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## China's Carbon Market: Development, Evaluation, Coordination of Local and National Carbon Markets and Common Prosperity

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# Working Paper

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## **China's Carbon Market: Development, Evaluation, Coordination of Local and National Carbon Markets and Common Prosperity**

**ZhongXiang Zhang**

# China's Carbon Market: Development, Evaluation, Coordination of Local and National Carbon Markets and Common Prosperity

By **ZhongXiang Zhang** (Ma Yinchu School of Economics, Tianjin University and China Academy of Energy, Environmental and Industrial Economics)

## Summary

To achieve the commitments to both carbon peaking and carbon neutrality, China should focus on those policies of significant impact on emissions reduction at the lowest cost. Launching the national carbon market with the power generation sector is a good start point in this direction. Since its operation, the carbon price has not experienced sharp fluctuations, and falls within a range of CNY40~60 per ton. The block agreement transaction dominates trading, but with an average discount rate of 9.6% in block agreement, the aforementioned carbon prices overestimate the overall carbon prices. While the overall compliance rate measured against entities reached about 94.4%, there are significant differences across provinces, with compliance rate ranging from 82.9% to a full 100% compliance. Entities engaging in trading are mainly for compliance, and therefore transaction is driven by compliance. This article argues that the development of the carbon market requires further reform of the electricity pricing mechanism and the coordinated development of various related markets. With respect to national carbon trading scheme itself, the article discusses the areas where more work needs to be done to ensure that the national carbon emissions trading scheme functions properly. This involves carbon emissions trading legislation, further improvement in the rules conducive to the use of carbon emissions trading as a market tool, and the expansion of the participating industries and the scope of the carbon market in terms of diversifying market players and increasing trading varieties. Given the co-existence of the national carbon market and regional carbon market pilots, the article suggests the specific areas for the regional carbon markets to take the initiative to strengthen the synergistic effects of national carbon market. Furthermore, the article strongly recommends to continuously increase the proportion of carbon allowances auctions, and to set up a transformation fund from the proceeds of paid allocation of allowances to support the transformation and upgrading of regions with low levels of development and technology in China.

**Keywords:** Carbon market, Carbon price, Electricity market, Allowance allocation, Common prosperity

**JEL Classification:** Q48, Q53, Q55, Q58, O13, P28, R11, H23

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# China's carbon market: development, evaluation, coordination of local and national carbon markets, and common prosperity

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## Abstract

To achieve the commitments to both carbon peaking and carbon neutrality, China should focus on those policies of significant impact on emissions reduction at the lowest cost. Launching the national carbon market with the power generation sector is a good start point in this direction. Since its operation, the carbon price has not experienced sharp fluctuations, and falls within a range of CNY40~60 per ton. The block agreement transaction dominates trading, but with an average discount rate of 9.6% in block agreement, the aforementioned carbon prices overestimate the overall carbon prices. While the overall compliance rate measured against entities reached about 94.4%, there are significant differences across provinces, with compliance rate ranging from 82.9% to a full 100% compliance. Entities engaging in trading are mainly for compliance, and therefore transaction is driven by compliance. This article argues that the development of the carbon market requires further reform of the electricity pricing mechanism and the coordinated development of various related markets. With respect to national carbon trading scheme itself, the article discusses the areas where more work needs to be done to ensure that the national carbon emissions trading scheme functions properly. This involves carbon emissions trading legislation, further improvement in the rules conducive to the use of carbon emissions trading as a market tool, and the expansion of the participating industries and the scope of the carbon market in terms of diversifying market players and increasing trading varieties. Given the co-existence of the national carbon market and regional carbon market pilots, the article suggests the specific areas for the regional carbon markets to take the initiative to strengthen the synergistic effects of national carbon market. Furthermore, the article strongly recommends to continuously increase the proportion of carbon allowances auctions, and to set up a transformation fund from the proceeds of paid allocation of allowances to support the transformation and upgrading of regions with low levels of development and technology in China.

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## 1. Introduction

China's stance toward international climate negotiations has been evolving concurrent with changes in domestic and international contexts. While China has been very active in participating international climate negotiations and undertaking domestic climate mitigation and adaptation measures since the early days of climate talks, there is a discrepancy between its domestic actions and its simultaneous reticence to act at the international level. In line with changing domestic and international contexts, China has been recalibrating its stance and strategy, and is widely seen as playing an increasingly positive role in this complex process (Zhang, 2017).

Zhang (2000a and 2000b) envisioned that China could make a voluntary commitment to total greenhouse gas emissions per unit of GDP at some point around 2020 and that a combination of a targeted carbon intensity level with an emissions cap at the sector level would be the most stringent commitment that it could make around 2020. It was only just prior to the Copenhagen climate summit in 2009 that China pledged to cut its carbon intensity by 40–45% by 2020 relative to its 2005 levels. While this is consistent with China's longstanding opposition to hard emissions caps on the ground that such limits will restrict its economic growth, this marked a point of departure from its longstanding position on its own climate actions.

Zhang (2009, 2011a and 2011b) argued that there is a room for further increase in China's climate commitments, and, based on the balanced analysis, suggested a 46-50% cut in its carbon intensity by 2020 (This turned out to be what China had actually achieved. China's carbon intensity was reduced by 48.4% by 2020) and that China needs to take on absolute emissions caps around 2030. In the Paris climate summit, for the first time China committed to absolute emissions target, aiming to cap its carbon emissions around 2030 and try to peak early, and to increasing the share of non-fossil fuel use to around 20% by 2030 (NDRC, 2015).

At the general debate of the 75th session of the United Nations General Assembly in September 2020, Chinese President Xi Jinping announced that China aims to have carbon emissions peak before 2030 and achieve carbon neutrality before 2060. This not only strengthens China's previous commitment to peaking around 2030, but also adds the new commitment to carbon neutrality before 2060. Several studies have suggested that China can do that, so the commitment to peaking before 2030 may not be surprising. For example, GEIDO (2021) suggests that China's coal consumption peaks by 2025 and carbon emissions peak around 2028. However, the new commitment to carbon neutrality came as a complete surprise to both international and Chinese experts, and is neither bowing to international pressure, nor is this pledge conditioned on other countries' commitments.

The new pledge constrains China's carbon pathways after 2030. Without the commitment to carbon neutrality, theoretically speaking, there could be a variety of China's emissions pathways after carbon peaking around 2030. One pathway could be

that emissions stay at the peak level for a while and gradually decline. Another pathway could even aim to peak at a very high level to enable to leave more space for future development and emissions. This commitment to carbon neutrality limits all these possibilities because the aforementioned pathways will significantly increase the difficulty in achieving carbon neutrality before 2060.

China has implemented a variety of programs and initiatives, and supporting economic and industrial policies and measures targeted at energy saving and pollution cutting over the past two decades. The country needs to further strengthen and expand these programs and initiatives and supporting policies to keep China's energy demand and pollution under control (Zhang, 2016).

However, these are necessary but not enough. To achieve both carbon peaking and carbon neutrality requires huge capital investment in the field of renewable energy, cross-regional power transmission, advanced energy storage, charging stations and hydrogen refueling stations in the transportation field, end-use electrification, green buildings, and energy saving and emission abating. A variety of studies project different outcomes, but all the forecasts for required investment exceed CNY 100 trillion over the next 40 years (Tsinghua University, 2020; GEIDO, 2021; Yi, 2021). Government finance can only cover a small portion of such a huge scale of investment, and the significant gap must be made up by social capital, which must be guided by market-oriented approaches. The carbon market can just play such a role in providing market carbon price signals, incentivizing and attracting resources to tilt towards low-carbon green projects, promote green and low-carbon development, and achieve the aforementioned dual carbon goals while helping entities cut emissions at the least cost.

