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Research on Fossil Energy Emission and Environmental Protection Equipment

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Abstract: With the severe challenge of global climate change, reducing fossil energy emissions has become a common concern of the international community. China, as the world's largest energy consumer and carbon emitter, the environmental protection of the emission equipment of its fossil energy enterprises is particularly important. In the process of energy transformation and development, it is an inevitable trend to move towards clean and low-carbon, and ensuring the safe supply of energy is the fundamental task to improve energy. Source production and consumption efficiency have an important connotation. This paper aims to explore the current situation of emission equipment in China's fossil energy enterprises, evaluate their environmental performance by analyzing most of the enterprise equipment, and analyze the core link of specific enterprises, including flue gas desulfurization and denitrification equipment and carbon capture and storage technology (CCS), and point out that the equipment used by most enterprises has a certain advanced nature and environmental protection. However, there are still some problems in quality, performance and wide application. Finally, it is proposed that enterprises should optimize technology according to their own conditions and seek government help and other targeted opinions and pertinent suggestions. Enterprises should actively respond to the call of national green development and sustainable development strategy to promote their own green transformation and sustainable development. To provide reference for the green transformation of China's fossil energy industry.

Keywords: Fossil energy, emission, environmental protection, equipment analysis.

1. Introduction

Fossil fuels, including coal, oil and gas, are an important part of the current global energy system. However, greenhouse gas emissions and pollutant emissions generated during the exploitation, processing and use of fossil energy have caused serious impacts on the global climate and environment. As the world's largest energy consumer, China's emissions from fossil energy companies are particularly problematic. Therefore, improving the environmental protection of emission equipment and improving energy efficiency has become the focus of the international community. Through case content analysis, literature review, data analysis and induction, this paper explores the research on fossil energy emissions and environmental protection equipment, and puts forward relevant suggestions for different equipment methods.

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2. The environmental impact of fossil energy emissions

The extensive use of fossil energy and its impact on the environment have become the focus of global attention. The burning of fossil fuels is an integral part of the functioning of modern society. However, the use of such fuels directly leads to the emission of a large number of greenhouse gases, especially the significant increase in carbon dioxide emissions. Figure 1 shows the relationship between carbon dioxide emissions from 1855 to 2015.

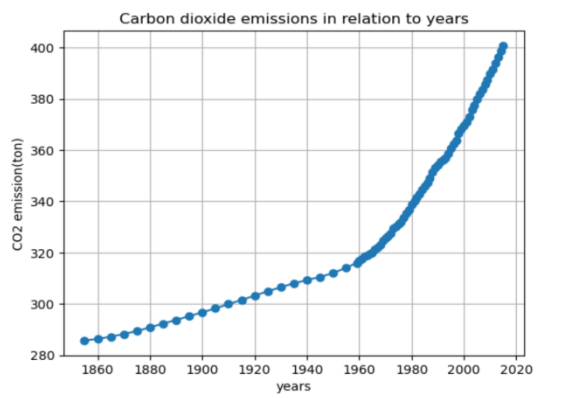

Figure 1: Carbon dioxide emission relationship (1855-2015).

Carbon dioxide, along with other greenhouse gases, accumulates in the atmosphere, enhancing the Earth's greenhouse effect and causing global temperatures to rise. Over the past century, the average temperature of the Earth has risen significantly as a result of human activities, causing phenomena such as increased extreme weather, melting glaciers, and rising sea levels. In addition, the exploitation and use of fossil energy has brought other environmental problems. The process of exploitation is often accompanied by the destruction of the ecological environment, such as deforestation and water pollution. Coal mining can lead to subsidence and groundwater pollution, while oil mining is often associated with the risk of oil spill accidents, with long-term negative impacts on Marine ecosystems. The use of fossil energy not only intensifies global climate change, but also causes direct damage to the ecological environment. Studies have shown that when the low carbon weight plays a large role, taking into account the carbon emissions of electric energy storage equipment can effectively reduce the operating costs of the integrated energy system, while reducing the total carbon emissions, which can reduce the environmental pollution caused by carbon emissions generated in the power generation process of the integrated energy system [1]. Therefore, actively transforming to renewable energy and taking measures to reduce carbon footprint are crucial to maintaining the earth's environment and the future well-being of mankind. We should adhere to the basic ideas of "bottom line thinking", "overall balance" and "innovation-driven". It can be alleviated and improved by speeding up the establishment of a new power supply security system, systematically reducing and channeling the cost of energy transformation, and building a new power system [2], The green transformation of fossil energy will be vigorously promoted.

