

Application of intelligent energy management and control system in industrial enterprises

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Abstract. Under the background of carbon peaking and carbon neutrality, the efficient use of energy has become the focus of research in the energy field. The article first analyzes the challenges in the energy management and control system based on the development status and trends of the intelligent energy management and control system of industrial enterprises; then proposes the system architecture and design of the intelligent energy management and control system of industrial enterprises, from energy monitoring, energy management, energy forecasting, energy analysis, energy diagnosis, energy optimization and other aspects provide comprehensive and strong support for the energy management of industrial enterprises, and realize the integration and automation of energy and production data.

1. Introduction

In 2020, at the United Nations General Assembly, China clearly stated that carbon dioxide emissions should reach their peak by 2030, and strive to achieve carbon neutrality by 2060. In the same year, the Central Economic Work Conference clearly identified carbon peaking and carbon neutrality as one of the eight key tasks in 2021. The "14th Five-Year Plan" points out that efforts should be made to improve energy utilization efficiency, improve the dual control system for energy consumption, reasonably control the total amount of energy consumption, establish and improve management systems such as energy budgets, promote efficient allocation and utilization of energy resources, and further promote industrial, building, transportation, public institutions and other key areas to save energy, and improve the energy efficiency level of new infrastructure.

The intelligent energy management and control system of industrial enterprises aims at "two highs and three lows" (improve the comprehensive energy efficiency of the system, improve the reliability of system operation; reduce the user's energy cost, reduce the carbon emission of the system, and reduce the emission of other pollutants in the system). Various energy resources such as heat, electricity, gas, etc., implement centralized and flat dynamic monitoring and digital management of the production, transmission and distribution and consumption links of the enterprise energy system, realize multi-energy complementarity and coordination optimization, and effectively improve energy utilization efficiency, to promote the sustainable development of energy. Building an intelligent energy management and control system for industrial enterprises is a powerful

driver for promoting energy transformation and achieving the goal of dual carbon control.

2. Analysis of the current situation

According to the China Energy Management System Industry Status Analysis and Development Prospect Research Report (2020 Edition) released by China Industry Research Network, with the increasing shortage of energy resources and the increasing energy demand, the proportion of energy costs in the operating costs of enterprises is gradually increasing. Increase, which also makes enterprise managers and production operators have to work hard to strengthen enterprise energy management from the perspective of reducing enterprise operating costs and improving enterprise comprehensive competitiveness. Therefore, enterprises urgently need to obtain an integrated solution of energy management and control, and the increasingly mature and widely used energy management system also provides an effective way for enterprise energy information management and continuous improvement of energy efficiency. The promotion of energy conservation in my country has intensified, and more and more enterprises have begun to use energy management systems. The adoption of energy conservation management systems by enterprises has promoted the rapid development of the energy management industry 20%.

In the production of industrial enterprises, the locations of each workshop and each process are relatively scattered, and each energy field measurement point is relatively remote. It is difficult to collect and transmit the data that needs to be monitored. At present, the energy management and control of most industrial enterprises is mainly through manual management. To periodically

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check or start and stop the energy equipment of the enterprise. Based on this situation, this paper proposes a design of an intelligent energy management and control system for industrial enterprises to achieve the purpose of detecting and controlling various energy consumption.

Main functions of intelligent energy management and control system

The main functions of the intelligent energy management and control system are real-time online monitoring, automatic collection, storage, analysis and utilization of energy data, analysis and alarming of data, real-time control of the production process, and reduction of energy costs for enterprises; centralized visualization of energy data; discovery And improve the cost of energy use, enhance the energy-saving potential of enterprises, establish an energy performance evaluation system, and promote a virtuous circle of enterprise production.

3. Intelligent energy management and control system construction goals

The intelligent energy management and control system is mainly used to support the construction of energy management and control centers in industrial enterprises. . The links in the whole process of integrated energy management and control include energy data collection, energy data monitoring, energy data statistical analysis, energy data optimization control and other links to build a complete industrial enterprise energy management system. Automatically collect the energy consumption data of each process, and conduct statistics and analysis on the chain ratio, year-on-year and proportion of various energy consumption by category. Make the energy consumption indicators do not deviate from the planned indicators, generate various data reports, real-time energy media measurement and monitoring, real-time trend analysis, visual management and early warning of energy consumption in each process, timely detection of abnormal energy consumption, timely follow-up correction, dynamic Master the production status of each process.

4. Features of intelligent energy management and control system

The intelligent energy management and control is based on the platform of automatically uploading energy consumption data. On this platform, various types of energy media are organized according to different energy uses. This system is divided into three levels.

- (1) Energy medium input, that is, various energy mediums in the plant are supplied from outside;
- (2) The energy consumption of the energy medium in the factory in units of workshops, that is, the energy consumption of various energy mediums in each production process in the factory.
- (3) For the energy medium output by the plant (mainly including compressed air, steam and third-party energy consumption), the metering instruments at the key nodes of each energy medium at each level are intelligentized,

and the data can be automatically uploaded, accumulated and analyzed in real time. Alarm when the monthly consumption of energy consumption data exceeds 95% of the planned value. According to this structural framework, individual functional requirements can be customized, and it has strong compatibility and expansibility of data metadata, realizes the daily supervision and management of various energy consumption indicators by relevant functional departments, and is conducive to production and operation decision-making. Daily supervision and improvement of energy consumption data at the level, so as to improve abnormal energy consumption indicators in a timely manner and maintain efficient and economical operation of production.

