

August 23, 2023

China's Carbon Emission Trading System (China ETS)

Executive Researcher, Zhongyuan Shen
Renewable Energy Group, Clean Energy Unit
The Institute of Energy Economics, Japan (IEEJ)

1. Overview of climate change policy

The Chinese government submitted its second “Nationally Determined Contributions” (NDC) aimed at the reduction of greenhouse gases by 2030 to the UNFCCC Secretariat in 2021. The latest version raised contributions from the first NDC submitted in 2015. The following six items cover the numerical goals of the second NDC.

- 1) Strive to realize peaking out of CO₂ emissions prior to 2030
- 2) Lower CO₂ emission per unit of GDP by at least 65% versus the 2005 level
- 3) Raise the non-fossil fuel percentage in primary energy consumption to about 25%
- 4) Increase forest stock volume by 6 billion m³ versus the 2005 level
- 5) Increase wind power and solar power facility volume by at least 1.2 billion kW
- 6) Strive to effectively realize carbon neutrality by 2060

The first item (peaking out goal) and sixth item (carbon neutrality goal) have attracted the most attention among these goals and are referred to as the “dual carbon goals” or “30-60 goals” in China.

Detailed climate change policy promotes priority measures, mainly in priority areas and sectors, with top-down type directions from the central government using industrial structure enhancement, low-carbon energy usage, energy saving, carbon absorption, and other policy methods. Within this context, China is implementing an Emission Trading System¹ (ETS) as a priority measure.

2. ETS design

In the 12th (2011-15) Five-Year Plan for National Economic and Social Development from 2011, regarding greenhouse gas emissions, China officially presented a goal of reducing the carbon dioxide emission intensity per unit of GDP by 17% versus the 2005 level and stated its intent for the first time to “gradually build a carbon emission allowance trading market.” It

¹ In China, the official program name is Carbon Emission Trading System. As similar programs, it also operates the Energy Usage Allowance Trading System, Water Usage Allowance Trading System, and Pollutants Emission Trading System.

also subsequently mentioned promoting a “carbon emission allowance trading market” in various national policies issued by the National Development and Reform Commission, including “Work Plan for Greenhouse Gas Emission Control during the 12th Five-Year Plan Period” (2011) and “Opinions on Accelerating Construction of an Ecological Civilization by the Central Committee of the Communist Party of China and the State Council” (2015). Against this backdrop, the National Development and Reform Commission launched regional ETS programs as trial programs in two provinces and five cities during 2013-15 (Beijing, Shanghai, Shenzhen, Tianjin, Chongqing, Hubei, and Guangdong).

In 2014, China formulated the Provisional Administrative Rules on Carbon Emission Trading and presented the concept of a national ETS framework for the first time. In 2015, it officially declared its intent to implement a national ETS program. It subsequently advanced further with related preparations and then announced the Administrative Rules on Carbon Emission Trading (Draft) (hereinafter, ETS Administrative Rules) in December 2020 and “2019-2020 Implementation Plan for National Carbon Emission Trading, Total Allowances Setting and Allocation (Power Generation Industry)” (hereinafter, ETS Power Generation Plan). It launched a national ETS program, albeit limited to the power generation industry, on February 1, 2021. Actual trading started on July 16, 2021, taking 10 years for China to initiate the national ETS.

2.1. Overview of the ETS program

ETS Administrative Rules stipulate that the criteria to qualify as a subject company for the ETS program are (1) an operator in a sector covered by the national ETS system designated by the national government and (2) an operator with an annual emission volume of greenhouse gases of 26,000 tons or more of carbon dioxide equivalent. Preparations are currently proceeding for eight industries with high energy consumption (petrochemicals, chemicals, building materials, steel, non-ferrous metals, paper and pulp, power generation, and airlines) as national ETS program candidates. However, as of July 2023, China has only designated the power generation industry based on the ETS Power Generation Plan.

