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Study on the Construction of Green Barriers and Synergy Mechanism of Carbon Neutrality Target in China-Mongolia Coal Trade

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Abstract – This paper reviews the research on green barriers, coal trade and carbon neutrality goals at home and abroad, focusing on the analysis of the synergy mechanism between the construction of green barriers and carbon neutrality goals in China-Mongolia coal trade. The study found that green barriers force enterprises to carry out technological innovation and promote the green transformation of the industry by raising environmental standards and technical requirements, while also promoting international cooperation and technology sharing. This paper further explores the current situation and challenges of China-Mongolia coal trade, and puts forward countermeasures and suggestions through technological innovation, financial support, policy and regulatory improvement, and public publicity, aiming to achieve the green transformation of coal trade and the early realization of carbon neutrality goals.

Keywords: China-Mongolia Coal Trade; Green Barriers; Carbon Neutrality; Mechanism Research

Research Background and Literature Review

1 Research Background

In today's global energy landscape, coal, as a traditional energy source, not only supports the industrial development of many countries, but also has a profound impact on global environmental changes. As an important part of the economic cooperation between the two countries, the coal trade between China and Mongolia carries special significance and challenges. Mongolia has rich coal resources and is one of the world's important coal exporters; China, as the world's largest coal consumer, has a strong demand for Mongolian coal. This supply and demand relationship has promoted Mongolia's economic growth and ensured China's energy security. However, with the increasingly severe global climate change, countries have put forward the "dual carbon" goal in their common pursuit of sustainable development, that is, carbon dioxide emissions strive to peak by 2030 and achieve carbon neutrality by 2060. This goal is reshaping the global energy structure and has put forward new requirements for China-Mongolia coal trade.

2 Literature Review

China has made important progress in its research on achieving its carbon neutrality goals. First, research on high-quality trade economic development and carbon neutrality points out that in order to achieve carbon peak and carbon neutrality goals, China must focus on carbon reduction strategies in the optimization and upgrading of its foreign trade structure, thereby effectively alleviating the impact of trade barriers brought about by the anti-globalization trend [1] . Second, research on the carbon neutrality path of the coal power industry has developed a coal-fired power production portfolio assessment tool to assess the trade-offs between energy, water resource consumption and carbon emissions in China's coal power industry under the carbon neutrality goal [2] . In addition, research on the relationship between foreign investment, trade and innovation shows that foreign direct investment (FDI), technological innovation (TI) and trade play an important role in achieving China's carbon neutrality goals, and recommends promoting green practices and environmental protection policies at the national level [3] .

In terms of the low-carbon transformation of the coal industry chain, the current situation and policy options of China's coal industry chain were studied and analyzed, and policy recommendations for realizing the low-carbon transformation of the coal industry chain were put forward [4] . Evaluation research on carbon trading policies shows that China's carbon emissions trading system has significant effects in promoting energy conservation and emission reduction, and is an effective policy tool to promote carbon neutrality [5] . In addition, there are studies using the environmentally extended multi-regional input-output model to analyze the impact of indirect CO2 emissions in China's coal production process and put forward relevant policy recommendations [6] .

Public perceptions of carbon neutrality are also an important area of research. Through cluster analysis of Weibo posts, the study found that most Weibo users have a positive attitude towards carbon neutrality [7] . Another study analyzed the dynamic relationship between international trade, technological progress and carbon emissions, and put forward suggestions for overcoming carbon trade barriers [8] . Research on carbon emissions trading policy and the green transformation of the manufacturing industry shows that carbon emissions trading policy has significantly promoted the green total factor productivity of China's manufacturing industry and improved the technical level and cleanliness of the energy structure [9] . Finally, the study on the role of green finance in the carbon neutrality goal analyzes the role of green finance in promoting China's low-carbon power transformation and puts forward relevant suggestions [10] .

