Climate policies in China: Renewable Energy Introduction and the National Emissions Trading Scheme

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ASSIA Working Paper Series 22-03

November, 2022

Applied Social System Institute of Asia (ASSIA)
Nagoya University

名古屋大学 アジア共創教育研究機構

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Abstract

In the context of an accelerating global decarbonization transition, China has pledged to achieve carbon neutrality by 2060. The Chinese government has been implementing various policy tools. We review renewable energy (RE) introduction policies and the emission trading scheme in detail in this chapter. On the one hand, the Chinese government enacted the Renewable Energy Law and promoted the introduction of RE power generation through a series of actions, including the “concession bidding system” and the “feed-in tariff system” for electricity generation from renewable energies. As a result, China has become the world's largest user of RE. On the other hand, China started a unified national emissions trading scheme for power industries after an eight-year operation of regional pilot markets. As of 2020, it could cover approximately 4,500 Mt of CO_2. Based on the stocktaking of the RE introduction policies and the emission trading scheme in China, we summarize the potential future issues. Along with the introduction of a large scale of renewable power capacities, it is necessary to improve the flexibility and stability of the power grid. Moreover, emission trading schemes for other energy-intensive industries, such as cement, petrochemicals, nonferrous metals, and steel, are also in urgent need but still under consideration.

Keywords:

renewable energy, feed-in tariff, emission trading scheme, carbon price

Abbreviation

CEA	Carbon Emission Allowance
CCER	Chinese Certified Emission Reduction
COP	Conference of the Parties to the United Nations Framework Convention on Climate Change
ETS	Emission Trading Scheme
EU-ETS	European Union Emissions Trading Scheme
FIT	Feed-in Tariff
GHG	Greenhouse Gas
LCOE	Levelized Cost of Electricity
CO_2	Carbon Dioxide
NDRC	National Development and Reform Commission
RE	Renewable Energy

1. Introduction

At the 21st Conference of the Parties to the United Nations Framework Convention on Climate Change (COP21) held in Paris in 2015, participating countries agreed to implement global warming countermeasures on a global scale. Since then, as the world has accelerated the movement toward decarbonization, China has set a goal of achieving carbon neutrality by 2060. To achieve this goal, the Chinese government has implemented various policies. In this chapter, we explain China's renewable energy (RE) introduction policy and carbon dioxide (CO_2) emissions trading system as decarbonization policies.

Coal is the main source of energy consumption in China, accounting for approximately 70% of primary energy consumption. Coal emits more CO_2 per calorific value than any other fossil fuel. This is partly why China is the world's largest CO_2 emitter, although its economy is smaller than that of the United States. Since most of China's coal consumption is used for power generation, shifting from thermal power generation to RE generation and introducing a CO_2 emissions trading system in the power sector are effective measures to reduce coal consumption.

The Chinese government enacted the Renewable Energy Law, which requires electric power companies to purchase RE power, and promoted a series of policies to encourage the introduction of RE power generation, including a "Concession bidding system for renewable power" and a "feed-in tariff" (FIT) system for RE power. As a result, China has become the world's largest user of RE. Section 2 introduces the policies that promote the expansion of RE use in China.

