On Optimization of Energy Management in the Production of Iron and Steel under the Background of Big Data

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Abstract: In the production of iron and steel, it takes a variety of primary and secondary energy sources with complex structures. It is difficult for traditional energy management mode to carry out hierarchical management in the production of iron and steel, and it is not dynamic enough and difficult to take into account the overall situation. It is easy to lead to the emergence of multi-head management and extensive management in the management process, and the management effect is not ideal [1]. By analyzing the energy consumption of iron and steel enterprises in the process of energy management and control in iron and steel production, this paper finds out the shortcomings of iron and steel enterprises in the process of energy management and control, and puts forward suggestions on energy consumption adjustment, energy utilization, and energy conservation quantification with the use of information technology under the background of big data, and puts forward the routing optimization with more low-carbon and efficient energy management in the production of iron and steel to reduce the pressure on energy and natural environment caused by the production of iron and steel.

Keywords: Big data, Production of iron and steel, Energy management, Routing optimization

Under the background of the continuous development of urbanization in China, the production of iron and steel has caused great pressure on energy and natural environment. Problems such as insufficient energy supply and serious environmental pollution have frequently arisen. Iron and steel industry is an important part of economy in China. The production of iron and steel can consume a large part of total energy output of China. Therefore, it is of great significance to study the scientific and rational use of energy in the production of iron and steel to reduce overall energy consumption [2]. In the traditional energy management mode of iron and steel enterprises, the use of macro regulation method to control the production and consumption of energy often requires a long time statistical and static calculation and analysis. The control objects are mostly single energy and equipment, and it is difficult to achieve the overall requirements of reducing consumption, reducing emissions and improving efficiency. In addition, the theory and method of traditional energy management mode need to be improved. It is often impossible to deal with the problem objectively if energy regulation only involves cost and output according to the experience of managers. To achieve the output target, more energy consumption and multi-environmental pressure will often be the cost [3].

1. Energy consumption status and reasons in the production of iron and steel

(1) Statistical Models of Energy Consumption Vary Greatly, Data Sources are Complex, and Ability of Overall Energy Forecasting is Insufficient.

The existence of historical factors makes Chinese iron and steel enterprises experience various production processes in the process of production of iron and steel, which makes the energy utilization level of iron and steel have particularity. In addition, the production cycle of iron and steel products is longer, the data comes from many aspects, and is more complex. It is difficult to make correct statistics and unification of the data when evaluating the data, which makes the results of data analysis can not reflect the actual situation more accurately. The lack of objectivity of the evaluation data will have a great impact on the objectivity of the evaluation of energy consumption level of iron and steel.

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(2) There is no Effective Data Analysis and Decision-making for Diversified Energy Sources.

In the production of iron and steel in China, the energy consumption of iron-making system reaches 70% of the total energy consumption, and the production cost can reach 55% of the total production cost. In the production of iron and steel, there are many kinds of main energy sources, such as converter gas, coke oven gas, blast furnace gas and mixed gas, and the coexistence of complicated production reaction mechanism, longer production process, complex data information and operational experience problems, which leads to the emergence of information diversification [4]. In addition, the harsh production environment, high temperature, high pressure, solid-liquid-gas coexistence, and other problems caused by human factors, such as record errors, incomplete data analysis, make energy consumption statistics, analysis and modeling become a difficult thing, and it is difficult to manage energy management globally.

(3) The Total Energy Consumption of Steel Production is High, and the Overall Energy Utilization Rate is not High.

Through the analysis of the energy consumption data of iron and steel enterprises, it is not difficult to find that some enterprises have low energy consumption of single device systems, but the total energy consumption is relatively high, which is often due to the waste of energy caused by the connection of process links and other auxiliary systems. At present, iron and steel enterprises generally establish energy control systems and establish environmental protection departments and energy management departments. However, the energy utilization rate of the process equipment of iron and steel enterprises is not high, and the equipment system is relatively backward. Even if the management measures are reasonable and effective, it is difficult to achieve the expected results after management.

(4) The Knowledge of Energy Consumption Mechanism is Insufficient, and Energy Management and Control is Difficult to Implement.

The production of iron and steel is complex and the production mechanisms used are numerous. The energy consumption mechanism in the production process includes heat balance energy conversion, material balance energy conversion, thermodynamics and kinetics. For a long time, the production process in the production of iron and steel lacks systematic theoretical guidance, and the establishment of the energy consumption model has become a difficult task [5]. Insufficient understanding of the energy consumption mechanism leads to blind control of energy consumption and difficulty in normal operation, which leads to more energy waste in the production process.

