Intelligent Construction and Management of Thermal Power Plant Based on Internet + Mode

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Abstract. How to respond to the national call, the establishment and management of intelligent thermal power plants under the Internet + mode is a problem that the current thermal power plant management staff needs to think about. Throughout the domestic large-scale thermal power companies have gradually entered the era of information and intelligent management. Based on this, the paper first analyzes the concept and characteristics of intelligent thermal power plants, analyzes its construction foundation, discusses the system architecture and business direction of intelligent thermal power plant construction, and combines new technologies such as artificial intelligence and new products to analyze intelligent thermal power plants. Prospects for development, thereby maximizing the economic benefits of the power plant and the social benefits.

1. Research background

In order to actively implement the national Internet + action guidance and promote the application and development of intelligent technology in thermal power plants, most of China's thermal power plants have begun to actively try in many projects, and then there have been a large number of "smart power plants" and "digital power plants". In the context of Internet+, the paper discusses the concept of intelligent power plant, the structure of intelligent power plant system, and the main construction content of the new power plant project infrastructure stage [1-3].

2. Intelligent thermal power plant concept

With the upgrading of productivity, the complexity and dynamics of business activities and the ability to gradually exceed the capabilities of human analysis and optimization, it is necessary to rely on intelligent technology instead of humans for process management, data analysis, decision optimization, and the core goal is to achieve intelligent production activities. The high degree of unity allows the system to work together. In this theoretical context, intelligent thermal power plants have the following three values and goals.

First, intelligently realizes the potential hidden danger display of the device, enabling it to operate more efficiently and sustainably. Second, let the machine replace humans and assist the staff to carry out thermal power plant management and operation and maintenance. Third, the production and operation process of the power plant will be more transparent and synergistic, making the management process more flexible and effective. Focusing on the above objectives, the construction of intelligent power plants needs to focus on the three-dimensional dimensions of intelligent sensing, intelligent

control and intelligent management. The big data analysis generated by coal-fired power generation in thermal power plants is used as a clue to deeply explore the value of data to create more benefits [4-5]. To this end, according to the latest definition of the industry, it can be concluded that the intelligent thermal power plant is based on modern digital information processing and communication technology, and integrates technologies such as intelligent sensing, control, management and execution to achieve synergy with the smart grid. A highly efficient, safe and environmentally friendly thermal power plant.

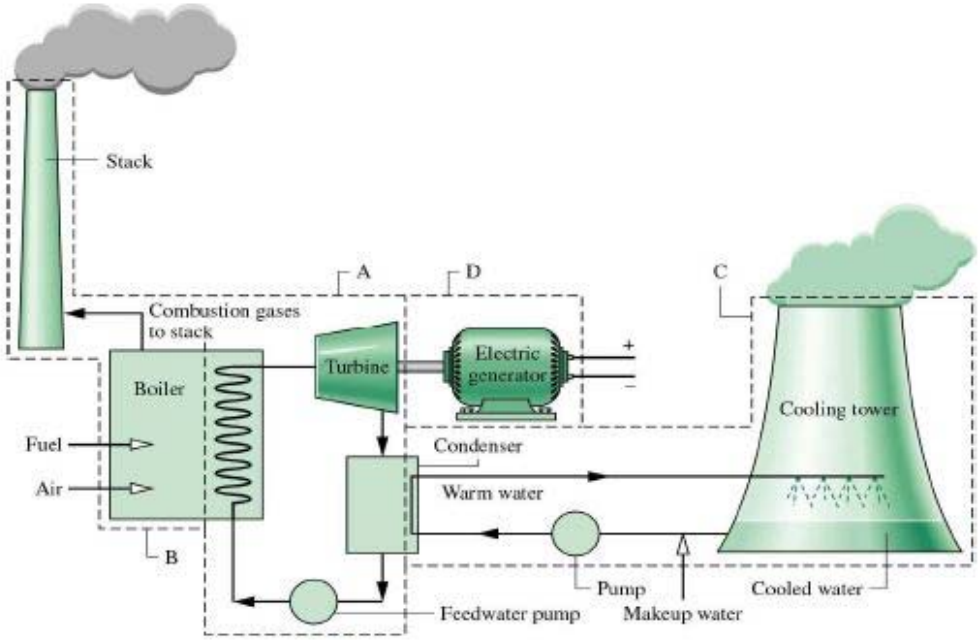

Fig. 1 Thermal power generation management process

3. Intelligent thermal power plant management system construction

According to the three perspectives of intelligent sensing, intelligent control and intelligent management, thermal power plants can roughly divide the intelligent system into four levels.

