ISO 50001 Energy Management System
Case Study

china

Ningxia Eppen Biotech Co., Ltd

Eppen formed a long-term mechanism of systematic energy saving through the EnMS project and achieved economic benefits of USD 4.7 million in 3years.

The Ningxia Eppen Biotech Co., Ltd of Administrative Office Building

Organization Profile & Business Case

Formed in Jun of 1999, Ningxia Eppen Biotech Co., Ltd has been focusing on production and sales of feed additives, food additives and fertilizers. EPPEN is among the top 3 enterprises in fermentation industry of China and top 500 private enterprises in manufacturing of China. EPPEN is recognized as National High-Tech Enterprise, Pioneering Enterprise for Industrialization of Agriculture, Modeling Enterprise in Intensive Processing of Agricultural Products, Designated Enterprise for production of daily stuff for ethnics and the Modeling Enterprise of Recycle Economy in Fermentation Industry, Resource-saving and Environment-friendly Enterprise, Top Ten Enterprise of Fermentation Industry.

In 2013, EPPEN built an energy management center. In 2015, EPPEN formulated the energy management policy of "focusing on the process, reliable products, ensuring customer satisfaction; focusing on prevention, scientific management, ensuring safety and health; optimizing the environment, saving energy and reducing emissions, promoting clean production; abiding by the law, continuously improving and creating a better life". Energy management system was established in 2015 and certification was completed in 2016. In 2016, a working group on energy conservation and emission reduction was set up with the President as the group leader and the Director of Technology Center as the Deputy Group leader. The working group presides over the overall planning and decision-making of energy management, and the Energy Conservation and Emission Reduction Office is set up under the Ministry of Technology Research and Development. In 2017, EPPEN participated in compiling the Cleaner Production Evaluation Index System of MSG Industry. In 2018, EPPEN participated in the compilation of "Green Factory Evaluation Requirements for Amino Acid Industry".

Case Study Snapshot	
Industry	Deep Processing of Agricultural Products
Product/Service	Feed Amino Acids and Monosodium Glutamate
Location	Ningxia, China
Energy management system	GB/T 23331 (ISO50001)
Energy performance improvement period	2016～2018
Energy Performance Improvement (%) over improvement period	6.6%(2015 energy consumption- 2018 energy consumption)/2015 energy consumption×100
Total energy cost savings over improvement period	USD 1.57 million (annual average)
Cost to implement EnMS	USD 9.66 million (annual average)
Total Energy Savings over improvement period	548.46 million (GJ) (annual average)
Total CO_2-e emission reduction over improvement period	304086 (Metric tons) (annual average)

In October 2016, EPPEN successfully won the national key leading enterprises of agricultural industrialization for the record, and in December 2016, EPPEN won the honorary title of "Top 20 Feed Additive Enterprises in China". In October 2017, EPPEN passed the third round of cleaner production audit and evaluation smoothly. In September 2018, the company passed the third round of cleaner production audit and acceptance. The evaluation experts highly evaluated the company's work in cleaner production. In May 2018, with 831 brand strength and 3.166 billion yuan brand value, EPPEN ranked among the top 25 of the national food processing group (No. 9), and won the "top 25 of the food processing group of brand value evaluation in 2018". In 2018, EPPEN won the advanced enterprise of energy saving and consumption reduction in Ningxia Hui Autonomous Region in 2017.

Business Benefits

From 2016 to 2018, the average annual energy management expenditure was 65.1597 million yuan, and the output economic benefit was 1058.96 (which can be calculated by statistics). Among them, the investment of conventional energy saving (management energy saving and technology transformation energy saving) is 5.21 million yuan annually, and the output economic benefit is 8.54 million yuan (which can be calculated by statistics). The other non-conventional energy-saving funds (energy-saving for overhaul and maintenance of key energy-using equipment and energy-saving for environmental protection and management) are all invested at 59.95 million yuan per year, which has produced enormous social benefits.

From 2016 to 2018, the average annual energy saving amount was 18714.2 tce, and the average annual energy consumption rate of 10,000 yuan output value was 1.82%. Annual average greenhouse gas emission reduction from 2016 to 2017 is 304,100 t (CO_2).