The National Development and Reform Commission (NDRC) in late October 2011 approved seven pilot carbon trading schemes in Beijing, Chongqing, Guangdong, Hubei, Shanghai, Shenzhen, and Tianjin. By June 2014, all seven carbon trading pilots started trading. These pilots together cover 2837 entities in 20 sectors. By June 2021, the all seven carbon trading pilots' total accumulated volume of traded allowances reached 480 million tons of CO<sub>2</sub>, and total accumulated value of traded allowances reached CNY 11.4 billion, with the average price of CNY 23.8 per ton of allowance traded (SCIO, 2021). Generally speaking, these carbon trading pilots have provided valuable references to improve their design, operation and compliance and to develop national emissions trading scheme, and have achieved the expected outcomes to some extent (Zhang, 2015a and 2015b, SCIO, 2021).

However, the volume of allowances traded in each pilot market is small, and there is lack of liquidity. Also the carbon price is so low that seriously affects incentives for investment in energy saving and emissions abating. Hoping that the carbon market will play a role in carbon neutrality, it is of great practical significance and urgency to promote the pilot to the national carbon emissions trading scheme (ETS).

China's national carbon market starts with power generation sector. This makes sense. As the European Union (EU) greenhouse gas ETS and China's carbon trading pilots show, emissions covered by an ETS generally account for a relatively large proportion of total emissions. The power generation industry has a large amount of carbon emissions, accounting for over 45% of the country's total carbon emissions. And the power industry has relatively homogeneous products, data is easy to verify and certify, and carbon quotas are easy to allocate. So national carbon market starting with power generation sector is a good starting point and will help form a carbon price signal across the whole society.

The national carbon emissions trading scheme covers 2162 power generation plants, each emitting at least 26,000 tons of CO<sub>2</sub> equivalent per year (MOEE, 2020a and 2020b). All together, all these covered power plants under the national carbon ETS emit over 4.5 billion tons of CO<sub>2</sub> emissions, accounting for over 45% of the national total carbon emissions. Since it launched its first trading on 16 July 2021, the national carbon market has operated more than one year, and all entities covered had experienced one compliance cycle by the end of December 2021. It is a right time to evaluate the operation of national carbon market and see how the market will go in the near future.

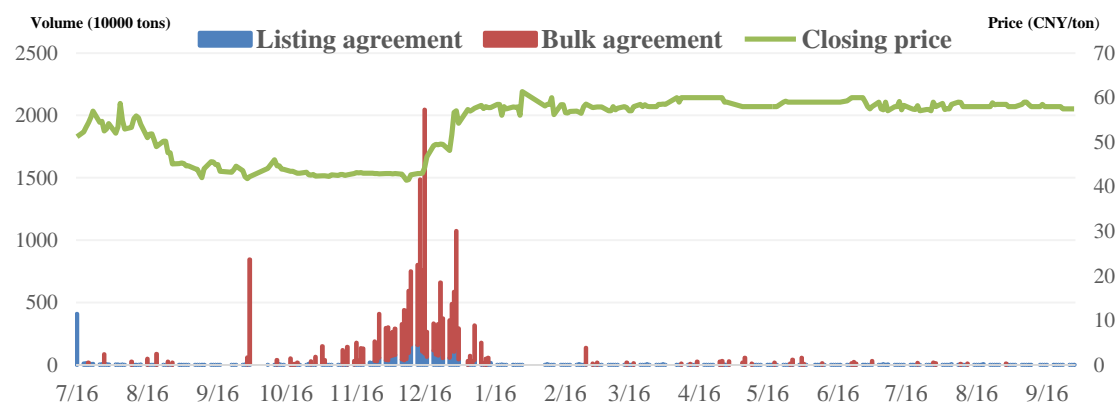
Against this background, this article discusses how China's national carbon market operates, what characteristics we can observe from its operation, how China's carbon market compares with the EU carbon market, what challenges it faces, how carbon market integrates with power market to achieve the desired outcomes, what the construction of united national market means for carbon market, what the focuses of the future development of national carbon market are, what the existing carbon pilots can do to strengthen the synergistic effects of national carbon market, and how carbon market serves as a means of helping achieve common prosperity. The better understanding of all these crucial issues not only helps understand the development and role of China's national carbon market in meeting the aforementioned dual carbon goals, but also helps refine its design, operation and compliance for the stable and healthy operation of the carbon market.

## **2. Evaluation of China's national carbon market**

Since it began trading on 16 July 2021, national carbon market has been operating smoothly. By 15 July 2022, national carbon market had been running for one year of 242 trading days, total allowance traded reached 194 million tons of CO<sub>2</sub> emissions, and total accumulated value amounted to CNY8.49 billion, with average carbon price equal to CNY43.8/ton. With China national ETS cap of 4.5 billion tonCO<sub>2</sub> in 2021 and the EU ETS cap of 1.61 billion tonCO<sub>2</sub> in 2021 and 819 million tonCO<sub>2</sub> in 2030, China's national carbon market covers the largest carbon emissions in the world, but it is not the largest market in terms of total value of traded allowances in a



commercial sense. According to the commercial market understanding in the general sense, China is still far from the EU--the largest carbon market. The annual trading value of China's national carbon market plus carbon trading pilots only amounted to €1.29 billion in 2021, while the corresponding trading value of EU ETS reached as much as € 683 billion in 2021, accounting for 90% of the world's total trading value (Refinitiv, 2022).



**Figure 1** Volume and price of carbon allowances traded, 16 July 2021--30 September 2022

*Source:* Drawn based on the trading data from Shanghai Environment and Energy Exchange.

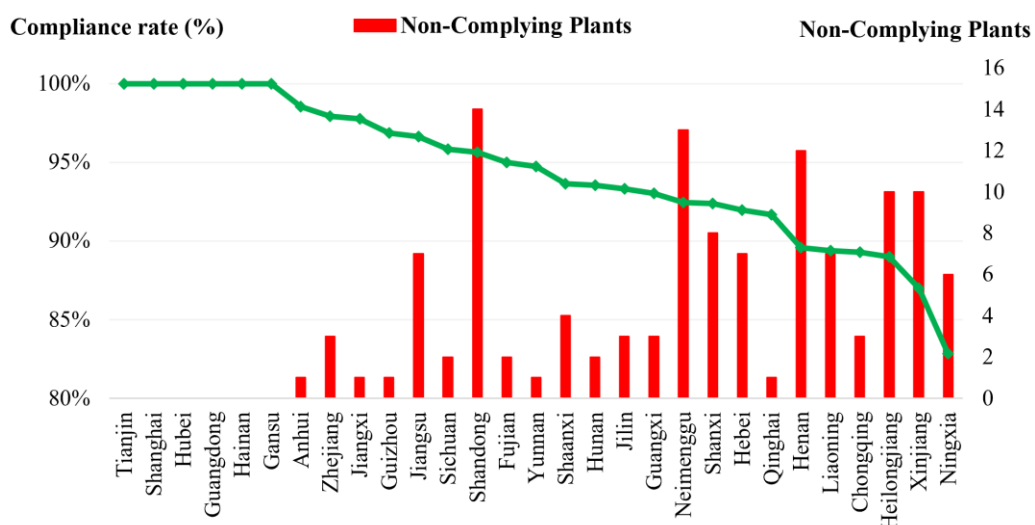
Since its operation, on the whole, the carbon price has not experienced sharp fluctuations, and the price fluctuates around the open price of CNY48/ton on the first trading day and falls within a range of CNY40~60/ton (see Figure 1). However, the aforementioned carbon price overestimates the overall carbon market price. In the first year of operation, the total bulk agreement transaction volume amounted to 161 million tons, 83.9% of the total volume of allowances traded; the total bulk agreement transaction valued at CNY 6.94 billion, 81.7% of the total amount of allowances traded. There is a certain discount in bulk agreement transactions relative to listed transactions, with an average discount rate of 9.6% (the average block agreement transaction price of CNY 43.1/ton versus the average listed transaction price of CNY 47.7/ton), and the maximum discount rate is 30%. However, it should be pointed out that bulk agreement transactions are mainly realized through quota allocation within the corporation group, direct negotiation between different emissions controlling enterprises or through intermediary negotiation. The resulting transaction is relatively complex, the transaction process is not transparent enough, and the transaction price settled is not a reflection of the value of the quota, nor does it reflect the marginal cost of emissions reduction in the industry. Not only price signals are distorted, but also this kind of transaction itself will increase transaction costs to a certain extent.