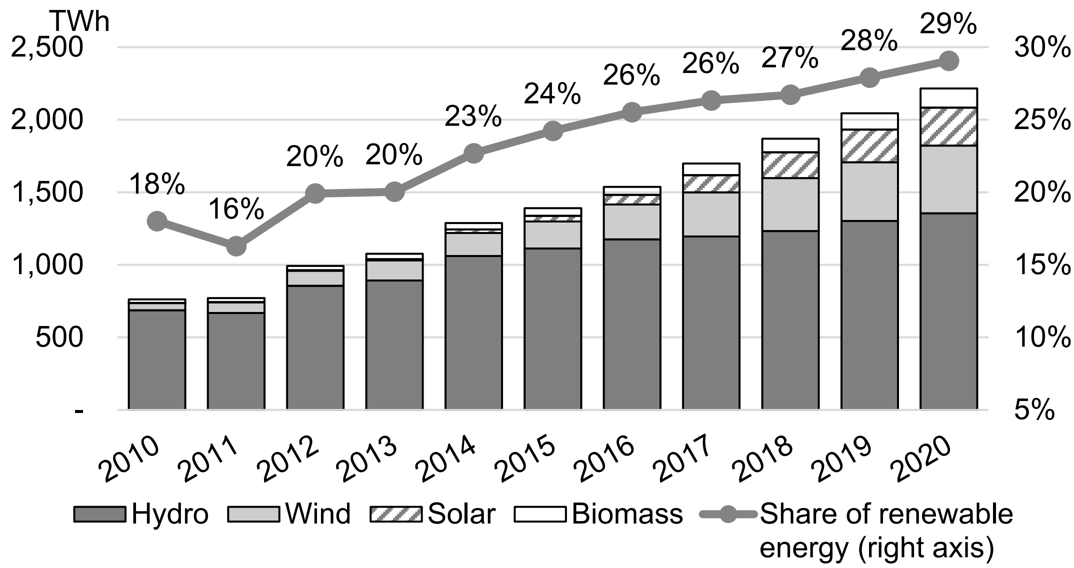
China also started a unified national emissions trading scheme (ETS) for the electric power industry on July 16, 2021. This scheme was launched eight years after China's pilot carbon market was established in Shenzhen in June 2013 and six years after the State Council announced its intention in September 2015 to establish a unified national carbon emissions market. In Section 3, the pilot projects for the ETS in nine Chinese cities and regions (Shenzhen, Shanghai, Beijing, Guangdong, Tianjin, Hubei, Chongqing, Sichuan, and Fujian) are outlined. We also describe the characteristics of the national unified ETS for electric power and examine the market performance in 2021 in Section 3. Section 4 discusses potential future issues regarding RE policies and the ETS in China.

2. Policies for RE energy promotion in China

2.1 Status of the introduction of RE

Figure 1 depicts the introduction status of RE in China. The line graph indicates the share of RE in the total power generation. It was only 16% in 2011, but it doubled to 29% in 2020. The bar graph indicates the composition of RE. RE comprises hydropower, wind power, solar power, and biomass, among which hydropower has the largest share, accounting for more than half of RE in 2020. However, the expansion rate of wind and solar power generation after 2011 is extremely large. If you take a look at their share in renewable energies, the share of wind power has tripled from 6.5% to 21.1%, and that of solar power increased from 0.0% to 11.8%.

Figure 1: Power generation and rate of China's RE



Source: Created by the authors using data from National Bureau of Statistics (2021)

2.2 Introduction of a concession bidding system for RE

China's RE industry development policy began in the 1990s for wind power generation and the 2000s for solar power generation. The RE Law, which came into effect in 2006, defined RE and clarified its role in the Chinese economy. The law also obliged power transmission and distribution companies to purchase the entire amount of electricity generated by RE generators. With the enforcement of this law, China's RE power generation has increased dramatically.

In addition, the National Development and Reform Commission (NDRC) have started the "concession bidding system for RE." This system calls for bidders for development rights for power generation projects of 100 MW or more in areas where natural energy resources are rich. Further, the system focuses on reducing power generation costs and increasing the domestic production rate of power generation facilities.

As presented in Table 1, the concession bidding system for wind power began in 2003. The capacity of wind power through concession bidding has reached 2700MW. The contract price was approximately 0.5 yuan/kWh. Since 2006, the Chinese government has provided generous support to wind power companies, including subsidies and tax incentives.

Table 1 Conditions and results of concession bidding for wind power

Year	Equipment domestic production rate standards	Region	Capacity (MW)	Contract price (yuan/kWh)
2003	Over 50%	Guangdong	200	0.501
		Jiangsu		0.436
2004	Over 50%	Inner Mongolia	400	0.382
		Jiangsu		0.519
		Jilin		0.509
2005	Over 70%	Jiangsu	450	0.488
		Gansu		0.462
		Shandong		0.600
2006	Over 70%	Inner Mongolia A	700	0.420
		Inner Mongolia B		0.466
		Hebei		0.501
2007	Over 70%	Inner Mongolia A	950	0.468
		Inner Mongolia B		0.522
		Hebei		0.551
		Gansu		0.521

Source: Created by the authors based on the studies by Jiang (2006) and Liu (2010)

Concession bidding was also conducted for solar power generation. In 2009, the Dunhuang Solar Power Plant with a capacity of 10 MW was constructed in Gansu Province as the first large scale solar power plant through bidding. With this as a start, the construction of large scale solar power plants began in China. As presented in Table 2, bidding for a concession of solar power generation was also conducted in 2010, and the total installed capacity of solar power generation increased to 290MW. The successful bid price was approximately 0.9 yuan/kWh, which was higher than that of wind power generation.