According to the ETS Power Generation Plan, the national ETS program in 2019-2020 covers the power generation industry (including self-generated power in other sectors) for companies or other economic entities with own use power facilities that have carbon dioxide emissions of 26,000t-CO₂ or more (about 10,000 tons of total energy consumption volume of standard coal equivalent) in any year from 2013 to 2019. Carbon dioxide emission volume includes direct emissions from fossil fuel consumption and indirect carbon dioxide emissions from purchased power. The corporate emission allowance is the total value calculated by the power generation unit based on the benchmark value for power generation (or heat supply).

This covers power-only units and cogeneration units and does not apply to heat supply facilities without power generation. Specifically, it applies to four types of fossil-fuel power generation units - conventional coal thermal at 300MW or more, conventional coal thermal at less than 300MW, non-conventional coal using coal waste, slurry, or water slurry, and gas thermal. In the case of mixed-combustion power generation units, mixed combustion with less than 10% biomass (including wastes and sludge) comes under the power generation unit of the primary fuel type. Excluded formats are biomass power generation, special fuel power generation, exclusively self-produced fuel power generation, and other mixed-combustion and special power generation that meet certain criteria.

2.2. Allocation method (paid/free)

According to the ETS Administrative Rules, the carbon emission allowance is mainly allocated as free allocations, with paid allocations to be introduced depending on the circumstance. The calculation of emission allowance in the power generation industry multiplies activity volume obtained via the following equation with the benchmark value (under the ETS Power Generation Plan). The procedure introduced the corrective coefficient to reflect unique technology characteristics for the unit and other factors. It does not set a corrective coefficient that factors in regional disparity.

$$\text{Power generation unit emission allowance} = \text{Actual power supply volume} \times \text{Power supply benchmark value} \times \text{Corrective coefficient}^2 + \text{Actual heat supply volume} \times \text{Heat supply benchmark value}$$

Table 1 Benchmark values in the power generation industry³

Type	Subject power facilities	Power supply (t-CO ₂ /MWh)			Heat supply (t-CO ₂ /GJ)		
		2019-2020	2021	2022	2019-2020	2021	2022
I	300MW or more, coal thermal	0.877	0.8218	0.8177	0.126	0.1111	0.1105

² Corrective coefficient = Cooling method corrective coefficient (R1) x co-heating ratio corrective coefficient (R2) x utilization rate corrective coefficient (R3). Water cooling: R = 1, Air cooling: R = 1.05. R2 = 1 - 0.22 x co-heating ratio. R3 set in four tiers based on the utilization rate. Utilization rate F ≥ 85% R3 = 1.0, 80% ≤ F < 85% R3 = 1 + 0.0014 x (85 - 100F), 75% ≤ F < 80% R3 = 1.007 + 0.0016 x (80 - 100F), F < 75% R3 = 1.015^(16-20F).

³ Benchmark values and corrective coefficients are reportedly based on a substantial amount of data, many contact discussions, and in advance ETS simulations. According to the International Energy Agency's (IEA) "IEA Emissions Factors 2022," average thermal power generation emission coefficients in 2019 for China were coal at 0.933.5 t-CO₂/MWh and gas at 0.334 t-CO₂/MWh and for Japan were coal at 0.898 t-CO₂/MWh and gas at 0.388 t-CO₂/MWh. Simple comparison is not possible because of differences in China's boundary using ETS data and the IEA's country boundaries.

	(conventional)						
II	Less than 300MW, coal thermal (conventional)	0.979	0.8773	0.8729	0.126		
III	Non-conventional coal thermal (50% or more waste or slurry)	1.146	0.9235	0.9303	0.126		
IV	Gas thermal (10% or less use of other fuel)	0.392	0.3920	0.3901	0.059		

Source) Prepared by the author from the Ministry of Ecology and Environment Materials.

