Research on Carbon Emission Trading in Pilot Cities of China's Carbon Trading Based on the Background of Carbon Neutrality

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Abstract: Based on the background of carbon neutrality, this paper selects carbon trading pilot cities to open up the seven-year carbon emissions and carbon emission data from 2013 to the present, analyzes the current status of my country's carbon emissions trading pilot cities, and analyzes the current low-carbon economic situation. Finally, based on the factor analysis of the activity of the carbon trading market, targeted countermeasures and suggestions for emission control companies and carbon trading pilot cities are put forward. Help my country achieve carbon peaks in 2030 and achieve carbon neutrality in 2060.

1. Introduction

In September 2020, President Xi, President of the People’s Republic of China, proposed at the 75th United Nations General Assembly that carbon dioxide emissions should reach the peak by 2030 and strive to achieve carbon neutrality by 2060[1]. The proposal of the dual carbon target poses new challenges to the development of my country's carbon market. It has pointed out the direction and clarified the goals for China's future low-carbon transformation to promote high-quality economic development and ecological civilization construction, and it has also boosted global confidence in responding to climate change. As a developing country with the world’s largest emissions, it will take about 30 years to quickly realize the vision of carbon neutrality after reaching its peak before 2030[2-5]. The task is extremely arduous, but overall the emission path will inevitably show a peak as soon as possible and steady progress. There is a process of decreasing, rapidly decreasing, stabilizing and neutralizing. Technologies that support carbon neutrality involve almost all industries and economic activities. From the perspective of ways to control carbon emissions, they can be divided into high-energy-efficiency recycling technologies, zero-carbon energy technologies, and negative-emission technologies. Governments, enterprises, and individuals play a vital and individual role in the process of moving towards a carbon neutral vision[6]. A scientific policy system is needed to form a systematic and effective incentive mechanism to promote capital and talents towards carbon neutral technological innovation. Converge quickly with the direction of market promotion and application. The specific carbon neutralization path is shown in Figure 1.

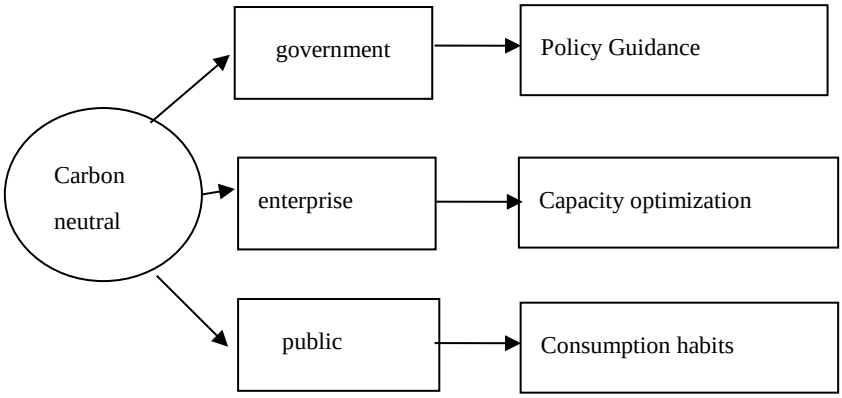

Figure 1. Carbon neutral social path

2. Current status of carbon emissions trading in pilot cities in China

This article introduces a carbon emission intensity index to measure my country's macro-carbon emission levels in the past nine years. Carbon emission intensity is the amount of carbon dioxide emissions produced per unit of gross national product (GDP) growth [7]. This indicator is mainly used to measure a country's economic and carbon emissions If a country's economic growth is at the same time, the amount of carbon dioxide emissions per unit of GDP is declining, then it means that the country has achieved a low-carbon development model.

$$\text{Carbon intensity}=\Delta CO_2 / \Delta GDP \quad (1)$$

The overall carbon trading volume and carbon trading volume of pilot cities in my country are shown in Figure 2 and Figure 3. The three cities with more carbon trading volume are Guangdong, Hubei, and Shenzhen. The total carbon emissions trading volume over the years has reached 7827.6, 7755.1 and 2708.5 million tons.

