year	Year
1	Built photovoltaic power station	1,731,600 USD/year	2014
2	Purchase new energy vehicles	2,259,149.89 USD/year	2015
3	Terminal public area lighting system energy - saving transformation	1,983,596.64 USD/year	2016
4	LED street lamp renovation in Four Road Station	115634.24 USD/year	2017
5	Runway side light reconstruction in airfield	101978.56 USD/year	2017
6	Central air-conditioning magnetic levitation cold water main engine	414811.54 USD/year	2018

Figure 7 Several key projects

Approach used to validate results

Firstly, energy consumption of some energy-using equipment and area are instant measure through the energy digital management system.

Secondly, each branch should record and analysis monthly energy consumption by theirs statistics department

Thirdly, the group organizes an energy review every year, and is conducting an energy audit every three years.

In addition, the project of EPC hired a third party as energy saving audit.

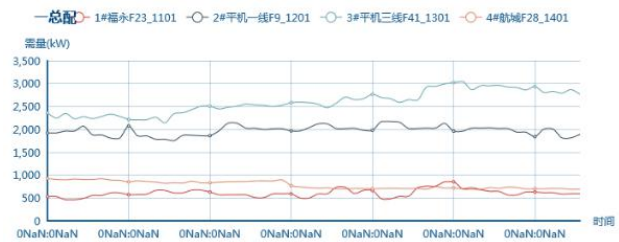


Figure 8 Real-time monitoring data

Baseline year: 2016

Baseline period: From January to December 2016

Reporting period: From January to December 2018

The calculation formula is:

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The methodology for the energy performance improvement.

① Shenzhen International Airport built the photovoltaic power station with the largest installed capacity (14.5MW) in the Airport Industry in China. The total energy production is 7526.52 million kW·h; cost savings about 89.45USD; and CO2-e emission reduction 69417.06 tons.

② Shenzhen International Airport built the largest water storage and cold energy utilization project in the Airport Industry in China, reducing the peak power by 16.9 million kW·h every year.

③ The lighting system of the public area of Shenzhen International Airport has been fully equipped with LED lamps. The total energy production is 1351.69 million kW·h; cost savings about 159.99USD; and CO2-e emission reduction 12826 tons.

④ The project of GPU replacing APU reduced a total of 100,974 tons of aviation fuel, and 298667 tons of CO2-e emission.

Tools & resources

① Cooperate with high-tech enterprises to build comprehensive digital management systems, which covering multidimensional information such as airport energy, building control, flight information, weather information, etc.

② Adopted the model of EPC business to build solar photovoltaic power stations and charging piles, and carried out energy-saving transformation of lighting systems.



Figure 9 Floating photovoltaic power station

③ Plan to establish a research center for smart energy technology, which will conduct research on green civil aviation from the perspectives of cutting-edge theories, patented technologies, applied technologies and standards.

④ Focus on green supply chain management, set up green supply chain management system, and link up and downstream enterprises to carry out energy saving and emission reduction work together to promote low-carbon development.

Transparency

Energy management program:

① In 2018, Shenzhen Airport (Group) Co., Ltd. and 9 branches passed the ISO 50001 at the same time.

③ In 2018, the 2nd airport of China obtained ACA certificate of Airports Council International.

Shenzhen Airport (group) Co., Ltd. applied to ACI for Airport Carbon Accreditation in March 2018, the carbon

emissions was 72,246 tons in 2017.



Figure 10 Airport Carbon Accreditation certificate

Lessons Learned

Integrative development.

- The third party professional technical team will be introduced to improve the professional level of the team and put forward new ideas, and directions for energy management and green airport construction.
- When purchasing energy services, products and equipment, make clear the energy performance request, and take the energy performance evaluation results as one of the reference for purchasing decisions.
- Integrate with ISO14000 environmental management system, improve the efficiency of energy and environment management, and continuing to improve the energy and environment management system.

Through the Energy Management Working Group (EMWG), government officials worldwide share best practices and leverage their collective knowledge and experience to create high-impact national programs that accelerate the use of energy management systems in industry and commercial buildings. The EMWG was launched in 2010 by the Clean Energy Ministerial (CEM) and International Partnership for Energy Efficiency Cooperation (IPEEC).

For more information, please visit www.cleanenergyministerial.org/energymanagement.