Allocations began with an initial allocation based on 70% of the unit power supply (heat supply) in 2018 and were confirmed in 2019 and 2020 values for actual performance. For the purpose of avoiding excessive burden on companies, however, the program adopted the total value of 20% of actual emissions and emission allowance as the maximum value of the compliance obligation for cases in which actual emissions exceeded the allowance. Furthermore, with the aim of promoting the gas power generation unit, the program set the allocated emission allowance as the maximum value of the compliance obligation for the gas power generation unit and hence exempted compliance for the portion exceeding the allowance. In the second compliance phase (2021 and 2022), it added a measure for borrowing up to 10% from the 2023 emission allowance.

In cases of a merger, spin-off, closure, or move outside of the administrative zone that affects a subject company, it is necessary to submit a report to the Ministry's Central Supervision Office of Ecological and Environmental Protection within 30 days. The Central Supervision Office adjusts free allocations based on actual conditions, reports to the Ministry of Ecology and Environment, and provides general disclosure, including related information.

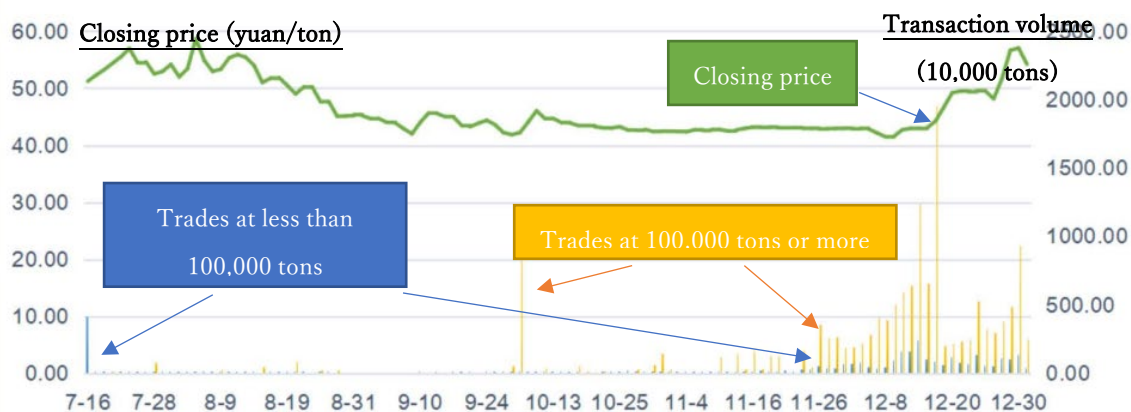
Companies that already received an emission allowance allocation under the regional ETC program at the time of the announcement of the ETS Power Generation Plan do not participate in the national ETS program. Other companies, meanwhile, participate in the national ETS program.

Regarding emission allowance trading, the ETS Administrative Rules limit the traded

product to the subject allowance for the time being and stipulate the addition of derivative products depending on future circumstances. They also indicate that subject companies, institutions, and individuals can partake as transaction participants. Transactions occur via the national ETS transaction system. It is possible to utilize the discussion method between parties, single-direction sales auctions or purchase auctions, or other methods that satisfy requirements. Permitted price fluctuation limits are $\pm 10\%$ versus the previous day's closing price for transactions of less than 100,000 tons and $\pm 30\%$ for transactions of 100,000 tons or more.

As implementation guidelines for ETS operation, the Ministry of Ecology and Environment formulated and disclosed the Carbon Emission Allowance Registration Administrative Rules (Draft), Carbon Emission Allowance Transaction Administrative Rules (Draft), and Carbon Emission Allowance Settlement Administrative Rules (Draft) in May 2021. Regarding operation conditions, the Ministry of Ecology and Environment announced the "Report on the National ETS Market's First Compliance Phase (2019-2020)" in 2022. According to the report, transaction activity in the first compliance phase involved 2,162 companies initially (though actually 2,011 companies after mergers, etc.) and covered 4.5 billion tons of CO₂ emissions. Other key data were 114 transaction days, 179 million tons of transaction volume, CNY7,661 million in transaction value, and CNY42.85/ton as the average transaction price (a single CNY is roughly 20 yen). Closing-price fluctuation had a range of CNY40-60 per ton, indicating stable movement in the transaction price (Figure 1). Furthermore, 847 companies had allocation shortages totaling 188 million tons. Allocation shortage and transaction volume were roughly equal. This suggests that transactions largely took place for compliance.