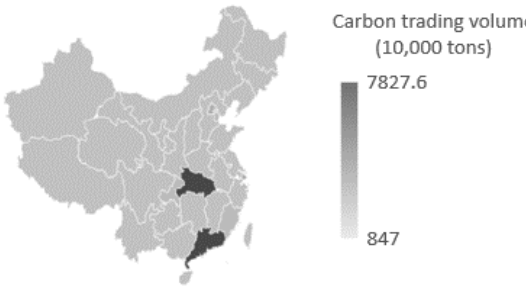

Figure 2. Regional distribution map of China's carbon trading volume

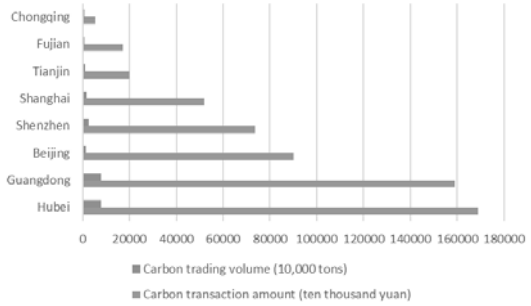

Figure 3. Total carbon trading since the establishment of pilot carbon trading cities

From Figure 4, the historical average unit price of carbon trading in China's carbon trading pilot cities in the past nine years is Beijing, Shanghai, Shenzhen, Guangdong, Hubei, Tianjin, Chongqing, and Fujian, which are in line with Beijing's strict pollution control policies[8]. In comparison, the unit price of carbon emissions trading in Shenzhen, Guangdong, and Fujian has shown a downward trend in the past nine years, and the emission cost of emission control companies has decreased; Beijing, Shanghai, Tianjin, Hubei, and Chongqing have shown an upward trend. The increase in the cost of corporate pollution discharge. This shows that China's macro-environmental energy conservation and emission reduction efforts are constantly increasing, and the pollution discharge policy is becoming more stringent. Therefore, emission control companies should actively upgrade their production capacity, optimize the industrial structure, and conform to the macro-industry background in order to be neutral in the low-carbon economy. An invincible place. The historical carbon emissions trading volume of pilot cities, from the time dimension, China's total carbon emissions trading volume increased slowly from 2013 to 2021 from a small amount to an explosive growth in 2015, and then

fell sharply and fluctuated slightly. Emissions are in a stable dynamic balance[9]. Corresponding to China's vigorous implementation of supply-side structural reforms since 2016, the upgrading of industrial production capacity directly drives the reduction of pollutant emissions and pollutant costs of emission control companies, and promotes China's low-carbon economy to enter a virtuous circle; from different provinces In terms of the main body of the city, the volume of carbon emissions trading in Guangdong and Hubei has taken the lead over the years. There are more structural industrial companies that are closely related. Therefore, based on the higher supply and demand of carbon trading volume, the unit price of carbon emissions trading in these two places is relatively high.

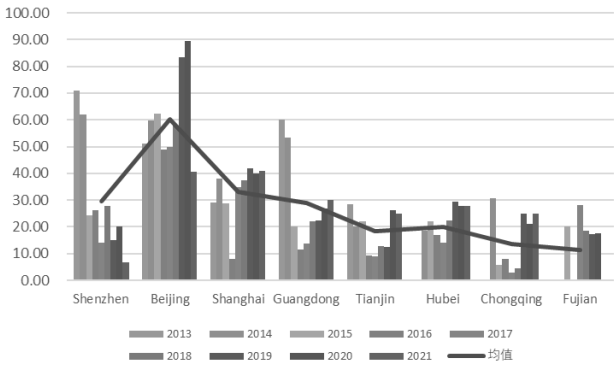

Figure 4. Historical unit price of carbon trading in pilot carbon trading cities

Except for Guangdong, Hubei, Shenzhen, Beijing, and Shanghai in 2015, carbon emissions were much higher than their own carbon emissions trading average. In other years, carbon emissions fluctuated around the average, showing a state of dynamic equilibrium. Among them, comparatively speaking The volume of carbon emissions trading in Chongqing has basically remained at an average value of about 213.67 in the past nine years [10]. This is closely related to the late opening of carbon emissions trading in Chongqing itself, the small size of the economy and the relatively closed carbon emissions market, which shows that the carbon emissions trading market is active and the opening time [11]. The size of the economy is positively correlated and negatively correlated with the carbon trading market.

