



# Practice of energy visual management system in energy saving and efficiency improvement of enterprises

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## ABSTRACT

with the rapid development of modern economy, the enterprise management mode is also changing. In the process of enterprise management, the energy visualization system can be used to control the energy consumption of enterprises. In order to better coordinate the relationship between economic development and environmental protection, the concept of sustainable development came into being, and also derived the corresponding enterprise information energy management system. In enterprises, the application of information-based energy management system can effectively reduce the energy consumption in the production of enterprises, improve the resource utilization efficiency of enterprises, and further promote the modernization process of enterprises. In order to achieve effective energy management and control, it is necessary to guide enterprises to establish energy systems through energy statistics. This paper analyzes the application of energy statistics in enterprise energy management, provides effective solutions to existing management problems, strengthens the rationality of enterprise energy management and control, and improves its economic benefits. Since the reform and opening up, the energy consumption of production in all walks of life has increased sharply, which has caused great damage to the ecological environment of our country. In order to further implement China's strategic goal of sustainable development and achieve the goal of energy conservation and emission reduction, more and more enterprises have optimized and adjusted their own industrial structure in order to achieve the goal of improving resource utilization efficiency. Today, China has officially entered the Internet information age. Information technology has been widely used in all walks of life. Information energy management system has become an important means for enterprises to achieve energy conservation and emission reduction. Energy is an issue related to China's strategic development, especially the improvement of economic level and the stimulation of energy consumption. In order to make good preparations for energy strategy, relevant enterprises should pay attention to the issue of energy management and control. While shouldering their own economic interests, they should also do a good job in energy conservation and emission reduction, achieve the established strategic objectives, and strengthen the energy management and control of enterprises through the application of energy visualization system, When the data exceeds the standard, an alarm message will be sent immediately, and the energy consumption will be effectively reduced, the waste of energy will be reduced, and the comprehensive competitiveness of the enterprise will be improved through monitoring and allocation.

**Keywords:** *energy visualization system; Enterprise energy management; energy statistics*

## 1. INTRODUCTION

In the past, the main measures for energy conservation and efficiency enhancement were the introduction of energy-saving technologies and equipment, which were only targeted at the improvement of points, Ignoring the great potential of energy saving and efficiency improvement from the perspective of visual management. "Energy visual management system is a system that comprehensively grasps the energy

saving situation of enterprises from the perspective of management; a system that closely combines management energy saving with equipment energy saving and optimizes energy utilization efficiency; and a system established for the three-dimensional improvement of enterprise energy use.

In terms of the overall production management of the enterprise, in addition to paying attention to production and energy consumption, the importance of safety

visualization management should also be emphasized. Bijing safety production has always been the primary issue related to the development and efficiency of the enterprise. The three aspects of production control process, safety key points and energy consumption information can be deeply connected, and the safety issues can be integrated into the energy visualization management system at the same time, so as to realize the real-time and predictable response of safe power consumption and equipment support<sup>5</sup>.

Firstly, this paper briefly analyzes the necessity of building an energy visualization management system; Secondly, from the three modules of production visualization, safety visualization and energy consumption visualization, the overall design scheme of the energy visualization management system is given; Finally, combined with the production business management practice of Tonghui Mining Co., Ltd. in Jiashi County, the detailed improvement methods of energy saving and efficiency improvement are proposed.

## 2. BASIC TASKS OF ENERGY STATISTICS

Energy consumption is indispensable in enterprise operation and management. At the same time, based on the production content of different enterprises, the more energy consuming enterprises need to use energy statistics in order to reduce enterprise expenditure costs. With the rapid development of economy, the types of energy that can be consumed by enterprises are becoming more and more complex. From basic water, electricity and gas to complex kerosene and biomass, they are facing huge energy losses<sup>[1]</sup>. In particular, the lack of basic energy consumption statistics in some enterprises leads to incomplete overall energy consumption statistics,

resulting in the lack of authenticity of relevant energy consumption data and the increase of enterprise costs.