According to the report, the ETS program operation effect was improving power generation carbon emission intensity by 1.07% versus the 2018 level in 2020. The questionnaire found that 80% of subject companies established dedicated departments related to carbon asset management. It also confirmed that 90% of subject companies intend to place more emphasis on statistical data and 46% plan to invest transaction income in energy savings and other measures.



Source: Prepared by the author using Ministry of Ecology and Environment materials (Document 4)

Figure 1 Transaction activity in the first compliance period

2.3. Availability of offset credits

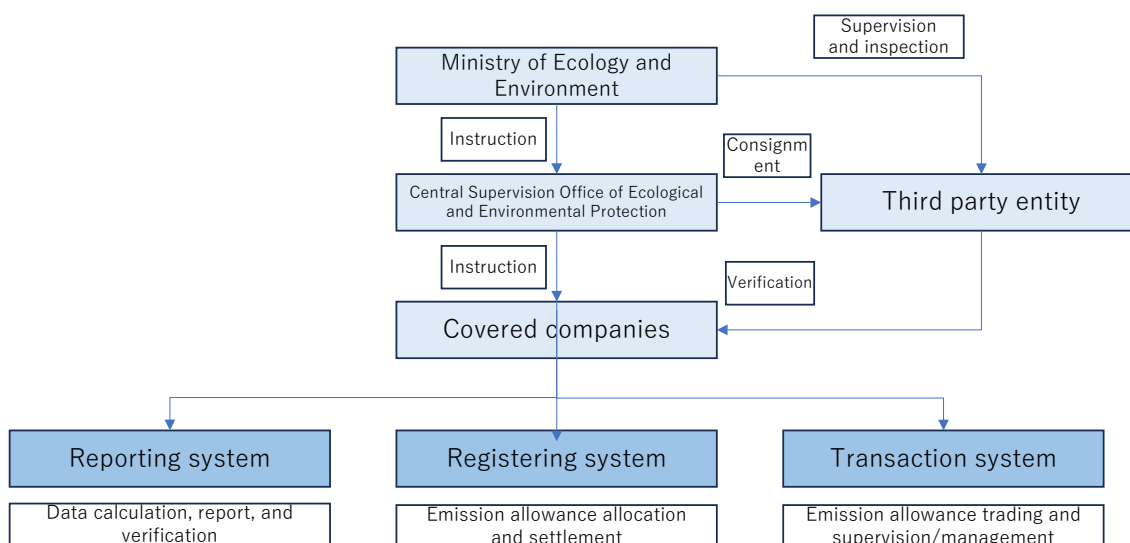
Subject companies apply these within the deadline set by the Ministry of Ecology and Environment. Offset based on the China Certified Emission Reduction (CCER)⁴ program is possible for up to 5% of the emission allowance. The program recognizes three types of CCER – renewable energy, forest absorption, and methane usage.

CCER usage volume in the first compliance period (2019-2020) was 32.73 million tons. A total of 189 CCER projects, such as wind power generation, solar power generation, and forest absorption, generated CNY980 million in income.

2.4. Emission volume MRV

As shown in Figure 2, the program manages and supervises data calculation, reporting, verification, allocation, settlement, market trading, and other activities related to the carbon emission volume of subject companies with different roles handled by key parties - program design and jurisdiction under the Ministry of Ecology and Environment, management and supervision by regional governments (provincial, metropolitan, etc.), and cooperation with program operation by third-party entities and industry organizations. China built three information systems for program operation – a data reporting system, an emission allowance recording system, and an emission allowance trading system.

