ISO 50001 Energy Management System
Case Study

2020 China

Guangzhou Baiyun International Airport co. Ltd.

Build an energy-saving, low-carbon emission and environmentally friendly Green Airport.

EnMS in Guangzhou Baiyun International Airport

Case Study Snapshot	
Industry	Airport, Public Buildings
Product/Service	Aviation business; Public service
Location	Guangzhou, China
Energy management system	ISO 50001
Energy performance improvement period	2 years
Energy Performance Improvement (%) over improvement period	10.44%
Total energy cost savings over improvement period	1321214.92USD
Cost to implement EnMS	1277153.14 USD
Total Energy Savings over improvement period	48283.24 GJ
Total CO_2-e emission reduction over improvement period	4789.42 tons

Organization Profile & Business Case

The first airport implemented the digital EnMS informatization platform in China.

Guangzhou Baiyun International Airport is one of top 3 airports in China and one of top 12 airports in world. Located in Guangzhou, it forms a "4-hour air traffic circle" with major cities in China and southeast Asia, a "12-hour air traffic circle" with major cities worldwide. It received73.386million passengers and delivered 1,920,288 tons of goods, in 2019. The main energies include electricity, diesel, gasoline, and natural gas. Despite the twin terminals went into operation in 2018, energy consumption still dropped by 48283.24 GJ in 2019 in the same situation.

"ISO 50001 standardizes promotes the standardization and specialization of the company's energy management, It is the cornerstone of the construction of the Green Airport."

— Qiu Jiachen, GM

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

Goals: Build a "safe, green, intelligent and humanistic" airport. Compared with 2018, the energy intensity to be reduced by 10% and the carbon emissions to be reduced by 12% by 2021.

Supporting tool: 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.

The support of energy management actions

① Carry out the strategic planning of energy conservation and emission reduction since 2017.
② Build an EnMS management team with 40 staff.
③ Formulate the company's energy policy: standardized management, energy saving leading, open innovation, green airport.
④ Communicate company’s Energy Conservation and Emission Reduction Commitments on website.

Business Benefits

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

Energy performance improvement program

①Conducts the energy review system, including:
- Implementation an energy consumption compliance assessment and adaptation. e.g. According to national regulations, identified the energy inefficient equipment and replaced by energy-efficient equipment.
- Identify and analysis the main energy used, main consumption area and key energy consumption equipment.
- Identify energy performance improvement opportunities. e.g. Energy-saving transformation of central air conditioning system.
- Indicate the energy-saving objectives, and set up the management and implementation plans.
- Develop the energy performance monitoring and analysis plans.

②Ensure the energy-saving objectives are taken responsibility by all departments(not only the EnPI), and the departments concerned to set up the saving planning based on different energy-using equipment to archive the objectives, including:
- Overall goal: indicate the overall level of energy usage at the group level (e.g. Comprehensive Energy Consumption, Unit Passenger Comprehensive Energy Consumption).
- Sub-objectives: indicate the energy usage levels by sector/unit (e.g. Comprehensive Energy Consumption for Unit Output Value).
- Indicators: indicate the energy efficiency of key energy-using systems and equipment (e.g. Comprehensive Cooling power consumption).
③Develop corresponding key control points according to the actual situations. For example,
- Setting down the outlet temperature and return water temperature of central air-conditioning cold-water host.
- Optimize the timer (opening and closing time of the lighting system).

Energy performance improvement achieved

The Guangzhou Baiyun International Airport terminal 2 is operating since April 26, 2018. Considering the accuracy of energy consumption, cost and other data, we made a comparative analysis of the data from June to December 2018 and June to December 2019.

Baseline year: 2018
Baseline period: From June to December 2018
Reporting period: From June to December 2019
The calculation formula is：

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

Energy performance parameters is Unit Passenger Comprehensive Energy Consumption.

Over improvement period, energy performance improved significantly.
①Energy Performance Improvement 10.44%, Unit Passenger Comprehensive Energy Consumption decreased from 284.88 GJ/thousands of person to 255.13 GJ/thousands of person.
②The total energy savings of Guangzhou International Airport is 48283.24 GJ.

NO.	Types of Energy	Energy Savings (GJ)	Improvement (%)
1	Electric power	21695.81	2.63%
2	Diesel	20030.80	7.38%
3	Gasoline	72.76	0.36%
4	Natural gas	6483.88	15.74%
5	**Total**	48283.24	4.17%

Figure 1 Energy Savings performance per types

GHG emissions reduction

Over improvement period, the total CO_2-e emission reduction of Guangzhou International Airport is 4789.42 tons, the rate of decline is 3.32%.