For the data content generated by different production and operation of the enterprise, it is necessary to establish an energy management method to complete the data collection, and different key collection points can be set. Of course, the relevant data collection work needs the corresponding hardware cooperation to effectively complete the work<sup>[2]</sup>. The control system based on Ethernet EPA uses the established protocol to effectively connect the data distributed in different places in series to complete the monitoring in the production process of the enterprise, so as to meet the production and operation of the enterprise. Similarly, in this set of visualization system, high-speed network communication signals are required to do a good job in the full digital management of the system, make its structure and function more flexible, and meet the needs of energy consumption and statistics of enterprises. The energy visualization system supports the integration of all information and data resources of enterprise energy<sup>[3]</sup>. It is more applied to production, covering infrastructure, scheduling, marketing and other fields, and realizes multiple functions such as data display, data monitoring, data analysis, data fusion command. It can be widely used in analysis, research and judgment, display and reporting, monitoring command and other scenarios. Through the data analysis generated under various application scenarios, the enterprise can be supported to quickly understand the utilization of resources by various departments. The consumption data of resources can also be displayed in visual scenarios, providing effective analysis for the efficient operation and production progress of the enterprise, and laying a solid foundation for the sustainable operation and maintenance of the enterprise.

Table 1 energy consumption distribution of Metro social security system

Equipment system	Traction power supply	Ventilation and air conditioning	escalator	lighting	Water supply and drainage	Weak current system	other
Energy consumption ratio	3.5-4.5%	20-30%	10-35%	7-12%	2-3%	1-2.5%	1-1.5%

The overall structure of the energy visualization system is composed of different equipment, signal processing and interface processing modules. The data content of different supervision stations is collected and

counted through different control methods, and then the relevant data content is recovered through communication to complete the preliminary visualization system setting.

Practical application: the energy visualization system is divided into seven sections, namely: platform overview, building energy consumption, branch energy consumption, sub item energy consumption, department energy consumption, regional energy consumption and system setting. At the same time, different theme colors and different usage languages can be set for the system.

After logging into the relevant system, you can see the overall overview of the platform, browse the relevant data through different modules, list the current energy consumption data, and even clearly display the energy consumption curve of the current month and different months under the data. The relevant data content will be automatically refreshed every 20 minutes to complete the interception of new data.

Click building energy consumption to view the energy consumption content in different buildings of the enterprise, and effectively compare the energy consumption content generated by different buildings, so as to understand the energy consumption details of the building at different times<sup>[4]</sup>. Relevant data can still be viewed by clicking to understand the consumption of different energy sources. The relevant data content is presented in the form of tables, and the data content can also be generated into histogram and pie chart, so that different data display methods can be used to view the energy consumption. You can also view the data content required by users according to different energy consumption categories and times, and the relevant data content can be printed by exporting. On the left side of the interface, there are different options, focusing on the energy flow chart. By selecting different dates, you can view the energy flow of the building classification.

Branch energy consumption is to make statistics on the data content of branch energy consumption. Select the relevant branch to view its energy consumption charts in different periods and on different dates in the past. The obtained data content can be displayed in a month on month manner. By using the method of year-on-year analysis to analyze the energy consumption of the branch roads of a building, you can learn the relevant contents of energy consumption of different branches, including date, time and category<sup>[5]</sup>. By clicking to view, the contents of relevant data are listed in the form of charts. It can also analyze the energy consumption and use of energy consumption at a certain time by means of data centralized reading. The relevant query methods can be selected according to the date, time and other methods to understand the energy consumption data of the branch. In the system, you can query the energy consumption cost

content and present it in the form of report. Select the content you want to view, and then all the costs of the project can be presented in the form of chart. The more prominent content is the content of distribution monitoring<sup>[6]</sup>. By selecting distribution monitoring, you can view different building names, understand the distribution charts of the building, and complete the query of relevant data content. Some other enterprises are involved in night operation. They can use the night energy consumption statistics method to compare the energy consumption of different branches at different times, check the corresponding energy consumption, and understand the specific energy consumption through query and export. The function of parameter query is to centrally display parameters through different time periods in the branch. You can select relevant data, use query and export to understand the parameter content and obtain valuable data.