2. Energy Management Mode and Current Status of the Production of Iron and Steel

By analyzing the characteristics of energy consumption in the production of iron and steel, it can be divided into three parts, that is, equipment and process, energy medium balance, global system optimization and energy saving thought. Different management modes of iron and steel enterprises are different. There are also differences in development stages, and specific energy management measures are different. The technology and management benefits involved are also different. But under the background of big data, iron and steel enterprises pay more and more attention to the application of advanced science and technology in the production process to achieve the goal of production automation and optimal process control. In the production of iron and steel, the use of information technology can play a role in optimizing energy allocation, rational use of energy and environmental protection. In the era of big data, iron and steel enterprises in China have achieved certain results in the optimization of energy management and control. But if we want to achieve better development results, we need to solve problems such as having no governance of energy management and control functions and information process, the basic level of energy management and control automation, to achieve the integration of energy management and control [6]. In recent years, with the development of computer technology such as big data and cloud computing, as well as the research of multi-energy forecasting and energy balance technology, a modern

information-based energy management mode has gradually formed, which can play a leading role in large data analysis and decision-making, energy forecasting and dynamic balance.

3. Optimal path of energy management in the production of iron and steel

The modern energy management mode under the background of big data is based on the statistical analysis of production data, and then forms a management mode of energy production, consumption and management. Establishing and improving energy management departments and rules and regulations is a prerequisite. Big data analysis and decision-making is the key to making the energy system scientific and safe. In order to promote the optimization of energy structure for production, promote the rational use of energy, realize the overall energy conservation of production systems, and then strengthen the energy management of iron and steel enterprises, and promote the scientific and effective management of energy systems, the specific optimal path of energy management is analyzed below.

3.1 Optimizing the Energy Consumption Structure for Propulsion

Optimizing the energy structure not only helps the energy management of iron and steel companies, but also plays a role in energy conservation and emission reduction. In the face of energy shortage and the inadequacy of the production process of iron and steel enterprises in China, it is necessary to realize the transformation of energy structure to low-carbon energy to optimize the energy structure, and then achieve the goal of breakthrough energy structure optimization [7]. Iron and steel enterprises should accelerate the pace of technological advancement, large-scale process equipment, and modernization of process management to ensure that energy consumption and pollutant emissions can be reduced in the production process, and the backward structure can be adjusted in time.

3.2 Promoting the Use of Energy Ladder

Regardless of whether the energy is primary and secondary, the ladder utilization is achieved according to the conversion rate. Iron and steel companies have a variety of energy media, including steam, gas, water, and electricity. Different energy media can be converted, and different energy media can be classified to promote energy use. The stratification of different stages in the production process and collaborative optimization can achieve comprehensive dynamic adjustment of multiple energy media. For example, when the fuel system is operating, the high-temperature environment generates secondary energy such as steam, which can be used for power generation. At low temperatures, the heat generated can be used for industrial heating.

3.3 Establishing Energy Management Information System

Energy management information system based on data-driven can realize energy management and overall energy saving. Traditional energy management mode realizes information sharing between different energy-using links in the production of iron and steel and energy management departments. Because of the lack of information sharing within enterprises, it is often difficult to make scientific and reasonable analysis when analyzing energy-consuming data, and difficult to provide effective decision-making information for managers and decision makers. Modern energy management mode can use modern information technology to collect, analyze, use and make correct decisions on energy data in the overall production situation, and then realize the optimization of energy management and energy saving in production process.

Iron and steel enterprises should analyze the characteristics of energy consumption in the production of iron and steel, and use modern information technology to establish and improve energy data acquisition and monitoring system, such as modern IOT technology, data processing technology and energy forecasting and balance technology. Then, using cloud computing and big data analysis, the energy transmission and distribution and balance system is designed, the process flow is reappeared in real time, and the dynamic balance of the system is directly regulated to ensure the reliability of the information used in system management and decision-making. In

addition, an enterprise resource planning system can be established to automatically provide relevant plans, such as production plans and maintenance plans, according to the prediction and analysis of energy management. Such systems are conducive to the optimization of energy management and control in production.

4. Summary

The traditional energy management mode does not have the overall macro-control function, and it is difficult to play an effective guiding role in the production process, resulting in more waste in the use of energy. Modern energy management mode in iron and steel enterprises can find the shortcomings of mediation energy in the conversion and transmission and distribution links in time to ensure the balance of energy supply and demand, and minimize the energy dissipation and outsourcing to achieve the goal of optimum energy allocation and reduce energy consumption [8].

By analyzing the characteristics and energy consumption of energy management modes of iron and steel enterprises in China, this paper finds out the current situation of energy management in the production of iron and steel and the shortcomings of traditional energy management modes, and puts forward that iron and steel enterprises should use modern information technology to establish energy management system scientifically and reasonably, and optimize the energy management of production of iron and steel, which provides a reference for the informationization and globalization of energy management in steel enterprises under the era of big data.

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