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MES System Based on Industrial Ecology in Energy Measurement Management

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Abstract: With the rapid development of China's economic level and the continuous improvement of energy consumption level, China's attention to energy production and energy has gradually increased. This paper aims to study the application of MES systems based on industrial ecology in energy measurement management. From the direction of ecology of sustainable development theory and the theory of industrial ecology, this paper proposes the enterprise ecosystem model not only for the specific enterprise unit, but also from the perspective of industrial system. This paper systematically studies the efficient energy management of enterprises, through the construction technology of MES platform and various coding scheMES, designs a set of energy management system based on MES, and applies the system to the enterprise energy measurement. This paper adopts the basic design concept of three-layer architecture in the overall design process, which divides the whole system into different functional units and sub-class functions, and finally ensures the correct use and good operation of the system. The experiment has proved that the work efficiency of this system has been improved to 100%. Compared with the traditional energy metering management system, the data processing speed of this paper is increased by about 5 tiMES.

1. Introduction

The management of energy enterprises in China is becoming more difficult, and the energy management mode urgently needs to be improved and improved urgently. And emission reduction targets. The improvement of China's energy management level can be achieved through the comprehensive integration of reasonable energy storage, energy management, energy efficiency and maximizing energy conversion, the correct application of energy equipment, power equipment maintenance and inspection and other services. Its energy management system is conducive to the effective implementation of energy conservation and emission reduction projects in China. In the

process of achieving the goal of energy conservation and emission reduction, China has made progress and efforts in increasing government supervision and scientific information support to [1-2].

In MES system based on industrial ecology in the application of energy metering management, many scholars to study, and achieve good results, such as: Allen D T development energy system in the production process of energy utilization has obvious effect, at the same time reduce unnecessary energy consumption, by saving costs for the enterprise, so as to create value [3]. After a period of energy efficiency data collection work, Pilloud F uses rich mathematical models and expert opinions, combined with the actual situation of enterprises, to propose effective energy saving and consumption reduction solutions. Through the remote control of software, control the operation efficiency of production equipment, reduce waste, and achieve the purpose of improving the production efficiency of [4].

This paper systematically studies the efficient energy management of enterprises, through the construction technology of MES platform and various coding scheMES, designs a set of energy management system based on MES, and applies the system to the enterprise energy measurement. This paper adopts the basic design concept of the tertiary architecture in the overall design process to divide the whole system into different functional units and subclasses to ensure the correct use and good operation of the system.

2. Research on the Application of MES System Based on Industrial Ecology in Energy Measurement and Management

2.1 The Application of Industrial Ecology

Industrial ecology is a rational and more pragmatic path for sustainable development. It supports sustainable development by understanding these theories like the reality of human development and the relationship between humans and the environment. In industrial ecology, technological advance is a prerequisite for success, because progress is the problem solution that this paper has created for itself, and of course, progress must be deliberately and carefully arranged to reduce the resulting side effects. In this way, industrial ecology can adapt to the definition of sustainable development: "meeting existing needs without compromising the capacity to meet future needs," the [5].

2.2 System Business Requirements

At present, only by reducing the production costs and optimizing the production structure can the enterprises be competitive and continue to develop. However, there are many factors to be considered in the production process of enterprises, which often ignore one and lose another, and cannot take into account the various resource advantages of enterprises. For example, now the system for the target enterprise production goes through multiple processing process, in each process or production scheme to produce unnecessary energy consumption (different production process, different equipment operation, and lead to different energy consumption), in this case using the traditional method of production planning or adjust the product structure, neither scientific basis, also cannot achieve the best energy saving scheme. At the same time, in the current enterprise production, the control of energy efficiency is still in the manual operation stage. When the energy consumption parameters are needed, they can only rely on the technical personnel to go to each monitoring point to obtain the data. Such an operation method is not only not timely, but also easy to produce errors. The statistics of historical data is still paper storage, which is impossible for

decision makers to effectively carry out the scientific planning and analysis of historical data. In most energy consumption enterprises, manual meter reading is still very common. The main deficiencies are: first, manpower waste, many enterprises large production area, plant, energy consumption equipment, usually each factory needs 2-3 professional meter reader, considering the production process of enterprises is generally 24 hours and has 8-10 factories, manpower demand is very large; second, affect the accuracy of data statistics, manual meter reading will inevitably appear data misreading, copying or even data loss; three, data is difficult to save, read, the old manual meter reading lacks intelligent information technology [6-7].