In order to further strengthen the construction of energy management system and clarify the responsibilities of various departments and positions, in September 2016, the company set up a leading group of energy conservation and emission reduction, with the president as the group leader, the director of technology center as the Deputy Group leader, the director of operation center, the finance department, the general manager of various departments, the manager of relevant functional departments and the manager of production department as members, and the office of energy conservation and emission reduction is located in technology. R&D Department. Technology Research and Development Department has two full-time energy conservation and emission reduction commissioners, and production departments have part-time energy conservation and emission reduction commissioners.

"Energy-saving is efficiency-enhancing"

—Liu Yao Zhou, Commissioner for Energy Conservation and Emission Reduction, Technology Research and Development Department

Plan

Guarantee of System and Procedural Documents：

In 2016, the company formulated its own energy management policy, and integrated with the quality and environmental management policy. In the past three years, the company has combed and merged, perfected more than 20 systems, procedures and manuals related to energy management, including energy conservation and emission reduction work manual, water resources management, etc., and standardized the company's energy procurement, use, measurement and assessment work. In 2016, the Energy Performance Parameters, Benchmarks, Objectives, Indicators Control Procedure and Energy Management Implementation Scheme Control Procedure of the Energy Management System will be merged with other systems (such as environmental management, occupational health and safety system) to simplify the number of process documents. In early 2018, a special "Water Resources Management System" was formulated, highlighting the importance of water resources management. At the end of 2018, the Energy Management System Manual was revised to adapt to the new organizational

structure and strategic development of the company, and to ensure the implementation and Realization of the commitment of the top decision makers.

Assessment and Planning of Energy Management：

The company conducts monthly statistics and Analysis on energy consumption and use, and forms business accounting analysis reports and monthly energy analysis reports. The reasons why the technical indicators and energy-saving target indicators have not been completed are analyzed and improvement measures are put forward. In addition, starting in 2018, we will carry out quarterly benchmarking analysis with other companies and propose improvement projects on the gap between them. At the beginning of each year, statistics, analysis and summary are made on the energy consumption and utilization of the previous year, and the company's energy self-survey report is formed. The company and its departments make annual summaries, analyze and summarize the business objectives and energy-saving goals of the previous year, put forward ideas and measures for improvement in the next year, and form an annual summary report.

"Focusing on Green Development and Making Contributions to the Sustainable Development of Society"

—Chairman Yan Xiao Ping

Do, Check, Act

Energy management training and enhance the professional communication :

The company's energy management training and professional promotion exchanges, mainly in the end of each year to develop the next year's company-level training plan (including the training of various professional systems) and participate in professional promotion training both inside and outside the region. The company has 30 internal auditors, and organizes at least one professional skill training for internal auditors every year. In addition, according to the needs of manufacturers with advanced technology and equipment to carry out technical exchanges and improve professional level. For example, in 2018, the company and Beijing Lepu Sifangyuan Science and Technology Energy-saving Services Co., Ltd. exchanged technologies on the "Recovery Project of Waste Heat from Fixed-row Boiler" and "Frequency Conversion Reform of Boiler Feedwater Pump" and put forward preliminary plans for transformation. Among them, the project of recovery of waste heat from fixed-row boiler is expected to recover 76,000 tons of steam annually, with an economic benefit of about 5.97 million yuan.

Basic Training of Energy Management System in 2017

Cost-benefit analysis:

From 2016 to 2018, the total input of energy management expenditure was 19.5491 million yuan, and the corresponding output economic benefit was 31.7688 million yuan. The average annual input of energy management expenditure is 65.1597 million yuan, and the economic benefit of output is 1058.96 (which can be calculated by statistics). The payback period of investment is about 6 years. Among them, the investment of conventional energy saving (management energy saving and technology transformation energy saving) is 52.082 million yuan annually, the output economic benefit is 8.536 million yuan (which can be calculated by statistics), and the payback period of investment is relatively short (about 0.6 years). The other non-conventional energy-saving funds (energy-saving for overhaul and maintenance of key energy-using equipment and energy-saving for environmental protection) are 59.9515 million yuan annually, and the corresponding output economic benefits are 2.0536 million yuan (which can be calculated by statistics). Although the payback period of investment is long, it