3. Environmental protection status analysis of energy company emission equipment

3.1. Analysis of current situation of energy emission companies

In the current context of global climate change and environmental protection, the environmental challenges faced by the emission equipment of energy companies are increasingly severe. The emission equipment of energy companies mainly includes boilers, gas turbines, industrial furnaces, etc. These equipment will produce a lot of waste gas, waste water and solid waste in the operation

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process, causing serious pollution to the environment. For example, coal-fired boilers emit large amounts of sulfur dioxide, nitrogen oxides, and particulate matter, while gas turbines produce large amounts of carbon dioxide. In response to these problems, energy companies have taken a series of measures to improve the environmental performance of emission equipment. First of all, enterprises have strengthened the maintenance and repair of emission equipment to ensure its normal operation and reduce the risk of accidental emissions. Second, enterprises actively introduce advanced emission treatment technologies, such as desulfurization, denitrification and dust removal, to reduce the concentration of pollutants in the exhaust gas. In addition, the company has also strengthened the treatment of wastewater and solid waste to reduce its impact on the environment through recycling and safe disposal.

However, although energy companies have made some progress in the environmentally friendly emission equipment, there are still some challenges. First, due to technical and economic restrictions, some enterprises are still using backward emission equipment, which is difficult to meet environmental protection requirements. Secondly, the continuous updating of environmental regulations and standards makes it necessary for enterprises to continuously invest in technological upgrading and transformation. In addition, the public's increasing attention to environmental issues has put forward higher requirements for the environmental responsibility of enterprises.

Therefore, there are certain problems and challenges in the environmental protection status of emission equipment of energy companies. In order to achieve sustainable development and meet environmental protection requirements, enterprises need to continue to increase investment, introduce advanced technology and management experience, strengthen environmental compliance and certification work, and improve environmental protection image and credibility. At the same time, the government and all sectors of society should also give more support and guidance to enterprises, and jointly promote the green development of the energy industry.

3.2. Emission equipment analysis

3.2.1. Flue gas desulfurization and denitrification device

With the increasing global awareness of environmental protection and the increasingly strict regulations on air pollution control in China, air pollution has become one of the important factors affecting the environment and public health. Especially the emissions of sulfur dioxide (SO_2) and nitrogen oxides (NO_x) have a particularly prominent impact on air quality. Anhui Province, as an important industrial base in eastern China, effectively controlling the emissions of these pollutants is the key to improving regional environmental quality. Therefore, taking the desulfurization and denitrification equipment in Anhui Province as an example, analyze the advantages and disadvantages of its equipment and production.

The desulfurization and denitrification technology mainly targets large industrial pollution sources, such as coal-fired power plants, and removes sulfur dioxide (SO_2) and nitrogen oxides (NOX) from flue gas through chemical or physical methods. There are many kinds of desulfurization and denitrification processes, the main processes are limestone (lime), gypsum, ammonia, sodium alkali, zinc oxide, magnesium, activated coke, solvent, flue gas circulating fluidized bed, spray drying, dioxygenated water, etc. At the same time, the main integrated technologies for desulfurization and denitrification include activated carbon adsorption, plasma technology, biological method, semi dry wet method, catalytic method and other technical methods [3].

The most common methods in Anhui province are wet limestone-gypsum desulfurization and selective catalytic reduction (SCR) denitrification technology. Wet limestone-gypsum desulfurization, because of its mature technology, high desulfurization efficiency, but also because of its complex equipment, high initial investment and operating costs and by-product processing difficulties, has not

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been applied to many enterprises. Selective catalytic reduction (SCR) denitration technology, especially the development of new catalysts, has further improved the denitration efficiency. However, the selective corrosion and regular replacement of catalysts remain challenges. These technologies can effectively reduce the emission of pollutants, but there are also problems, such as high operating costs and difficult disposal of by-products. Most of Anhui's desulfurization and denitrification facilities are concentrated in coal-fired power plants and large industrial boilers. According to the survey, although the operating efficiency of most facilities has been improved in recent years through technological upgrading, there is still a big gap between the overall level and foreign advanced technology.