Equipment monitoring and control due to the use of manual view and operation, the main problems include: first, energy consumption equipment running state monitoring is not objective, each operator work experience and technical level is inconsistent, make equipment running potential problems can not be found in time, equipment efficiency decline, and even equipment damage, and equipment monitoring is equipment control precondition, wrong data can cause wrong operation, cause waste of energy. Second, the use and control of the equipment is also through the operator's subjective control of the equipment, the equipment operation is not timely, and the misoperation will affect the operation efficiency of the equipment and even the efficiency of the whole system.

In the case of the product price and the market competitiveness in contradiction, realizing the energy saving and consumption reduction in the production process can greatly improve the competitiveness of enterprises. At present, the energy consumption control of the target enterprises is mainly conducted through the traditional manual operation and some DCS control software applications, and the people who manage and analyze the information technology processing and acquisition control parameters are lack of the experience of production practice, and the managers with the production practice experience are somewhat outdated in the way of energy information collection. Whether there is an energy efficiency monitoring, analysis and control platform that can be combined with the production process of enterprise products, as a management tool for energy monitoring and management staff in the production process, without the need for professional computer technicians, it is particularly important for [8-9].

To sum up, the energy metering of key energy consumption enterprises should not adopt the old meter reading mode, and the monitoring and control of the equipment should gradually rely on the energy efficiency parameter automatic collection technology. In this way, the personnel cost is reduced, the data collection is accurate, the later analysis error is reduced, and the analysis module is used.

2.3 Algorithm Selection

Conformance test includes not only hierarchical single rank test, but also hierarchical total rank consistency test. According to the characteristics of the judgment distance array, CI (the negative average of the other feature roots outside the maximum feature vector of the judgment matrix) is introduced as the index [10] of the degree of deviation in the AHP method.

Among them, the CI judgment indicators:

$$CI = \frac{1}{n-1}(\lambda_{max} - n) \quad (1)$$

At the same time, on the basis of further research, RI (the average random consistency index independent of order) is proposed to correct the CI value, and the consistency index CR should

replace the consistency deviation degree index CI as the test standard to judge the consistency of the matrix.

$$CR = \left(\frac{CI}{RI} \right) (2)$$

The RI values are the corrected indents used to remove the inconsistency in the judgment matrix caused by the distance array order.

3. Application Research and Design Experiment of MES System on Energy Metering Management Based on Industrial Ecology

3.1 Research on Enterprise Energy Consumption Data Model

Establish enterprise energy consumption parameter database is the basis of energy efficiency analysis and core, and for enterprise energy efficiency test, we need to focus on accurate measurement to the energy consumption parameter system classification statistics, our purpose is to use the system classification method, using the advantages of computer database will complex energy consumption project perfect, accurate list, and with half ratio of energy consumption, let enterprises can clearly see the energy consumption, make the enterprise focus to governance and improve. The test and efficiency analysis of the main energy-consuming equipment can be obtained, including [11-12].

The database building procedure is shown in Figure 1:

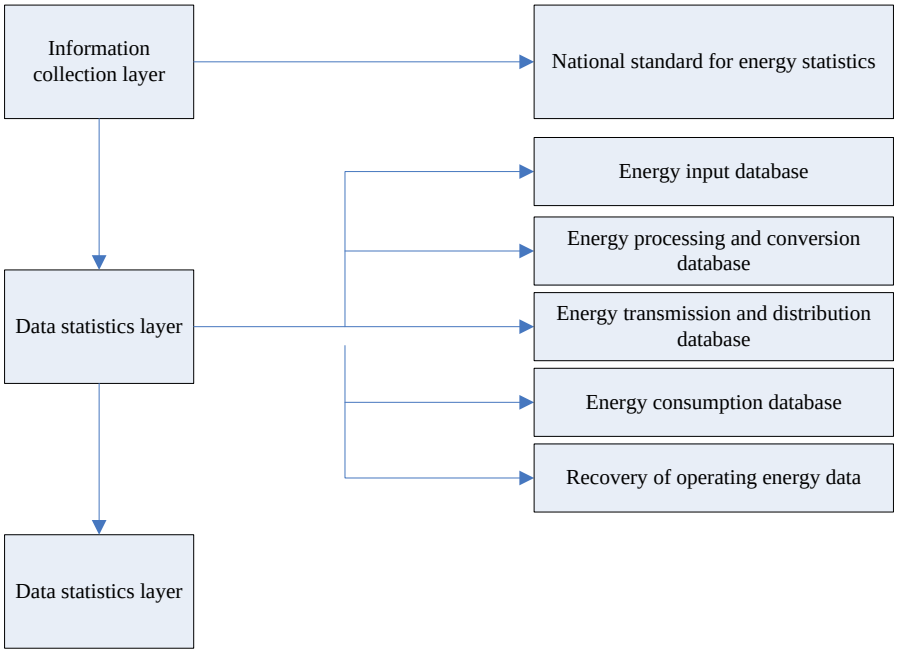

Figure 1. Enterprise energy consumption data model

3.2 Experimental Design

This paper designs experiments for the energy metering management system designed in this