⁴ Domestic credit program comparable to Japan's J credits



Source: Prepared by the author using Ministry of Ecology and Environment materials (Document 2)

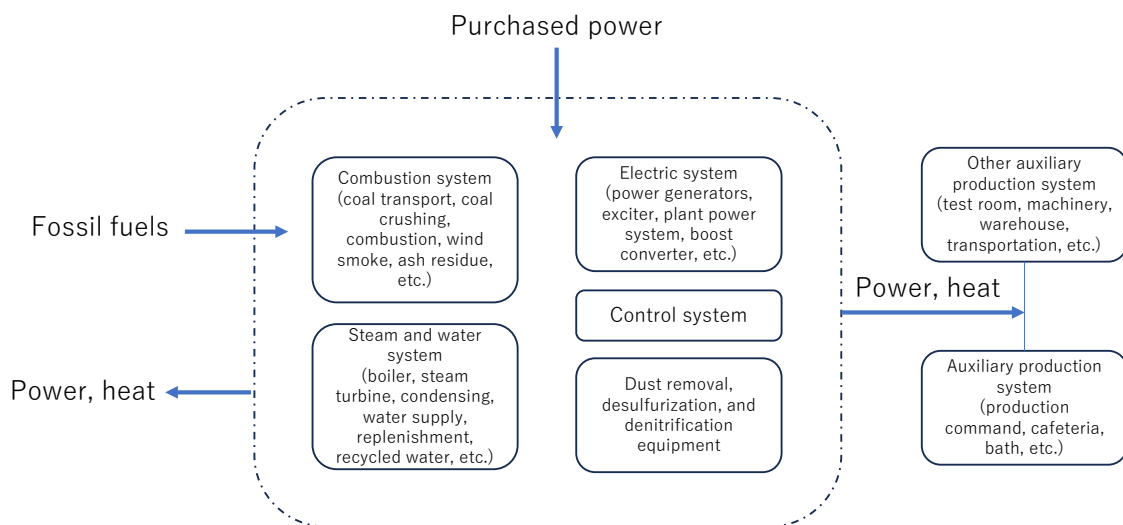
Figure 2: Overall image of China’s national ETS program

Subject companies have an obligation to report to the Ministry’s Central Supervision Office of Ecological and Environmental Protection by March 31 of each year and retain data records and management ledgers for at least five years. Companies bear responsibility for the accuracy of reported data. Penalties are CNY10,000-30,000 for false reports and CNY20,000-30,000 for non-compliance within the required period as well as suitable reduction of the allocation in the next fiscal year. There is recourse to pursuing criminal responsibility in cases involving crimes.

The Central Supervision Office verifies reports and sends verification results to subject companies. It can consign verification to third-party verification entities. Its reviews utilize a “double random, one-open” method (random section of the verification target and verifying agent and disclosure of verification results). The verification entity bears responsibility for the accuracy of verification results. As standards, the verification process uses the Ministry of Ecology and Environment’s “Guidelines on Calculating and Reporting Company Greenhouse Gas Emissions (power generation facilities)” and “Technology Guidelines on Verification of Company Greenhouse Gas Emissions (power generation facilities).” The Ministry of Ecology and Environment supervises and inspects verifications by third-party entities. During the first compliance period, it inspected 401 subject companies and 35 related third-party entities. Following inspections, it announced the discovery of serious fraud at four third-party entities and disclosed the company names.

The above-mentioned guidance provides detailed rules on power generation boundary and emission source decisions, the method of calculating emissions from fossil fuel combustion,

the method of calculating emissions of purchased electricity, the method of calculating total emissions, the method of calculating production volume (power generation volume and heat production volume), the data quality management plan and requirements, the periodic report, and specifications related to information disclosure. For example, it defines the power generation boundary in the manner shown in Figure 3. The power generation boundary is power generation facilities (within the dotted line areas in the Figure), mainly the combustion system, steam and water system, electricity system, and control system and dust removal, desulfurization, and denitrification systems. It does not include other auxiliary production systems or auxiliary ETS production systems in the plant area.