### 3. INFORMATION BASED ENERGY MANAGEMENT SYSTEM

The information-based energy management system means that based on the concept of sustainable development, the enterprise collects and processes the information and parameters in the process of using its own energy by using information technology, so as to optimize the management of its own production process, energy consuming equipment and system by using energy management software. Enterprises can control energy consumption and monitor the operation status of energy-saving equipment in real time through the information-based energy management system, so as to have a more comprehensive grasp of enterprise energy efficiency and provide strong data support for the realization of their own energy conservation and emission reduction goals.

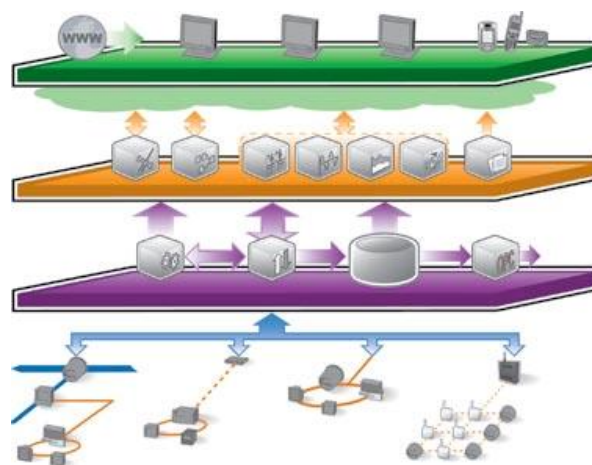


Figure 1 system management

### 3.1 System architecture

The architecture of enterprise informatization energy management system is mainly composed of the following parts.

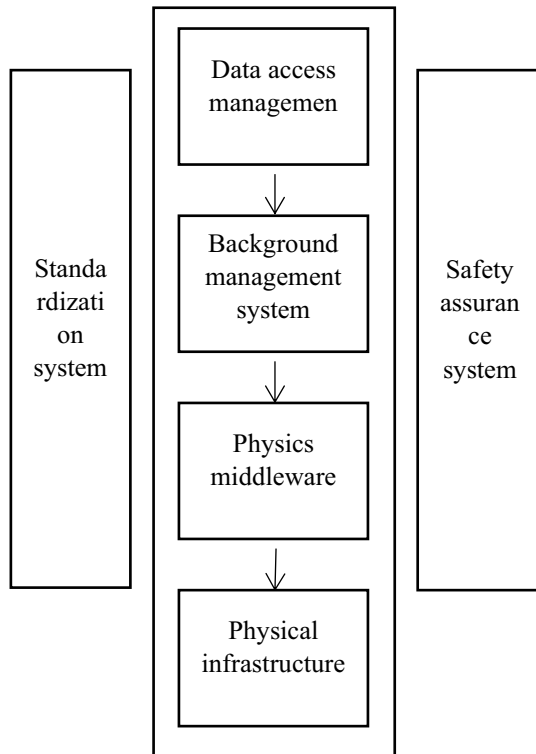


Figure 2 overall system architecture

#### 3.1.1 System management

As the top part of the whole system, the system management mainly aims at the managers and operators, which is the direct window of human-computer interaction. The system software and hardware equipment are the main components of the system management layer [7]. The hardware equipment includes printers, industrial computers, etc. Software equipment mainly refers to the human-computer interface, which is responsible for collecting, analyzing and processing various energy consumption data on site, and reflecting them in the form of data, images, etc.