Desulfurization and denitrification equipment and carbon capture and storage technology play a key role in controlling and reducing air pollution and greenhouse gas emissions, but their wide application is restricted by many factors such as economy, technology and policy. In the face of these challenges, governments, industry and all sectors of society need to work together to promote the development and application of these key technologies through technological innovation, policy support and international cooperation to achieve the goals of global environmental protection and sustainable development.

3.2.2. Carbon capture and storage technology

Carbon capture and storage (CCS) is an effective means to reduce industrial greenhouse gas emissions. Carbon capture and storage technology involves capturing carbon dioxide produced during industrial processes and storing it in underground rock formations to reduce greenhouse gas concentrations in the atmosphere. CO2 capture technology refers to the separation of CO_2 from the flue gas generated by fossil energy combustion, and then the use of carbon capture equipment for high concentration compression, easy transportation and storage. According to the economy and operability of carbon capture, the objects of CO2 capture are mainly large centralized CO_2 emission sources, such as coal-fired power plants, steel plants, cement plants, ammonia plants, etc [4]. Among them, coal-fired power plants are the largest and longest-term stable source of concentrated emissions [5].

The implementation of CCS technology can not only effectively mitigate the problem of global warming, but also provide a feasible technical path for enterprises to meet carbon emission standards. However, CCS equipment is complex and costly, and understanding the capabilities and requirements of this equipment is key to optimizing investments and operations. The main application industries of carbon capture and storage technology are concentrated in related chemical processes, equipment manufacturing and energy supply and consumption fields led by the petrochemical field. The technical effects of carbon capture and storage technology can be summarized into the following 10 dimensions: (1) Total emission reduction; (2) Equipment, process, equipment cost reduction; (3) The system efficiency is improved; (4) The technical complexity is reduced; (5) Reduced energy consumption; (6) comprehensive consumption reduction; (7) Improvement of economy and income level; (8) Comprehensive environmental improvement; (9) Adequacy improvement; (10) Pollution avoidance [6].

CCS technology consists of three core components: carbon capture, carbon transport and carbon storage. The main equipment used in the carbon capture process includes absorption towers, adsorption units and membrane separation systems. The absorption tower absorbs CO_2 in the flue gas by chemical or physical means. The adsorption device uses a solid adsorbent to capture CO_2. The membrane separation system separates CO_2 through a semi-permeable membrane. The choice of these devices depends on the composition and volume of the trapped gas, as well as the desired trapping efficiency. Carbon transport is usually done by pipeline or tank truck. For large-scale CCS projects, it is common to build dedicated CO_2 transport pipelines, which must have high safety features and good sealing to prevent CO_2 leakage. Carbon storage primarily involves geological

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storage facilities, including injection wells and monitoring systems. Injection wells are used to inject supercritical CO_2 into underground storage. The monitoring system is used to monitor the behavior of CO_2 and the safety of storage in real time.

3.3. Device application challenges

Desulfurization and denitrification equipment and carbon capture and storage technology have become the key technologies to achieve this goal. However, the implementation of these technologies is not without obstacles, and they face many problems and challenges in practical application. Due to the increasing demand of natural gas in our country, the requirements of natural gas desulfurization technology are also increasing, which puts forward new challenges to the purification of natural gas. The main challenge of natural gas desulfurization technology is the increasing complexity of raw gas temperament [7]. In addition, there is often no engineering application of localized equipment and there are some problems in quality, performance, delivery schedule, after-sales service, etc., to varying degrees, the enthusiasm of enterprises to use localized equipment, coupled with some desulfurization projects in the bidding work, require the purchase of a certain proportion of foreign equipment, which aggravates the difficulty of localization implementation [8].