Given that an ETS is considered a means of helping entities meet the emissions obligation at the lowest cost, compliance rate is a key indicator to evaluate the performance of an ETS. Based on the first compliance cycle of national carbon ETS,



overall compliance rate is high. By 31 December 2021, the national carbon market had been running for 114 trading days, and the overall compliance rate was 99.5% measured against allowances.

The compliance rate measured against the number of entities is even crucial, because it reflects the difficulties faced by small entities in meeting the compliance obligations, and will be a decisive factor in determining whether the national carbon ETS achieves the full compliance with emissions obligations and how quickly the national carbon ETS expands. However, the central government did not release the compliance information against the number of entities at all. We have done diligent work to seek for this missing information of paramount importance.



**Figure 2** Performance of 29 provinces in China’s national carbon market in 2019-2020, ranging from 83% to a full 100% compliance

*Sources:* Drawn based on the author’s own compiled data from the 29 provinces’ departments of ecology and environment.

In the first half of 2022, the competent departments of ecology and environment in various provinces or equivalent one after another announced their own performance of the entities covered under the national carbon ETS and penalties in their provinces. Beijing provided a list of 14 key emissions controlling entities covered, but there was no specific performance of these entities made available. Also the data of Tibet was not founded. In the end, we have compiled the compliance data from 29 provinces or equivalent in China. Based on the information released from 29 provinces, we found that there are 121 non-complying entities in the first compliance cycle, and that the overall compliance rate measured against the number of entities was lower, but it still reached 94.4%. Moreover, there are significant differences across provinces or equivalent. As shown in Figure 2, in terms of the number of entities, while Guangdong, Hubei, Shanghai, Tianjin, Gansu and Hainan had a 100% compliance rate, the lowest compliance rate at the province level recorded at 82.9% in Ningxia, whose compliance rate measured against allowances was as high as 98.3%. The

compliance rate in Heilongjiang was low using either of the aforementioned measures, being the third lowest (89.0%) against the number of entities and the lowest (95.9%) against allowances respectively. For a country as a whole, 14 provinces or equivalent, or 48.3% of all, had the compliance rate below the national average in the first compliance cycle.

Coal-fired power plants that failed to comply with the emissions targets could partly be related to the policy of high limit value of carbon content of coal combustion element in power generation. The high limit policy requires coal-fired plants to carry out the measurement of carbon content of coal burned in power plants to calculate their carbon emissions, otherwise the default value would be used. But the default value is punitive, 20%~ 30% higher than the measured value when the enterprise does not measure the value. So power plants that have not carried out measurement of elemental carbon content before or have been forced to use the high limit value to calculate carbon emissions due to non-standard measurement, resulting in an overestimation of their carbon emissions by 20%~30%. For a power plant of 600 MW under the carbon price of CNY 50 per ton, this difference will increase the compliance cost of CNY 20-30 million.<sup>1</sup> The first case of data fraud disclosed by the Ministry of Ecology and Environment is to avoid this policy by SinoCarbon Innovation & Investment Co. for falsifying and forging the test report of Inner Mongolia Ordos High tech Materials Co. and instructing several emissions controlling enterprises for the production of false coal samples and other fraud problems (MOEE, 2022a).

As shown in Figure 1, entities engaging in trading are mainly for compliance, and therefore, transaction is driven by compliance. From the perspective of trading volume of allowances, except that the trading volume on the first day reached 4 million tons, the trading volume on subsequent trading days was basically less than 200000 tons, and the trading volume on some trading days was between 10 tons to 1000 tons. This trading pattern remains until mid November 2021, from which onwards, trading increases significantly. More than 20 million tons were traded on 16 December 2021, and 136 million tons were traded in December 2021, 3.2 times that of the combined total traded in the previous 5 months, which were 76% of the total traded in the first compliance cycle and 70% of the total traded in the first year of operation. With the completion of allowance surrendering, transaction has then dropped significantly. From then onwards to the end of September 2022, the trading

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<sup>1</sup> In 2021, the carbon dioxide emissions per unit thermal power generation in China were about 828 g/kWh (China Electricity Council, 2022). For a plant of the capacity of 600 MW operating 4000 hours a year, it emits 199 million tons of CO<sub>2</sub> emissions a year. The carbon price on China's national carbon market fell within a range of CNY40~60 per ton in the first year of operation. Assuming that the carbon price is CNY 50 per ton, this means the total compliance cost of about CNY 10 billion if there is no abatement at all, 20%~30% of which is CNY 20-30 million.

volume on most of trading days was basically less than 200 tons, and the trading volume on quite number of trading days was between 10 tons to 100 tons. This led to a lack of liquidity. The transaction volume in the first compliance cycle accounts for 2% of the total quota of power generation plants, while the traded volume of allowances in the EU ETS reached 758% of the total annual quota in 2021.

This could be lack of understanding of the carbon emissions trading scheme and awareness of carbon asset management not strong yet. Of 2162 power generation plants covered in the national carbon trading scheme, only 186 power generation plants in the seven carbon pilots are included in the national carbon trading scheme, implying that more than 90% of the power plants have not participated in the pilot trading. The results are not different from the carbon pilots. According to the carbon pilots, trading peak appears as compliance approaches the end. One month before the end of the first compliance cycles, transaction volume of Shanghai and Beijing accounted for 73% and 75% of the total transaction volume during the first compliance cycles, respectively. Carbon prices soared at the end of compliance. In the last week of the performance order correction period, Beijing market prices rose day by day, with a weekly increase of 24.5% (Zhang, 2015b).

### **3. Coordinated development of electricity market, green electricity and carbon markets**

The development of the carbon market requires further reform of the electricity pricing mechanism. This also involves in the coordinated development of various related markets, such as power market, green electricity market and carbon-related markets.

Currently, China's national carbon trading scheme only includes the power generation sector. Carbon trading mainly guides the structural adjustment within the power industry through rising coal-fired power costs. But if the carbon price rises too fast and too high, coal-fired power plants cannot afford it, because electricity tariffs have remained regulated by the central government, so power generating plants have to bear all incremental costs of carbon abatement alone and do not allow to pass through the carbon costs incurred (Zhang, 2014 and 2015b). So coal-fired power plants have no desire for high carbon price because they cannot afford it alone. This leads to the situation in which carbon prices don't reach to reasonable levels for the emissions abatement purpose, and consequently they cannot play a role in prodding economic restructuring and upgrading of downstream industries on the power consuming side.

Thus, implementing emissions trading in the power sector creates a new impetus for power pricing reform to allow the pass-through of carbon costs in the electricity sector. From the national perspective, we should therefore make full use of the opportunity of the construction of the national carbon market to promote the reform of the electricity pricing mechanism, let electricity prices to reflect market supply and

demand and the cost of carbon emission reduction, form a price system that organically integrates electricity prices and carbon prices, and to promote coordinated development of the carbon market and electricity market.