Table 2 Conditions and results of concession bidding for solar power

Year	Region	Capacity (MW)	Contract price (yuan/kWh
2009	Gansu	10	1.0900
2010	Shaanxi	20	0.8687
	Qinghai A	30	0.7288
	Qinghai B	20	0.8286
	Gansu A	20	0.8265
	Gansu B	20	0.7803
	Gansu C	20	0.8099
	Inner Mongolia A	20	0.8847
	Inner Mongolia B	20	0.7978
	Inner Mongolia C	20	0.8444
	Ningxia	30	0.9791
	Xinjiang A	20	0.7388
	Xinjiang B	20	0.9317
	Xinjiang C	20	0.9907

Source: Created by the authors based on the study of Hu (2011)

2.3 Introduction of the FIT system

FIT is a system that obligates power transmission companies to purchase power generated by RE for a certain period at a price determined by the government. FITs for wind and solar power started in 2009 and 2011, respectively, ending the bidding system for RE development rights. Regarding the fixed purchase price, the purchase price for wind and solar power generation is set by region, and the purchase period for both is 20 years.

The Renewable Energy Law Amendment Bill enacted in 2010 stipulates that power transmission and distribution companies should share the increased cost of purchasing RE power generation among electricity consumers nationwide. With this, the collection system of the RE power generation promotion levy started.

The purchase price changes every year, Table 3 presents the purchase price for wind-generated power as of 2019, and Table 4 presents the purchase price for photovoltaic power as of 2019. The purchase price is categorized according to the abundance of RE resources and the construction cost in each region. Four resource zones were established for wind power generation, and the purchase price was set low in areas with abundant wind power resources. Further, three categories of resource zones were established for solar power generation, and the purchase price was set low in areas rich in photovoltaic resources[1]. The purchase price of solar power is slightly higher than that of wind power.

Table 3 FITs by resource zone for wind power (2019)

Resource zone	Purchase price	Target area
1st	0.34 Yuan/kWh	Inner Mongolia: Regions other than those in the 2nd zone Xinjiang: Urumqi, Ili, Kelamayi, and Shihezi
2nd	0.39 Yuan/kWh	Inner Mongolia: Chifeng, Tongliao, Xin'an, and Hulunbuir Hebei: Zhangjiakou and Chengde Gansu: Jiayuguan and Jiuquan
3rd	0.43 Yuan/kWh	Jilin: Baicheng and Songyuan Heilongjiang: Jixi, Shuangyashan, Qitaihe, Suihua, Yichun, and Daxin'anling Gansu: Regions other than those in the 2nd zone Xinjiang: Regions other than those in the 1st zone Ningxia
4th	0.52 Yuan/kWh	Regions other than those in the 1st, 2nd, and 3rd zones

Source: Created by the author based on the NDRC (2019a)

1 There are some "local production for local consumption" type of projects in solar power generation as an anti-poverty measure in poor rural areas. In such cases, the resource zone was the same as the general solar power generation, but the purchase price was set higher.

Table 4 FITs by resource zone—solar power (2019)

Resource zone	purchase price	Target area
1st	0.40 Yuan/kWh	Ningxia, Qinhai: Haixi Gansu: Jiayuguan, Wuwei, Zhangye, Jiuquan, Dunhuang, and Jinchang Xinjiang: Hami, Tacheng, Altay, and Kelamayi Inner Mongolia: Regions other than the 2nd zone
2nd	0.45 Yuan/kWh	Beijing, Tianjing, Heilongjiang, Jilin, Liaoning, Sichuan, and Yunnan Inner Mongolia: Chifeng, Tongliao, Xin'an, and Hulunbuir; Hebei: Chengde, Zhangjiakou, Tangshan, and Qinhuangdao Shanxi: Datong, Shuozhou, and Yizhou Shaanxi: Yulin and Yan'an Qinghai: Regions other than those in the 1st zone Gansu: Regions other than those in the 1st zone Xinjiang: Regions other than those in the 1st zone
3rd	0.55 Yuan/kWh	Regions other than those in the 1st and 2nd zones

Source: Created by the authors based on data from the NDRC (2019b)

2.3 End of FIT system

The levelized cost of electricity (LCOE)[2] of wind power in China in 2019 was about US$50/MWh, which is about half of that in 2014, and the LCOE of solar power in 2019 was about US$43/MWh, which is about a quarter of that in 2014. However, the LCOE of coal-fired power generation in China in 2019 was US$50–72/MWh, which is at the same level as that of wind and solar power (Wang (2020)). As a result, the FIT system for power generated by RE has lost its meaning, and the FIT system for large scale wind and solar power generation finished by 2021[3].

