

# ISO 50001 Energy Management System Case Study

China

## Haier Group Company



Open intelligent energy management platform based on energy management system construction

### Company Profile & Business Case

Haier Group is a leading global provider of good life solutions. It has been through five strategic development stages since it was established in 1984. Haier Group is committed to becoming an eco-type enterprise led by the Internet of Things era.

In 2012, Haier established EnMS and promoted to apply in the whole group, and realized the transformation of traditional high-energy industrial parks into green and low-carbon parks.

In 2013, Haier developed and constructed Haier's smart energy management platform according to the implementation requirements of the energy management system (ISO50001). It made Haier become the first enterprise who combined energy management system and Internet technology for energy management in the industry. It realized various kinds of factories for the group. The energy medium was intelligently monitored, data collected and analyzed, and improved in energy efficiency from the front-end purchase, distribution, and consumption.

Based on the energy management system (ISO50001), Haier Smart Energy Management Platform integrated industry-leading resources through advanced technologies such as the Internet, big data, and cloud computing. It interred rom the front-end, collected and analyzed data, optimized and adjusted dynamically, in order to reduce energy and increase energy efficiency. A

diversified energy management platform that provides solutions and value-added services was achieved.

At present, the platform had access to more than 30,000 sets of equipment, 100,000 pieces of remote transmission instruments, 60 kilometers of optical cable, 3,000 kilometers of cable, 12 main modules, 61 sub-modules and 563 application scenarios. It covered 15 provinces and autonomous regions. It had 55 interconnected factories and access to 73 interconnected factories. It also provided smart energy butler services and has hosted 58 group factories.

It mainly solved six energy management problems: reducing energy costs by distributing energy, reducing the incidence of energy accidents by real-time monitoring of Internet of Things, adjusting energy structure with the help of big data energy analysis, reducing grid impact energy storage peak frequency FM, guaranteeing normal production of the enterprise by intelligent front-end warning and building information opening interaction by diversified service platform.

The smart energy management platform effectively improved the energy allocation, utilization efficiency and energy use safety of enterprises, reduced energy costs, and helped enterprises to develop green, providing effective data support for the continuous improvement of Haier's energy management system.

Taking gas-fired heat and power triple-supply projects as an example, natural gas was the main fuel to drive gas-fired power generation equipment such as gas turbines, micro-combustion engines or internal combustion engine generators. The electricity generated during the process was used to meet the requirements of users. The waste heat discharged from the system after power generation was recovered by waste heat. Equipment (waste heat boiler or waste heat direct combustion engine, etc.) supplied heat and cooling to users, improved primary energy utilization of the entire system, realized energy cascade utilization and provided grid-connected power for energy complementation, economic benefits and efficiency of the entire system. They were all superimposed to greatly improve energy efficiency and achieved energy saving and emission reduction.

Introduction to Case Study	
Industry	Household Electrical Appliance Manufacturing
Product/Service	Appliances
Address	Qingdao, China
Energy Management System	ISO 50001
Schedule for Energy Efficiency Improvement	2013 -2017
Percentage of Energy Efficiency Improvement on Schedule ( % )	43.26%
Total Energy Saving during Improvement Period	\$50000000
Cost for Applying EnMS	\$15000000
Total Energy Saving during Improvement Period	1756937.88 GJ
Total CO2 Reduction during Improvement Period	157105.02 t

The application of this system in Haier ZhongDe Industrial Park had an annual energy saving of 293,000 GJ, a carbon dioxide emission reduction of 26,000 tons, a monthly energy cost reduction of 30%, and an annual energy saving cost of approximately \$300000.