However, the reality in China suggests that a comprehensive power pricing reform may take time. Until this long-awaited reform is undertaken, we have to look for other options to reflect the carbon costs in power generation. Just like coal-fired power plants that are mandated to install desulfurization and denitrification facility receive power price premium for desulfurization and denitrification (Zhang, 2014), the National Development and Reform Commission, the solo organization in China that is mandated to set and change power prices, could offer power price premium for carbon abatement. If the central government decides to take this option, that price premium for carbon abatement would be offered nationwide to all fossil fuel-fired power plants for their carbon abatement, not only those included in the carbon trading schemes (Zhang, 2015b).

Green electricity and the Chinese Certified Emission Reduction (CCER) are effective means of reducing emissions and compliance costs. Initially, the EU carbon border adjustment mechanism (CBAM) provision does not cover indirect emissions from electricity generation, but this part of emissions have been included in the bill passed by the European Parliament on 22 June 2022 (European Parliament, 2022). The inclusion of indirect emissions from electricity in the CBAM increases demand for green electricity. In particular for those entities exporting goods to the EU market, using green electricity in the production will reduce indirect carbon emissions embodied in products and will thus lower potential carbon tariffs to be paid to the EU under the EU CBAM provision.

However, green electricity and CCER in China overlap in related emissions reductions. China allows the covered entities in the national ETS to meet up to 5% of their emissions caps. The EU certainly eyes on those overlapped emissions reductions that the entities use for their domestic compliance purposes, and at the same time are used for reductions in carbon tariffs for the use of green electricity. Thus, the overlapped emissions reductions need to be excluded to avoid double-counting reductions and overestimating emissions reductions. From a positive perspective, given that green electricity trading is an important way for enterprises to achieve green and low-carbon development in China, the transmission of CBAM costs may become an important positive factor in promoting the development and consumption of domestic green electricity. Moreover, in the carbon emissions reduction accounting guidelines of some industries, green power is not deducted from the amount of power purchased by enterprises. If the enterprises purchase green electricity, it is equivalent to paying extra costs. Therefore, there is necessity to open up the price mechanism of green power and carbon emissions reduction and integrate them into a unified cost system.

#### **4. The focuses of the construction of the national carbon market in the future**

More work needs to be done to ensure that the national ETS functions properly. This will involve four key areas: carbon emissions trading legislation; further improvement in the rules conducive to the use of carbon emissions trading as a market tool; which sectors should be given priority for inclusion, and diversifying market players and increasing trading varieties.

##### **4.1 Carbon emissions trading legislation**

Ideally, a national ETS legislation needs to be established to authorize emissions trading at the national level to ensure that a nationwide carbon emissions trading scheme functions properly in China (Zhang, 2015b). Even if the Interim Measures on the Management of Carbon Emissions Trading (Revised draft) released by the Ministry of Ecology and Environment (MOEE, 2021) are finally issued as a formal regulation, it is only a MOEE's regulation, and the binding force is low.

However, as the carbon market expands beyond the institutional jurisdiction of administrative regions, disputes could become more intensive and frequent. The only MOEE provisions are not enough. In fact, if the national carbon market is to achieve real circulation, it is very important to ensure that all the emissions data are properly measured, reported and verified with the aim to make each unit of emissions reduction reliable and comparable among sectors and across regions. This requires a national legislation. The national legislation should provide united guidelines and methodologies on design and operation of ETS and enforcement of measurement, reporting and verification (MRV) and penalties for non-compliance, ascribes allowances as financial assets and defines their valid duration with the aim to generate economically valuable and environmentally credible reductions and to provide a solid basis for building a sound national ETS. If it is not possible in the short term, at least the proposed carbon emissions trading management regulations need to be elevated to more binding State Council regulations (Zhang, 2015b).

##### **4.2 Further improvement in the rules governing carbon emissions trading**

The practice of carbon emissions trading in the OECD countries shows that a strong punishment mechanism is crucial to the orderly operation of the carbon emissions trading market. In the Interim Measures on the Management of Carbon Emissions Trading (Draft for comments) released by the MOEE in April 2019, for entities not in compliance with emissions obligations, in addition to deducting the same amount of shortfall allowances from the amount to be allocated to non-complying entities in the following year's allocation, non-complying entities will be charged at 3-5 times the prevailing yearly average market prices for each shortfall allowance (MOEE, 2019). However, in the Interim Measures on the Management of Carbon Emissions Trading (Revised draft) released by the MOEE in March 2021, the penalties for non-compliance have been significantly weakened, and are even weaker than the relevant penalties in the current carbon trading pilots. For the entities that violated the

regulations, the competent department has retained the same amount to deduct the shortfall allowances when allocating carbon emission allowances for the next year, but the penalty amount has been adjusted to only a fine of more than CNY 100,000 to less than CNY 500,000 (MOEE, 2021). The weakened measures are not conducive to the orderly operation of the national carbon trading market. Therefore, it is of great practical significance and urgency to further improve the rules conducive to the use of carbon emissions trading as a market tool to achieve the dual carbon goal.

The policy of high limit value of carbon content of coal combustion element in power generation is the controversial area. The policy initially aims to encourage coal-fired plants to measure carbon content of coal burned to calculate their carbon emissions and thus take emissions reduction measures. The high limit value of 0.03356 tC/GJ must otherwise be adopted for enterprises that have not measured the carbon content. But the default value sets to be so punitive so as to induce and amplify the falsification of carbon emissions data to a certain extent. In June 2022, the Ministry of Ecology and Environment issued a notice to adjust the default value of carbon content per unit calorific value of coal from 0.03356 tC/GJ to 0.03085 tC/GJ, down by 8.1%, regardless of coal type (MOEE, 2022b). This downward adjustment makes the carbon dioxide accounting data closer to the real situation and reduces the pressure on power plants to comply with the emissions obligations. This is a good step forward, but given that the accounting based method is still the main method to determine the carbon emissions in the national carbon market for a period of time in the future, it is suggested that the competent department should learn from the previous reasonable classification of grid emissions factors and the management method of continuous updating, gradually establish a more scientific classification and more reasonable measurement of the carbon content database of coal-fired power plants, and continue to improve and update it to ensure that the carbon emissions accounting results are more accurate and responsibilities are clearer.

#### **4.3 Which sectors should be given priority for inclusion?**

Expanding industry participation in carbon markets and the scope of the carbon market can help increase market liquidity and stabilize carbon prices. If the MRV of carbon emissions are guaranteed, the more industries covered, the greater the heterogeneity of enterprises, the greater the gap between enterprises' emissions reduction costs, and the more carbon trading between them, which is conducive to reducing the total compliance cost under any given overall emissions reduction target. The question then is which industries will be given priority to be included in the national carbon market in the second batch?

In addition to power generation, China aims to cover petrochemical, chemicals, building materials, iron and steel, non-ferrous metals, papermaking, and aviation in the next five years or so. How quickly it can materialize depends at least on the accuracy of emissions data and the size of emissions. The more accurate data, the more easy and quick a sector is covered. The more emissions a sector emits, the more



crucial a sector to meet the overall emissions reduction goal, the more important a sector is included. This is why power generation industry is considered first in the national carbon market: the power industry has relatively homogeneous products, data is easy to verify and certify, and carbon quotas are easy to allocate, while it accounts for a large portion of the national carbon emissions.

Indeed, the expansion of the national carbon market is postponed because of the problems of carbon data accounting. The carbon emissions allowances issued to each entity to be covered in any carbon trading scheme are closely related to both the quantity of products and production methods. It means that if an entity producing the same product has multiple technological processes, there will be multiple baselines. This increases the difficulty of accurately calculating the amount of allowances issued. Therefore, the competent authorities need to spend a lot of time every year to find out the baseline levels of various industries. By contrast, the EU ETS is based on cap-and-trade. Therefore, regardless of other conditions, there is only one baseline for the same product, which is conducive to the industry's transition from high carbon emissions to low carbon emissions. This suggests that China's national carbon market should consider changing from carbon emissions intensity control to total emissions control as soon as possible in order to be in line with the dual carbon goals.