After that, the Chinese government started a new system called the "grid parity project." Grid parity projects are projects in which wind and solar power plants sell electricity at benchmark prices for coal-fired power generation in the same region for more than 20 years without receiving subsidies. Participants in this project can enjoy preferential treatment, such as priority rights in power transmission, purchase of all generated electricity, issuance of a "Green Power Certificate," guarantee of grid connection, and financial support. The first solicitation for grid parity projects (4.5 GW) was made in May 2019. The breakdown was 4.5 GW for onshore wind power, 14.8 GW for solar power, and 1.5 GW for distributed power generation ("local production for local consumption" type).

[2] LCOE means the average cost per unit of power generation. It is calculated based on the total costs necessary for power generation, such as construction costs, operation and maintenance costs, and fuel costs as well as profits and the estimated power generation during the operation period.

[3] Subsidization policies now continues for offshore wind power and distributed power generation, but they are scheduled to phase out by 2030.

After the end of the FIT, the interest in RE power policy shifted from quantitative expansion to market efficiency. In 2021, a new product called “green power” was introduced in the power trading market, adding environmental value to RE power. Suppliers of RE electricity are required to obtain the above-mentioned “Green Power Certificates,” which are purchased for firms to reduce CO_2 emissions. In addition, as already mentioned, as RE power fluctuates depending on the weather, the supply of RE power requires adjustment power to stabilize the electricity in the grid. The Chinese government established the “Ancillary Service Market” (CNCTST (2020)) to trade electric power adjustment means, such as power storage facilities or pumped storage power generation. This has made the RE market more efficient.

3. ETS in China

3.1 Industries and companies covered by the ETS

As a market-based climate policy instrument, ETS provides economic incentives for its covered entities to achieve emission mitigation. Currently, 26 ETSs are in force, including EU-ETS, Korea ETS, and Japan ETS (Tokyo, Saitama) (ICAP (2022)). The catalyst for creating an ETS in China was the 15th Conference of the Parties at the United Nations Framework Convention on Climate Change (COP15) held in Copenhagen in December 2009. At COP15, the Chinese government announced a national goal of reducing the country’s carbon emissions per unit of GDP by 40%–45% of the 2005 levels by 2020. The carbon markets were set up to achieve this goal in 2020.

In China, the government set up pilot programs for a certain systemic reform in certain areas before the implementation of nationwide systemic reforms. One example of such pre-implementation processes is the recent reform of indirect taxes in the 2010s. Until 2011, China’s indirect tax system entailed a business tax and a value-added tax. Goods were subject to the value-added tax, whereas the business tax was levied on services. The dual existence of these taxes had many adverse effects, so the two taxes were integrated to form a single value-added tax. The pilot project to integrate them into one value-added tax was introduced in Shanghai on January 01, 2012, followed by Beijing, Jiangsu, and other provinces, and then expanded nationwide in 2013. However, until 2013, the services subject to the tax did not include rail transport, telecommunications, or real estate. The service industries subject to the tax were gradually increased, and all service industries nationwide came under the value-added tax system in 2016.

The ETS also started in the form of pilot projects in several rural areas. In October 2011, the NDRC issued the “Notice on the Implementation of ETS Pilot Projects.” In 2013, the ETS pilot project was introduced in Shenzhen (June 18, 2013), Shanghai (November 26, 2013), Beijing (November 28, 2013), Guangdong (December 19, 2013), and Tianjin (December 26, 2013). In 2014, other ETS pilot projects were launched in Hubei (April 2, 2014) and Chongqing (June 19, 2014). After that, another pilot market was opened in

Sichuan (December 16, 2016) and Fujian (December 18, 2016), making the total number of pilot markets nine.