International research has also made significant progress on green barriers, coal trade and carbon neutrality targets. First, research on green carbon science explores the production and utilization of coal, methane, CO2, biomass and waste plastics, and proposes future development prospects [11] . Secondly, the study on carbon tariffs and WTO environmental protection exceptions explores the legal framework of carbon tariffs as invisible "green" barriers, and recommends that countries respond to carbon tariffs in developed countries through multilateral trade rules [12] .

The role of green technology innovation and renewable energy in Turkey's goal of achieving carbon neutrality has also been verified. Research shows that green technology innovation and renewable energy can significantly reduce carbon emissions [13] . In addition, the role of trade in environmentally friendly products on environmental sustainability was analyzed by constructing a green openness index, confirming its positive role [14] . Regarding green development in the context of carbon neutrality, the study explored the relationship between economic development and green and low-carbon behavior under the carbon neutrality scenario, and proposed a theoretical framework for promoting endogenous

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economic growth through green behavior [15] . Regarding the carbon neutrality goal of G7 countries, the study evaluated the role of environmental policy, green innovation and comprehensive risk index in achieving the carbon neutrality goal, and recommended strengthening environmental policy and green technology research and development [16] . Finally, the study on decarbonization of the EU power industry analyzed the impact of tightening the EU emissions trading system targets under the European Green Deal on the decarbonization of the power industry, showing that tightening targets can significantly accelerate the transformation of the power industry [17] .

Although important progress has been made in the research on green barriers, coal trade and carbon neutrality goals, there are still some shortcomings. First, most studies focus on the static analysis of green barriers and lack long-term follow-up research on their dynamic impact. Second, existing studies focus more on the coal use stage and lack a comprehensive analysis of the entire life cycle of coal. Finally, the implementation effects of carbon neutrality policies vary greatly in different regions, and existing studies have failed to fully reveal the reasons and solutions for these differences.

Analysis of the Current Situation of China-Mongolia Coal Trade

The latest data from the Mongolian National Statistics Office revealed that in December 2022, Mongolia's coal exports reached 7.2566 million tons, a surge of 56.7% compared with the same period last year, despite a slight month-on-month decline of 8.8%. In 2013, Mongolia's total coal exports set a new record, reaching a total of 69.6085 million tons, a surge of 37.7869 million tons compared with 2022, achieving a significant annual growth of 118.8%, demonstrating Mongolia's strength in the field of coal exports Momentum and significant expansion[1] . As Mongolia's most important trading partner, China's coal imports from Mongolia account for more than 80% of Mongolia's total coal exports[2] .

Transformation of China-Mongolia Coal Trade under the Goal of Carbon Neutrality

1 The strategic significance of the carbon neutrality goal

China's carbon neutrality goal is not only of environmental significance, but also of far-reaching economic and social strategic significance. First, promoting the development and application of green and low-carbon technologies will promote the rapid development of new energy, energy conservation and environmental protection industries, and provide new impetus for economic transformation and upgrading. According to data from the National Bureau of Statistics, China's renewable energy power generation accounted for 29.5% in 2020, indicating great potential for green transformation. Secondly, achieving the carbon neutrality goal will help improve environmental quality, improve the quality of life of the people, and meet the long-term goal of sustainable development.

For Mongolia, as a resource-based economy, the strategic significance of its carbon neutrality cannot be ignored. Mongolia relies on the export of mineral resources, especially coal, which makes its economy highly dependent on the fluctuations of the global energy market. By promoting the carbon neutrality strategy, it can not only reduce dependence on fossil energy, but also promote economic diversification and reduce the risk of external

[1] Data source: https://en.nso.mn/home
[2] Data source: https://www.voanews.com/a/mongolia-looks-to-sell-more-coal-to-china-as-world-shuns-polluting-fuel-/6829908.html

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shocks. In addition, Mongolia has abundant solar and wind energy resources. The development of new energy will help optimize its energy structure and provide new opportunities for international investment.