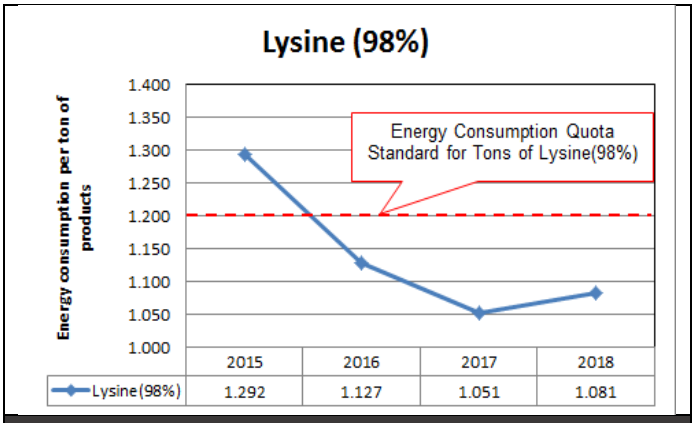
produces enormous social benefits. The statistical tables of input and output benefits of energy management expenditure of the company from 2016 to 2018 are shown in the table below.

Time	Energy saving type		Cost to implement EnMS (ten thousand yuan)	Output benefit (ten thousand yuan)
2018	Direct energy saving	Management category	6	125.5
		Technical modification	530.05	847.34
	Indirect energy saving	Maintenance of key energy-using equipment	1829.07	60.9
		Environmen-tal protection	9622.9	/
	Total		11988.02	1033.74

Evaluation and Improvement of Energy Performance:

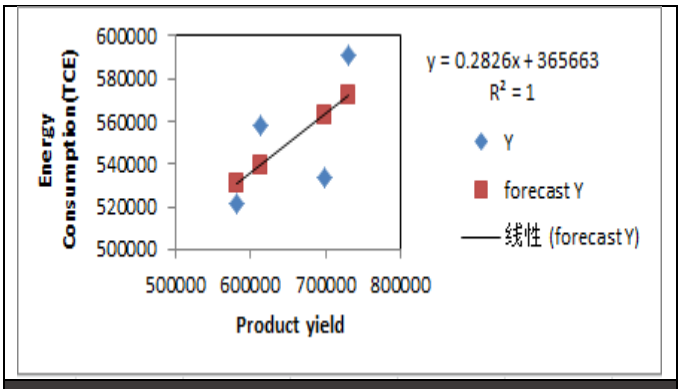
The company inspects the energy performance parameters of the production department weekly and forms the process operation report. In view of the deviation of energy performance parameters found in the inspection, the workshop is required to propose corrective measures and completion time, and follow up for verification. The company organizes internal audits of the system once or twice a year, and finds out the problems and highlights in the operation of the system by giving full play to the role of internal auditors. The first one-week internal audit was conducted in April 2018. A total of 334 problems were found in the audit, including 0 system problems, 205 implementation problems and 129 effectiveness problems. The second rolling internal audit was conducted from August to November 2018. 277 personality problems, 5 common problems and 3 typical problems were found in the internal audit. The company guarantees the effectiveness of the system through internal audit supervision, inspection and rectification.

The company established the energy management system in 2016 and passed the certification. Through the implementation and improvement of the system in the past three years, the energy consumption per ton of the company's products has been declining. Take lysine products as an example, Energy consumption per ton of products decreased from 1.292 tce in 2015 to 1.081 tce in 2018.



Energy Unit Consumption of Lysine Tons in Recent Four Years

We use the linear regression analysis of product output and corresponding energy consumption from 2015 to 2018. Through analysis, it is found that there is a linear relationship between output and energy consumption, and a mathematic model is found which can predict output and energy consumption relatively accurately.



The line fit plot of Product yield and Energy Consumption

Energy Management Method:

(1) Goal-oriented three-level performance appraisal management

The company has formulated a "five-year energy management plan", and at the beginning of each year formulated annual energy-saving indicators and operational targets. Annual energy-saving indicators through the monthly KPI to achieve the company level, Department level, workshop level three-level target assessment management. At the end of 2018, the company formulated the management rule of energy-saving target, and guided the production departments to do their best to achieve the target targets with attractive positive incentives.