As presented in Table 5, in each of these ETS pilot projects, the criteria for the covered industries and firms within these industries are quite different. Shenzhen and Shanghai, which have the widest range of target industries, have the highest number of industries, whereas Chongqing regulates only heavy industries. Every area regulates its electricity and heat supply and steel industries. Many areas also regulate the chemical and petrochemical industries. Shanghai is the only one regulating the construction sector. In terms of the threshold criteria for companies located in the target industries, Shenzhen has the lowest standard emission (i.e., 3,000t CO_2). However, with baseline emissions of 60,000 coal-equivalent tons (tce) of energy use (approximately 156,000t CO_2-equivalent) until 2016, Hubei Province's market had the highest baseline CO_2 emissions. This figure is the highest of all the markets even after the baseline level was reduced to 10,000 tce (about 38,000t CO_2-equivalent) in 2017. The next largest markets in terms of baseline CO_2 emissions are Sichuan and Fujian, at 26,000 tons.[4] The number of companies subject to the criteria started to increase in 2017, as the criteria were lowered from 10,000t CO_2 to 5,000t CO_2 in the Beijing pilot project and from 20,000t CO_2 to 10,000t CO_2 in the Tianjin pilot project.

Table 5 Covered industries and firms for each ETS pilot project

Area	Target industries	Remarks (as of 2018)
Beijing	Electricity and heat supply, cement, petrochemicals, manufacturing, transportation (buses, subways, etc.), services, and other industrial sectors	・Those with average annual emissions of 10,000t CO_2 or more from 2009 to 2011 ・From 2016, those with emissions of 5,000t CO_2 or more in 2014 were added
Tianjin	Electricity and heat supply, steel, chemicals, petrochemicals, and natural gas extraction	・Those with average annual emissions of 20,000t CO_2 or more from 2009 to 2015 ・From 2016, those with emissions of 10,000t CO_2 or more were also included
Shanghai	Electricity and heat supply, steel, petrochemicals, chemicals, nonferrous metals, construction materials, spinning and weaving, paper manufacturing, rubber, synthetic textiles, transportation (air transportation, airports, shipping, ports, and subways), commerce, hotels, and finance	・Industrial sectors: Those with emissions of 20,000t CO_2 or more in either 2010 or 2011 ・Nonindustrial sectors: Those with emissions of 10,000t CO_2 or more in either 2010 or 2011

4 One ton of coal-equivalent energy use corresponds to approximately 2.6t CO_2 in terms of CO_2 emissions.

Area	Target industries	Remarks (as of 2018)
Shenzhen	Twenty-six industrial sectors, including electricity and heat production, processing, manufacturing, transportation (ports, buses, and subways), and large public buildings	・Industries that have had emission levels of 3,000t CO_2 or more during any of the years from 2009 to 2011 ・Operators of large public facilities of 10,000 square meters or more
Chongqing	Heavy industries	・Industries that have had emission levels of 20,000t CO_2 or more during any of the years from 2008 to 2012
Guangdong	Electricity and heat supply, steel, cement, petrochemicals, paper manufacturing, and aviation (air transportation and airports)	・Those with emissions of 20,000t CO_2 or more in either 2011 or 2012
Hubei Province	Electricity and heat supply, steel, automobiles, nonferrous metals, glass, cement, chemicals, petrochemicals, food, synthetic textiles, paper manufacturing, pharmaceuticals, etc.	・Those with emissions of 60,000t CO_2 or more in 2010 or 2011 ・From 2017, industries that have had energy consumption levels of 10,000 tce or more in any year from 2014 to 2016 were included
Fujian Province	Electricity, steel, chemical industry, petrochemicals, nonferrous metals, aviation (air transportation and airports), construction materials, paper, and ceramics	・Industries that have had energy consumption levels of 10,000 tce or more in any year from 2013 to 2015 were included
Sichuan Province	Electricity, steel, chemicals, nonferrous metals, paper, aviation (air transportation and airports), and construction materials	・Industries with emission levels of 26,000t CO_2 or more in 2016 or 2017

Source: Created by the authors based on ICAP (2022)