Source: Prepared by the author using Ministry of Ecology and Environment materials (2018)

Figure 3: Power generation boundary

3. Observations

China’s national ETS program started trading activity as the world’s largest carbon market, despite the COVID-19 pandemic, and its completion of the first compliance phase with a 99.5% compliance ratio has significant implications. In the second compliance phase, the program set the benchmark value for the power generation industry at a roughly 8% tougher level, and the trading price exceeded the average price from the first phase. This means that the price signal related to carbon has strengthened. Looking ahead, the main point is whether China is capable of bringing in other industries with high energy consumption at the appropriate time.

Meanwhile, China needed a preparatory period of 10 years for an ETS program restricted to the power generation industry. Even though it formulated detailed calculation guidelines for data related to the power generation industry and put efforts into verification by third

party entities and training of subject companies during this period, data falsification and other serious fraudulent acts occurred. Compared to the power generation industry, other industries with high energy consumption present more complexity in data calculation and verification, setting benchmark values, and other tasks. It will not be easy to expand the ETS program, and there is a possibility of falling behind the plan. In any case, China needs more time than the roughly five years⁵ of preparation in Europe and Korea to achieve a full-fledged rollout of the ETS program.

Furthermore, the Ministry of Ecology and Environment issued a report indicating that the ETS program effect was 1.07% improvement in power generation carbon emission intensity over two years (0.54% annually). However, the actual improvement in standard coal equivalent intensity in power generation for the thermal power unit of 6,000kW or more in the five years through 2020 prior to implementation of the ETS program was 0.63% annually. At this point, it is hence not possible to conclude that the rollout of the ETS program delivered an advance in energy savings. China is likely to incrementally bolster the benchmark values similar to Europe, and it is necessary to continue monitoring the program effect. It is also essential to assess the program effect from a variety of perspectives considering reports that the EU ETS program, a predecessor, weakened corporate interest in green investments.

Reference documents, etc.

Shen Zhongyuan (2016), “Estimating Chinese Unified Carbon Market Size – Implications of a Giant Four-billion t-CO₂ Market”

<http://eneken.ieej.or.jp/data/6645.pdf>

Ministry of Ecology and Environment (2020), “The Administrative Rules on Carbon Emission Trading (Draft)”

https://www.mee.gov.cn/xxgk2018/xxgk/xxgk02/202101/t20210105_816131.html

Ministry of Ecology and Environment (2020), “2019-2020 Implementation Plan for National Carbon Emission Trading, Total Allowances Setting and Allocation (Power Generation Industry)”

<https://www.mee.gov.cn/xxgk2018/xxgk/xxgk03/202012/W020201230736907121045.pdf>

Ministry of Ecology and Environment (2022), “Report on the National ETS Market’s First Compliance Phase (2019-2020)”

<https://www.mee.gov.cn/ywgz/xdqhbh/wsqtz/202212/P020221230799532329594.pdf>

⁵ Europe took roughly five years from announcement of the program construction concept in the “Green Paper on greenhouse gas emissions trading within the European Union” (2000) until rollout of the pilot phase (2005), and Korea required about five years from issuance of a document on ETS program deployment in accordance with the “Framework Act on Low Carbon, Green Growth” (2010) until official program rollout (2015).

National Development and Reform Commission (2021), “Work Plan for Reform and Enhancement of the National Coal Thermal Power Unit”

<https://www.ndrc.gov.cn/xxgk/zcfb/tz/202111/P020211103333054582799.pdf>

Ministry of Ecology and Environment (2022), “Example of Data Falsification in a Carbon Emission Report by China Carbon Energy Investment Technology and Other Third-Party Entities Disclosed by the Ministry of Ecology and Environment”

https://www.mee.gov.cn/ywgz/xdqhbh/wsqtz/202203/t20220314_971398.shtml

European Commission (2023) “Carbon Border Adjustment Mechanism: Questions and Answers”

https://ec.europa.eu/commission/presscorner/api/files/document/print/en/qanda_21_3661/QANDA_21_3661_EN.pdf

Ministry of Ecology and Environment (2018) “Guide for the Calculation and Reporting of Greenhouse Gas Emissions by Companies Related to Power Generation Facilities”