Due to the high initial investment and operation and maintenance costs of desulfurization and denitrification equipment, this is a big burden for many enterprises, and the construction, operation and maintenance of CCS technology facilities are expensive, and energy consumption is large. Technical adaptability and stability: Environmental regulations vary greatly from region to region, and technology needs to adapt to diverse environmental requirements. At the same time, the stability and durability of the equipment are also limiting factors for the promotion of technology. Although CCS technology has been used commercially, it still faces the problem of technological immaturity in a wide range of industrial fields. The issue of by-product treatment and utilization, for example, the effective use or disposal of gypsum produced by wet limestone-gypsum desulfurization, remains problematic. In addition, in terms of public acceptance, CCS technology projects may face opposition based on local community concerns, such as environmental impact and safety concerns about storage sites.

4. Recommendations for enterprises on energy emission equipment

In order to further achieve environmental protection and resources, we should increase the intensity of research in this area, and strive to develop new processes and new technologies [7]. For desulfurization and denitrification technology, the enterprise can choose the appropriate technology and equipment, according to the specific emission characteristics and financial status of the enterprise. To choose the appropriate desulfurization and denitrification technology, in addition to the by-products generated by the equipment, you can explore the economic utilization of the way, such as gypsum applied to the building materials industry. It can also pay attention to the specific laws and regulations of the country, and use tax incentives, subsidies and other policies to reduce investment and operating costs. For carbon capture and storage technologies, companies should conduct a preliminary feasibility assessment to assess their annual CO_2 emissions, capture difficulty and cost-effectiveness. Comprehensive consideration of equipment selection and utilization. Strengthen technology research and development and personnel training: invest in technology research and development to train professionals in related fields. Develop equipment that is more environmentally friendly, energy efficient and has fewer by-products. In addition, enterprises should strengthen communication with the government and all sectors of society: to ensure that the project has policy support and public recognition.

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Desulfurization and denitrification equipment and carbon capture and storage technology play an important role in helping companies meet environmental goals, but their application comes with high costs and technical challenges. Enterprises should reasonably select and optimize these technologies according to their own conditions, and actively seek government support and participation in R&D and innovation to achieve the dual benefits of economy and environmental protection. Enterprises should actively respond to the call of the national green development and sustainable development strategy to promote their own green transformation and sustainable development. Reduce dependence on fossil energy and reduce carbon emission intensity by developing new industries such as clean energy and renewable energy. At the same time, they should strengthen cooperation and exchanges with the international community to jointly address the challenge of global climate change.

5. Conclusion

In the context of globalization, climate change and environmental protection have become important issues that cannot be ignored. This paper discusses in depth the environmental protection equipment used by fossil energy enterprises and the methods and suggestions to reduce pollutants, especially the flue gas desulfurization and denitrification equipment and carbon capture and storage technology (CCS). After a comprehensive literature review and data analysis, this paper finds that although these equipment has a certain advanced nature and environmental protection. However, there are still problems in terms of quality, performance and wide application. The existence of these problems undoubtedly increases the pressure on environmental protection, but also restricts the sustainable development of the energy industry. By strengthening technological innovation and R&D investment, optimizing production processes and processes, strengthening environmental management and monitoring, and promoting green transformation and sustainable development, enterprises can effectively improve the environmental performance and economy of emission equipment and reduce the emission intensity of pollutants to lay a solid foundation for achieving the goal of carbon peak neutrality.

In short, the development and application of environmental protection equipment is an effective way to solve the problem of fossil energy environmental pollution. Only by continuously improving technology, improving data quality, optimizing maintenance strategies, and promoting cross-functional cooperation can we better meet the operational needs of future petrochemical equipment management and achieve sustainable production and development [9]. Although the emission equipment of China's fossil energy enterprises has made certain progress, it still faces many challenges. We need to learn from international advanced experience with an open mind, and at the same time, we must dig deep and make use of our own cultural heritage to find a green transformation path that suits China's national conditions. Only in this way can we demonstrate China's responsibility in the challenge of global climate change, and make greater contributions to the cause of global environmental protection. To protect the environment without sacrificing economic development and achieve sustainable development goals.

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