② Solution of compressing air: After investigating the current situation of the use of air compressors in 82 small and medium-sized enterprises, SMEs did not have a unified management system for air compressor equipment. It caused disorderly management of the use of the air compressors, waste of energy and increasing enterprise cost. At present, the finished model of the air compressor on the market was 20 cubic meters and 40 cubic meters. Due to the special nature of the unstable production of small and medium-sized enterprises, it was extremely wasteful in the use process. According to this situation, we purchased and customized machines with first-class energy efficiency and two-stage compression. It could be customized according to the actual production of different types of machines, such as 50 cubic meters, 30 cubic meters, etc. and reduce the cost of enterprises to invest more than 30%.

③ Recycling of heat: In the operation of the air compressor, 70% of the energy was converted into heat. It needed to be cooled by water to generate waste heat. By recovering the waste heat, the effective use of resources was achieved. It was proved by practice that two 20 cubic meters of air pressure could supply domestic hot water for 700 rooms in two dormitories and reduce the cost of equipment and electricity generated by the use of water heaters by about \$200000/year.

***Haier will adhere to the EnMS construction, improve the innovation continuously and make new achievements in the field of energy management.***

—***Ruimin Zhang CEO***

## Business Benefits

Since the establishment of EnMS, the Group's comprehensive energy consumption per 10,000 yuan had decreased by 43.26%, saving energy costs by \$50000000, reducing emissions by 1,759,193.88GJ, and reducing CO2 157105.02t. Established and implemented EnMS cumulative investment of \$15000000, of which only research and development of Haier smart energy management platform, investing \$8000000, eliminating high-energy, high-pollution processes, research and development of new technologies, and energy-saving projects and other inputs of \$7000000.

The construction of Haier's smart energy management platform enabled Haier to continuously summarize and innovate while conducting daily energy management, and derived multiple sets of excellent energy solutions. It relied on EnMS to continuously improve and optimize, and tried to promote the market. Currently, diversified promotion of textiles, automobiles, catering, office services, special steel and other industries. had been completed.

The changes of business model were formed during the process of online data monitoring, energy saving analysis, offline energy operation and maintenance by smart energy management platform. Three market-oriented business models were promoted: smart energy triple supply management mode, compressed air third-party operating mode, output seven types of socially replicable solutions, and the beginning of social services - connected value-added services, so that enterprises had the ability to continuously improve the energy efficiency

of enterprises. At present, the platform had provided energy solutions for 73 business units, and conducted business negotiations with 12 major industries such as electronics, textiles, equipment construction, transportation, and chemical industry, and replicated Haier's smart energy management platform model in each industry. At the same time, demonstration areas were established in 11 regions including Qingdao, Chongqing, Wuhan, Hefei and Tianjin.

Promoting the implementation of energy-saving projects to improve energy performance. Through big data inductive analysis of hidden dangers, looking for weak links in energy management. All parks and factories promoted energy conservation projects based on their own energy management gaps to ensure energy management performance and annual target indicators were achieved. A total of more than 300 energy-saving projects had been implemented in 2013-2017, including: boiler elimination, photovoltaic power generation, energy-saving transformation of injection molding machines, replacement of hot junction furnaces, peak-to-peak charging of forklifts, replacement of natural gas, operation of air compressors, reusing of water, high energy consumption elimination and raw material substitution. These projects had achieved a win-win situation in energy-saving and economic benefits. Only the Qingdao Park had eliminated coal-fired boiler projects, reduced annual emissions of sulfur dioxide by 56.76 tons, smoke and dust by 27.58 tons, nitrogen oxides by 117.4 tons and 3,250 tons of coal slag.

## Plan

In 2009, Haier group began to explore the road of refined energy management and built the group's energy management system model under the guidance of Qingdao energy conservation department.

In 2012, Haier formally established the energy management system (ISO50001), and maintained the compliance operation in accordance with the requirements of the group's top management. In 2015, it was audited and certified by SGS general standard technical service co., LTD., a third-party auditing institution entrusted by Qingdao municipal government.