#### 3.1.2 Network communication layer

The network communication layer mainly includes bus network and Ethernet equipment. As a bridge for data information exchange, the network communication layer is mainly responsible for collecting, classifying and

transmitting various data returned by the field equipment, and transmitting various instructions from the upper computer to the field equipment.

#### 3.1.3 Field measurement and control layer

As the terminal of data acquisition, the on-site measurement and control layer is mainly composed of intelligent water meter, intelligent electricity meter and other energy monitoring equipment, which is responsible for measuring the energy consumption of water, electricity and so on.

### 3.2 System software function module

#### 3.2.1 Enterprise power transformation and distribution operation monitoring module

This module is mainly responsible for monitoring the power consumption of the whole enterprise and digitizing the power consumption information of the enterprise. In addition, the module can also collect and display real-time data such as power consumption parameters of measurement points, and has the functions of historical record query, power consumption exceeding the standard alarm, data table printing, etc. Through this module, the management personnel can reasonably dispatch the power consumption of the enterprise, learn from each other's strong points to make up for each other's weak points, and handle the faults in time.

#### 3.2.2 Load analysis and prediction module

On the basis of the above power transformation and distribution operation monitoring system, the load analysis and prediction module can realize the detailed analysis of the load, which is convenient for the managers to scientifically manage the energy consumption of their own enterprises according to the load and production conditions, so as to improve the power consumption efficiency of their own enterprises, and save the power consumption expenditure of enterprises under the condition of ensuring the power safety of enterprises. The load analysis and prediction module of the information-based energy management system mainly forecasts the maximum power load of the enterprise through the analysis of historical operation data and in combination with the production plan of the enterprise, so as to help the enterprise better carry out energy allocation and management.

#### **4. IMPORTANCE OF INFORMATIZATION ENERGY MANAGEMENT SYSTEM FOR ENTERPRISE ENERGY CONSERVATION**

Although the modernization construction of most enterprises in China has achieved remarkable results, and has the corresponding information management system and ERP system, a large number of enterprises have the problem of backward information level of energy management, which hinders the improvement of the overall management level of enterprises [8]. The information-based energy management system can provide the enterprise managers with detailed energy measurement data, so that the enterprise managers can find the energy problems in their production process in time, and take corresponding control measures in time to reduce the economic losses caused by energy waste. The application of information-based energy management system in enterprises can help enterprise managers control the maximum demand. It can not only help enterprises save the energy expenditure of the maximum demand, which is conducive to the economic operation of enterprises, but also intelligently control the load in different periods of time. Next, a detailed analysis is made on the benefits brought by the information-based energy management system to the enterprise.

According to the case analysis, an automobile manufacturing enterprise reduces the cost of power consumption while ensuring production, so as to improve economic benefits. However, due to the large plant area, it can not timely obtain the reliable power consumption information of key energy consuming equipment, lack of corresponding basis for the regulation and comprehensive scheduling of workshops and departments, and lack of effective evaluation means. These problems bring great difficulties to the power consumption management. Therefore, it is decided to build information-based energy management and carry out information-based transformation, so as to adopt effective methods for real-time monitoring and achieve the effect of intelligent and information-based management. The system analyzes the power consumption of more than 20 substations and 65 lines in the whole plant through the central control. From the typical load curve, the greater the load fluctuation, the more obvious the peak valley difference, and also reflects the unreasonable electricity charge. Through the management system, a comprehensive analysis of the current total voltage drop is carried out to master the current power grid and historical operation conditions, so that the current unit typical load curve can be effectively

analyzed to form different indicators, and effective management assessment and technical means can be combined to form corresponding management, so as to reduce the electricity expenditure. At this stage, the load expenditure of discontinuous electric furnace for heat treatment is 200kW, the load of medium frequency furnace is 4000kW, and the load of 5t electric furnace is 5000kW. By increasing the load rate, the overall electricity consumption is reduced, and the production cost is saved by nearly 20% through information-based energy management. In this case, the stable production of the company is ensured, and good economic benefits are also formed. In enterprises, information-based energy management system can realize the organic combination of energy management and information, energy management and production management. It can be said that information-based energy management system is a necessary means for enterprises to achieve long-term energy conservation, and can bring greater benefits to enterprises.

