

STUDY ON ENTERPRISE TOTAL MANAGEMENT MECHANISM OF ENERGY CONSERVATION

AN JIN-ZHAO*

Abstract: The energy saving management is important to enterprise's competitiveness and a key factor of social sustainable development. This study proposes a way of enterprise energy management optimizing with total energy saving management. Total energy saving management must have the nature of entire personnel, overall process, and enterprise scope. So, the systems engineering theory is essential to total energy saving management. In this paper, the systems engineering theory is employed to build the enterprise total energy saving management system. The optimizing of energy saving management system should contain total energy saving management guarantee system, total energy saving measuring system, total-staff energy saving management, overall process energy saving control, and analysis of overall process energy-saving potential. The way proposed is useful to improving the effectiveness of energy saving management.

Keywords: total energy saving management, three-grade energy saving management network, analysis of overall process energy-saving potential

INTRODUCTION

Today, efficiency of energy conservation and emission reduction has become a key factor of the enterprise's competitiveness and the social sustainable development. So the research of management mechanism in energy conservation and emission reduction is useful. But most of the past researches results have focus on the government management mechanism in energy conservation and emission reduction. In this paper, a way was proposed to improve the enterprise energy management with total energy saving management. Total management of energy saving could help enterprise get satisfying energy consumption level.

The technical reform and management innovation are important for reducing energy consumption. And energy management is indispensable to modern manufacturing. Total energy saving

* School of Management, Northwest University for Nationalities, Lanzhou, P.R. China, 730124
e-mail: anjinzhao6@163.com

management could help the advanced manufacturing technology and equipment play better.

The enterprise energy saving management refers to storage, transportation, producing process, manufacturing technology, equipment, operating, accounting, and so on. So especially management organization and full time managers are indispensable to examine and coordinate the energy saving work. And comprehensive, overall process and entire personnel are essential to systematic management on energy saving. The way of energy saving management should be improved during practice¹.

Total energy saving management is inspired by total quality management theory and proposed. Total energy saving management must be related to enterprise sustainable development strategy. It must be efficiency to excavate enterprise's energy-saving potential, and promote enterprise's beneficial efficiency. And it should optimize the enterprise's energy-saving and cost-reducing operations in all directions.

Total energy saving management must have the features of overall personnel, overall process, and overall enterprise. The performance of total energy saving management system needs a scientific and effective research. The research should consider all corresponding factors restraining the energy conservation and emission reduction's performance. In this paper, the essential functions of enterprise's energy saving management system are studied. And this study's final objective is to form a total energy saving management mechanism for enterprises to get better energy consumption level and promote their competitiveness².

This research studied the total energy saving management mechanism comprehensive. And overall energy-saving management guarantee system, overall energy-saving measuring system, overall staff participation in energy saving, overall process energy-saving control, and overall operations energy-saving potential analysis are the research focus.

¹ Wang Xiaojie, Zhou Yingnan, Liu Huanhuan (2010). "Research on the Forecasting Model of Energy-saving Potentials in Industry Enterprises". *China Population, Resources and Environment* [J], Vol.20, No.5, pp.27-30.

² Wang Yafei, Zheng Minghui (2012). "Allocation of Energy Consumption among Provinces in China and Energy Saving Analysis", *Guizhou Agricultural Science* [J], Vol.40, No.5, pp.195-200.

OVERALL ENERGY-SAVING MANAGEMENT GUARANTEE SYSTEM

Overall energy-saving management guarantee system is a synthesis of institutional framework, responsibility, program, process, and resources. It's built to realize energy saving target. The overall energy-saving management guarantee system is the organization guarantees to realize the target of energy saving. It is necessary to build the overall energy-saving management guarantee system according to the integrity principle of systemically engineering. And the system should be a close-loop system with an information feedback channel³.

The enterprise should build a perfect energy conservation organization. The responsibility of the organization should be clear. The staff in the energy conservation organization should be professional, and be qualified to the duty. Then the working standard should be established to restrain these workers in this organization.

Then, the three-grade energy saving management network must be built. It includes workshop energy management group, workshop section energy management network, and plant energy management group. The measures of energy conservation management should be formulated, and it's necessary to energy conservation examination and rectification.

Periodic inspection should be carried out by the plant energy management group. Casual inspection should be implemented by the workshop energy management group. And the self-inspection is also indispensability for workshop section energy management network. The record of inspection must be completely.

The professional management by the three-grade energy saving management network is important, and the masses participation in energy saving management is of equal importance. Then the stereoscopic management network system would be built with the professional management and the masses participation.

At last, the regular meeting of energy conservation should be held on schedule. So the rules of regular meeting are essential to ensure the

³ Liao Hua, Wei YiMing (2012). "China's Energy-Economic Development Stage and Energy Conversation Potential in the Long Run". *Science &Technology and Society [J]*, Vol.27, No.2, pp.216-218.

energy conservation management is efficiency according to the intended target⁴.

OVERALL ENERGY-SAVING MEASURING SYSTEM

The entirely measurement and evaluation is the base of energy management, so it is important to build the overall energy-saving measuring system.