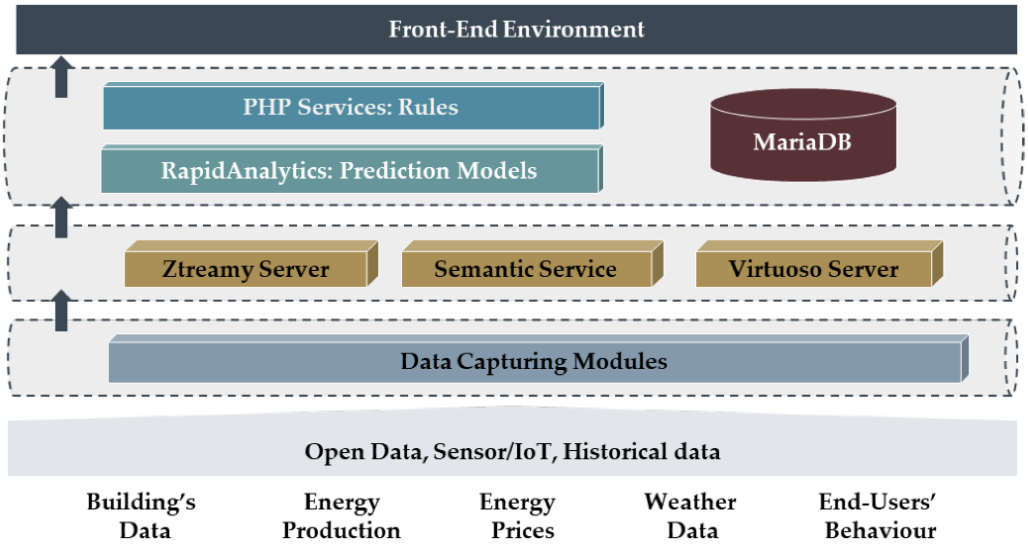

Fig. 2 Thermal power plant intelligent construction management level

3.1. Thermal power plant equipment and measurement layer

In this level, IoT technology and advanced measurement technology are introduced mainly according to the distribution of fieldbus, so that information such as equipment, personnel, environment, location and other information in the power plant is transformed into digital information, which enhances the device's perception ability and provides intelligent construction and management [6]. Data basis. The smart technologies that need to be applied include 3D visualization technology, radio frequency technology, wearable devices, etc., which are integrated through the Internet of Things technology to achieve comprehensive spatial awareness. The use of digital thermal power plants and other related technologies to implement transparent management of boiler power generation and power generation, and establish cost control indicators under the electricity market. The breakthrough in measurement problems such as monitoring market electricity price, boiler power generation efficiency, and power generation energy consumption provides support for control and management.

3.2. Real-time control and optimization layer

This level is mainly built on the distributed control system and the field bus control system to realize centralized data processing of thermal power plants to achieve online optimization. Mainly through the auxiliary electric energy to enhance the automatic level of the whole process; through the application of industrial big data analysis technology to achieve automatic optimization of various working conditions such as thermal power plant load optimization scheduling, boiler combustion power generation optimization, etc., to ensure that the unit automatically adapts to the external environment, working conditions, etc. [7] Change and maintain operation on a comprehensive optimal boundary line of safety, economy and environmental protection.

3.3. Production Power Management

The production power generation layer is mainly based on the fuel combustion plan and management information system of the thermal power plant. It integrates and integrates the power generation production and management data of the thermal power plant, and takes the safety production and fuel-efficient application as the main objectives, and uses the data analysis method to optimize the whole process. Such technologies realize intelligent management of production and power generation in thermal power plants. At the existing technical level, three-dimensional visual technology can be adopted to establish a three-dimensional integrated management system for equipment, and the plant area wireless network, wireless radio frequency technology, two-dimensional code and wearable device technology can be applied to the Internet of Things technology and video, two-vote system [8-9]. Centralized management such as access control, establishing an intelligent security system, and implementing functions such as personnel maps, work order maps, and smart tickets. Through the integration of information systems such as enterprise resource planning and management information systems, an integrated work platform for employee role customization is established to eliminate information islands and optimize organizational processes, so that the production and operation management of thermal power plants is faster and more efficient. Promote the establishment of thermal power plant production and operation indicators, establish an automatic report generation system to reduce the pressure on staff, and achieve the "real-time cost" indicator system.

3.4. Remote Monitoring and Service Layer

This level makes full use of Internet big data analysis technology to break geographical boundaries, establish a remote data center between group companies and regional companies, give full play to the advantages of analysis in crew clusters, give full play to expert technical strength, carry out data mining, and realize data value creation. It can mainly predict the early degradation of equipment, remote monitoring and analysis of boiler combustion power generation impact factors, generator energy analysis, and generator group index analysis. It can realize the simulation training operation of the steam turbine generator set, the 3D model maintenance and other simulation training services.