#### **5. APPLICATION OF INFORMATION-BASED ENERGY MANAGEMENT SYSTEM IN ENTERPRISES**

##### ***5.1 Lack of enterprise energy conservation management***

First of all, in the process of applying information-based energy management system, enterprises generally have the problem of limited management level. The reason is that the application of information-based energy management system in Chinese enterprises is in the initial exploration stage, so enterprises can not learn from the application experience of other enterprises when applying information-based energy management system. Secondly, in some enterprises, managers lack attention to the information-based energy management system, and do not have the ability to skillfully use the information-based energy management system, which leads to problems such as incorrect data analysis and inaccurate prediction, and can not give full play to the application value of the information-based energy management system in enterprises [4].

##### ***5.2 Difficulties in enterprise production data collection***

In addition to the above-mentioned problems, enterprises still have the problem of difficult data collection in the process of applying the information-

based energy management system. Because the information-based energy management system needs to collect, analyze and uniformly process various energy consumption data in the production process of enterprises, it is difficult to collect data. In addition, the production scale of the enterprise has been expanded, but the data collection range of the information-based energy management system has not been updated in time, resulting in the failure of the data collection device of the information-based energy management system to fully collect all data.

### ***5.3 The operation process of informatization energy management is complex***

Due to the complexity of the operation of the information-based energy management system, in the process of its application, a problem in a certain link will have a serious impact on the subsequent production of the enterprise, and even require downtime for maintenance. In the process of applying the information-based energy management system, enterprises also need to regularly upgrade the hardware equipment and software system of the information-based energy management system. This process also needs to temporarily stop the operation of production equipment.

## **6. APPLICATION STRATEGY OF INFORMATIZATION ENERGY MANAGEMENT SYSTEM IN ENTERPRISES**

### ***6.1 Strengthen the functions of enterprise managers***

First of all, in the process of applying the information-based energy management system in enterprises, the management functions of managers should be given full play. First, the management personnel shall, on the basis of combining relevant energy management laws and regulations in China, formulate information-based energy management rules and regulations that conform to the actual situation of their own enterprises. Second, management personnel should regularly check and guide the implementation of informatization energy management rules and regulations of all departments and personnel. Third, managers should set an example to improve their attention to the information-based energy management system, so as to improve the attention of all staff to the information-based energy management system.

### ***6.2 Strengthen investment in information construction***

One of the most important preconditions for the application of information-based energy management system in enterprises is sufficient information construction fund support. Enterprises should increase the investment in information-based energy management system, so as to better promote the implementation of information-based energy management system in enterprises. For example, enterprises can set up special funds for information-based energy management to provide sufficient funds for the construction and daily maintenance of information-based energy management system; Or increase the introduction of informatization talents, provide rich salary for informatization energy management talents, and establish a special informatization energy management system operation and maintenance team.

### ***6.3 Improve the standardization of information management procedures***

When applying the information-based energy management system, enterprises should formulate standardized information-based energy management procedures. First, we should make a good technical plan for the information-based energy management system, and we can hire professional technicians from a third party to provide training and guidance in the enterprise. Second, before the information-based energy management system is put into use, a feasibility analysis should be done to comprehensively consider whether it can meet the production objectives of the enterprise. Third, the application effect of the information-based energy management system should be checked regularly, and the total amount of energy saved in different stages should be calculated.

## **7. CONCLUSION**

To sum up, for enterprises, the application of information-based energy management system can effectively improve the resource utilization efficiency of enterprises, reduce unnecessary costs, effectively control various energy waste problems of enterprises, and help enterprises achieve the sustainable development goal of energy conservation and emission reduction. Therefore, information-based energy management system is the inevitable trend of energy-saving development in all walks of life.

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