The efficiency entirely measurement is the foundation of the implement of energy conservation regulations, the reducing of energy consumption, competition of energy saving, and reward of good energy saving operations.

The entirely energy saving measurement could help enterprises to know well about the energy consumption of all operations, adopt specific energy-saving measure, and ensure to achieve the energy-consumption index successfully⁵.

Structure of energy-saving measuring system

The overall energy-saving measuring system includes plant level subsystem, department level subsystem, and group level subsystem. The three subsystems would be the base of measuring and evaluation. So the three-grade energy saving management network would have an efficiency data base. And all of the staff would care for the energy-saving though their operations.

Accounting of energy consumption cost and benefits

Establishing and perfecting all kinds of energy consumption's original record, standing book, and report forms, could provide accuracy information for systemically analysis of energy consumption. The accounting of energy consumption cost and benefits must be accuracy, scientific, and timelessness. Though the accounting, enterprises could know well about all kinds of energy consumption' cost and share. So the enterprises could be cleat the key emphasis of energy-saving work. It's useful to minimize the cost of energy consumption, and maximize the economic benefits of enterprises.

⁴ Zheng Minghui, Wang Yafei (2012). "Energy Consumption Provinces Configuration and Energy Saving Potential Analysis". *Technology Economy & Management Research* [J], No.4, pp.113-116.

⁵ Wu Peilin, Wang Jianjun, Wang Hua (2012). "Energy Conservation Potential Analysis in Compressed Air System for Industry Enterprises". *Compressor Technology* [J], No.1, pp.38-40.

Examination and verification system

Building the examination and verification system is essential for supervision and monitoring of energy-saving's effectiveness. The energy conservation must be examined and verified usually. The enterprises must insist to tracking and monitoring all of the energy-consuming equipments. And the rectification must be carried out timely, when the problems are recognized. The key issue is reorganization of key energy consumption operations' key problems. Examination and verification system provide a scientific base of energy quota management, rewards, and penalties. Then the workshop would be actively to reducing energy consumption, and the workers would be enthusiasm with energy saving⁶.

OVERALL STAFF PARTICIPATION IN ENERGY SAVING

All of the staff participate in energy saving is important for total energy saving management. Many weakness of energy conservation could be found by the employees working at basic level.

Rational proposal from all employees

Encourage all of employees to analysis the energy conservation related to their own job, to find out the operations which could be carried out with less energy consumption. Then select the good advice. Give the relevant employees rewards. Build the rational proposal records. And determine the problems according to the records. Organize an energy conservation management group to study the problems. Analyze these problems with mathematical statistics methods. Get the primary cause to formulate feasible measures to improve the related operations and equipments.

Building training system

The professional ability of all employees is important to overall staff participation in energy saving. So the entirely energy conservation training program should be built, and be brought to the enterprise's employees training program. And select some employees to participate in government's professional training⁷.

⁶ Zhou dianmin, Li guanding (2012). "Energy-saving Potential of Compressed Air System Analysis and Countermeasures in Iron & Steel Enterprises". Shanghai Energy Conservation [J], No.3, pp.15-18.

⁷ Wang Mingjie, Li Yuling, Yang Li (2011). "Analysis on Industrial Energy Saving Potential of Hebei in 12th Five-year Program". Journal of Shijiazhuang University of Economics [J], Vol.34, No.1, pp.67-69.

Building rewards rules and enforcement regulations

In order to raise the employees' enthusiasm of participation in total energy saving management, it's essential to building rewards rules and enforcement regulations. The employees who have make contribution on energy conservation should be gave rewards in a big way. The employees and departments which didn't obey the energy saving rules should be punished according to related regulations. Then the employees and department in enterprises would be activity to participate in improvement of their operation ways and equipment to reduce the energy consumption.

OVERALL PROCESS ENERGY-SAVING CONTROL

Total energy conservation management should analyze the entirely process of energy distribution and transition, scientifically plan, monitor, and exploit potentialities. The optimizing should be according to the operations of the entirely process. The no-load, half load, equipment start, and equipment stop would make loss of energy which are the focuses of regulation, detection, and analysis.

The design of overall process energy conservation control system should adopt systemically analysis way. The systemically analysis must have a base of information about objectively energy consumption. So the collection of energy consumption information and record should be carried out firstly⁸. The collection includes two aspects.

Efficiency test is the first step of collection. The efficiency test could help to get the basic information of enterprise's energy consumption, and the information of main energy-consuming equipment's efficiency. It would be the foundation of the systemically analysis.

Drawing the energy consumption control chart is the second step. The control chart provides the performance of implementing of energy consumption index. And it would also provide the comparative data for analysis⁹.

⁸ Qu Xiaoe (2011). "Chinese Provincial Industrial Energy Efficiency and Energy Saving Potential: Empirical and Simulation-based DEA". *Economic Management [J]*, Vol.33, No.7, pp.16-24.

⁹ Liao Hua, Wei YiMing (2011). "China's Mid to Long Term Energy Conservation Potential: International Comparison and Foreign Experience". *Chinese Soft Science [J]*, No.2, pp.21-31.