In descending order of the pilot cities' average carbon emissions trading volume in the total market share over the past nine years, they are: Guangdong (32.52%), Hubei (28.49%), Shenzhen (15.73%), Shanghai (6.95%), Beijing (5.96%), Tianjin (3.81%), Chongqing (3.64%), Fujian (2.91%). It shows that China's provinces and cities have different levels of carbon emissions trading and different levels of market activity. Among them, Guangdong and Hubei have the largest market share of carbon trading volume. The sum of those is nearly 61%, which is more than half. Because the unit prices of the two carbon emissions trading are 198,500 yuan/ton in Hubei and 288,900 yuan/ton in Guangdong, the carbon transaction cost of Hubei emission control enterprises is relatively low, and carbon emissions trading The trading results are more significant. Not only the carbon trading market is active, but the unit carbon trading cost is lower, and the carbon trading efficiency is higher. For the government, it should actively learn and explore the Hubei carbon trading model to optimize the carbon trading efficiency of the exchange; For emission companies, when conditions permit, some of their factories can be transferred to areas with lower carbon transaction costs such as Fujian, Chongqing, and Hubei, so as to reduce the cost of corporate pollution, improve the overall profitability of the company, and at the same time expand the scale of the company's own production and operation. , To achieve a double effect. Directly reflect the inflow of capital industry by the governments of Hubei and other regions, increase government fiscal revenue, increase corporate profitability, achieve a win-win situation, and ultimately promote the development of China's low-carbon economy, realize a circular economy and a state of sustainable development.

3. Analysis on the structure of carbon emissions trading volume in pilot cities

From Table 1, using the 2015 carbon emissions trading volume as the base period data, the pilot city carbon trading volume structure analysis shows that since 2015, the overall carbon emissions trading volume of China's provinces and cities has shown a downward trend year by year, and the carbon emissions trading volume has continued to shrink. In 2020, the total carbon emissions trading volume was only 24% of the total carbon trading volume in 2015. It shows that since 2015, China has successfully upgraded the supply-side structure and optimized the production capacity structure. The production efficiency of emission control enterprises has increased, and the emission of waste gas pollutants has been reduced. Costs have fallen, and are basically in line with the macroeconomic environment of the low-carbon economy. By 2020, the average unit price of national carbon emissions trading will basically remain at 269,100 yuan/ton. It is relatively found that, affected by the supply and demand of the carbon trading market, the year when the unit price of carbon trading is lower In 2015 and 2016, its carbon trading volume was also slightly higher than in other years.

Table.1. Analysis of Carbon Emission Trading Amount Structure

The transaction amount	2015/ 2015	2016/ 2015	2017/ 2015	2018/ 2015	2019/ 2015	2020/ 2015
Shenzhen	1	0.47	0.16	0.06	0.02	0.02
Beijing	1	0.14	0.14	0.21	0.31	0.12
Shanghai	1	0.07	0.19	0.2	0.25	0.19
Guangdong	1	0.1	0.11	0.14	0.2	0.34
Tianjin	1	0.02	0.06	0	0	0.75
Hubei	1	0.12	0.14	0.13	0.12	0.26
Chongqing	1	0.08	0.4	0.02	0.35	0.1
Fujian	1	0	0.34	0.23	0.39	0.04
total	1	0.15	0.14	0.14	0.18	0.24

In summary, with the advancement of carbon trading time and the gradual standardization of the carbon trading market, the carbon trading market in China's pilot provinces and cities is gradually on the right track at this stage. Among them, the Guangdong and Hubei carbon trading markets are relatively active, and the carbon emissions trading volume and trading are relatively high. A large market share in China, it has a good reference for the development of carbon emissions trading in other regions of China. Affected by the macro low-carbon environmental policy, the carbon emission intensity has gradually declined since 2015, and the total carbon emissions trading volume in 2020 is only 43.4009 million tons, only 19.28% of the carbon trading volume in 2015. It shows that the carbon emissions of emission control companies are gradually decreasing, and the low-carbon economy development momentum is good across the country. The relevant main emission control companies should actively respond to low-carbon policies and better adapt The general direction of the macro low-carbon economy.