Carbon emissions of cement in building materials industry and electrolytic aluminum in non-ferrous industry are relatively easy to account for in the other seven major industries. The new version of the emissions data accounting standard has been formulated. So from the perspective of accuracy of carbon data accounting, cement and electrolytic aluminum industry should be given priority for inclusion.

From the perspective of the size of emissions, first and foremost, priority should be given to industries with large carbon emissions, data that are easy to verify, and carbon allowances that are easy to allocate. Iron and steel and cement industries are not only important basic industries in the national economy, but they are also major carbon emitters. Carbon emissions of the iron and steel and cement industries account for about 13-15% and 10-12% of China's total carbon emissions, respectively. Accounting for about 25% of China's carbon emissions, therefore, these two industries are the two key industries to meet China's dual carbon targets. Iron and steel, and cement industry should be given priority for inclusion. Combined with the power generation industry accounting for 45% of the national total emissions, the total carbon emissions of these three industries account for about than 70% of the country's total carbon emissions.

Some external factors or pressure also play a role in such a consideration for prioritization. For example, those sectors that are subject to the EU CBAM are given priority to be included to lower the burden of carbon tariffs. From the perspective of the external environment, iron and steel, and cement industry covered by the EU CBAM should be given priority to be included in the national carbon market to reduce



the impact of EU CBAM.

If iron and steel, cement industry, and electrolytic aluminum are included, then about 70% of national total carbon emissions are covered under China's national trading scheme. This coverage will far exceed the EU's carbon trading system coverage, which covers about 45% of the EU's total carbon emissions. Further coverage expands to industries such as petrochemical, chemicals, other building materials, non-ferrous metals, papermaking, and aviation in the next five years or so.

#### **4.4 Diversifying market players and increasing trading varieties**

The NDRC in March 2016 submitted the Measures on the Management of Carbon Emissions Trading (Draft for review) to the State Council (NDRC, 2016). A section summarizing comments from other agencies shows that the NDRC refused a call by China Securities Regulatory Commission to remove references to futures trading. The NDRC views the inclusion of futures trading is the common practice in all other carbon emissions trading schemes, and helps improve the market liquidity. However, in accordance with the deployment requirements of the central government and the State Council, the NDRC later emphasizes that the carbon market as a policy tool orients towards for controlling greenhouse gas emissions and that the operation of the carbon trading system avoids excessive speculation and excessive financial derivatives, there is no reference to trading varieties, either in regulations or in practice.

While this is initially considered necessary for ensuring the smooth and standardized operation of national carbon trading, it is necessary to gradually increase the types of transactions and accelerate the innovation of products and services though, as national carbon trading runs smoothly. The national carbon market needs to 1) explore and develop products or services, such as carbon sink trading, carbon quota pledge loans, carbon asset pledge financing, carbon funds, carbon trusts, international carbon factoring financing, carbon trading financial consulting; 2) gradually introduce carbon financial derivatives, such as carbon forward, carbon futures; and 3) to diversify market players to allow individual and institutional investors and financial institutions to enter into the market for trading. All these help improve market liquidity.

However, it should be emphasized that the financial products and services of these carbon markets should serve to reduce the cost of carbon abatement as the starting point. In essence, carbon emissions trading is a market-based means to encourage emissions reduction at a lower cost. It helps emissions controlling entities achieve emissions reduction at a lower cost, reduce the cost of compliance, and improve the overall compliance rate. This is the essential attribute of the carbon market resulting from carbon emissions trading. The development of carbon market financial products and services must deal with the relationship between the essential attributes of the carbon market.

## **5. What should the existing carbon pilots do next?**

The national carbon market cannot be achieved overnight. Zhang (2015b) points out that until a nationwide carbon market will become fully functional, the regional ETSs will continue to function in parallel with a national carbon market and those entities covered in the existing regional ETSs will be unconditionally integrated into a nationwide ETS if they meet the latter's threshold. The current national carbon market is indeed a dual-track operation of the regional carbon market and the national emissions trading system. In the context of the construction of the national carbon market, it is necessary to seriously consider how local or existing carbon pilots should do and play their role in the next step in strengthening the effects of national carbon market.

The notice of opinion on the Interim Measures on the Management of Carbon Emissions Trading (Revised draft) released by the MOEE in March 2021 stipulates that, after the implementation of the regulations, the regional carbon emissions trading market will no longer be established. After the establishment of the national carbon market, the industries involved in the regional carbon market, if aligned with the coverage of the national carbon market, must be included in the national carbon market. The local carbon market will no longer issue carbon allowances to key emissions entities included in the national carbon market, and these key emissions entities will no longer participate in the regional carbon market. Industries that have been included in the regional carbon market but have not covered by the national carbon market, and emission entities that do not meet the emissions thresholds in the industries covered by the national carbon market, remain in the regional carbon market, and the regional carbon market will continue to be responsible for the allocation and clearing of their carbon allowances.

According to the current design of the national carbon market, the aforementioned eight major high energy consuming and high emitting industries will all be included in the national carbon market in the near future, and the national carbon market will have a higher priority. This will inevitably reduce the size of the carbon market in carbon trading pilots. The number of key emissions entities covered by the local carbon market may increase more, but the carbon emissions of a single entity will be greatly reduced, thus resulting in a substantial decrease in the overall quota size of the local carbon market. This will have an impact on the liquidity of the local carbon market. The central government should clarify the timing for the inclusion of other high energy consuming and high emitting industries in the national carbon market as soon as possible, so that the local carbon market can shift to include other industries that are critical to the local realization of the dual carbon targets according to the pace of incorporating these industries into the national carbon market, thus helping achieve the local double carbon goals.

Although the national carbon market officially launched online trading in July 2021, it

is still not perfect in terms of coverage, system design, or market operation. This requires regional pilot carbon markets to continue to provide pilot experiences for the national carbon market. In fact, the national carbon market is in the stage of co-existence of the nationwide carbon market and regional carbon market pilots. This provides room for the regional carbon markets to take the initiative, seek for areas of innovation, and continue to make the full use of the local pilot carbon markets to promote local energy conservation, emissions reduction and economic transformation and upgrading. However, since they co-exist, it is necessary to clarify their respective goals. Here are the few areas where the local carbon markets can form a synergistic effect with the national carbon market.

First, the regional carbon market can continue to explore and improve more mechanism designs. The carbon market is a policy market, and the way the government issues allowances and the degree of looseness have a great impact on carbon prices. For example, the national carbon market has not yet carried out paid allocation of carbon allowances, and there are only a few carbon trading pilots to auction allowances except for the Guangdong carbon market (Zhang, 2015a). For reference, the EU ETS keeps increasing the portion of auctioning in allowance allocation, rising from 5% in phase 1 (2005-2007), 10% in phase 2 (2008-2012) to 57% of the total amount of allowances in phase 3 (2013-2020), and the share of allowances to be auctioned remains the same in phase 4 (2021-2030) (European Commission, 2021).

Experience shows that paid distribution of allowances can help to form a higher carbon price, reduce the total amount and intensity of emissions more effectively, and can also effectively deal with external policy changes, such as the possible impact of the EU CBAM on China's exports. From the national carbon market transactions in 2021, it is found that the market's trading activity is not active, which is not only related to the operation mechanism of the carbon market, but is also affected by the overall oversupply of allowances obtained by power generation plants but the reluctance of emissions controlling plants to sell. Li et al. (2022) found that the average surplus, that is, the proportion of the surplus quota to the total quota, is about 9%. Of the five largest national power generating groups in China whose total installed power capacity accounts for nearly half of China's total installed power generation capacity, Huadian Group has the highest quota surplus, accounting for 16.2% of the total quota, followed by China Energy, Huaneng Group, Datang Group, State Power Investment Group with the quota surplus of 10.5%, 10.4%, 9.5% and 8.2% of its total quota, respectively. Power plants cannot judge how tight the future quota allocation scheme would be. Selling quota might leave impression that their quotas are indeed in surplus and are therefore allocated tight quotas in the future (so-called the whip a quick ox phenomenon). As would be expected, they are generally reluctant to sell allowances, thus resulting in very few transactions not for the purpose of compliance. As major power generating groups are reluctant to sell allowances, small power plants across China will find hard to purchase allowances in shortage for

compliance, thus leading to non-compliance. This also explains why the overall compliance rate measured against the number of entities is lower, in some provinces substantially lower, than that against allowances. The reluctance of some companies to sell can be alleviated by allocating carbon allowances through auction.