NO.	Types of Energy	CO2-e Emission Reduction (tons)	Improvement (%)
1	Electric power	3179.03	2.63%
2	Diesel	1455.95	7.38%
3	Gasoline	4.93	0.36%
4	Natural gas	149.51	7.08%
5	**Total**	4789.42	3.32%

Figure 2 CO2-e Emission Reduction per types

Costs and energy cost savings

Overall energy cost savings = Savings from the EnMS + savings from projects with capital investment
Savings from the EnMS is382570.99 USD.
Savings from projects with capital investment is 938643.93 USD.
Overall energy cost savings is 1321214.92USD.
Estimated staff time: one half year to one year
Percent of overall cost savings that was due to operational savings: 36.4%

NO.	Project name	Time	Efficiency Benefit (USD)
1	LED renovation in Public Area road	2018	224242.03
2	Energy saving renovation of company office building	2018	110947.71
3	LED renovation in T1 peripheral	2019	178060.75
4	Gas boiler renovation	2019	425393.43
5	**Total**	/	938643.93

Figure 3 projects with capital investment

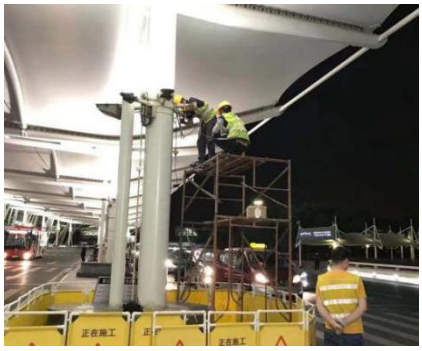


Figure 4 LED renovation in T1 peripheral

Any non-energy or other benefits

①Promote the clean energy sources, build 2MW solar photovoltaic power stations, use 259 electric automobiles and built over 100 charging piles.
②Install digital vehicle fuel consumption monitoring system to optimize vehicle scheduling and operation mode and reduce gasoline and diesel consumption.
③Increase airline APU replacement facility utilization, Among them, the utilization rate of APU replacement facilities of Chinese airlines reached 97.76%.
④Optimize aircraft take-off and landing process, shorten aircraft launch and taxiing time.In 2019, consumption of 494.33 tons of jet fuel was reduced.

Figure 5 Using APU replacement facilities

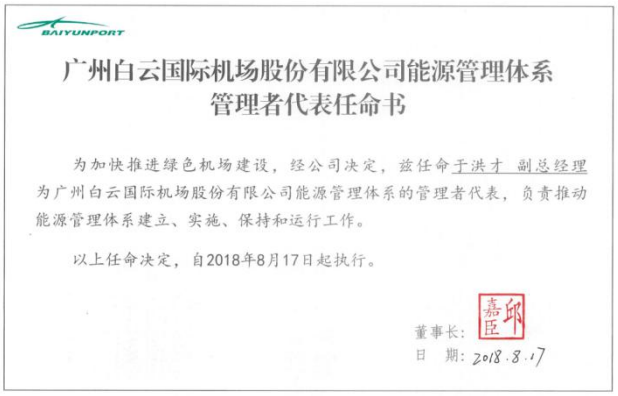
Plan

Develop the company implementation plan EnMS

Get the support

①Strengthen the communication and training to raise employees' awareness of energy conservation. No country or economy is immune from the consequences of climate change. It is our bounden duty to reducing GHG emissions.
②Appoint EnMS management representatives and make clear their responsibility for promoting the construction, operation, maintenance and improvement of the energy management system.

③The Construction Management Department is designated as the centralized department for the company's energy management, responsible for organizing and implementing various activities of EnMS.



广州白云国际机场股份有限公司能源管理体系
管理者代表任命书

为加快推进绿色机场建设，经公司决定，兹任命于洪才 副总经理为广州白云国际机场股份有限公司能源管理体系的管理者代表，负责推动能源管理体系建立、实施、保持和运行工作。

以上任命决定，自2018年8月17日起执行。

董事长：邱嘉臣
日 期：2018.8.17

Figure 6 Letter of appointment of EnMS management representative

Develop energy performance parameters

①Comprehensive Energy Consumption and Unit Passenger Comprehensive Energy Consumption: As there is a great correlation between airport energy consumption and passenger flow, we not only considering the Comprehensive Energy Consumption of the airport, but also considering energy intensity, and take the Unit Passenger Comprehensive Energy Consumption as a key energy performance parameter.
②Unit Area Energy Consumption: The energy consumption of the buildings, compared with the energy consumption per unit area.
③Equipment influence parameters: the refrigerating capacity of the central air conditioning, lighting time etc.

