A summary of carbon emission trading economy in energy field

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Abstract. To implement China's action goals of achieving carbon peak by 2030 and carbon neutrality by 2060, The Opinions of the Central Committee of the Communist Party of China and the State Council on Completely, Accurately, and Comprehensively Implementing the New Development Concept and Doing a Good Job in Carbon Peaking and Carbon Neutrality, as well as 《the State Council's Action Plan for Carbon Peaking before 2030》, clearly state that "we must accelerate the construction of a clean, low-carbon, safe, and efficient energy system. Energy enterprises must firmly establish a clear direction for green and low-carbon development, and strive to become the" leader "in energy efficiency while maintaining national energy securities. With the official launch and steady development of China's carbon emission trading market, it is of significant milestone significance for achieving China's "dual carbon" strategic goals. In the context of tackling global climate change, as the carbon emission in the energy sector account for more than 70% of China's total carbon emission, it is an effective system to control greenhouse gas emission through the carbon emission trading system. Carbon emission trading is the only way to lead the development of Low-carbon economy in the energy sector using market mechanisms. The carbon emission trading economy is a major institutional innovation and a complex system engineering involving multiple disciplines and fields. With the continuous improvement of the construction of the national carbon emission trading market, this review discusses the background, development status, operating mechanism, problems and challenges, future prospects and other aspects of carbon emission trading in the energy field, analyzes the carbon emission trading market, which will enrich the research content of the economy of carbon emission trading, and provide some reference for the strategic planning of the carbon emission trading market.

Keywords: Carbon emission trading, transaction, economy, energy

1 Introduction

The global response to climate change caused by carbon emission has seriously affected the living environment of humans and is urgent [1]. The energy sector accounts for over

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70% of China's total carbon emission [2]. The eight major industries with carbon emission are: power generation, petrochemicals, chemicals, building materials, steel, nonferrous metals, papermaking, and domestic civil aviation. Eight key industries are included in the scope of carbon emission trading firstly [3]. As we all know, in 2021, China's first batch of key emission units in the power generation industry participating in the national carbon emission trading exceeded 2162, and the carbon emission of these enterprises exceeded 4 billion tons of carbon dioxide, which means that China's carbon emission trading market will become the carbon market with the largest greenhouse gas emission in the world [4]. The carbon emission trading adopts the "total amount control and emission trading" mechanism, which refers to the determination of the total amount of carbon emission quota within a certain time limit in a certain area, and the allocation of the total amount to individuals or organizations, so that they can legally own carbon emission rights, and allow such rights to be traded directly in the trading market participants like commodities [5]. This trading method can ensure that the actual carbon emission do not exceed the limited total emission, or offset them with other supplementary trading targets, in order to achieve the carbon emission control goals in the most cost-effective market mechanism. Carbon emission trading quota is a kind of virtual transaction. Its basic elements include: transaction object, organizational boundary, time scale, total amount target, organizational quota, transaction, accounting, quota payment and performance, and the support system established around the above elements [6]. The essence of carbon emission trading is to allow enterprises with low emission reduction costs to reduce emission more, and then sell the saved carbon emission quota at a relatively high price for profit; At the same time, enterprises with high emission reduction costs are allowed to reduce emissions and purchase carbon emission quotas at relatively low prices, thereby reducing the emission reduction costs for each enterprise to achieve its goals. From a macro perspective, carbon emission trading is equivalent to reducing the cost of achieving the overall emission control goal while achieving the overall social emission control goal, that is， under the existing institutional mechanisms, achieving greater overall development benefits in the summation of the established overall emission control goal, and thus generating a carbon economy.

