Present status and development suggestions of carbon emission permit trading

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Abstract. As one of the effective measures for reducing the greenhouse gas emissions, the carbon emission permit trading has drawn more and more attentions from all countries worldwide and made significant development. The emergence and development of carbon emission permit trading is reviewed in this paper, and the conditions of international carbon emission permit trading are demonstrated. The present status of China's carbon emission permit trading is analysed, and the development suggestions regarding the construction of China's carbon emission permit trading market is provided.

1. Introduction

The global warming is not only the environmental problem, but also the economic, political, social and sustainable development issues of the human sustainable development. It is profoundly affecting the revolution of our life style and global industry, and becomes one of the important topics that cause international concern. The international society generally thinks that the establishment of carbon emission permit trading system is the significant method for suppressing the greenhouse gas emissions, promoting the energy conservation and emission reduction, and encouraging the technical innovation.

2. Emergence and development of carbon emission permit trading

As early as in 1977, the USA's Clean Air Act Amendments had already confirmed the quantity-based trading mechanism proposed in the Pollution, Property and Prices of J. H. Dales, in the legal form. As per the "Common but Differentiated Responsibilities" principle, the United Nations Framework Convention on Climate Change was adopted in June 1992 and officially entered into force in March 1994. It established the fundamental framework for the international society to jointly address the global climate change issues. The Kyoto Protocol was adopted in December 1997, and entered into force in February 2005. It specified the quantitative criteria upon the carbon emissions of developed countries during the period of 2008~2012, and required that the average carbon dioxide emissions of major industrial countries in the world should be 5.2 less than the emissions in 1990. During this period, the developing countries would not undertake the emissions reduction obligation [1].

The carbon emission permit refers to the permit that grants a country or an enterprise to emit the limited greenhouse gas within a given period [2]. The concept of carbon emission permit was firstly proposed by the Canadian Economist J. H. Dales in 1968. As the carbon emission permit occurs based on the market mechanism, namely, the carbon emissions will be controlled through the trading of carbon emission permit, the carbon emission permit trading must be dependent on a certain mechanism. The validity of Kyoto Protocol open the gate of carbon emission permit trading, which
established the following three trading mechanisms: Firstly, the "Emissions Trading" (ET) of emission allowance transaction, namely, partial developed countries are allowed to transfer their partial allowable emissions (emission allowances). Secondly, it is the clean development mechanism (CDM), namely, the investors of partial developed countries are allowed to obtain the "certified emission reductions" (CERs) from the emission reduction projects that are implemented in the developing countries and in favor of the sustainable development of developing countries, so as to offset the greenhouse gas emission reduction obligation of its own country. Thirdly, it is the joint implementation mechanism (JI), namely, partial developed countries are allowed to obtain the emission reduction credit from the emission reductions produced from the investment projects in other industrialized countries. In essence, it equals to the transfer of the same emission reduction allowances among the industrialized countries. Among the three trading mechanisms, the ET is the allowance-based carbon market, while the CDM and JI are the project-based carbon market. The interaction of ET and CDM will provide the price reference for the CDM project, promote the development of CDM project in the developing countries, and cover more emission reduction sectors through the JI project, so as to realize more emission reductions.

Since the Kyoto Protocol entered into effect in 2005, the global carbon market trading scale has been expanded for about 100 times. As predicted by the World Bank, the carbon emission permit trading volume would reach US$ 190 billion in 2012, which would exceed the oil futures, and become the world's largest market. At present, there are four major Carbon Emissions Exchanges in the world: European Union Emission Trading Scheme (EU ETS), Chicago Climate Exchange (CCX), UK Emissions Trading Group (ETG) and National Trust of Australia (NSW).

3. International carbon emission permit trading conditions

The EU is the most positive region where the emission reduction is promoted, and also the most active market of carbon emission permit trading. At the beginning of 2005, the EU officially started the EU ETS which adopted the cap-and-trade mechanism, namely, the EU and the governments of its Members set an upper limit of emissions, and a given amount of allowance, that is, European Union Allowances (EUA), would be assigned to every enterprise that was subject to such system. In addition, the emissions cap of all enterprises should also not exceed such upper limit. If it is possible for the enterprise to ensure that the actual emissions are less than the assigned emissions allowance, such enterprise may sell the remaining allowance on the emission market. Otherwise, such enterprise must purchase the emission permit on the market. At present, the EU ETS has already become the world's largest carbon emission permit trading market, which accounts for 84.4% of the global carbon market trading.