3.2 Setting emissions allowances for ETS pilot projects

The allocation of emission allowances becomes complicated when the scheme covers multiple areas and industries (Demailly and Querion (2006)). Emission allowances for the ETS pilot projects vary from area to area and industry to industry because the following factors were considered: 1) regional CO_2 reduction targets and targets for related sectors, 2) air pollution control targets, and 3) regional economic and industrial development targets. The differences are also because economic and air pollution conditions vary from region to region (Jiang et al., 2016), the CO_2 reduction targets (vs. 2015) in the 13th Five-Year Plan (2016–2020) vary from region to region, and the targets are not for the total CO_2 emissions but for CO_2 emissions per unit of GDP, making the context of China more difficult to understand. Although the aggregate CO_2 reduction target per unit of GDP for China is 18.0%, it is higher (20.5%) in the more developed areas of Beijing, Tianjin, Hebei, Shanghai, Jiangsu, Zhejiang, Shandong, and Guangdong. Furthermore, this target is 19.5% in Fujian, Jiangxi, Henan, Hubei, Chongqing, and Sichuan. In Shanxi, Liaoning, Jilin, Anhui, Hunan, Guizhou, Yunnan, and Shaanxi, the reduction target is 18.0%, which is the same as the national target. However, in the less developed northwestern provinces of Inner Mongolia, Heilongjiang, Guangxi, Gansu, and Ningxia, the reduction target, which is 17%, is below the national target. In Hainan, Tibet, Qinghai, and Xinjiang, the reduction target is 12.0%, which is far below the national target.

The emission allowances are calculated using either the benchmarking method or the grandfathering method. The benchmarking method involves multiplying the actual corporate activity by a coefficient to obtain the emission rate or any other metric on the industry's top players. The grandfathering method involves applying a certain reduction rate to the base-year emissions volume (average annual emissions during the past several years).

3.3 Characteristics of the unified national ETS

By incorporating the experience gained from the regional pilot projects, the unified national ETS was launched in July 2021 and started in the electricity supply sector and may be extended to cement, petrochemicals, nonferrous metals, steel, etc. Consequently, China now has a national market and nine local markets operating simultaneously. The national ETS has two locations—the Unified National Carbon Emission Rights Registration and Exchange in Wuhan and the Unified National Carbon Emission Rights Exchange in Shanghai. A carbon registration system and a trading system were established and are being operated by the China Hubei Provincial Carbon Emissions Exchange and the Shanghai Environment and Energy Exchange, respectively.

Currently, the National ETS only covers the electric power sector. Moreover, it covers a total of 2,163 power plants that have extremely high annual CO_2 emission levels, i.e., more than 26,000 tons. The benchmark values for CO_2 emissions quotas vary depending on the type of power plant, which are 0.877t CO_2/MWh for coal-fired power plants of 300 MW class and above, 0.979t CO_2/MWh for coal-fired power plants of 300 MW class and below, and 0.392t CO_2/MWh for gas turbines. These figures are then further adjusted based on the cooling method or the volume of heat supplied. The initial allocations were carried out without charge. The preliminary allocation (initial allocation) of emissions allowances is based on 70% of the actual electricity supply in the 2018 fiscal year. The allocation of emissions allowances was then adjusted in accordance with the actual electricity supply in 2019 and 2020.

There are two methods for trading emissions allowances—negotiated trades and bidding. Furthermore, there are two types of negotiated trades—listed negotiated trades and large-lot negotiated trades. For listed negotiated trades, the size of the trade is 100,000t CO_2 or less, and the trading price is set within a range of 10% above or below the closing price of the previous trading day. Large-lot negotiated trades are trades wherein the size of the trade is 100,000t CO_2 or more, and the trading price is set within a range of 30% above or below the closing price of the previous trading day.

Currently, Carbon Emission Allowances (CEAs) are traded by China's national ETS (Cong & Wei, 2010). The allocation approaches of the allowances have been debated for a long time—since market-based carbon pricing started (Flues & van Dender). These allowances have been allocated to each company. Chinese Certified Emission Reductions (CCERs) will also be traded in the near future. CCERs are carbon offset credits issued for emission reduction in voluntary carbon emission reduction projects. They are equivalent to J-credits (formerly known as domestic credits) in Japan.