4. Countermeasures and suggestions based on the background of carbon neutrality

Construct first-level indicators and second-level indicators based on the relevant influencing factors of the carbon trading volume of each pilot city. The first-level indicators include national economic accounting and specific second-level indicators, regional GDP and household consumption levels; fixed asset investment and real estate and specific second-level indicators Fixed asset investment in the energy industry, production of major energy products (thermal power generation), urban energy product supply, consumption of major energy products; fiscal and specific secondary indicators, local fiscal revenue and expenditures, city overview, and secondary indicators of urban public transportation , Urban green space and gardens; resources and environment and the main pollutant emissions in the specific secondary indicators of exhaust gas and forest resources; energy consumption of various

industries and specific secondary indicators of industry, construction, transportation, post and telecommunications.

Principal component analysis is used as the factor extraction method, and the 21 variables are rotated by the maximum variance orthogonal method, and the number of factors is determined according to the cumulative contribution rate exceeding 95%, and the rotated eigenvalues, contribution rate and cumulative contribution rate are combined, and finally The four factors extracted basically contain the total information of 21 indicators. Therefore, the above 21 indicators can be combined into F1, F2, F3, and F4, as shown in Table 2 after the revised factor analysis indicators.

Table.2. Revised factor analysis index

1	Thermal power generation	2	Resident consumption level	4	Average unit price
	Total urban liquefied petroleum gas supply		Forest stock		Coal consumption
	Local fiscal revenue	3	Carbon trading volume		Crude oil consumption
	The total length of the public transport operation line		Carbon trading amount		Steel production
	Urban green area		Coke production		Total output value of construction industry
			Highway mileage		

From the main factor scores, comprehensive scores and rankings of the current status of carbon trading in each city, according to the corresponding weights of each factor and the specific secondary indicators of each city, the comprehensive ranking obtains the overall carbon trading situation of the seven cities, as shown in Table 3. From high to low, they are Guangdong, Hubei, Beijing, Fujian, Chongqing, Shanghai and Tianjin. Specifically, according to the size of its comprehensive average, it is divided into three categories. They are Guangdong and Hubei where the first type of carbon trading market is active; the second type of carbon trading market is generally active in Beijing; the third type of carbon trading market is less active in Fujian, Chongqing, Shanghai, and Tianjin. It shows that due to the short opening time and the large regional differentiation of carbon trading demand in my country's carbon trading pilot cities across the country, the current carbon emissions trading activity is insufficient, and the carbon trading activity needs to be further developed. Among them, the Guangdong and Hubei regions have leading positions in the carbon trading office , Should be actively maintained. Other regions should follow the example of Guangdong and Hubei, actively learn advanced experience, and release the carbon emission market activity.

Table.3. Classification results of pilot cities for carbon emissions trading in China

category	city	Comprehensive mean level
1	Guangdong, Hubei	>2000
2	Beijing	(100,2000)
3	Fujian, Chongqing, Shanghai, Tianjin	<0

5. Conclusions

Based on the current status of carbon trading in my country’s carbon emissions trading pilot cities and the final three-level classification, it is concluded that China’s current low-carbon economy is improving, but due to the short opening time of the carbon emissions trading market, there are still immature, irregular, and active markets. Insufficient degree. Combining the influencing factors of the carbon trading situation, finally put forward the following suggestions to the emission control enterprises and carbon trading pilot cities: First, experience learning. Draw lessons from the advanced experience of Hubei, Guangdong and other places in the more active carbon trading markets to increase carbon emissions trading volume and trading volume to release the vitality of the carbon trading market; second, the docking of emission control companies. According to the different nature of the control and discharge enterprises, scientific classification and treatment. Heavy chemical companies

with high carbon emissions are appropriately given a certain degree of carbon trading price policy inclination and preferential treatment. For high-tech carbon emission companies, a three-year buffer period will be given; third, large-scale emission control companies will be attracted to settle in. Provide policy subsidies to enhance the competitive advantage of local carbon emissions trading.

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