In order to undertake the emission reduction obligation, the USA actively behaves in the domestic carbon trading market and has the relatively perfect carbon emission trading system which falls into four types of trading systems, namely, Chicago Climate Exchange (CCX), Regional Greenhouse Gas Initiative (RGGI), Western Climate Initiative (WCI) and Climate Action Reserve (CAR). As the world's second-largest carbon sink trading market, Chicago Climate Exchange (CCX) is the significant component of greenhouse gas emission permit trading market. Meanwhile, it is also the world's sole market where the emission reduction trading for six types of greenhouse gases will be conducted, and the world's first and the North American sole pioneer organization and market trading platform that carry out the voluntary greenhouse gas emission reduction transaction and have the legal binding effect upon the emission reduction. The RGGI is a compulsory emission reduction system which only takes the emissions reduction in the power sector as the target. This system adopts the cap-and-trade system, which only involves 10 states in the Northeastern USA and Mid-Atlantic. Except for the cap and trade, this system also allows to obtain the carbon offsets in the project participation manner. Initially established in February 2007, the WCI was the regional trading system jointly established by the Arizona, California and other 5 states of Western USA. The established emission reduction target is that the greenhouse gas emissions will be reduced by 15% by 2020 compared with that in 2005, which intends to promote the formulation and implementation of climate change policy through the
linkage among states. The applicable sectors of this system include the industry, power, business, transportation and resident fuel use. Officially started in 2009, the CAR is a project-based carbon emission trading system. It formulates an exploitable, quantifiable and verifiable greenhouse gas emission reduction standard, and releases the project-based carbon emission allowance, which intends to establish a trading system that covers the whole Northern America. Its coverage scope only involves four major sectors, namely, agriculture, forestry, transportation and industry.

Initially established in March 2002, the UK ETS is the world's first extensive greenhouse gas emission permit trading system. This system adopts two patterns, namely, cap-and-trade system and credit trading system. The cap-and-trade system shall firstly determine an absolute emission reduction indicator and then assign the indicator to each enterprise, forming the emission allowance. The credit trading system refers to the additional emission reduction amount resulted from the relative emission reduction target proposed by the participants and other energy efficiency enhancement or emission reduction special scheme plan. This system totally includes 33 organizations, and the climate change agreements are signed with 6,000 enterprises. The UK ETS trading mechanism is very flexible, and there are many participants, while the emission reduction enthusiasm is very high. Therefore, the effect is very obvious.

The most representative pattern in the Australian carbon emission trading system is the New South Wales Greenhouse Gas Abatement Scheme (GGAS). In January 2003, the New South Wales GGAS was officially implemented, and the target enterprise at which this system was mainly aimed, also belonged to the power sector. The GGAS adopts the cap-and-trade mechanism. Firstly, it is required to determine the total emissions of the power plant as per the predefined product of statistic per capita emissions and population. Then it is required to assign them to the power sector as per a certain proportion, and finally determine the obtainable carbon emissions. The GGAS system has the local and compulsory features.

The formation of carbon emission permit trading market system, drives the development of carbon finance sector. The carbon emission permit gradually becomes a new value symbol that is active on the international financial market. During the period of 2005~2010, the carbon emission permit trading on the financial market accounted for a year-by-year increasing proportion in the world's total trading volume, namely, the proportion was increased from 74.55% in 2005 to 98.10% in 2010. Even if the CDM market is dominated by the primary market, the secondary market trading volume has still begun to greatly exceeded the primary market, since 2008. In 2010, the trading volume of the CDM's secondary market reached US$18.3 billion.

