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Research on the Realization Path of Low-carbon Transformation of Digital and Intelligent Enabling Thermal Enterprises

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Abstract

Energy, as one of the largest emission industries, plays a pivotal role in the process of helping to achieve the "double-carbon" goal in China. Driven by technological progress, all kinds of traditional energy enterprises should actively implement the concept of high-quality development, formulate and implement green development strategies, promote the low-carbon transformation of enterprises, and assume the responsibility of promoting the low-carbon social development while promoting economic development. This paper, with thermal enterprise, for example, first discusses the current background, the motivation of the implementation of low carbon transformation and obstacles, and then around the heat, heat transfer, heat transfer, heating and other main business, design puts forward the relying on intellectualization technology to realize the realization of low carbon transformation path, for the same enterprise of low carbon green development provides a useful reference and reference.

Keywords

Thermal Enterprises; Digital Intelligence; Low-carbon Transformation; Realization Path.

1. Foreword

All In recent years, due to the rapid development of the global economy and society, the transformation of energy enterprises has undergone profound changes, which also makes the energy industry become a topic of concern from all walks of life. In 2021, General Secretary Xi Jinping's series of important arrangements on "carbon peak and carbon neutral" drew a grand blueprint and pointed out the way for promoting climate and environmental governance and sustainable development. For thermal enterprises, heating energy saving has become the consensus of the industry, and the intelligent upgrading of heating is the inevitable trend of heating energy saving industry. In terms of policy, with the introduction of the Notice of The State Council on the Issuance of comprehensive Work Plan for Energy Conservation and Emission Reduction during the 13th Five-Year Plan period and other policies, the national energy conservation and emission reduction efforts have been intensified, and the progress of energy conservation renovation of existing residential buildings has been accelerated. In terms of economic benefits, improving the utilization efficiency of heating and reducing the heat loss are the subjective initiative of heating enterprises to carry out energy-saving transformation in various links. Policy promotion superimposed economic benefits to drive heating energy saving has become the industry consensus.

The low-carbon transformation of thermal enterprises is one of the important measures to cope with climate change and reduce greenhouse gas emissions. Under the dual-carbon target, facing the pressure of low-carbon transformation, the development of digital technology provides the feasibility for the low-carbon operation of thermal enterprises. Yang Jixian (2010) elaborated the characteristics of China's energy resources and the status of supply and demand, Introduce the connotation of low carbon economy and the influence of low carbon economy on the energy industry, Put forward that the heating enterprises in the low-carbon economy

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environment, The response measures are to change the concept of development, pay attention to the training and use of talents, continue to increase investment in science and technology, optimize the industrial structure, We will upgrade the industrial structure, Strengthening energy conservation and emission reduction work; Tong Guangyi (2021) first explained to achieve the "double carbon" goal, The energy industry is having a difficult task, This paper analyzes the shortcomings and shortcomings of the transformation of China's energy enterprises under the background of double carbon, The evolution path of smart energy system based on distributed generation technology, based on user-energy complementary technology, based on digital technology and UHV technology, based on advanced energy storage technology and modern information technology, And analyze the main characteristics and supporting functions of the smart energy system, The realization path of smart energy system under the background of two-carbon is proposed.

This paper is based on the "double carbon" target and economic and social development under the requirements of thermal industry transformation, the thermal enterprise low carbon transformation implementation path, through the analysis of thermal enterprise implementation of low carbon transformation development motivation and obstacles and implementation path, to explore the thermal enterprise low carbon transformation development prospects, reasonable measures are put forward.

2. Analysis of the Drivers and Obstacles of the Implementation of Digital Intelligence and Low-carbon Transformation Development

2.1. Cause Analysis

2.1.1. Pressure on Environmental Governance and the Promotion of International Policies

On September 22,2020, Chinese President Xi Jinping announced at the 75th Session of the United Nations General Assembly that China aims to peak its carbon dioxide emissions by 2030 and strive to achieve the carbon neutral goal by 2060. According to the Research Report on China's Carbon Peak by 2030, China's total carbon emissions in 2019 were about 10.5 billion tons, of which energy-related activities were about 9.8 billion tons, accounting for 87 percent. In terms of energy supply types, coal-fired power generation and heating emissions accounted for 44% of the total energy-related carbon emissions, while coal, oil and natural gas emissions accounted for 35%, 15% and 6%, respectively. With the advance of time, the country will eliminate high-energy consumption and high-emission equipment, and accelerate the elimination of backward production capacity, which means that the traditional energy industries such as power, heat, coal and oil, will face the huge challenge of national emission reduction and carbon reduction requirements. The goal of "double carbon" is an important starting point to accelerate the construction of ecological civilization and achieve high-quality development. For traditional energy enterprises, carbon neutrality is both an opportunity and a tough battle. It is imperative to realize low-carbon operation with the help of intelligent transformation and upgrading.