4. Intelligent construction of new construction of thermal power plant infrastructure

4.1. Establish a unified device identification system

The thermal power plant infrastructure project must start the synchronization of the power plant identification system coding from the design stage. On this basis, the equipment power plant identification system coding, material coding and fixed asset coding must be actively carried out to realize the interrelated relationship between the system and the equipment. To achieve data sharing of equipment, finance, and assets.

4.2. Establishing a three-dimensional digital visualization system

The establishment of the three-dimensional digital system can realize the simulation operation of the equipment in the plant area, and solve the problems such as errors and omissions that may occur in the initial stage of design. The 3D visualization digital system enables cross-checking and optimization of design drawing information, enabling meticulous management of bulk materials and cables. The 3D model will display the sense of nature and vivid digital simulation power plant on the platform, laying the foundation for the application of intelligent equipment such as 3D management, virtual simulation, security system and inspection robot [10].

4.3. Engineering to achieve intelligent digital handover

Power generation enterprises can simultaneously acquire power plant operation and maintenance data during project construction and completion, which is an intelligent digital handover of engineering. The handover materials include engineering documents, models and data, covering design documents, equipment filing documents, procurement documents, installation and commissioning documents, engineering completion documents, 3D models of thermal power plants, design data, identification code data, and construction management data. The digital transfer of engineering is based on the power plant identification system. With the equipment model as the core, the equipment design, construction, operation and maintenance data and other equipment are related to the 3D model and dynamic drawings of the equipment. At the same time, the system can also integrate operational data such as real-time process data and device defect records to achieve full lifecycle management of the device.

4.4. Intelligent Security System

The intelligent security system ensures the level of security protection through the integration of new technologies such as on-site 3D display model, device QR code, industrial WIFI, wireless RF technology, mobile terminal and access control, video surveillance, and other existing systems. The security system implements the following functions.

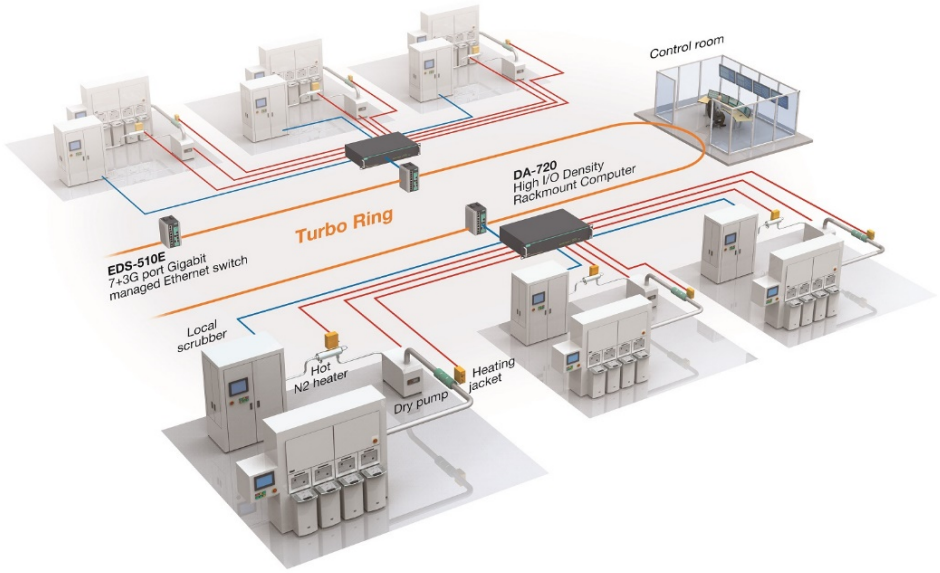

Fig. 3 Thermal power plant intelligent security system

First, the two-vote operation can be realized, and the device can be linked online and synchronized. Second, the electronic fence function is implemented. For the more dangerous areas, the employees who lack the work rights have the alarm function after approaching the area, and the third, realize the work order map and the person map function, and can view the geographical location of the employees and the work orders online. Fourth, the three-dimensional scene camera monitoring enables real-time acquisition of live images and the ability to block video at specific times as needed. Fifth, the automatic delineation of employee positions, work tickets, and operation tickets was established, and access rights were set. sixth. Realize the three-dimensional positioning of fire alarms and timely implement emergency measures.

5. Conclusion

The intelligent construction and management of intelligent thermal power plants involves the infrastructure construction and operation and maintenance process, and is a relatively long-term, systematic project. The improvement of the intelligent level cannot only improve the overall work reliability, power quality and comprehensive benefits of operation and maintenance of thermal power plants, but also improve the work efficiency of employees, improve the working environment, reduce the work pressure of employees, and improve the economic benefits of thermal power plants. With the adjustment and optimization of the domestic energy structure, the degree of coal utilization has been greatly improved. To this end, adhere to the combination of effectiveness and forward-looking, security and openness, new technology applications and management innovation, in order to ensure the long-term effectiveness of intelligent construction and management of thermal power plants.

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