<https://www.mee.gov.cn/xxgk2018/xxgk/xxgk06/202212/W020221221671986519778.pdf>

Contact: report@tky.ieej.or.jp

Overview of China’s National ETS Program

Overview	Name	China’s National Carbon Emission Trading System
	Program starting date	June 2021
	Program period	From 2021: Only applies to the power generation industry Plans to broaden scope during the period through 2025 (14th Five-Year Plan Period)
	Goals and purpose	1) Utilize the market mechanism to effectively curtail greenhouse gas emissions, steadily lower carbon emissions, and contribute to advancement of a low-carbon society
	Summary	1) (Coverage sector) Only power generation in the initial stage 2) (Coverage standard) Coal and gas thermal power generation operators (including self-generation) with carbon dioxide emissions of 26,000t-CO ₂ or more in any year from 2013 to 2019 3) (Emission allowance allocation method) Benchmark method (allocation based on power generation efficiency) 4) (Credit usage) Use of the China Certified Emission Reduction (CCER) program possible for up to 5% of the emission allowance (limited to three types – renewable energy, forest absorption, and methane usage) 5) (Subject operator responsibility) Bears responsibility for GHG management, reporting, compliance, information disclosure, and accepting supervision 6) (Emissions total allocation) Decided comprehensively in accordance with national goals by the Ministry of Ecology and Environment 7) (Trading participants) Subject business operations, institutional investors, individuals 8) (Trading products) Add products other than actual emission allowances at the appropriate time
	Penalties	1) Incur penalty fees of CNY10,000 to CNY30,000 for non-compliance, etc. 2) Face criminal responsibility in cases of committing crimes
Scope	Unit	Business operator
	Main operator criteria	Power generation industry (including self-generated power in other sectors) for companies or other economic entities that have carbon dioxide emissions of 26,000t-CO ₂ or more in any year from 2013 to 2019 (planning to apply to industries with high energy consumption (petrochemicals, chemicals, non-metals, steel, non-ferrous metals, paper and pulp, and airlines)
	Covered gases	CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs, SF ₆ , NF ₃
	Coverage	Covers 2,162 electricity firms, roughly 4.5 billion t-CO ₂ in total emissions
Allocation method	Allocation method	1) Applies benchmark standards 2) Mainly no-charge allocation initially, introduce paid allocation as appropriate 3) Allocate respectively to 2019 and 2020 in the first compliance phase (allocate respectively to 2021 and 2022 in the second compliance phase)
	Burden mitigation and leakage measures	1) Compliance upper limit at 20% of the allocation (compliance exempted for surplus beyond 20% over the allocation) 2) Preference for the gas power generation unit (compliance upper limit at the allocation level)

Flexibility measures	Banking, borrowing	Not approved in the first compliance period (though accepts voluntary amortization of surplus allowance) (borrowing allowed up to 10% from 2023 in the second compliance period)
	Other credit usage	Permits use within 5% of CCER
	Price spike measures	The exchange operator has responsibility to effectively prevent excessive speculative trades.
	Volume measures	The Ministry of Ecology and Environment decides the total amount of carbon emission allocation and allocation method in accordance with national greenhouse gas emission regulation criteria and based on a comprehensive review of economic growth, industrial structure adjustments, energy structure optimization, air pollution emission adjustment and management, and other factors
Market	Price	1) Prices on the first trading day (July 16, 2021): Starting price at CNY48/ton, closing price at CNY51.23/ton 2) Prices during the first compliance period: Fluctuation range of period closing prices at CNY40-60/ton, period-average at CNY42.85/ton, and period final-day closing price at CNY54.22/ton 3) Closing price on June 20, 2023: CNY57.53/ton
	Transaction volume	1) 1.79 trillion tons of cumulative transaction volume in 2021, CNY7,661 million in cumulative transaction value
	Exchange	Shanghai Environment and Energy Exchange handles trading-related work

Source: Prepared by the author from various materials