2.1.2. Drawing Inspiration from the Progress of Digital Intelligence Technology and the Effectiveness of Industry Application

In the era of digital transformation of the global economy, the digital economy is highly integrated with the real economy, and the digital transformation and upgrading of traditional enterprises has become a trend. The progress of digital intelligence technology has brought remarkable results to the application of the thermal industry. By introducing emerging technologies, such as cloud computing, big data, the Internet of Things and artificial intelligence, heating systems can achieve more refined adjustment and improve household satisfaction. In

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terms of specific applications, some enterprises have achieved full coverage of unmanned meter reading, built a reliable and stable intelligent remote meter reading system, completely solved the problems of manual meter reading and remote control, realized cost reduction and efficiency increase, and opened intelligent measurement. At the same time, with the help of the intelligent thermal refined management cloud platform, realize the combination of the Internet of Things and big data, providing heating enterprises with automatic refined solutions from the heat source to users. Digital transformation provides a new solution to the traditional heating system. Through the continuous integration of technology, business and industry, the heating industry is moving towards the ultimate goal of high efficiency, energy saving and people-oriented wisdom. This transformation will not only help to improve the balance of heating, but also take into account the goals of energy conservation, emission reduction, safety and efficiency.

2.1.3. The Urgent Need for its Own Development and Effectively Fulfilling its Social Responsibilities

As an important enterprise of energy supply, thermal enterprises have the responsibility and obligation to actively respond to national policies, promote low-carbon development and assume social responsibilities. To save energy and reduce emissions, improve energy efficiency, and reduce carbon emissions. Therefore, thermal enterprises should take measures to carry out carbon asset management, promote the adjustment of energy structure, strengthen communication with users and participate in public welfare undertakings, so as to carry out digital intelligence and low-carbon transformation and achieve sustainable development.

2.2. Analysis of Obstacles

As powerful digital technology and ability to change our economic pattern, thermal enterprises in low carbon transformation has made some progress: some companies have begun to introduce clean energy, such as natural gas, geothermal energy, etc., to replace the traditional coal heating, at the same time using advanced energy saving technology, such as cogeneration, heat pump to improve energy efficiency, reduce carbon emissions. However, thermal enterprises are still facing many challenges in the process of low-carbon transformation, and most enterprises still have the problem of difficult transformation.

2.2.1. Technical Difficulty

China's energy industry started late, weak foundation, backward technology. The realization of the low-carbon transformation of thermal enterprises requires the adoption of new low-carbon technologies and equipment, equipment purchase, installation, operation, maintenance and other issues require the enterprise to invest a lot of manpower, material resources and financial resources. In addition, these technologies also require enterprises to upgrade and transform their technologies according to their own conditions. If the enterprise cannot solve these problems in a timely and effective manner, it will affect the work efficiency and economic benefits of the enterprise.

2.2.2. Economic Costs

The capital scale of traditional energy industry is different, most traditional energy enterprises lack the technical elements necessary to realize intelligent transformation and upgrading, insufficient intelligent infrastructure construction, insufficient scope and means of data collection, and aging equipment and facilities, all these have become the bottleneck restricting energy enterprises to realize intelligent transformation and upgrading. This requires enterprises to spend a certain amount of time and energy, as well as enough funds to support the low-carbon transformation, in order to achieve disruptive, transformative energy series of technological breakthroughs.

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2.2.3. Difficulty in Management

Traditional energy enterprises want to maximize the peak of carbon, and carbon neutrality to achieve double carbon, they should not only strengthen research, optimize the energy structure, but also take the initiative to transform and develop low-carbon green direction, which is also the pressure and severe challenges in the traditional "double carbon". Low-carbon transformation requires the company to make corresponding adjustments and changes in management, so that the internal employees into digital employees and unify the transformation of employees, such as personnel training, process reengineering, performance assessment, etc., which require the company to carry out fine management, increasing the difficulty of management.

2.2.4. Ability and Awareness of Employees

Under the background of digitalization, networking and intelligence, traditional industries have been influenced by digitalization, networking and intelligence, and the intelligent development of machines and equipment has gradually replaced artificial labor and become the future development trend. Enterprise is transformation requires a large number of digital talents, and our energy industry due to the inherent limitations of traditional energy industry, the lack of intellectual talents, enterprise employees also lack of low carbon transformation consciousness, enterprise low carbon transformation is more need internal staff actively cooperate with and participate in, if employees lack of low carbon consciousness and participation, will have a negative impact on the transformation of the company.