According to the requirements of the energy management system (ISO50001), Haier group had set up an energy conservation committee to be responsible for the implementation of the energy management system. The specific implementations were as follows:

- ① Establishing an energy management system manual and 19 first-level program documents to control the operation of the group's energy management system.
- ② Annual energy saving plan and performance management: a third party was entrusted to audit last year's reports on their utilization of energy and analyze last year's energy management situation each year. According to the report the audit results, an energy baseline data was set to develop energy management plan and goal for the next year. A clear target of no less than 6.5% reduction in energy consumption was set. Energy conservation project to decrease energy consumption was supported and implemented. Jointing with group human resource to develop energy management performance evaluation mechanism. Energy management goal should be brought into the group compensation management system to guarantee the energy management plan and goals to achieve.
- ③ As the top management, the group President put the group energy management system (ISO50001) into the company's strategic development plan; group energy conservation supervision center was set to supervise and assess the targets and indicators of each park; energy management departments was set to be responsible for the operation of the park system and the completion of the target indicators in 15 parks. A total of 55 interconnected plants had set up a factory-level energy management team, with the owner as the first person responsible for energy management. A three-level energy management system operating framework including the group, the park and the factory, and supervision-assessment mechanism were implemented.
- ④ The management mode which combined energy management system (ISO50001) and persons together was carried out. Group signed the annual energy management system goals and indicators assessment commitment with each responsible person to ensure the to achieve the annual goals and indicators. The key energy use position should specify person to take responsibility. Group signed responsibility commitment of position energy management system target index with position responsibility person to ensure position energy management responsibility to person; The ultimate purpose of the energy management system was to ensure the implementation of the system requirements and improve the efficiency of energy saving. Haier's management mode which integrated person and mode by pre-bet, found difference in the process and the post-

sharing mechanism ensured the realization of the system operation goals

*"The change requires the support of management innovation. Establishment of energy management system is an innovation of Haier in energy management, which enables us to develop from a traditional high-energy consuming industrial park to a green and low-carbon park, and continuously improve energy efficiency. "*

—Ruimin Zhang CEO

## Behavior, Examine, Implement

① Performance evaluation: internal audit was operated for operation and energy management system every month on each production line and factory group. According to the review report from auditing situation, took A, B, C, D four location. The performance in a month for area C and below C would be rejected. The performance in a year for area C and below C would be rejected. The report would be sent to top management on the group's monthly meeting and distributed to each department. Each department put forward to improve and develop the department improvement scheme to promote and implement according to the requirements of the top management.

② Daily operation: developing the system internal audit plan and daily-weekly-monthly energy management review plan. Review and evaluation to plant energy management system operation and energy consumption indicators in 15 parks were operated by 60 energy management system managers monthly. b the Energy use situation of each plant every week were analyzed, reported, assessed and public announced. Daily use of the terminal energy management personnel inspection and system monitoring combined with the mode of each production site for 24 hours of energy management supervision and inspection and found problems in time closed loop.

③ According to the ISO50001 operation control requirements, the intelligent energy management platform was used to monitor the limit value of all the plant energy medium and over-limit alarm. All operation curve for energy operation were retained. Prediction

analysis was used to guide the energy equipment maintenance and operation.

④ According to the requirements of the ISO50001 performance monitoring, executing annual target responsibility system which took a single energy consumption as evaluation index, to main products factory and production line, like air conditioning, washing machine, kitchen electric, electric heating, refrigerator etc. Energy management index evaluation of the field gap review closed-loop model was used which broke down to each month and executed monthly nodes transverse, longitudinal evaluation and weekly performance tracking. 1140 energy gap problems were found during 2013-2017. All the problems were tracked the rectified in place in accordance with the hidden trouble closed-loop principle which was "four pass, not till tomorrow" in group.