4. Present status of China's carbon emission permit trading

4.1. China's principle for constructing the carbon emission permit trading
The first principle is fair principle. The western scholars think that the air is the common resources of our human beings. Therefore, the global external and collective action theory is generally adopted to explain the international climate cooperation. With regard to the international carbon emission reduction allowance undertaking, the unfair issue exists between the developed countries and developing countries. We need to stress the reality of China's per capita emission level, and comprehensively balance the relationship between the fairness and efficiency. The second principle is sustainable development. As per the requirements of Bali Roadmap, and with regard to the responsibility and obligation, the difference exists between the developed countries and developing countries. Among them, the developing countries may carry out the concrete actions and project actions within the sustainable development field, while the developed countries are committed that the overall emission reduction target belongs to the compulsory obligation. Therefore, we must prevent the developed countries from exerting more emission reduction obligations to China. The third principle is "Common but Differentiated Responsibilities". At present, China's greenhouse gas emission cap is relatively huge, and it is also very hard to improve such situation within a very long period of time in the future. Therefore, the carbon dioxide emission intensity per unit of GDP is also
relatively high. Except for addressing the domestic issues related to the carbon emissions, the government shall undertake the corresponding international responsibility. Based on the "Common but Differentiated Responsibilities" principle, China, as a developing country, shall enjoy the immunity right of up-to-the-standard emission reduction [3].

4.2. The essence and development status of China's carbon emission permit

China's present so-called "carbon emission permit" is also called the CERs (Certified Emission Reductions) generated in the CDM project [4]. CDM refers to the clean development mechanism, which is a new international cooperation mechanism established under Article 12 of the Kyoto Protocol and is participated in by developing countries. This mechanism not only assists the Contracting Parties of developing countries to realize the sustainable development, but also assists the Contracting Parties of developed countries to realize the commitment of obeying the cap control and emission reduction. The core contents of CDM are as follows: the developed countries shall provide the cashes and advanced technical equipment, and jointly implement the emission reduction project that contributes to the mitigation of climate change, within the territory of developing countries. The acquired CERs will partially contribute to the commitment of obeying the cap control and emission reduction provided in the Kyoto Protocol. As shown by the research, China, as the largest developing country and carbon emitter, has already occupied the main status on the CDM development market and become the biggest beneficiary of CDM project, by virtue of the favorable investment and legal environment.

China has begun to implement the carbon emission permit trading pilots in seven provinces (cities), since 2013. The national carbon emission trading system has already been started at the end of 2017, and under the process of policy formulation and infrastructure construction. The main legal basis of the present national carbon emission trading system includes: the departmental rules Interim Measures for the Administration of Carbon Emission Permit Trading released by the National Development and Reform Commission at the end of 2014, and the Program for the Establishment of a National Carbon Emissions Trading Market (Power Generation Industry) released by the National Development and Reform Commission at the end of 2017. In addition, the carbon emission trading regulations are also actively formulated, such as the Ordinance on the Management of Carbon Emission Permit Trading released in 2016 [5].

4.3. Issues existing in the CDM project

Since the Kyoto Protocol came into effect on February 16th, 2005, a few issues regarding the operation of CDM have still existed hitherto. The implementation of CDM project mainly includes seven steps: project design and description, national approval, validation and registration, project financing, monitoring, verification/validation, and CER issuance.

(1) Whether the CDM is fair. As per the "Common but Differentiated Responsibilities" principle, the developed countries that have already completed the industrial revolution shall undertake more historical responsibility upon the global warming. Therefore, the Kyoto Protocol only formulates the emission reduction tasks to the developed countries, but such requirements are not made for developing countries, which undoubtedly enables the developing countries to become the biggest winner of this game. However, as time goes on, the carbon emissions of major developing countries, such as China, India and Brazil, have already exceeded one half of the world's total emissions. In the future, the developing countries must undertake more responsibilities.

(2) Whether the CDM takes effect of actual emission reduction. This issue seems ridiculous, but it really exists. As the CDM does not provide the emission reduction requirements upon the developing countries, some scholars think that this is a "zero-sum game". The German environmental policy expert Lambert Schneider thinks that the CDM does not actually guide the emission reduction, which only provides the transaction between the potentially avoided gas emissions of developing countries and the actual emission reduction of developed countries. In China, some scholars also confirm the CERs generated in the CDM project as the inventory, because the final purpose is to sell out the CERs.
It is thus clear that the developing countries will pay more attention to the economic benefits brought by the CDM, instead of the meaning behind it.