3. The Realization Path of the Intelligent Low-carbon Transformation of Thermal Enterprises

3.1. Establish the Organization and Management System under the Guidance of the Enterprise's Digital Transformation Strategy

Firstly, enterprises need to firmly establish the concept of green and low-carbon development.Thermal power enterprises need to take effective measures, Reduce energy consumption and reduce pollutant emissions, Improve energy efficiency and resource utilization; Promote the circular economy model, To achieve resource recycling and waste reduction, recycling, harmless; Strengthen the concept of environmental protection, Pay attention to environmental protection in the process of production and operation, Establish a green corporate image; Actively develop and utilize renewable energy and clean energy sources, Such as solar energy, wind energy, geothermal energy, etc., Reducing the reliance on traditional fossil fuels; To meet the needs of The Times, Advocating a green and low-carbon development concept, Promote enterprise employees to actively participate in the low-carbon transformation of digital intelligence, Create a good atmosphere for full participation and joint promotion, Let it understand that the current society is that " the numbers are the resources, Numbers are the assets ", To adapt to the new requirements of information, network and The Times, Promote the reform of enterprise digital intelligence; Actively fulfill our social responsibilities, Focus on ecological and environmental protection and sustainable development, Promote the sound interaction between green and low-carbon development and social progress.

Secondly, enterprises should improve their organizational and management systems that are suitable for digital transformation. To improve the organization and management system adapted to the digital transformation requires the thermal enterprises to start from many aspects: establishing a digital transformation leadership team, Set up a digital intelligence transformation leadership team composed of senior leaders of the enterprise, Responsible for developing the digital transformation strategy, organizing and coordinating various

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departmental resources, Promote the smooth implementation of the low-carbon transformation of thermal enterprises; Adjust the organizational structure, According to the own needs of thermal enterprises in the low-carbon transformation, Adjust the organizational structure of the enterprise, Establish an organizational system to adapt to the transformation of digital intelligence, Strengthen cross-departmental collaboration, Strengthen the communication and collaboration between various departments, Breaking down the departmental barriers, Create an atmosphere of collaborative work, Jointly promote the intelligent transformation and upgrading of thermal power enterprises.

3.2. Build an Intelligent Operation System Around the Core Business

3.2.1. Networked Technology Helps Multiple Heat Source Mining

In recent years, many thermal power companies have developed diversified heat source management systems. As a form of central heating, the purpose of implementing multi-heat source network heating is to further improve the flexible scheduling of heating system under the premise of ensuring the heating quality of users. Especially in the background of the current comprehensive energy science and technology revolution, the heating company has realized a more efficient multi-heat source network heating through the construction of intelligent, automatic and information system. The second is based on the general heat network system of heat source integration, thermal company in order to improve the heating low carbon efficiency, to ensure the biggest operating saving, avoid in the heat network and final heating system, thermal company establish generic heat network system of heat source integration calculation and design process, using high quality data for reliable prediction, thus more accurate records to determine the needs of the local heating system. By building a heat source integration system based on a pan-thermal network system, it also provides a more controllable system and requires less maintenance than the oversized system, thermal companies reduce the historical load and are able to match the consequent system requirements.

3.2.2. Machine Learning Algorithm is Used to Realize the Intelligent Scheduling of Heat Exchange Stations

In the era of low carbon, the development and application of intelligent control system is the primary problem faced by all thermal companies. This helps to achieve the transparency of the heating network intelligent goal, but also makes the city heating to obtain more security. In order to comply with this trend, the heating company actively promotes the development of the pipe network intelligent management and control system, carries out the compilation and design of the distribution network planning scheme, does a good job in the planning of the heat distribution network, carries out the intelligent transformation of the city's urban heat distribution network, and strives to achieve the fit with the actual heating demand situation.

Secondly, the thermal company builds an independent heat source control system based on intelligent scheduling, and uses various equipment in the heating site, such as ultrasonic heat meter, intelligent temperature control valve, intelligent modular heat exchange unit, etc. Collect and summarize the indoor temperature, outdoor temperature, heating flow and other data of the heating terminal in real time, and upload them to the heating management platform of the heating company. Through the sorting, storage, calculation and analysis of the whole network data of the heating system, scientific evaluation and analysis of the operation parameters and energy data of each station, to realize the intelligent control of energy number, effectively improve the energy utilization efficiency and heating control ability, and promote the gradual transformation of the company from a high energy consumption enterprise to a green intelligent heating enterprise.