Therefore, the regional carbon market should carry out more exploration and practice of the paid allocation of allowances, so as to provide reference for the paid allocation of the national carbon market. Even if carbon allowances are allocated free of charge, the principle of moderate and tight control of total emissions in the allocation of allowances in the local carbon market also provides a reference for tightening the baseline for the allocation of allowances in the national carbon market. For example, in 2019, among the 111 enterprises in Hubei province that adopted the carbon emissions intensity reduction method, 73% of the enterprises cut their emissions intensity; among the 228 enterprises allocated allowances by the historical method, 60% of the enterprises lowered their emissions (Cao, 2021). Hubei's experience shows that the free emissions allowances obtained by enterprises decrease year by year, and the proportion of enterprises with quota gaps gradually increases, which can effectively force enterprises to reduce their emissions. The quota allocation plan for the second implementation period of the national carbon market has not been announced so far, but like the first compliance period, it is still a two-year compliance period. To what extent the baseline for allowance allocation in the second compliance period can be tightened affects whether the overall oversupply of allowances in the first compliance period can be effectively resolved. The experience of the local carbon market in this regard can provide references.

Second, the regional carbon market can include more industries and emissions entities. The economic development stage and industrial structure of each region are different. Based on the actual local circumstances, industries that plan to be included in the national carbon market but have no clear timetable can be initially included in the regional pilot carbon markets. For example, the Hubei pilot carbon market currently includes 16 industries, of which the 8 industries are planned to be included in the aforementioned national carbon market. At least in the short term, those emissions entities, which are unlikely to be included in the national carbon market, are included in the regional pilot carbon market. For example, as Beijing has service-dominated economic structure, universities, hospitals and other institutions are all Beijing key carbon emitting entities covered by its carbon pilot market. These first tries accumulate experience, and provide useful exploration for the national carbon market.

The third is to explore the regional carbon market earlier than the country to take the lead in the transition to a mass-based carbon market. Both the regional carbon market and the national carbon market are currently rate-based carbon markets. The central government encourages regions capable of taking the lead in reaching the carbon peak. The pilot carbon trading regions such as Shanghai, Beijing, and Shenzhen have clearly proposed to reach the carbon peak in 2025 ahead of the national carbon

peaking before 2030. Therefore, these regions meet the conditions of the transition from a rate-based emissions trading structure to a mass-based trading system. Goulder and Morgenstern (2018) show that converting from the rate-based structure to a mass-based system could offer important benefits in terms of both cost-effectiveness and economic efficiency. These regions can thus implement a mass-based system earlier than the country as a whole, exploring the close integration of the local emissions reduction path with the local carbon markets. Combined total emissions control, coverage of sectors and entities and allowance allocations with local annual emissions reduction targets, this undoubtedly provides a very useful reference for the national carbon market.

The fourth is to explore the construction of a regional carbon market across the institutional jurisdiction of administrative regions through the carbon market in the Guangdong-Hong Kong-Macao Greater Bay Area. The current local carbon market is limited to the existing provincial and municipal administrative divisions, and there is no regional carbon market that spans across the institutional jurisdiction of provinces and cities. The central government is now vigorously promoting the strategy of the Guangdong-Hong Kong-Macao Greater Bay Area, so how to promote its construction in an all-round and multi-angle? On the one hand, Guangdong is a large emitting province, and Guangdong and Shenzhen have the market foundation for carrying out carbon trading pilots for more than 8 years. On the other hand, it is difficult for Hong Kong and Macao to form an independent carbon market. Therefore, the establishment of a unified carbon market in the Guangdong-Hong Kong-Macao Greater Bay Area can indeed act as a carrier to promote in-depth cooperation in the Guangdong-Hong Kong-Macao Greater Bay Area. If a unified carbon market in the Guangdong-Hong Kong-Macao Greater Bay Area can be formed, it is possible to integrate the financial/carbon emissions trading institutions of Guangdong, Hong Kong and Macao, Shenzhen and the futures exchanges and carbon emissions exchanges in Guangzhou, so as to truly achieve a strong alliance and expand the carbon market.

The Guangdong-Hong Kong-Macao Greater Bay Area carbon market can play a role at least in the following aspects. In addition to the aforementioned regional carbon market including more industries and emissions entities before the national carbon market, some rules can be innovated before the national carbon market, including international benchmarking standards. Generally speaking, the construction of the national carbon market is relatively cautious, and the liquidity and volatility of the national carbon market will be strictly limited. In view of this, the carbon market in the Guangdong-Hong Kong-Macao Greater Bay Area can aim at liquidity, focus on carbon finance, and pilot some financial instruments and trading products before the national carbon market, so as to diversify trading products and services. Making full use of the international reputation of Hong Kong and Macao, the Guangdong-Hong Kong-Macao Greater Bay Area carbon market can carry out international carbon emissions trading first, play the role of a window for interconnection with the international carbon market, and lay the foundation for the future development of

international carbon emissions trading across the country. To promote this work, on the basis of the existing Guangzhou, Shenzhen Carbon Emissions Exchange and Guangzhou Futures Exchange, we can establish a unified carbon market in the Guangdong-Hong Kong-Macao Greater Bay Area, which is invested, operated and managed by the three parties of Guangdong, Hong Kong and Macao, taking into account more enterprises and financial institutions, enabling Hong Kong and Macao to play a better role, and truly promoting it as a part of the national strategy to strengthen in-depth cooperation in the Guangdong-Hong Kong-Macao Greater Bay Area.

The fifth is to explore the linkage between the national carbon market and the regional carbon market, and conduct carbon allowances trading between the national carbon market and the regional carbon market. Even if there is a national carbon market, China's carbon market is still a regionally segmented market. There is no linkage between regional carbon markets, and the national carbon market is also disconnected from all regional carbon markets. Therefore, China's carbon market is still not a unified market. Since the launch of the national carbon market, the price has stabilized at CNY 40~60 per ton, which is about twice the average carbon price of the regional carbon market. With the strengthening of emissions reductions targets over time, the national carbon market price is widely expected to continue to rise over time (Slater *et al.*, 2022)<sup>2</sup>. This will have a certain psychological impact on the regional carbon market price level related to carbon price signals. In 2022, most of the carbon prices in the carbon pilots will be rising. In February 2022, the carbon price in the Guangdong pilot once reached a record high of CNY 95 per ton, which is much higher than that of the national carbon market. In the long run, the carbon price in most carbon trading pilots will increase with the increase in the national carbon price, but the average price in the local carbon markets will still be far lower than the national carbon market price.