(3) Whether the social responsibility behind the CDM project is equal. The cost price for the application of CDM project, including the one-time paid fees, such as the project search, estimated emission reduction, prepared technical document, approval of host country, environmental evaluation and etc. In addition, it also includes the monitoring cost, verification and validation cost, adjusted income sharing (2% of the annual income of CERs), and the fees resulted from the management income sharing and others during the whole project process, while the project cost is as high as US$200,000~250,000. Obviously, this cannot be undertaken by all enterprises. At the same time, as per China's regulations, the state will obtain 65% of the CDM project income, and the enterprise will obtain the remaining 35% income. However, the emission reduction is the responsibility of the whole society, while the obligation, rights and interests shall not be undertaken and shared by the government and few enterprises only.

5. Suggestions regarding the establishment of China's carbon emission permit trading market
With regard to the construction of China's carbon emission permit trading market, the following suggestions are given:

5.1. Accelerating the construction of carbon emission permit trading market
In order to treat the environmental pollution, it is required to rely on the market adjustment. The carbon emission permit trading is implemented only under the adjustment of market mechanism, which will promote the enterprise to enhance the capacity, reduce the greenhouse gas emission, sell the remaining greenhouse gas emissions to the enterprises in need, and provide them with the corresponding economic returns. Then, the target of environmental protection and promotion of economic sustainable development will be achieved. We need to further properly use the national carbon emission permit trading system, expand the scope of trading sector, properly construct the domestic carbon trading market, and establish the market-oriented carbon finance mechanism. It is required to realize the substantial fairness of carbon emission permit trading, based on the "Common but Differentiated Responsibilities" principle. We need to exert the power in the carbon trading permit market mechanism, so as to develop, adjust and allocate the low carbon industry by means of the low-carbon finance.

5.2. Perfection of initial allowance allocation system
The China's carbon emission permit trading system shall adopt the cap control as the basic principle. Under the guidance of such principle, the state may freely grant the greenhouse gas emission permit to the existing enterprises on the present market, and offer a certain policy incentive to the enterprise that newly enters the market, carries out the high-tech, and realizes the emission reduction. The enterprise that realizes the carbon emissions surplus may transfer the surplus carbon emission allowance to the excessive emitter, while the seller obtains the revenue compensation, and the purchaser satisfies the emission requirements. This not only balances the market trading, but also encourages the market competition.

5.3. Strengthening the carbon market policies and regulations, and supervising the construction of law enforcement system
The national carbon market construction shall go ahead of the rest, so as to construct the open, fair and impartial policy and legal environment. In the upper law, it is required to define the rights and obligations of the key emitters, verification bodies, trading bodies, government administrative departments, and other participants during the process of carbon trading implementation, clearly define the legal responsibilities of each party, and define the variable types of illegal acts and punishment measures. It is required to fully take the supervision and management functions of the national and local competent authorities, sectors and departments, establish the territorial law
enforcement system relying on the local law enforcement agency, and strengthen the construction of supervision mechanism on the national level, so as to fully guarantee the seriousness and enforcement power of carbon trading system [6].

5.4. Implementing the strict carbon emission cap control
China has already formulated the overall goal of the challenging carbon emission intensity and peak value during the period of 2020–2030, while the carbon emission cap-and-trade system is the significant measure for realizing the overall goal and it is required to determine the strict carbon trading cap control target. Based on the determination of key emitters' emission data "from bottom to top", and in combination with the national-level and provincial-level emission reduction target and other factors, the national carbon market construction shall scientifically and reasonably determine the allowance cap and allowance allocation methods of the national carbon market, moderately tighten up the allowance allocation, and establish the allowance adjustment mechanism, so as to respond to the change of economic and market situations. It is suggested to adopt the industrial structural adjustment and optimization as the orientation, establish and detail the industrial carbon emission control coefficient, and expand the application range of industrial reference line method. When the electric power, thermal power and other production section emissions are incorporated, it is required to fully research and simultaneously incorporate the impact of indirect emission resulted from their consumption upon the allowance cap, so as to avoid the repetitive computation.