⑤ Analyzing the gap with accurate policy and promoting the implementation of energy-saving projects to improve energy performance. Through big data analysis of hidden problems, weak links in energy management were found. Each park and factory promoted the implementation of energy conservation projects according to their own energy management gaps, so as to ensure the completion of energy management performance, namely the annual target index. From 2013 to 2017, more than 300 energy conservation projects were implemented, including: Boiler elimination, photovoltaic power generation, injection molding machine and energy saving transformation, substitute, forklift peak charging knot furnace, gas substitution, air compressor operation, process selection, and gray water recycle and high energy consumption, raw material substitution and so on. Energy-saving benefit and economic benefit double wins were realized. Only the Qingdao Park had eliminated coal-fired boiler projects, reduced annual emissions of sulfur dioxide by 56.76 tons, smoke and dust by 27.58 tons, nitrogen oxides by 117.4 tons and 3,250 tons of coal slag.

⑥ Intelligent means to help energy management system continuous improvement. The intelligent energy management platform collected, stored the energy use information of enterprises and monitored the energy use 24 hours in real time. Through the system algorithm module, the energy system in the park was regulated and configured in advance to optimize the energy consumption structure in the park, reduce energy consumption, improve the operation performance of the energy management system and achieve the purpose of continuous improvement.

⑦ Developing super energy saving products, and fulfilling the social responsibility of large enterprises. < Implementation Plan of Energy Efficiency "Leader" System> jointly issued by National Development and Reform Commission, Ministry of Finance, Ministry of Industry and Information Technology, State Administration, State Administration of Energy, State Administration of Quality Supervision, Inspection and Quarantine and National Standards Commission marked the official launch of China's energy efficiency "leader" system.

⑧ Haier Energy Management System (ISO50001) not only used in the production process, but also paid more attention to influence of product. The first batch of "leader" of energy efficiency products included three kinds of products like household refrigerators, flat TV and speed controlling type room air conditioner. After the first selection, field test of energy efficiency, secondary selection and social public link, "leader" of energy efficiency product catalog were selected from 477 models, and Haier products accounted for more than 40%.

⑨ The first set of Haier energy saving leader refrigerator energy efficiency standard far exceeded the European highest A+++ + level energy efficiency and saved 40% of electricity for users; One product of Haier refrigerator with a capacity of 101L used less than 1 KWH for three days. Haier air energy water heater won "star of energy efficiency" energy saving champion hold by the ministry of industry and information technology; Haier magnetic levitation central air conditioning saved up to 50% energy and entered the national development and reform commission energy-saving technology directory. Its social energy-saving effect was significant.

⑩ Haier development zone industrial park and Laoshan industrial park were awarded the honorary title of "clean production demonstration park" successively due to the establishment of energy management system (ISO50001) and continuous improvement, continuous improvement of energy efficiency, and significant energy-saving effect during 2013-2014.

## Transparency

In the energy management system in the process of operation and development of intelligent energy management, Haier set up a talent cultivation system met the need of energy management development by hiring a third party consultancy expert and energy

management system training, regular internal selection examination in Haier university, social recruitment and joint training with the college set up in line. It made Haier energy management team emerged a batch of both proficient in the energy management system and cross-border integration of information technology, effectively helped the development of Haier energy-saving industry.

## 5 ) Tools and Resources

① Important tool: Haier intelligent energy management platform

② Training tools: Haier online training system

③ Energy System Evaluation: energy management system (ISO50001)

④ Performance evaluation tool: 161 budget management system

⑤ Energy consumption prediction management tool: improved seasonal index method

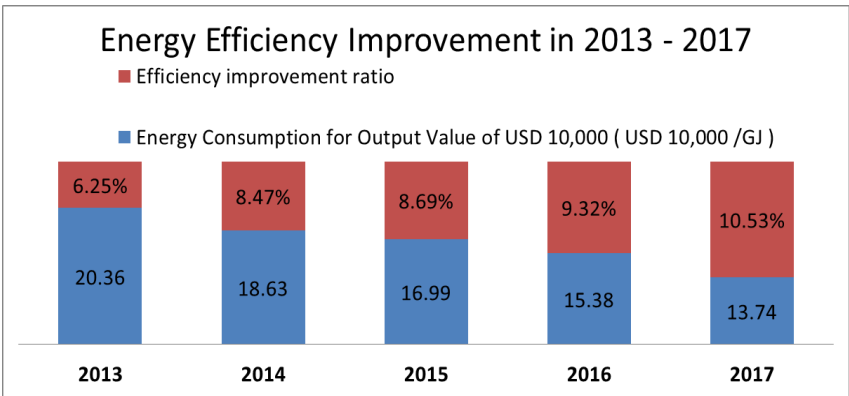
⑥ Energy calculation method : (last year output energy consumption per ten thousand yuan - output energy consumption per ten thousand yuan) x output value