If the enterprise would start an engineering project, the technical level of similar projects should be known by investigation and demonstration. Then the energy consumption standard could be confirmed. The design department should work out more than three design plan from different angles. These plans should be argued and compared by experts. The selected plan would be used as the basis of purchase material, project construction, acceptance inspection, operation, manufacturing management, and so on.

During the entirely process, any energy-consuming operation and department should be in the side of analysis and monitoring.

OVERALL OPERATIONS ENERGY-SAVING POTENTIAL ANALYSIS

Total energy saving management need to analyze the entirely energy consuming process's energy saving potentiality. The analysis should contain all of the operations, equipments, useless waste residue. Any step of energy consumption should be comprehensively analyzed¹⁰.

All of the energy consuming equipment should be analyzed though the following several aspects:

Whether all of equipments are the best? Whether there is better equipment to replace?

Did the design of equipment considered the economic efficiency of energy conservation?

Is the energy consumption of equipment maintaining least?

Is there operating way with less energy consumption?

Is this step absolutely necessary?

After these analyses, the energy's use and real value would be clear.

The energy conservation potentiality would be evaluated. And the energy conservation suggestions would be proposed. Then, the energy economic effects should be analyzed to get the possibility of replacement with other fuel. At last, the most reasonable operational program would be determined¹¹.

¹⁰ Liao Hua, Wei YiMing (2010). "China's Energy Consumption: A Perspective from Divisia Aggregation Approach" [J]. *Energy*, Vol.35. No.1, pp. 28-34.

¹¹ C.J. Cleveland, R.K. Kaufmann, D.I. Stern (2000). "Aggregation and the Role of Energy in the Economy". *Ecological Economics*, Vol.32. No. 2, pp. 301-317.

CONCLUSIONS: SUGGESTIONS ON CONSTRUCTING AN EFFECTIVE ENTERPRISE MECHANISM OF TOTAL ENERGY CONSERVATION MANAGEMENT

To construct an effective enterprise's management mechanism of energy conservation and emission reduction, we should pick up the total energy management for the reform and improvement of enterprise's energy management mechanism. overall energy-saving management guarantee system, overall energy-saving measuring system, overall staff participation in energy saving, overall process energy-saving control, and overall operations energy-saving potential analysis are the critical factors to energy conservation and emission reduction management mechanism's performance.

ACKNOWLEDGMENT: Supported by the Young and middle-aged scientific research fund project of Northwest University for Nationalities (Study on energy-conservation innovation ability of Gansu manufacturing industry based on process mining technology. Project No: X2010-19 XBMU-2010-AD-134) and the Chinese central college basic scientific research business expenses special fund project (Research on networked manufacturing mode based on quality chain theory. Project No: 31920130088).

References

- Cleveland C. J., R K. Kaufmann, and D.I. Stern (2000). "Aggregation and the Role of Energy in the Economy". *Ecological Economics*, Vol.32. No. 2, pp. 301-317.
- Liao Hua, Wei YiMing (2010). "China's Energy Consumption: A Perspective from Divisia Aggregation Approach". *Energy*, Vol.35. No.1, pp. 28-34.
- Liao Hua, Wei YiMing (2011). "China's Mid to Long Term Energy Conservation Potential: International Comparison and Foreign Experience". *Chinese Soft Science*, No.2, pp.21-31.
- Liao Hua, Wei YiMing (2012). "China's Energy-Economic Development Stage and Energy Conservation Potential in the Long Run". *Science & Technology and Society*, Vol.27, No.2, pp.216-218.
- Qu Xiaoe (2011). "Chinese Provincial Industrial Energy Efficiency and Energy Saving Potential: Empirical and Simulation-based DEA". *Economic Management*, Vol.33, No.7, pp.16-24.
- Wang Mingjie, Li Yuling, Yang Li (2011). "Analysis on Industrial Energy Saving Potential of Hebei in 12th Five-year Program". *Journal of Shijiazhuang University of Economics*, Vol.34, No.1, pp.67-69.
- Wang Xiaojie, Zhou Yingnan, Liu Huanhuan (2010). "Research on the Forecasting Model of Energy-saving Potentials in Industry Enterprises". *China Population, Resources and Environment*, Vol.20, No.5, pp.27-30.
- Wang Yafei, Zheng Minghui (2012). "Allocation of Energy Consumption among Provinces in China and Energy Saving Analysis", *Guizhou Agricultural Science*, Vol.40, No.5, pp.195-200.

Wu Peilin, Wang Jianjun, Wang Hua (2012). "Energy Conservation Potential Analysis in Compressed Air System for Industry Enterprises". *Compressor Technology*, No.1, pp.38-40.

Zheng Minghui, Wang Yafei (2012). "Energy Consumption Provinces Configuration and Energy Saving Potential Analysis". *Technology Economy & Management Research*, No.4, pp.113-116.

Zhou dianmin, Li guanding (2012). "Energy-saving Potential of Compressed Air System Analysis and Countermeasures in Iron & Steel Enterprises". *Shanghai Energy Conservation*, No.3, pp.15-18.