5.5. Emphasizing the data quality and strengthening the capacity construction of emitter
In light of a great number of key emitters covered by the national carbon market, and the variable management level, the authenticity, accuracy and scientificity will face many challenges. It is suggested to ensure the data quality from the following aspects: Firstly, it is required to fully mobilize the forces of the provincial and municipal competent authorities and industrial sectors, strengthen the basic capacity-building of key emitters with regard to the allocation of measuring equipment, implementation of monitoring plan, carbon emission data actual measurement of key equipment, and etc., and improve the reporting quality of carbon emission data. Secondly, it is required to accelerate the platform construction and integration of key emitter carbon emission data direct reporting system, and implement the data sharing and verification comparison of carbon emission data and energy consumption online monitoring data. Thirdly, it is required to establish the verification procedures and standards of strict carbon emission historical data and annual data, uniformly verify the report template, arrange the financial funds, support the verification works, and improve the verification quality. Fourthly, it is required to carry out the annual evaluation or industrial self-discipline and other regulations upon the verification body, so as to ensure the independence, impartiality and accuracy of the verification works.

5.6. Extensive conduct of international cooperation and talent training
With the enhancement of China's comprehensive power, the international society requires China to undertake more responsibility, with regard to the carbon emission permit trading issue. In addition, the EU, USA and other countries also set the trade barriers upon China's export commodities, such as the imposing of carbon tariffs, and etc., from time to time. Therefore, we shall extensively carry out the international cooperation, learn the experiences of the carbon emission permit from the developed countries, and establish the image of a responsible major country.

Firstly, it is required to strengthen the enforcement work. China shall timely compile and submit the national communication on performance information, and continue to promote the implementation of CDM project, as per the requirements of United Nations Framework Convention on Climate Change and Kyoto Protocol. It is required to actively disseminate China's policy, action and effect for controlling the greenhouse gas emission and establishing the carbon emission permit trading to the international society. As per the "Common but Differentiated Responsibilities" principle and fair
principle, it is required to actively participate in the international negotiation of climate change, and promote the overall and effective implementation of China's carbon emission permit trading.

Secondly, it is required to strengthen the practical cooperation. We shall actively participate in the international conference within the climate change field, participate in the international exchange and dialogue, and carry out a wide range of learning and cooperation, including the discipline research field of carbon trading, technical R&D of carbon emission reduction and carbon emission market management. It is required to learn, absorb and utilize the overseas advanced technology, and innovate our own core technology, and draw lessons from the relatively mature carbon trading and management experiences of developed countries. In addition, it is required to make progress together with the emerging countries, jointly strengthen our capacity for addressing the climate change, and promote the low carbon project cooperation with other developing countries.

Thirdly, it is required to strengthen the relevant researches and talent training. As the carbon emission permit trading is the new topic in China, and the carbon emission permit trading market is also the emerging market in China. Our relevant research is still not mature, and we are still lack of the professional talents. In the future, it is required to strengthen the capacity building in this regard, so as to lay a good foundation for the good development of carbon emission permit trading market. For one thing, it is required to strengthen the research related to the carbon emission permit trading and the relevant theory and mechanism. It is required to establish the professional research institute in the universities and research institutions, and establish a professional research team. For another, it is required to intensify the training efforts of carbon trading professional talents. It is required to emphasize the national education regarding the climate change, actively carry out the science popularization for addressing climate change, and continuously perfect the construction of relevant discipline system. It is required to intensify the basic research and scientific research talents training of carbon trading and carbon emission market, continuously develop the service talents of carbon market, and expand the team consisting of a group of strategy and policy experts, which will be in favor of China's participation in international negotiation.

6. Conclusion
Although the construction of China's carbon emission permit trading system has already made a certain achievement, we still have a long way to go, compared with the developed countries. In order to realize the strategic target of sustainable development, China shall fully emphasize and give play to the function of carbon emission permit trading system, at the same time, promote the energy conservation and emission reduction of the enterprise by means of the market, and finally contribute to the reduction of global greenhouse gas emissions.

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