Achieving carbon neutrality is not only necessary to combat climate change, but also a strategic choice to promote sustainable economic and social development. In the process of promoting carbon neutrality, China and Mongolia can not only enhance their own international image and competitiveness, but also contribute to global climate governance and achieve harmonious development of economy, environment and society.

2 Impact of the carbon neutrality goal on China-Mongolia coal trade

Globally, the proposal and implementation of carbon neutrality goals are profoundly reshaping energy production and consumption patterns, and have a significant impact on the traditional coal trade pattern. As the world's largest coal consumer, China is also the main destination for Mongolia's coal exports. Coal trade activities between the two countries are facing unprecedented transformation pressure under the vision of carbon neutrality.

In the short term, the carbon neutrality goal has prompted China to accelerate the adjustment of its energy structure and reduce its reliance on high-carbon energy. According to data from the National Bureau of Statistics of China, the proportion of non-fossil energy in primary energy consumption in China has increased year by year since 2020, and is expected to reach about 20% by 2025. This trend directly reduces China’s demand for coal imports and has an immediate negative impact on Mongolia’s coal exports. Mongolia's coal industry, which has long relied on the Chinese market, must now face the reality of shrinking demand, which may lead to a decline in coal exports and revenue in the short term.

From a long-term perspective, the impact of the carbon neutrality goal is even more profound. China is vigorously promoting the research, development and application of green and low-carbon technologies, including the development of clean energy and the clean utilization of traditional energy technologies. This not only means that China will gradually phase out or transform inefficient and highly polluting coal-fired facilities, but will also promote the popularization of renewable energy, such as wind energy, solar energy and hydro energy. According to the International Energy Agency's forecast, by 2030, China's renewable energy power generation will exceed coal power generation and become the dominant energy source. This structural change will significantly reduce China’s long-term demand for Mongolian coal, forcing Mongolia to reassess the future of its coal industry and explore the path to economic diversification and green transformation.

For Mongolia, the challenge of carbon neutrality is also accompanied by opportunities. The Mongolian government can take this opportunity to promote the modernization of the coal industry and improve the clean utilization efficiency of coal, while increasing investment in non-fossil energy, such as developing wind and solar energy projects, to attract cooperation from China and other countries in the field of green energy. In addition, Mongolia can also take advantage of its rich mineral resources and geographical location to develop green mining and logistics industries, paving the way for future economic transformation.

The impact of the carbon neutrality goal on China-Mongolia coal trade is complex and far-reaching. It not only changes the supply and demand dynamics of coal, but also prompts the two countries to conduct profound reflection and adjustments in their energy structure and economic development model. In the face of this challenge, China and Mongolia need to jointly explore a new path for low-carbon, green and sustainable coal trade through technological innovation, policy guidance and international cooperation.

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3 Green transformation path of coal trade

The green transformation of China-Mongolia coal trade is a complex and challenging process, which is related to the adjustment of the energy structure of the two countries and the future development direction. First of all, improving the level of clean and efficient use of coal is an important step in achieving green transformation. This includes the adoption of advanced coal cleaning technologies, such as clean coal technology, coal gasification and liquefaction technology, and technologies to improve coal combustion efficiency. For example, China has implemented supercritical and ultra-supercritical technologies in some coal-fired power plants, which has greatly reduced coal consumption and pollution emissions. The promotion and application of this technology can serve as a typical case of the green transformation of China-Mongolia coal trade.

Secondly, the development of renewable energy is another key path to achieve the green transformation of coal trade. Mongolia has abundant solar and wind energy resources, while China has strong R&D and manufacturing capabilities in solar and wind energy technologies. The two countries can carry out deeper cooperation on renewable energy projects, such as jointly building wind farms and solar power stations, to promote the optimization and upgrading of energy structure. In addition, China can support the development of renewable energy in Mongolia in terms of technology and funds, and promote the diversification and greening of energy trade between the two sides.