## Experience and Lessons

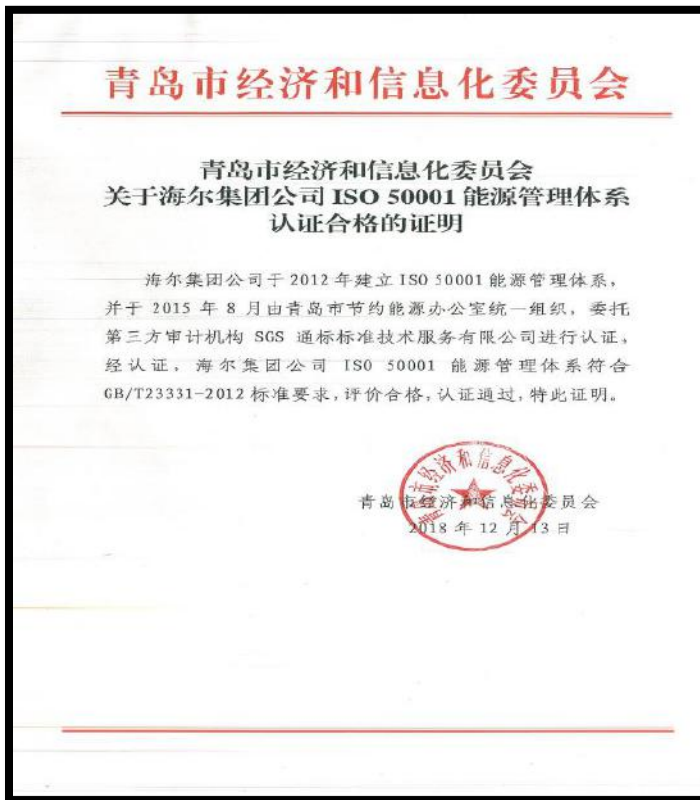
A. Adhered to the intervention of the whole process of EnMS, integrated the system management into the long-term planning of the company and innovated continuously.

The change required the support of management innovation. Establishment of EnMS was an innovation in energy management for Haier, which enabled us to develop from the traditional high-energy-consuming industrial park to a green and low-carbon park and continuously improved the energy utilization efficiency.

B. Explored the smart energy management of enterprises under the big data model based on EnMS. Realizing the energy saving, consumption and cost reduction, and efficiency improvement of enterprises through energy consumption analysis, energy prediction and the energy solution of platform iteration and upgrading. It was a new model and platform of supply-side structural reform  
C Adhered to the principle of full participation in EnMS operation. Haier's "integrated management mode of personnel and orders" was the world's advanced enterprise management mode. Through the single-in-one mode, the participants in the whole process of the production process was affected. The popularization and application of Six Sigma and 6S management methods helped EnMS to run full-time and ensure the



In 2013-2017, through the implementation of EnMS, the Group's comprehensive energy consumption per 10,000 yuan of output value had dropped by 43.26%, saving a total of \$50000000, saving a total of 1,759,193.88 (GJ) achievement of target indicators and reducing CO<sub>2</sub>157105.02t.



Haier Group Company established ISO50001 in 2012 and passed the evaluation. The Qingdao Economic and Information Technology Commission issued the certification documents. It is planned to complete the EnMS re-certification in 2019 and apply for a certificate.