2 Status and mechanisms

2.1 Basic situation

Green economy refers to economic activities that support environmental improvement, respond to climate change, and save and efficiently utilize resources. It refers to financial and economic services provided for project investment and financing, project operation, risk management, etc. in the fields of environmental protection, energy conservation, clean energy, green transportation, green buildings, etc., collectively known as green economy. According to Coase theorem, carbon emission trading is based on the basic principles of property rights economics [7]. The specific trading method is for government departments to determine the total amount of emission and allocate carbon emission rights to various emission control enterprises within the total amount range. Each enterprise can decide whether to transfer or enter the market for trading based on

their actual situation, in order to achieve the goal of controlling carbon emission and achieving economic benefits. The market types of carbon emission rights trading are divided into primary market and secondary market. The primary market is the market system for initial allocation of carbon emission rights, and the government completely monopolizes the right to use carbon emission rights. The seller using the primary market is only the government. The secondary market is a market system in which holders of carbon emission rights carry out spot trading. The core of the Carbon emission trading market is the "internalization of Externality", that is, it "puts on the table" hidden emission reduction costs such as enterprise technological transformation, green finance, and social consumption, which are expressed in carbon prices.

2.2 Legal basis

In 2020, the Ministry of Ecology and Environment issued the "Carbon Emission Trading Management Measures (Trial)". In terms of access standards, quota allocation, emission trading, emission verification and quota settlement, the access standards are to cover units in the industry whose annual greenhouse gas emission exceed 26,000 tons of carbon dioxide equivalent, and units included in the national carbon emission trading market will no longer participate in the local market; The quota should be mainly distributed free of charge, and paid allocation should be introduced in due course. It may adopt transfer by agreement, one-way bidding or other market trading methods that meet the provisions; Key emitters may use nationally certified Voluntary emission reductions (CCER) to offset up to 5% of their carbon emission allowances.

2.3 Market size

On July 16, 2021, the national carbon emission trading market officially opened, becoming the world's largest carbon emission trading market covering greenhouse gas emission. On the first day of trading, the trading volume of the national carbon emission trading market was 4.104 million tons, with a turnover of 210.23 million yuan and an average transaction price of 51.23 yuan/ton. According to public data, from January 4, 2022 to December 30, 2022, the national carbon market operated for a total of 50 weeks and 242 trading days, with daily transactions per trading day, with an annual turnover of 50.8895 million tons of carbon emission allowances, an annual turnover of 2.814 billion yuan, and an average transaction price of 45.61 yuan/ton. Among them, the transaction volume from November to December 2022 exceeded 33 million tons, accounting for more than 60% of the total annual transaction volume. From an economic point of view, the trading volume of the general derivatives market will far exceed that of the Spot market, which is expected to reach 7 to 10 times of the latter. At present, experts predict that China will emit 11 billion tons of carbon dioxide a year when the "carbon peak" is reached. Due to the industrial structure, 30% to 40% of this will not be reduced, which is 3 billion to 4 billion tons per year. If the price of 40 to 60 yuan per ton is calculated, the annual market trading volume will reach 120 billion to 240 billion yuan, then the trading volume of Carbon emission trading derivatives market will reach

one trillion RMB yuan level, and this is only the volume of the primary and secondary markets.

3 Issues and challenges

Starting from the energy field, carbon emission trading has gradually expanded to eight industries, and then to the whole industry and society. Carbon emission trading has brought about carbon economy, but also forced industrial upgrading and technological progress in the energy industry. At this point, there are two options to choose from, whether to adopt a carbon tax route or a carbon emissions trading route, or to synchronize the two approaches like in Europe. There have been some controversies before, but in the end, China chose a more active and flexible development approach for carbon emissions trading, and designed an overall architecture for the future massive carbon market. At present, the most acute problem is that the cost of reducing carbon emissions for carbon emitters is too high, the technology for reducing carbon emissions is not mature, and there are too few available technologies, most of which are still in the demonstration project stage and cannot meet the requirements of commercial application temporarily. The main consciousness of carbon emission control is insufficient. The current challenge is how to establish a nationwide carbon trading system, how to make ordinary carbon traders profitable in the carbon market, how to expand the market trading volume and make the trading mechanism more flexible. Capital is profit driven, the trading entity obtains a "green premium" through carbon emissions trading.