Considering that the carbon emissions covered by the national carbon market is much higher than that of the regional carbon markets, from the perspective of reducing the compliance cost of key entities covered in the national carbon market, the central government should consider allowing key emissions entities in the national carbon market to purchase carbon allowances from the regional carbon markets. It helps to reduce their total compliance cost. The linkage between the national carbon market and the regional carbon markets can start with trading in regional carbon markets that have done a good job in MRVing carbon emissions data, and gradually expand to other regional carbon markets that meet emissions data requirements. As the national carbon market incorporates more industries and emissions entities and conducts

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<sup>2</sup> Based on the survey that collected 417 responses from stakeholders in different industries, the average carbon price in the national carbon market in 2022 is expected to be CNY 49/ton, rising to CNY 87/ton by 2025 and CNY 139/ton by 2030 (Slater *et al.*, 2022).



transactions with more regional carbon markets, the existing regional carbon markets may focus on specific participants, such as emissions entities from industries not included in the national carbon market, small and medium-sized enterprises, emissions companies (units) and individuals. It is also possible to use the regional carbon market to develop more carbon financial products and services, such as voluntary emissions reduction trading, carbon inclusive finance, carbon funds, carbon mortgage loans, carbon futures, carbon options, etc. All these will help accumulate experience in the stable implementation of the national carbon market. According to the above development, the Chinese carbon market will be formed with the national carbon market as the mainstay and the distinctive regional carbon market as the supplement.

## **6. Carbon allowances and proceeds of paid allocation tilted towards less developed regions to help achieve common prosperity**

In 2012, the report of the 18th National Congress of the Communist Party of China (CPC) made that “we must adhere to the road of common prosperity” one of the eight basic requirements for the new victory of socialism with Chinese characteristics, and emphasized that “common prosperity is the fundamental principle of socialism with Chinese characteristics”. The 10th meeting of the Central Finance and Economic Commission in August 2021 made the latest statement of the CPC’s Central Committee on common prosperity, which gradually realized the common prosperity of all people and was placed in a more important position.

There is a consensus that common prosperity is not to lie flat, but to persist in development, and it is high-quality development, which continuously improves the prosperity of the whole society. Carbon emissions trading that China is now vigorously advocating and promoting, the so-called carbon market, is a market-based means that helps achieve energy conservation goals, environmental constraints goals and dual carbon goals, and at the same time has the least impact on economic development. Well designed, carbon market can serve as a means of helping achieve common prosperity.

### **6.1 Carbon allowances tilted towards less developed regions to help achieve common prosperity**

The carbon market is a policy market. While the general public calls the domestic financial market and the stock market policy markets, they are different from each other. To say that the financial market and the stock market are policy markets, it is more because these markets are too disturbed by policies. However, the carbon market is completely a policy market. Given the carbon emissions target, under the carbon emission trading system, the emissions reduction is given a market value, and its market value is closely related to the overall strictness of carbon emissions constraints and the allocation method of allowances. When determining the environmental goals and the total amount of carbon quotas, the central government



can give a full consideration of the gaps between regions, urban-rural gaps, and income gaps, and allow more relaxed environmental constraints for regions with relatively low levels of economic development. More total carbon emissions quotas and greater development/carbon space is given. Just like in the international climate change negotiations, each country has different stages of development and different levels of development and technology, and commitments of each country are determined under the principle of common but differentiated responsibilities. Developed countries have to take more responsibility for emissions reduction, while developing countries have to assume the level of climate-related responsibility comparable with the level of their development. At the same time, developed countries should provide financial and technical assistance to developing countries.

Since the implementation of energy-saving targets in terms of energy use per unit of output in the “Eleventh Five-Year Plan” period (2006-10), the central government has set different energy-saving targets after taking into account the differences in development, technology, and energy structure across regions when establishing energy-saving targets for provinces and municipalities. For example, the national energy-saving target of the “Twelfth Five-Year Plan” period (2011-15) is 16%, and the energy-saving target of each province and municipality ranges from 10% to 18%, with a difference of 8%. The national energy-saving target of the “13th Five-Year Plan” period (2016-20) is 15%, and the energy-saving targets of each province and municipality are set at 10% to 17%, with a 7% difference. In the determination of carbon constraints and total carbon allowances, not only the differences between regions should be further considered, but also the total carbon emissions constraints may have a greater impact of a wider scope, so the weight of this consideration should be even higher. The differences may be larger than the differences between the previous energy intensity constraints across regions.

## **6.2 Proceeds of paid allocation of allowances tilted towards less developed regions to help achieve common prosperity**

Allowances can be distributed either free of charge or through auctions. Except for Guangdong, the carbon pilot market is basically distributed free of charge, and there are a small number of auctions in Shanghai and Shenzhen for companies that have difficulty in compliance (Zhang, 2015b). The national carbon market now only includes the power industry, and all allowances are issued free of charge, and no paid allocation of carbon allowances has yet been carried out. We strongly suggest to continuously increase the proportion of carbon allowances auctions. On the one hand, experience shows that paid distribution helps to form a higher carbon price, reduce the total amount and intensity of emissions more effectively, and can also effectively respond to external policy changes, such as the possible impact of the EU CBAM on China’s exports. On the other hand, the proceeds obtained from the auction of quotas can be used to set up a transformation fund. The EU ETS keeps increasing the portion of auctioning in allowance allocation, rising from 5% in phase 1 (2005-2007) to 57% of the total amount of allowances in phase 3 (2013-2020) (European Commission,

2021). The EU's transformation fund is built on the proceeds of carbon allowances auctions. In addition, the EU is about to impose carbon tariffs on products from other countries that have not adopted the same level of carbon emission reduction as the EU. Carbon tariffs will be levied once the products land in the EU, and will have different repercussions. Developing countries are firmly opposed to the EU's implementation of carbon tariffs, but if all revenues collected from carbon tariffs are returned to developing countries, especially low-income developing countries for manufacturing decarbonization, economic transformation and upgrading, and climate mitigation and adaptation, then there may be less resistance to it.

The development stage and level of each region in China are different. For the benefit of the country as a whole, all regions, regardless of the level of development, must commit to a certain amount of emissions reductions. Developed regions have a high level of economic development and are more capable of doing this. A certain amount of funds are obtained by auctioning quotas, and the central government will coordinate them to support the transformation and upgrading of regions with low levels of development. It not only reflects fairness, but also is conducive to meeting the goals of the national unified energy and environmental constraints.

### **6.3 Issuing more carbon allowances to individuals of low-income groups**

Low-income groups generally do not have private cars. Based on the average number of kilometers driven by a car every year and how much gasoline is consumed, we can calculate an average carbon emissions from a private car. If you don't have a private car, you may take more public transportation. We can calculate the average total carbon emission of public transportation in each region to derive an average carbon emissions of an individual taking public transportation. The individual difference between the average emissions from private cars and the average emissions from public transport without private cars can be used as the basis for allocating allowances to low-income groups. Allocation of quotas to low-income groups may also be decided in other ways. Here is just a suggestion for reference, mainly to bring out this issue.

It is required that individual carbon allowances must be sold in the year of allocation or a certain percentage of individual carbon allowances must be sold; if they are not sold in the year of allocation, a certain percentage will be voided, or the allowance will be voided when a car is available. Requiring to sell in the current year is partly because there may be some changes in income next year, and there may be a private car. But this requirement is mainly to encourage the realization of quotas, increase income, and increase the liquidity of the carbon market. On the other hand, the national carbon market has not yet allowed carbon allowances to accumulate over time. Whether individual allowances are allowed to be accumulated over time, it is best to be consistent with whether the national carbon market allowances are allowed to be accumulated over time.

Finally, it should be emphasized that China is aiming at establishing a large unified market. The energy and environment market is an important part of the construction of a unified large national market, and the construction of a national unified carbon market is then an important part of building a unified national energy and ecological environment market. Although the carbon market is a policy market, the government can take into account different development stages of regions and treat them differently in setting the total amount of carbon allowances and the manner and degree of leniency in issuing allowances, thus reducing differences between regions and helping achieve common prosperity.