However, there will be a series of challenges in the green transformation process. One of them is the dual barriers of technology and capital. Efficient and clean coal technology is usually expensive, while the initial investment and maintenance costs of renewable energy are also high. Solving this problem requires intergovernmental policy support and financial subsidies, as well as the introduction of international capital. For example, by setting up a green development fund specifically to support green transformation projects in China-Mongolia coal trade.

In addition, policy and regulatory uncertainty is also a major obstacle. Inconsistencies in energy policies and environmental standards between the two countries may affect the implementation of green transformation projects. Therefore, establishing a bilateral energy cooperation mechanism to coordinate the policies and actions of both sides is key to ensuring the smooth implementation of green transformation. Such a mechanism could include regular policy dialogues, joint research projects, and technical exchanges.

The green transformation of China-Mongolia coal trade is a systematic project that requires the efforts of technological innovation, capital investment, policy support and international cooperation. By overcoming these challenges, it will not only promote the optimization of the energy structure of the two countries, but also provide an important demonstration for the response to global climate change.

The Construction of Green Barriers and the Synergistic Mechanism of Carbon Neutrality Goals

1 Principles and Strategies for Building Green Barriers

Building green barriers in the Sino-Mongolian coal trade is an important strategy aimed at protecting the environment and promoting sustainable development. The construction of such barriers should follow several basic principles: first, scientificity, that is, all measures must be

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based on scientific research and technical evidence to ensure that their environmental protection effects are feasible; second, rationality, which means that the measures should be fair and reasonable, not only in line with environmental protection requirements, but also taking into account the actual needs of economic and social development; finally, operability, emphasizing the feasibility of the implementation of policies and measures, ensuring that they can be effectively implemented in the existing technology and management system.

First, we can start with technical standards. Establish strict coal quality and emission standards, such as limits on sulfur and ash content, as well as sulfur dioxide and particulate matter emission standards during combustion. For example, the EU has set extremely strict environmental standards for coal imports and use, which has prompted suppliers to improve coal quality and reduce environmental pollution.

Secondly, the formulation and implementation of environmental protection laws and regulations are the key to building green barriers. China and Mongolia can jointly discuss and implement a series of cross-border environmental protection laws and regulations, such as the control of dust and noise during coal transportation and the requirements for ecological restoration in mining areas. By formulating legally binding environmental protection laws and regulations, it can be ensured that environmental protection measures in the coal trade process are effectively implemented.

Furthermore, the establishment of market access conditions is also an effective strategy for building green barriers. An environmental standard certification system can be introduced, and only companies and products that meet specific environmental standards can enter the other party's market. This can not only improve the overall environmental standards of the coal industry, but also promote the development and application of environmental protection technologies. For example, the United States has promoted the environmental protection of goods on the market through certification and labeling systems, effectively guiding the environmental protection behavior of consumers and producers.

Through the construction of scientific, reasonable and operational green barriers, China-Mongolia coal trade can achieve a greener and more sustainable development path. This will not only help improve the environment of the two countries, but also help build a fair and reasonable international trade environment. Through strict technical standards, comprehensive environmental protection regulations and effective market access mechanisms, it can ensure that coal trade will not only promote economic development, but also take into account environmental protection and social responsibility.

2 Synergistic Path between Green Barriers and Carbon Neutrality Goals

Green barriers, i.e. trade barriers set up in the name of environmental protection, have attracted widespread attention around the world in recent years, especially in the China-Mongolia coal trade, where they have played an important role in promoting the goal of carbon neutrality. Green barriers can not only restrict the entry of high-pollution, high-carbon emission products into the market, but also encourage companies to adopt cleaner production technologies and energy, thus forming a positive driving force for environmental protection in international trade. In order to achieve the "dual carbon" goal, China has begun to implement a series of strict environmental protection standards and carbon emission restrictions. These measures constitute green barriers to a certain extent, prompting Mongolian coal companies to adopt more environmentally friendly technologies and methods in the process of mining, transportation and processing to reduce carbon footprint.