3.1 The coverage

Mainly so far, there are 31 carbon emission trading markets and 30 carbon tax mechanisms in the world, covering nearly 12 billion tons of carbon emission in 46 countries and 32 regions, accounting for about 22% of global greenhouse gas emission. From the development history of foreign carbon emission trading markets, most of them have experienced the development process from small to large, gradually expanding the emission control industry, lowering the market threshold, and increasing the list of enterprises. The coverage of carbon emission trading will gradually expand in China. In the future, it will gradually expand to every natural person, every enterprise, every legal entity, and every carbon emitter.

3.2 The quota

Free carbon emission quotas expected to gradually reduce. The proportion of free quota in China's carbon emission trading market will be gradually reduced, and the amount of free carbon emission quota will be gradually reduced. In the future, considering targets such as carbon peaking and carbon neutrality, it is expected that the proportion of free carbon emission quotas will gradually decrease and the amount of free carbon emission quotas will gradually decrease. Currently, China has only experienced two carbon quota periods., Taking the second compliance cycle as an example, the carbon

quota of the same carbon emitter is 90% of the first compliance cycle, reduced by 10%. This means that after cultivating the concept and habit of carbon emission trading, the carbon quota will gradually decrease over time.

3.3 The price

With the expansion of coverage and reduction of free quota, it is expected that the price of China's carbon emission trading will gradually rise. Taking the European Union as an example, the carbon price in the EU has steadily increased since 2017. In November 2017, the carbon price was only 7 euros/ton, but recently the carbon price has exceeded 110 euros/ton, with an increase of over 1500%, which is about 20 times the current market carbon price in China. Carbon price is an important tool to guide low-carbon transformation and development. Currently, China's carbon price is still relatively low. In the future, with the further expansion of market coverage, free carbon emission quotas will gradually be reduced, and it is expected that China's carbon price will gradually rise.

4 Suggestions and prospects

Transforming into a green and low-carbon development approach has become the preferred answer. Driven by the goal of carbon peaking and carbon neutrality, the coverage of the national carbon emission trading market will further expand to other industry emission entities in the future, the free carbon emission quota will be gradually tightened, and the carbon emission costs of industries such as high energy capacity will increase significantly. The extensive growth model relying on the expansion of low-end industries will be difficult to sustain, which will help promote the transformation of the economic and industrial structure to low-carbon development. After the carbon emission trading market internalizes the cost of carbon emission, it will also enhance the willingness of enterprises and other emission subjects to save energy and reduce emission. The energy-saving service industry will usher in an important opportunity period, and the demand for energy-saving transformation, carbon emission diagnosis and other services is expected to grow rapidly. The particularity of the energy industry, energy security is a prerequisite and guarantee for national security. Carbon economy will bring about a huge derivatives market.

5 Conclusions

(1) We should actively, steadily, and orderly promote the action of carbon neutrality and peak carbon emissions, convert from dual control of pollution emissions and energy consumption to dual control of carbon emissions, and build a beautiful China.

(2) After the maturity of China's carbon emissions trading market, a domestic carbon trading market with a certain volume will gradually connect with international markets

such as Europe and America, and carbon prices will also tend to synchronize, forming a unified global carbon market.

(3) Negative carbon technology will usher in huge market opportunities, such as the utilization of carbon, the conversion of carbon dioxide into carbon polymers and ultimately into artificial starch, the production of fuels such as methanol and methane from carbon dioxide, and the production of high value-added carbon materials such as carbon nanotubes from carbon dioxide. These will bring new industrial opportunities to the global carbon market, perhaps generating direct profits from carbon emissions trading while producing products.

(4) The concept of zero carbon will become the goal pursued by the manufacturing industry, and a large number of zero carbon factories, zero carbon parks, zero carbon power plants, and zero carbon industries will be common in the near future.

(5) Building a highly participatory market for carbon emissions for the entire society and the entire population is a common concept in the future society. China will solemnly fulfill its commitment to all humanity under the strong leadership of the government, and as a developing country, contribute its own efforts to global ecological environment protection.

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