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3.2.3. The Construction of the Intelligent Heating Platform Realizes the Integrated Heating Management

In order to achieve the goal of integrated heating management, the heating company has carried out the construction of intelligent heating platform in recent years, and upgraded and transformed the regulation and energy saving needs of the district heating hot water pipe network. Heat network and pipe network intelligent regulation is improving heating efficiency, the key to low carbon development, and build a heat network and pipe network intelligent control simulation system, can help thermal company to build a vertical heating hot water pipe network regulation model, and develop the control software platform, improve the operation efficiency of hot water pipe network distribution control system. At the same time, the development of the intelligent control simulation system of the heat network and pipe network can be used for the initial adjustment of the pipe network of the heating hot water pipe network, and the online monitoring of the heating official website, so as to reduce the hydraulic imbalance of the pipe network and improve the operation efficiency of the pipe network. The intelligent control simulation system of heat network and pipe network is a system matching with various heating conditions. In the system development process, the thermal company constantly optimizes the model, and verifies the rationality of different heat sources, external temperature and other parameters.

3.3. Build a Guarantee System for Digital and Intelligent Operation

First of all, enterprises should increase capital investment to improve operational efficiency, enhance competitiveness, and promote sustainable development. Digital intelligence operation can help thermal enterprises to improve the operation efficiency of heating equipment, reduce energy consumption and cost, but also improve heating quality and service level; can help thermal enterprises to improve service quality and efficiency, enhance enterprise competitiveness; promote sustainable development, reduce environmental impact and resource waste through digital transformation and intelligent operation.

Secondly, strengthen cooperation and communication between enterprises: strengthen cooperation and communication with enterprises in the same industry, traditional energy companies are facing increasing competitive pressure and increasing market demand. Therefore, they must realize resource sharing and information exchange with other companies. Through the integration of technological innovation development, promote industry platform, make originally simple competition or cooperation between enterprises gradually change, establish a new multi-level, networked competition relationship, and the sustainable development of competitive advantage as strategic goals, jointly explore digital fu can low carbon transformation best practices and solutions, promote the sustainable development of the industry.

Finally, training professional talent team: the lack of talent is also an important factor restricting the intelligent transformation and upgrading of traditional energy enterprises. Enterprises should strengthen the construction of talent team, cultivate a talent team with digital technology and management ability, and provide talent guarantee for the low-carbon transformation of enterprises. Enterprises can through a series of digital talent training plan, including the introduction of digital technology, training, practice and examination, etc., the enterprise with professional knowledge staff training into digital knowledge talents, at the same time established for digital talent incentive mechanism and digital talent exchange platform, improve digital talent work ability and work enthusiasm, so as to realize the sustainable development of the enterprise.

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4. Conclusion

In this paper, the realization path of the low-carbon transformation of digital and intelligent enabling thermal enterprises is studied, In this paper, taking the thermal power enterprise as an example, The pressure of environmental governance and the promotion of international policies, the pressure of environmental governance and the promotion of international policies, the urgent needs of enterprises and the effective performance of social responsibilities, the analysis of the low-carbon transformation of thermal enterprises, Analyzing the transformation barriers from four perspectives: technical difficulty, economic cost, management difficulty, staff ability and consciousness, Research from the network technology to help the multiple heat source mining, Intelligent scheduling of heat exchange stations using machine learning algorithms, The intelligent operation system of the heating company is analyzed from multiple perspectives. Finally, based on the above research results, useful inspirations and conclusions are summarized to further enrich the research on the transformation of thermal enterprises.

First discusses the current background, the implementation of low carbon transformation motivation and obstacles, and then around the heat, heat transfer, heat exchange, heating business, design puts forward the relying on intellectualization technology to realize the realization of low carbon transformation path, based on the above results summarizes the beneficial enlightenment and conclusion, further enrich the energy enterprise transformation research, for the same enterprise of low carbon green development provides a useful reference and reference.

References

[1] Kuang Lichun, Zou Can, Huang Wei, etc. China's energy demand forecast and transformation development trend under the vision of carbon neutrality [J]. Petroleum Science and Technology Forum, 2022,41 (1): 9-17.

[2] Xiong Guangqin, Shi Daqian, Li Meina. The impact of the low-carbon city pilot on the green technology innovation of enterprises [J]. Scientific Research Management, 2020,41 (12): 93-102.

[3] Tan Xianchun, Guo Wen, Fan Jie, et al. Carbon peak, carbon neutral policy framework and technology Innovation Policy Research [J]. Proceedings of the Chinese Academy of Sciences, 2022,37 (4): 435-443.

[4] Li Wei. Introduction to the -- and SIAM management methodology [J]. Internet and Military-civilian Integration, 2020 (08): 11-15.

[5] Zhou Xiaoxin, Zhao Qiang, Zhang Yuqiong. Development prospects and key technologies of China's energy and power system under the goal of "double carbon" [J]. Management of China Electric Power Enterprises, 2021 (31): 14-17.