paper.First, it is to compare the resource utilization rate before and after the system input, and by comparing the efficiency of the system resource utilization before and after the use of the system, the superiority of this system is judged. Secondly, we analyze the performance of the system, and study the parallel application rate and the data processing speed of the system.

4. Experimental Research and Analysis of MES System Based on Energy Metering Management in Industrial Ecology

4.1 Before and after the System Input

This paper tests the energy measurement management system designed in this paper, records the personnel data analysis before and after the use of the system, and judges the superiority of this system by comparison. The experimental data are shown in Table 1.

Table 1.Data analysis before and after system input

	Analysis of energy production and consumption data	Loss management	availability factor	Carbon dioxide emissions	work efficiency
Before the system is used	90	30	75	20	75
After the system is used	70	6	95	8	100

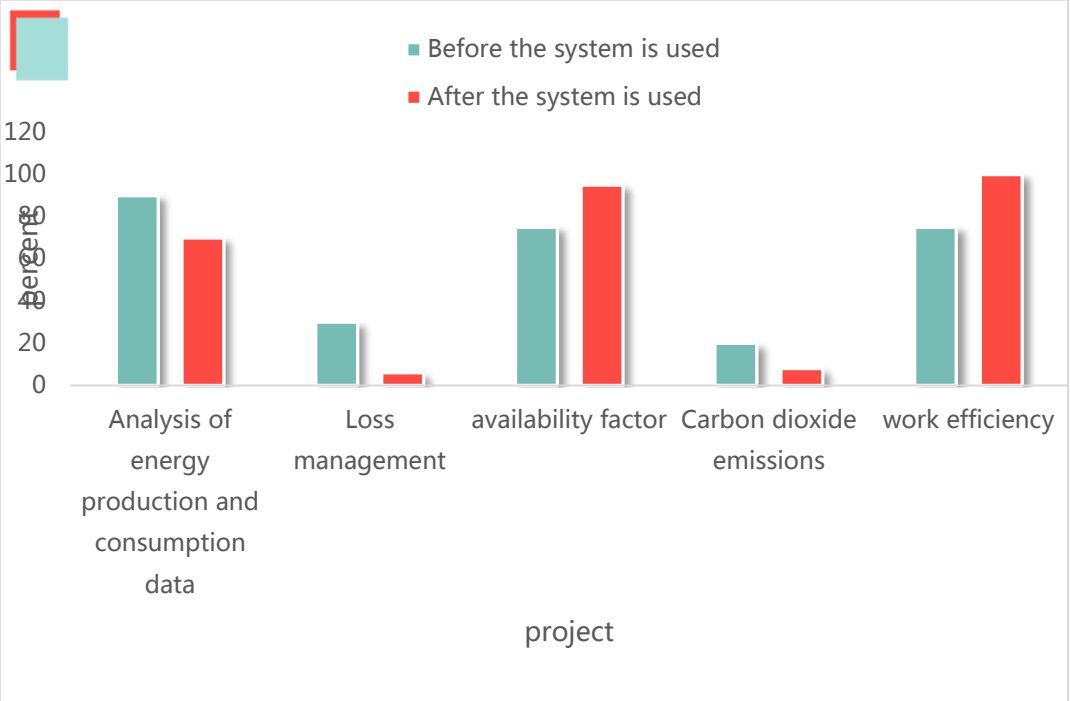

Figure 2. Comparison of the data input before and after the use of the system

As can be seen from Figure 2, there is less analysis of energy use data, but less data is used relative to loss management. But the energy usage rate and carbon dioxide have been greatly improved for the energy usage rate and the work efficiency, especially since the work efficiency has reached 100%.

4.2 System Performance Analysis

This paper analyzes the system performance of this paper and compares it with the traditional energy measurement management system. The first is the response time of the system for parallel application. Both people use 200 people in parallel. Secondly, data processing of the same data set is used to record the data processing time of both. The experimental data are presented in Table 2.

