LUISS

Corso di laurea in Strategic Management

Cattedra Energy & Climate Change Policy

The Chinese ETS
Status and perspectives of Chinese market-based carbon pricing system

Prof. Governatori Michele

RELATORE

Prof. Taraborrelli Angelo

CORRELATORE

Flavio Petrucci Matr. 785101

CANDIDATO

Introduction

Chapter 1 – The Chinese Emission Trading System: Origins, Structure and Functioning

1.1 From pilot programmes to national implementation: the evolution of Chinese ETS
1.2 The national system launched in 2021: main features
1.3 Sectoral coverage and allocation criteria
1.4 Price dynamics and trading volumes: available data and initial assessments
1.5 Structural weaknesses and challenges

Chapter 2 – Comparison with the EU ETS

2.1 EU ETS: brief overview and current structure
2.2 Coverage, allocation and governance: similarities and differences
2.3 Carbon prices and market depth: comparative analysis
2.4 Lessons from the EU ETS and their applicability in China
2.5 The Chinese ETS: adaptive imitation or a global relaunch?

Chapter 3 – The Chinese ETS and EU Relations

3.1 Strategic dialogue between China and the EU on carbon pricing
3.2 The role of the Chinese ETS in the context of the EU CBAM
3.3 Chinese responses to the Carbon Border Adjustment Mechanism
3.4 Opportunities for coordination and mutual recognition
3.5 ETS as a tool for climate diplomacy and economic positioning

---

Chapter 4 – Future Prospects of the Chinese ETS

4.1 Planned sectoral expansion
4.2 Strengthening institutional capacity and MRV (Monitoring, Reporting, Verification)
4.3 Integration with financial instruments and international carbon markets
4.4 Reform paths and future scenarios: ETS as a driver for climate neutrality?

Conclusion

Introduction

In recent decades, the People's Republic of China has experienced unprecedented economic growth, accompanied by a sharp increase in energy consumption and greenhouse gas emissions. In this context, the climate issue has gradually emerged as one of the main structural challenges of the Chinese development model, assuming not only environmental but also economic, social and geopolitical relevance. China's accession to the 2015 Paris Agreement and its official commitment to peak emissions by 2030 and achieve climate neutrality by 2060 represent a crucial step in this trajectory.

Within this framework, the introduction of carbon pricing instruments has taken on a central role in China's climate strategy. Among these, the Emission Trading System is the main market mechanism adopted to steer corporate behaviour towards emissions reduction through the allocation and trading of emission allowances. After an initial phase of regional experimentation, which began in 2013 with several pilot programmes, China launched a national ETS in 2021, which is now the world's largest carbon market in terms of emissions covered.

The aim of this thesis is to systematically analyse the evolution, structure and functioning of the Chinese ETS, highlighting its distinctive features, critical issues and prospects for development. In particular, the thesis aims to: reconstruct the path that led from regional pilot programmes to the implementation of the national system; examine the mechanisms for allocating allowances, sectoral coverage and price dynamics; compare the Chinese model with the European Union ETS, highlighting convergences and divergences; analyse the role of the ETS in the context of China-EU relations, also in light of the introduction of the Carbon Border Adjustment Mechanism; and finally, discuss possible future scenarios for the system, with a particular focus on its ability to contribute to long-term decarbonisation goals.

The thesis is structured in four chapters: the first one is devoted to the analysis of the Chinese ETS, from its experimental origins to the characteristics of the national system, including an examination of pilot programmes and major structural weaknesses. The second chapter offers a comparison with the European ETS, considered the main international reference point for carbon markets. The third chapter explores the implications of the Chinese ETS in relations with the European Union, with a particular focus on the dialogue on carbon pricing and the effects of the CBAM. Finally, the fourth chapter explores the future prospects of the system, analysing reform paths and possible scenarios for its evolution.

Through this analysis, the paper aims to contribute to the understanding of the Chinese ETS not only as an instrument of domestic climate policy, but also as an increasingly important element in global climate governance.

Chapter 1 – The Chinese Emission Trading System: Origins, Structure and Functioning

1.1 From pilot programmes to national implementation: the evolution of China's ETS

China's rapid economic growth in recent decades has come at the expense of high energy consumption and a sharp increase in emissions, contributing to significant environmental challenges. In 2006, China surpassed the United States to become the world's largest emitter of CO_2[1] .

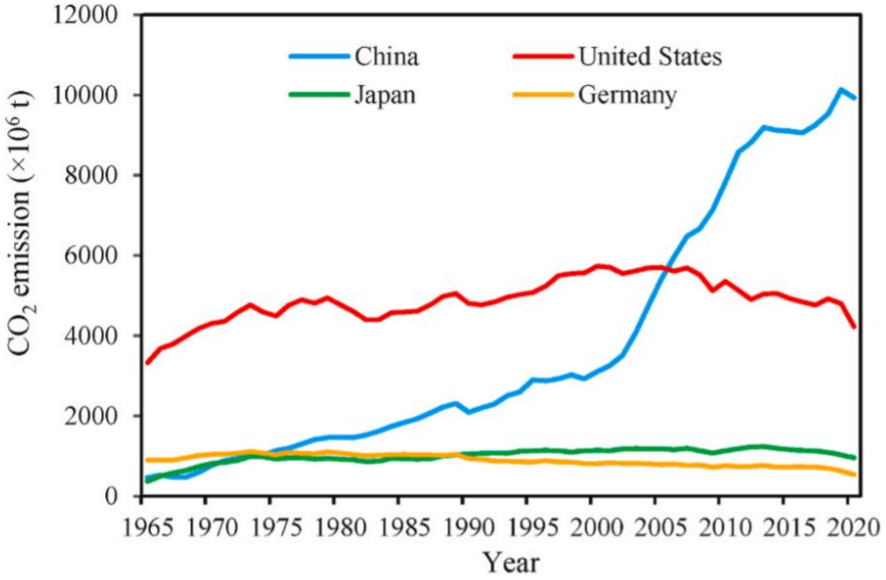


Figure1. Emissions (1965-2020)