5. Function analysis of intelligent energy management and control system

5.1 Energy monitoring

Carry out energy data collection, processing and forwarding functions, and monitor the energy medium pipeline network and energy supply and demand balance. Real-time monitoring of the current, electricity, power, etc. of each process equipment, key energy-consuming equipment, facilities, etc., monitoring and management of the operating status, shutdown and start-up, fault alarm and other signals of each equipment. At the same time, it can remotely monitor the progress of the equipment, implement remote control of key equipment, and set the alarm value of the related equipment, so as to realize the over-valued sound and light alarm, so as to find the problem in time, adjust and deal with it in time.

5.2 Energy analysis

The energy consumption analysis of each production process is carried out. The proportion of energy consumption of different production processes in their total production costs, and the proportion of energy consumption of equipment with high energy consumption in different production processes, as well as statistics and analysis of various energy media, and the consumption of various energy media. Daily, weekly and monthly automatic statistics and analysis, statistical analysis of output and energy consumption of each shift, and abnormal energy consumption analysis.

5.3 Energy efficiency analysis

Analyze the energy efficiency of equipment, compare it with the set industry benchmark, compare with the energy efficiency level of energy-saving equipment with the same function, and compare the energy efficiency of similar equipment in the enterprise. The targeted inspection and maintenance ensure that the equipment is in good operating condition and maintain the economical operation of the equipment.

5.4 Cost analysis

Analyze the cost of each process, and analyze the production balance and economy of each process according to the analysis of the consumption difference of each unit of energy medium in different periods, so that the manager can clearly grasp the equipment operation status of the process; analyze the cost of each unit. According to the total energy consumption of the unit and the operation of the pipe fittings energy-consuming equipment, master the operation status of the equipment in each link of the process, so as to discover the advantages and disadvantages of the production organization of each team, and promote the production organization method with high economic efficiency; Weekly and monthly automatic statistics and analysis of media usage costs,

It provides real, reliable and effective data support for the weekly cost analysis and monthly cost analysis of the whole plant's production and operation, thereby improving the production and operation performance of the enterprise.

6. System application

This system has been actually applied to a manufacturing enterprise in Hunan. By collecting a total of about 20,000 measuring points of various instruments, it can classify, classify and classify 13 kinds of energy media including electricity, gas, water, steam, compressed air and diesel in the whole plant. Unified control.

In terms of equipment energy efficiency, through the energy efficiency benchmarking of key energy-consuming equipment, the company's key equipment energy efficiency analysis, index benchmarking management and other functions have been realized. The level of energy efficiency management provides support for energy-saving diagnosis. Carry out energy efficiency ratio analysis for single equipment with large energy consumption, timely discover, replace or eliminate high energy consumption equipment, and reduce the energy consumption cost of enterprises

In terms of energy use, through the comparative analysis of energy consumption at all levels such as the company, the factory department, and the operation area, we promote the effective management and control of energy waste in each unit. In the company's energy consumption analysis, the deviation analysis between the company's total energy consumption, energy medium energy consumption (electricity, gas, water, etc.) and energy plan is realized according to the annual, monthly and daily cycles. Analyze the energy ratio, that is, the ratio of each energy medium to the total energy consumption, and display the analysis results in the form of a pie chart. Analyze the comprehensive energy consumption and the energy consumption trend of each energy medium, compare with the deviation of the plan, and reflect the year-on-year amount at each time point. When the energy consumption reaches 95% of the demand plan, a limit alarm will be issued. When the demand plan is exceeded, an over-limit alarm is issued.

In terms of energy cost, through the analysis of the consumption difference of each unit of energy medium in different periods, the production balance and economy of a certain process can be intuitively judged, so that managers can clearly grasp the equipment operation status of the process and pinpoint the occurrence of problems. the real reason. It has promoted the level of production organization and equipment management at the grass-roots level, and it is also conducive to the management and technical personnel at the grass-roots level to find and improve the deficiencies in their daily work, identify and strengthen the weak links in the production process, and increase the inspection and maintenance of equipment. , improve the economy of equipment operation, and enhance the initiative and enthusiasm of grassroots personnel.

7. Conclusion

The current situation of energy management in industrial enterprises, the main problems and future development directions of energy management and control systems are analyzed, and the system architecture and system design of intelligent energy management and control systems in industrial enterprises are proposed. Energy diagnosis, energy optimization and other aspects provide comprehensive and strong support for energy management of industrial enterprises, and realize the integration and automation of energy and production data. The intelligent energy management and control system for industrial enterprises in this paper realizes comprehensive supervision of various data and helps enterprises achieve sustainable development. Finally, taking an industrial enterprise in Hunan as an example, the application and effectiveness of the system are verified, the refined energy management is strengthened, and the energy efficiency level is improved.

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