With the data base on the digital energy management system, the data statistics department collect and analyze the energy performance data of relevant variables and equipment influence parameters

Support the target achievement

①Set energy performance target as one of the important annual appraisal target of the company.
②Communicate the Control Procedures, including Energy-saving Objectives, Indicators and Implementation Plans. This document defines the principles, contents, procedures and methodologies of implementation.
③During the operation, the departments are strictly required to implement the energy-saving actions and continuously optimize the economical operation programs to effectively improve the energy efficiency of the system.
④Implement energy performance monitoring, measures, analysis and management. Not only do the comparation with the annual energy consumption, but also analyze the monthly year-on-year energy consumption.
⑤Carried out the energy review and refine the assessment objectives & EnPI to various departments.

Decisions making on energy management implementation plan

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 energy performance has been significantly improved. From top decision makers in our company to front-line employees, they are becoming more and more supportive of energy conservation activities and more and more aware of energy conservation. At present, we have applied the requirements of the EnMS to all processes such as design, construction, transformation and recycling."

— Huang Mingsheng, Director of Construction Management Department

Do, Check, Act

Continuous improvement.

Organization

①**Company level:** set up EnMS leadership and working group, composed of the company's top management and heads of each department, who will be responsible for the overall supervision and promotion of the EnMS activities.
②**Department level:** set up the Energy Manager, employing personnel with corresponding certificates of qualification, technical level and experience, who will be responsible for the implementation of the EnMS activities.
③**Job level:** set up the Energy Administrator, who will be responsible for the operation and maintenance of various energy-using equipment to ensure the economic operation of equipment.
④**Audit level:** set up part-time energy management system auditors to participate in the review and auditing of the energy system.

Drive and support

①**Financial support:** set aside special funds for energy management and energy conservation projects, every year.
②**Human resources support:** recruiting outstanding professionals graduated from universities and colleges, and the third party professional technical team will be introduced to improve the level for energy management.
③**Technical support:** set up Energy-saving Technology Research and Development Laboratory, and equipped with software and hardware development and system debugging platform.

Key actions

①The Company organizes trainings for energy management staff on policies and regulations, systems, measurement and energy management.
②The Company organizes energy-saving technical trainings for the front-line technicians on HVAC, power distribution and transformer, baggage, buildings and construction and other technical teams on an regular basis to improve their energy-saving awareness and professional ability.

③The Company conducts various special publicity activities in the Energy Conservation Publicity Week.
④Organize the internal audit and management review activities, find the nonconformity and correct it in time.

Figure 7 Energy conservation campaign in 2019

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 their 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.

The methodology for the energy performance improvement.

①Guangzhou Baiyun International Airport plans to build a new photovoltaic power station with 10MW. The total energy production will be 10 million kWh/year;

cost savings is around 229640.3 USD/year; and CO2-e emission reduction 527.1 tons/year.
②The high-pole lamp of the public road of Guangzhou Baiyun International Airport has been fully equipped with LED lamps. The total energy production is 140.5 million kWh/year; cost savings about 143471.6USD/year; and CO2-e emission reduction 74.06 tons/year.
③The project of GPU replacing APU reduced a total of 138051.65tons of aviation fuel, and 408337.52 tons of CO2-e emission.

Tools & resources

①Cooperate 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.
②Strengthened energy metering management, smart meters have more than 90%, the energy equipment over 100kW is equipped with measuring instruments.
③Install digital energy management system to ensure real-time statistics and energy use analysis, monitor the operation of energy equipment, and improve energy management efficiency.

Figure 8 The digital energy management system

Transparency

Energy management program:
In January 2019, the company passed the ISO 50001, and through the website, WeChat, and other channels to disclose the information.

In January 2020, the company obtained ACA certification from Airports Council International, the carbon emissions was 137610.25 tons in 2018.

Lessons Learned

Integrative development.

- Good planning (identifying key energy equipment& facilities, tap energy saving potential).
- Precise management (monitor performance goals in real time.)
- Customization of the system (making it applicable to the airport/service industry).

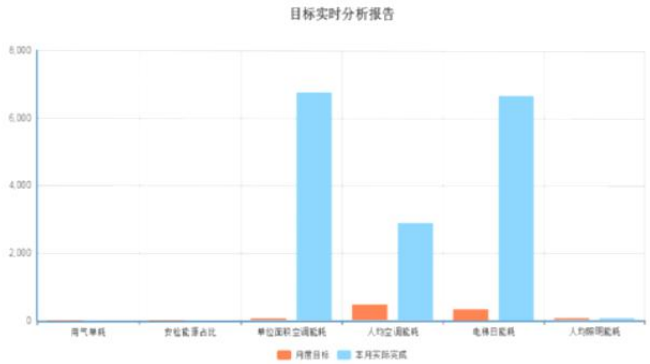


Figure 9 Monitor performance goals in real time

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.

CLEAN ENERGY MINISTERIAL
Accelerating the Transition to Clean Energy Technologies

ipeec