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This synergistic mechanism of green barriers and carbon neutrality policies, on the one hand, forces companies to innovate their technology by raising environmental standards. In order to continue to maintain coal exports to China, Mongolian coal companies are forced to upgrade coal mining and washing technologies to reduce the sulfur and ash content of coal products, while exploring ways to cleanly utilize coal, such as developing coalbed methane resources and promoting coal liquefaction technology. On the other hand, it also promotes cross-border cooperation, especially in the fields of clean energy technology sharing and carbon capture, utilization and storage (CCUS). For example, some Chinese companies have begun to cooperate with Mongolian coal companies to jointly develop and apply clean coal utilization technologies, such as coalbed methane extraction, coal liquefaction and gasification technologies, and coal-fired power generation technologies to improve energy efficiency. The application of these technologies will help reduce the overall carbon emissions of the coal industry.

In addition, the introduction of green financial instruments has also provided financial support for the green transformation of China-Mongolia coal trade. China has provided Mongolian coal companies with financing channels through green bonds and green funds, which are specifically used to invest in environmental protection projects and low-carbon technology transformation. This not only helps coal companies cope with the challenges brought by green barriers, but also accelerates the pace of the two countries towards the goal of carbon neutrality.

The synergy between green barriers and carbon neutrality policies is vividly reflected in the Sino-Mongolian coal trade. Although green barriers may increase the cost pressure of coal enterprises in the short term, in the long run, they can force enterprises to innovate and promote the transformation and upgrading of the industry, thus helping to achieve the carbon neutrality goal. By improving the quality of coal products and promoting the development of clean coal technology, the Sino-Mongolian coal trade, driven by green barriers, not only reduces the impact on the environment, but also lays the foundation for the low-carbon economic transformation of the two countries. It not only promotes the green transformation of the coal industry, but also promotes technological innovation and international cooperation, and contributes to the realization of the global carbon neutrality goal. However, this process also faces many challenges, including high technical costs, large funding gaps, and uneven policy implementation. It requires governments, enterprises and all sectors of society to work together to continuously optimize the design and implementation strategies of green barriers to ensure that they can effectively promote emission reductions without causing unnecessary obstacles to international trade.

Challenges and countermeasures

1 Challenges

In the process of building green barriers to China-Mongolia coal trade, both domestic and foreign countries face a series of challenges. First, from a domestic perspective, as a coal exporter, Mongolia's coal industry may be directly affected by green barriers, resulting in rising production costs and declining market competitiveness. At the same time, Mongolia is relatively backward in environmental protection technology and regulations, and it is difficult to meet the high standards of green barriers, which will put some pressure on Mongolia's coal exports. In addition, there may be differences in the domestic understanding and acceptance

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of green barriers, and some companies and stakeholders may oppose it due to short-term losses.

From an international perspective, the construction of green barriers to China-Mongolia coal trade also needs to consider the reaction and rules of the international market. The global coal market is complex and changeable, and international environmental standards and regulations are constantly updated. This requires China and Mongolia to maintain a high degree of sensitivity and flexibility when building green barriers to cope with changes in the international market. At the same time, China and Mongolia also need to face competition and challenges from other coal exporting countries. How to ensure the effectiveness of green barriers while avoiding trade disputes and frictions is also a major problem.

In the process of achieving the carbon neutrality goal, obstacles such as technology, funding and policies should not be ignored. In terms of technology, key technologies such as clean utilization of coal and carbon capture and storage are not yet mature, and require a lot of research and development funds and human and material resources. In terms of funding, achieving carbon neutrality requires a lot of capital investment, including technology research and development, equipment updates, infrastructure construction, etc., which places high demands on the financial strength of China and Mongolia. In terms of policy, the two countries may have differences and disagreements in the formulation and implementation of carbon neutrality policies, and need to strengthen communication and coordination to form a joint force. In addition, the process of policy implementation may also encounter problems such as inadequate supervision and inadequate implementation, and it is necessary to establish a sound supervision mechanism and accountability system.