Table 2. Performance comparison of traditional energy metering system and this system

	Use the reaction speed in parallel	**data processing rate**
The traditional system	**1.3**	**6.2**
This paper system	**0.2**	**1.3**

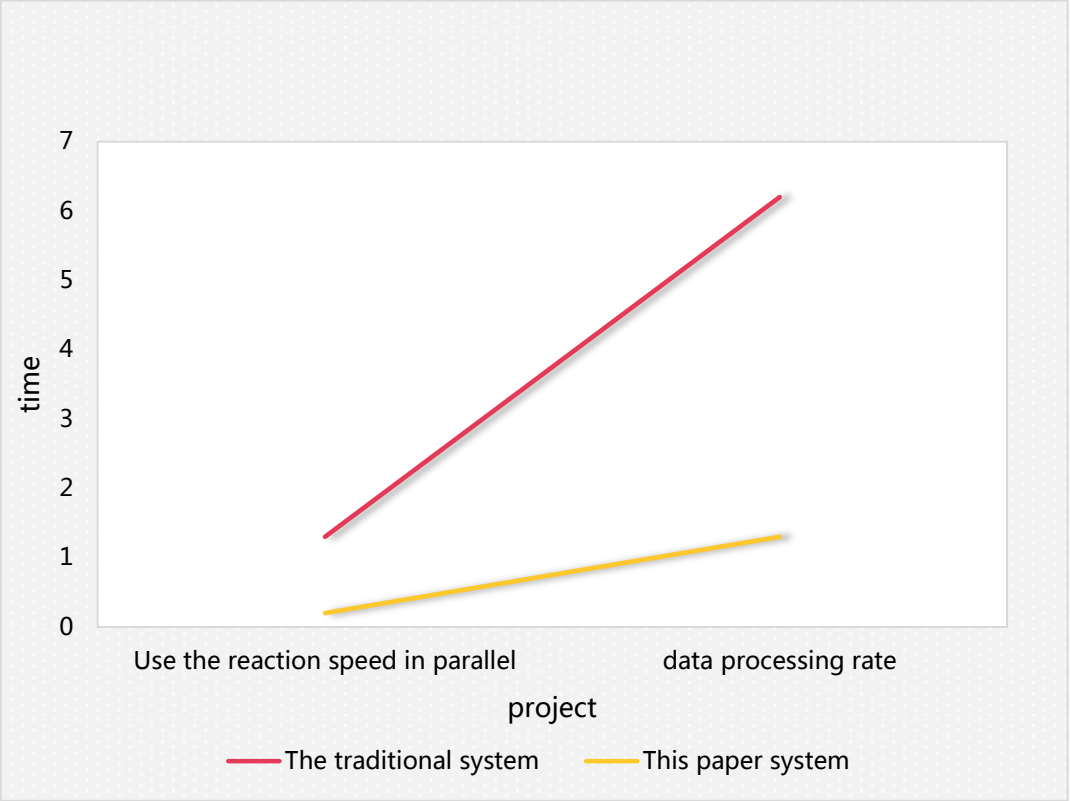

Figure 3. The two sides use the average response time and data processing in parallel

As can be seen from Figure 3, the performance of the system in this paper is greatly improved when compared with the traditional system, and it is greatly improved. In particular, the data processing speed is greatly improved compared with the previous system, which is about 5 tiMES, which can make the data processing of energy measurement more effectively.

5. Conclusions

This paper is on the basis of analyzing similar energy management system at home and abroad, actually examines the needs and advantages and disadvantages of the enterprise in energy management, and designed a set of enterprise energy management system, in the overall design process mainly realizes the following functions: through the system function design, with the support of advanced technology to realize the enterprise energy production, consumption, transformation, operation monitoring, equipment management and other processes of effective management, realize the goal of effective energy management. Responsible for the real-time collection of the instrument data information of each unit shift point, calculating the input and output quantity, packaging and submitting the device input and output data, energy operation parameter calculation, energy equipment maintenance and inspection, etc. The amount of energy stored is accurately calculated by the effective control of the determination conditions such as density, pressure and temperature. It mainly includes the beginning of tank receipt and payment, the end of tank collection and payment, energy measurement and energy calculation and other functions.

To realize the comprehensive monitoring and accurate management of energy equipment, through the function management of enterprise energy reasonable utilization, effective circulation, energy saving and emission reduction.

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