However, for the construction of the carbon market, the unification of the big market means the unification of rules, which can reflect the equivalence of carbon emissions quotas. As has been the case, in the carbon trading pilots, the allocation of carbon allowances in many industries is based on the benchmark method. In some pilot areas, the benchmark standards are set relatively low, and the implementation is relatively loose, which makes it too easy for some companies to comply with the quota requirements. By contrast, in other pilots, the benchmarks are set too high, resulting in that some enterprises that control energy consumption well have not been recognized in terms of quotas for their efforts in energy conservation and emissions reduction. They have to pay more to buy quota in the market. Therefore, from the perspective of carbon emissions quota allocation, the core of the carbon market, the construction of the national carbon market must first speed up the establishment of a unified national system and rules, which not only makes the carbon price comparison of the same industry in various regions comparable to a certain extent, but also facilitates in the next step to promote the linkage between the national carbon market and the local carbon market, and to trade carbon allowances in the national and regional carbon markets so as to form larger national carbon market covering more industries and regions.

## **7. Conclusions and discussions**

China's commitment to carbon neutrality before 2060 came as a complete surprise to both international and Chinese communities. To achieve both carbon peaking and carbon neutrality requires huge capital investment. Government finance can only cover a small portion of required investment, and the significant gap must be made up by social capital, which must be guided by market-oriented approaches. The carbon market can just play such a role in providing market carbon price signals, incentivizing and attracting resources to tilt towards low-carbon green projects, promote green and low-carbon development, and achieve the aforementioned dual carbon goals while helping entities cut carbon emissions at the least cost.

Launching the national carbon market with the power generation sector is a good start point and will help form a carbon price signal across the whole society. Since its operation, the carbon price has not experienced sharp fluctuations, entities engaging

in trading are mainly for compliance, and the overall compliance rate is high, although there are significant differences across provinces. Under the premise of ensuring its smooth and standardized operation after the launching of carbon trading across the country, it is necessary to accelerate the expansion of the participating industries and the scope of the carbon market. Iron and steel, cement industry, and electrolytic aluminum account for about 25% of the national carbon emissions, and should be given priority for inclusion of the national carbon trading scheme. Further coverage expands to industries such as petrochemical, chemicals, other building materials, nonferrous metals, papermaking, and aviation in the next five years. As such, about 70% of the national total carbon emissions are covered under the national trading scheme. That will enable carbon pricing to play a crucial role in incentivizing energy-saving and carbon abating, and ensure the dual carbon goals to be met at the least cost.

In the meantime, given the co-existence of the nationwide carbon market and regional carbon market pilots, the regional carbon markets can continue to take the initiative to strengthen the synergistic effects of national carbon market, exploring earlier than the country as a whole to take the lead in the transition to a mass-based carbon market and exploring the construction of a regional carbon market across the institutional jurisdiction of administrative regions through the carbon market in the Guangdong-Hong Kong-Macao Greater Bay Area. In this area, it is also suggested to explore the linkage between the national carbon market and the regional carbon market, starting with trading in regional carbon markets that have done a good job in MRVing carbon emissions data, and gradually expanding to other regional carbon markets that meet emissions data requirements. Regardless of whether or not to undertake these efforts, there exists necessity to further reform the electricity pricing mechanism and coordinate the development of various related markets, such as power market, green electricity market and carbon-related markets to promote coordinated development of the carbon market and electricity market.

That said, going forward, there are a lot of rooms for improvement in design, operation and compliance of China's national carbon ETS. First of all, the quota allocation plan does not provide long-term stable policy expectations for market players. In the case of the overall oversupply of allowances in the first compliance cycle, power generation plants are generally reluctant to sell allowances, reflecting their panic mentality. On the one hand, power plants cannot judge how tight the future quota allocation scheme would be, thus resulting in very few transactions not for the purpose of compliance. This is not conducive to carbon market price discovery and resource allocation. On the other hand, the lack of a long-term pricing mechanism is difficult to guide power plants' low-carbon investment, which has hindered the emissions reduction process to a certain extent.

Thus, there is necessity to establish a scientific long-term mechanism for quota allocation. The EU ETS has clearly defined the declining overall quota over time for

each phase in advance. The establishment of a scientific long-term quota allocation mechanism, such as quota adjustment mechanism and baseline updating mechanism, is conducive to the emissions controlling enterprises' clear expectations of the quota tightening scale and quota updating time, so as to make informed decisions to ensure the long-term stable operation of the carbon market.

Second, the block agreement transaction dominates trading in allowances in current national carbon ETS, and should have more listing trading for increasing transparency and efficiency. The transaction process of block agreement is not transparent enough, and the transaction price settled is not a reflection of the value of the quota, nor does it reflect the marginal cost of emissions reduction in the industry. Not only price signals are distorted, but also this kind of transaction itself will increase transaction costs to a certain extent.

Third, the less developed regions and small entities across the whole country may be the constraint to the full compliance of national carbon ETS. In the seven pilot areas of carbon trading, the development level of Chongqing can reflect most of China. Even if the deadline for compliance was postponed one month later than the original plan deadline, the compliance rate was only 70% in the first compliance cycle. The difficulties faced by Chongqing show that it is not easy to promote carbon trading from the pilot areas to the whole country. Similarly, Ningxia, one of the poorest regions in China recorded the lowest compliance rate at the province level in the first compliance cycle. Noticeable difference in the overall compliance rate against allowances and against entities respectively reflects the difficulties faced by small entities in meeting the compliance obligations, and will be a decisive factor in determining whether national carbon ETS achieves the full compliance with emissions obligations and how quickly national carbon ETS expands.

Fourth, paid allocation of carbon allowances has not yet been carried out in national ETS, and it is strongly recommended to continuously increase the proportion of carbon allowances auctions. Not only because paid distribution helps form a higher carbon price, reduce the total amount and intensity of emissions more effectively, and can also effectively respond to external policy changes, such as the possible impact of the EU carbon border adjustment mechanism on China's exports. Auctioning carbon allowances helps alleviate the reluctance of plants to sell allowances in surplus. More importantly, the proceeds obtained from the auction of quotas can be used to set up a transformation fund to support the transformation and upgrading of regions with low levels of development and technology in China. It not only reflects fairness, but also is conducive to meeting the goals of the national unified energy and environmental constraints.

Finally and fundamentally, data quality, supervision and management are the top priority for the stable and healthy operation of the carbon market. Why power generation industry is considered first in the national carbon market and why its

expansion is postponed are because of the accuracy of carbon emissions data. The problems of emissions data are not only on the side of the emissions controlling entities. They involve other institutions as well. Based on special monitoring on the quality of carbon emissions reports undertaken at the end of 2021, the MOEE found that the third-party carbon verification service institutions falsified and forged detection reports, made false coal samples, and reported distorting and inaccurate conclusions, which endangered the stable and healthy operation of the carbon market. Some of these problems are related to the emissions accounting guidelines concerned are not clear enough, and some are related to the policy of high limit value of carbon content of coal combustion element in power generation. The MOEE has made detailed adjustment in emissions accounting guidelines, making the carbon emissions accounting boundary and emissions sources of power generation enterprises more clear, and fossil fuel emission calculation formula more scientific and reasonable; refining the standard of coal element detection methods; and specifying update of test report requirements and retention mechanism and update of requirements for periodic reports and annual greenhouse gas emission reports, etc. The MOEE has also updated grid emissions factors, and has made downward adjustment of controversial high limit value of carbon content of coal combustion element in power generation. All these efforts and adjustments are good steps forward to address the problems of imperfect MRV system and poor emissions report data exposed in the national carbon market. Going forward, the governments at central and provincial levels should learn from the going practice and, wherever necessary, the MOEE should adjust emissions accounting guidelines to strive to improve the quality of emissions data to ensure that the carbon emissions accounting results are more accurate. The equal emphasis is given to supervision and management of the third-party carbon verification service institutions. Taken together, these efforts ensure that all the emissions data are properly measured, reported and verified and real and accurate, and each unit of emissions reductions are reliable and comparable among sectors and across regions.

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