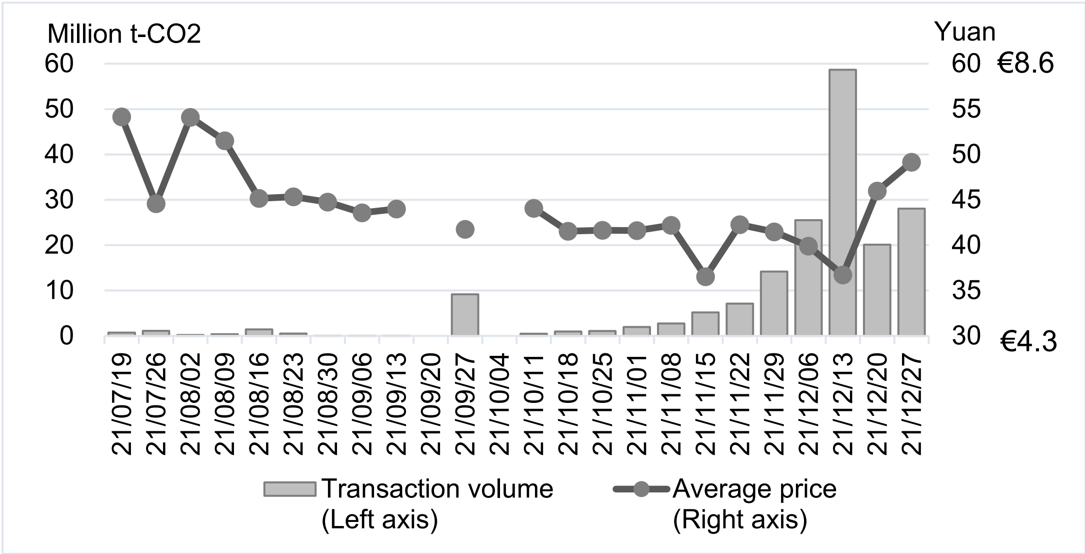
3.4 ETS price movements

According to the National Carbon Market Transaction Data Overview, the total volume of CEA transactions from the opening of the national ETS in July 2021 to the end of the year was 179 million tons, with a total transaction value of RMB 7.661 billion. From this figure, the average price of CO_2 is RMB 42.8 per ton, which is approximately 770 yen at a rate of 18 yen per RMB.

The restricted period is one year, and covered companies must achieve their emissions quota by year-end. Companies that exceed their quota must purchase emissions allowances from the ETS or purchase offset credits (a "cap and trade" system). Figure 2 depicts the weekly volumes and prices traded in the national ETS. Regarding price movements, the price exceeded RMB 50 per ton in the first few weeks of trading but gradually declined thereafter, falling to RMB 40 per ton in December 2021. However, at the end of the year, when the covenant period had almost ended, the price rose to 50 RMB per ton. This is still considerably lower than that in the European trading market (European Union-ETS (EU-ETS)). The price in Europe has increased sharply since December 2020—when the EU raised its greenhouse gas (GHG) reduction target. Therefore, as of September 1, 2021, it was more than 60 euros per ton of CO_2 (7,800 yen at a rate of 130 yen per euro).

Regarding the trading volume, except for the week before China's National Day, the weekly trading volume did not reach 10 million tons until late November. However, as the end of the covenant period approached, the volume quickly increased, and during the week of December 13, the trading volume exceeded 50 million tons.

Figure 2 Trading volume and prices in China's ETS



Source: Created by the authors based on data from the National Carbon Market Transaction Data Overview. Available at: <http://www.tanjiaoyi.com/tanhangqing/>

4. Future issues

4.1 RE

In 2021, the Chinese government announced the "Circular of the State Council on an action plan for peaking carbon emissions before 2030." Table 6 summarizes the five-year action target related to RE. As of 2020, the share of RE in primary energy consumption was 15.9%, but the plan aims to increase this ratio to 20% by 2025 and 25% by 2030. This means that more than half of the new increase in primary energy demand will be covered by RE.

Table 6 China's long-term target for RE

	2021–2025	2026–2030
RE rate in primary energy consumption	20%	25%
RE rate in new primary energy consumption	50%	—
New hydropower installed capacity	40GW	40GW
Total installed capacity of wind and solar power generation	—	1200GW
New power storage installed capacity	30GW	—
Total installed capacity of pumped-storage power generation	—	120GW
RE power generation	3.3Tri. kWh	—
Ratio of RE power generation	33%	—

Source: Created by the authors based on papers by State Council (2021) and NDRC (2022a)

Regarding the introduction of RE, the target is set to build 80 GW of new hydroelectric power plants and expand the total installed capacity of wind and solar power generation to over 1,200 GW by 2030. It is also decided to develop large scale offshore wind power generation. Although the national target for offshore wind power generation has not been announced, the total individual targets of several provinces that are positive about the development of offshore wind power generation is to reach approximately 60 GW by 2025.