(2) Promoting comprehensive energy management through system auditing

The company has established energy management system, measurement management system, environmental management system and other systems. The comprehensive energy management of the company can be achieved through system auditing, including the improvement of system and procedure documents, operation guidance or business process optimization, management of key energy-using equipment, energy metering management, training, energy procurement and supply, target formulation and assessment, and evaluation of legitimacy and compliance. In 2018, the company carried out two internal audits and one external audit of energy management system, among which the external audit of the system was re-certification audits. The audits found five general non-conformities and 29 recommended improvements. At present, the general non-conformities have been rectified..

(3) Promoting the Achievement of the Goals with Energy Management Projects as the Grasp

The company has formulated a management system for innovative improvement projects. Through project points and bonuses, all employees are encouraged to submit rationalization proposals and innovative improvement projects, which can also serve as a reference basis for transfer and salary adjustment. For example, in 2017, there were 3964 rationalization improvement proposals submitted by employees, 67 ABC innovation improvement projects and 27 closing projects, achieving tangible economic benefits of 42.03 million yuan. In addition, the company can reduce consumption and increase efficiency by introducing advanced technology and equipment at home and abroad. For example, MSG production department and lysine production department implemented energy-saving pump transformation of circulating water system, which saved about 1.9 million kWh per year. The company uses advanced winding heat exchanger in fermentation workshop, MVR evaporator in ammonium sulfate section instead of traditional low-efficiency evaporator, and advanced heat pump technology in extraction workshop to further reduce the use of fresh steam.

Energy management tools：

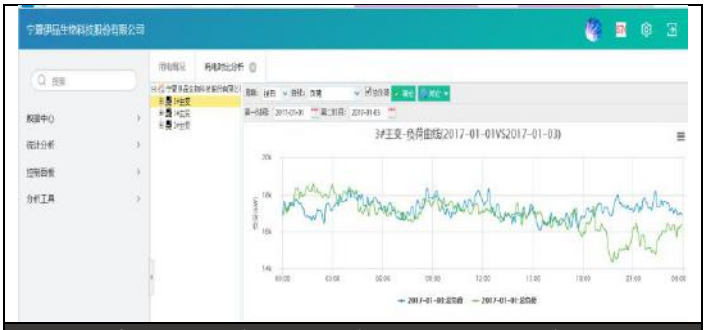
In 2013, the company built an energy management center. The system has the functions of real-time data collection, historical data query, automatic report generation and energy balance verification. It greatly improves the transmission speed of energy consumption data and reduces the accounting time and manpower cost of energy consumption. The energy management center has raised the company's energy management level to a new level, providing a good basis for the follow-up evaluation and assessment of energy use. At the same time, it is convenient for the energy balance and dispatch management of the company, making the company's production plan delivery and coordination balance have more timely, scientific and reasonable reference basis

Energy Management Center

In 2016, the company cooperated with Ningxia Taigu Energy Management Science and Technology Services

Co., Ltd. to build "Power Demand Side Management User Terminal Monitoring System". Through the installation of 564 electric energy monitors, an electric energy measurement platform is established and connected with the external network. On this platform, we can directly see the power consumption of 55KW and above motors and the load of the main transformer. This system is helpful to realize on-line real-time monitoring of the company's power usage, and is convenient for timely discovery of power problems and diagnosis and solution. At the same time, the company's electricity consumption situation can be more accurately predicted based on historical data.

Peak and Valley Level Electricity Analysis in the Power Terminal Monitoring System



3 # Transformer Load Curve in the Power Terminal Monitoring System

Transparency

At the beginning of each month, the company reported to the local government's "Ningxia Energy Conservation Information Management System" the energy use and output value of the month, and participated in the local government's energy self-survey report at the beginning of each year. Carbon emission verification and review are carried out in mid-year, and the results of verification and review are reported to relevant departments. The local government announces the company's energy consumption and energy-saving goals in mid-year.

Lessons Learned

- Companies should maintain production lines in high-load production to achieve efficient use of energy, especially public auxiliary facilities;
- Based on the target of operating profit, we need to balance "cost control" and "investment in overhaul and technological transformation". Complete next year's production plan and maximize operating profit under the condition of ensuring stable operation of equipment (i.e., the lowest failure rate and the least unplanned shutdown).
- The company always regards energy saving and consumption reduction as an important driving point to reduce costs and increase efficiency. By constantly strengthening the hardware construction of energy management, introducing advanced energy-saving technology and equipment with the help of constantly improving system, and exerting the strong professional internal auditor team, the company's energy management level can be improved by leaps and bounds.