2 Countermeasures and Suggestions

In response to the complex challenges in building green barriers to China-Mongolia coal trade and achieving carbon neutrality goals, we need to adopt multi-dimensional and in-depth countermeasures and suggestions.

At the technical level, the two sides should deepen cooperation and focus on the research and development and application of clean coal utilization technology, such as breakthroughs in carbon capture, utilization and storage (CCUS) technology, to reduce carbon emissions during coal use. Through technological innovation, not only can production costs be reduced, but the market competitiveness of coal products can also be improved, providing solid technical support for the construction of green barriers.

In terms of funding, the government should play a leading role and encourage enterprises to increase their investment in environmental protection through various means such as setting up special funds, providing low-interest loans, tax incentives, etc. At the same time, it should encourage social capital to enter the field of green energy and environmental protection technology, form a diversified investment and financing system, and provide sufficient financial guarantee for the realization of carbon neutrality goals.

In terms of policies and regulations, the two countries need to further improve their environmental laws and regulations and standards systems, clarify the specific requirements and implementation paths of green barriers, strengthen supervision, ensure the effective implementation of laws and regulations, and impose severe penalties on violations. At the same time, strengthen international policy coordination and docking, learn from international advanced experience, and promote international cooperation and exchanges on carbon neutrality policies.

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In addition, public publicity and education are also an important part that cannot be ignored. Through various channels such as media and education, we can increase the awareness and support of all sectors of society for green barriers and carbon neutrality goals, and create a good atmosphere for the participation of the whole society. This can not only enhance the public's environmental awareness, but also provide stronger social supervision and support for enterprises and governments.

Through comprehensive measures in technology, funding, policies and public publicity, we can effectively respond to the challenges in building green barriers to China-Mongolia coal trade and achieving carbon neutrality goals, and promote the green transformation of coal trade and the early realization of carbon neutrality goals.

Conclusion

In the global context of achieving the goal of carbon neutrality, the green transformation of China-Mongolia coal trade is imminent. By building green barriers and implementing strict environmental protection standards and carbon emission restrictions, China-Mongolia coal trade can be effectively promoted to develop in a green and low-carbon direction. This article reviews relevant research on green barriers, coal trade and carbon neutrality goals at home and abroad, and finds that most of the research focuses on static analysis, lacks long-term follow-up research on its dynamic impact, and has little comprehensive analysis of the entire life cycle of coal. In addition, existing research has failed to fully reveal the differences in the implementation effects of carbon neutrality policies in different regions and their causes.

In this context, this paper proposes a green transformation path for China-Mongolia coal trade, including improving the level of clean and efficient use of coal, developing renewable energy, and overcoming technical and financial barriers. Specifically, by adopting advanced clean coal technology and strengthening cooperation between China and Mongolia on renewable energy projects, the optimization and upgrading of the energy structure can be achieved. In addition, the introduction of green financial instruments, such as green bonds and green funds, can provide financial support for green transformation projects. Establish a bilateral energy cooperation mechanism to coordinate policies and actions to ensure the smooth progress of the green transformation.

In terms of the collaborative path of building green barriers and achieving carbon neutrality goals, this paper finds through the analysis of China-Mongolia coal trade that improving the quality standards of imported coal and promoting clean coal utilization technology can not only reduce environmental pollution, but also promote technological innovation and transformation and upgrading of the coal industry. However, the construction of green barriers and the realization of carbon neutrality goals still face many challenges, such as high technical costs, large funding gaps, and poor policy implementation.

In response to these challenges, this paper proposes comprehensive countermeasures such as technological innovation, financial support, policy improvement and public education. Through efforts in technology, funding, policy and public publicity, the green transformation of China-Mongolia coal trade can be effectively promoted and the carbon neutrality goal can be achieved. The research in this paper provides a theoretical basis and practical guidance for the green transformation of China-Mongolia coal trade and the realization of the carbon neutrality goal, which has important practical significance and application value.

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