If the above introduction targets are achieved, the total capacity of RE power generation facilities will greatly exceed the 2021 figure of 1,259 GW of thermal power generation in 2030, and RE will become China's main power source[5]. However, in addition to the introduction of a large amount of electricity from RE sources, it is necessary to improve the flexibility and stability of the power grid. Therefore, the “long-term target for RE” set a goal of installing 30 GW of storage capacity by 2025 and increasing the total installed capacity of pumped storage to 120 GW by 2030.

The emphasis of policies that are aimed at increasing the proportion of RE is shifting from expanding the introduction of RE to efficient use of RE. As already mentioned, subsidies for large scale solar power and onshore wind power generation have been abolished, and currently, only offshore wind power generation is eligible for subsidies. It was decided to promote the decarbonization of transportation and the use of hydrogen as an energy carrier to improve the efficiency of using RE, the development of RE storage facilities, and the strengthening of power grids.

In the field of transportation, the government is strongly promoting the introduction and expansion of electric vehicles (EV) and fuel cell vehicles (FCV) because they use renewable power. The central government has implemented measures such as providing subsidies to consumers and reducing or exempting automobile acquisition taxes to support the purchase of new energy vehicles (Rui et al. (2021)). Although the central government's preferential treatment will phase out in the future, local governments are expected to continue to provide their own subsidies. In addition, the government has developed transportation infrastructure, such as charging stations for EVs and hydrogen filling stations for FCVs, to promote the use of EVs and FCVs (Rui et al. (2021)). Moreover, the NDRC (2022b) obliged new detached houses built after 2022 to be designed so that EV charging facilities can be added after construction and called for existing residential complexes and commercial facilities to install EV charging facilities.

Incidentally, the use of green hydrogen[6] is attracting attention as a method of effective use of RE. Hydrogen was considered as energy for the first time in the “Energy Law (Provisional)” enacted in 2020. However, expanding the use of hydrogen does not necessarily lead to decarbonization as most hydrogen is currently made from fossil fuels (so-called gray hydrogen)[7]. Therefore, green hydrogen is the basis for future hydrogen

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[5] Peking University Institute of Energy (2021) predicts that CO_2 emissions from the power sector will peak in 2025.

[6] Green hydrogen is hydrogen produced by electrolyzing water using electricity from RE sources.

[7] Currently, there are two main hydrogen production methods—reforming hydrogen from fossil fuels (e.g., steam reforming) and recovering hydrogen generated from coke ovens, etc. Hydrogen processed by such methods is called gray hydrogen as these production processes emit CO_2.

production in the “Hydrogen industry Development Medium- to Long-Term Plan 2021–2035” announced in 2022. However, the produced hydrogen does not have a green or gray color, so users cannot distinguish between them. Therefore, the government launched China's first “green hydrogen certification system” in 2020 to support the green hydrogen industry (China Hydrogen Alliance (2020)). The government's support policy for green hydrogen has been substantialized.

4.2 ETS

The Chinese government has a high level of confidence in the ETS. The ETS will provide economic incentives to reduce GHG emissions, reduce the cost of reducing GHG emissions, and promote green technology innovation and industrial investment. At present, China’s ETS only covers the electric power industry. However, there are plans to create ETSs for other energy-intensive industries, such as cement, petrochemicals, nonferrous metals, and steel. Whether these markets will emerge as industry-specific carbon markets or integrated carbon markets that involve multiple industries is still being considered.

There is another issue that requires addressing and reconciliation in the future. This issue pertains to the coexistence of CO_2 reduction targets for businesses and provinces. Province-specific CO_2 reduction targets must also be strictly met.[8] In many cases, the production area (i.e., the area of energy consumption) and the final consumption area are different; the electric power industry is a typical example. Some people believe that individuals in areas where goods and services are consumed should also take responsibility for CO_2 emissions. The issue of coordination between the production and consumption areas for goods and services is also likely to arise.

It is interesting that while China, a socialist country, is emphasizing price mechanism, it is also ironic that Japan, a market economy, does not have a national-level carbon market. However, in December 2021, Japan’s Ministry of Economy, Trade, and industry also launched the “Working Group on the Improvement of the Environment for Appropriate Use of Carbon Credits to Achieve Carbon Neutrality.” Although Japan has carbon credit schemes such as J-credits, the trading of credits in these schemes are arm’s length transactions that do not provide price signals. As carbon pricing (a policy to change the behavior of emitters by putting a price on carbon) is becoming increasingly common around the world, Japan can also create a system to facilitate trading in carbon credits.

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[8] See Reuters’ article dated September 16, 2021.

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