As a signatory to the 2015 Paris Agreement, China has officially committed to reducing peak emissions by 2030 and achieving carbon neutrality by 2060. In order to pursue these goals, the People's Republic of China has implemented various measures to mitigate its environmental impact, including the introduction of an Emissions Trading System (ETS) aimed at reducing greenhouse gas emissions. In 2013, China launched pilot ETS programmes in eight regions and cities: Beijing, Shanghai, Tianjin, Shenzhen, Chongqing, Guangdong, Hubei, and Fujian. These pilots operate in parallel with the National ETS, covering sectors and entities not included in the national system.
Below is a brief description of these programmes:

[1] Huang, W., Wang, Q., Li, H., Fan, H., Qian, Y., & Klemeš, J. J. (2022), "Review of recent progress of emission trading policy in China", Journal of Cleaner Production

1.1.1 The Shenzhen ETS

The Shenzhen ETS was the first to become operational in June 2013 and is the only sub-provincial pilot project, implemented in the city of Shenzhen, located in Guangdong Province, with its own independent regulatory framework. As of 2020, this ETS covered approximately 45.42 $MtCO_2$, from more than 650 entities[2] , in various sectors, including water, gas, heating, manufacturing, electronic equipment, waste management, ports, subways and public buses, and, in 2024 its coverage expanded to other sectors, such as data centres, solid waste, accommodation and catering, wholesale and retail trade, warehousing and postal services, software and IT services, as well as government agencies and public institutions.

The allocation methods are benchmarking, for sectors such as water, electricity and gas networks, and grandfathering[3] , used for sectors such as waste management, ports, underground railways, public transport and certain selected chemical production facilities. With the exception of the two auctions held in 2014 and 2022, allowances are allocated free of charge and all entities are required to surrender allowances corresponding to their total verified emissions.

With regard to the Monitoring, Reporting and Verification (MRV) mechanism, the ETS requires entities subject to the obligation to prepare monitoring plans and monitor their emissions in accordance with those plans; In addition, annual reporting of CO_2 emissions to the competent authority for the ETS is required by the end of March of the following year, using emission factors differentiated according to different sources, and the industrial entities subject to the scheme must also submit an annual statistical report on production indicators to the municipal statistics department by the end of March of the following year. Finally, third-party verification of the annual emissions report is mandatory, and the competent authority may entrust this task to a specialized agency. In addition to the China Certified Emission Reduction (CCER[4]) national offset programme, this ETS allows the use of local offset units, including those from the Tan Pu Hui[5] system, up to a maximum of 20% of the compliance gap can be covered by offsets: this is intended to partially offset emission obligations, with the cap proportionally linked to the extent of any shortfalls. The Shenzhen ETS is regulated by a specific law enacted by the Shenzhen People's Congress, the city's legislative body.

In accordance with the Shenzhen Emissions Trading System Implementation Plan to support peak carbon emissions and achieve carbon neutrality, the system will adopt an absolute cap on emissions starting in 2027.

[2] Emission Trading Worldwide – Status Report 2025, ICAP (International Carbon Action Partnership)

[3] This method consists of the allocation, i.e. the free allocation of emission rights by the state to entities subject to charges based on historical emissions

[4] Credits issued to entities that carry out voluntary emission reduction activities certified by the Chinese government

[5] Mechanism to encourage and reward low-carbon behaviour and purchases, and to develop a market for low-carbon goods and services for domestic use

1.1.2 The Beijing ETS

The Beijing ETS, launched in November 2013, is one of three Chinese pilot programmes whose regulatory framework has been formally adopted by the respective regional congress. It adopts a bottom-up approach to setting the cap: the total cap is calculated by aggregating the verified emissions of all entities involved. The Beijing ETS covers approximately 30%6 of the city's total emissions, including those from industrial and non-industrial sectors such as electricity grid operations, heating, cement, petrochemicals, other industrial producers, services, public transport and domestic aviation.

Allowances are allocated free of charge through benchmarking and grandfathering methods or through auctioning, and the entities involved must surrender a number of allowances equivalent to their total verified emissions. With regard to the MRV mechanism, the ETS requires entities subject to the obligation to prepare monitoring plans and monitor their emissions in accordance with those plans; in addition, they must submit the data collected annually to the authorities, which must be verified by third parties. Finally, the government organises a review by experts of all verification reports, and some reports are subject to further verification by a fourth party.

Between 2013 and 2023, Beijing was the only regional pilot programme in China to implement a price stability mechanism through a minimum price (CNY 20, approximately USD 2.78) and a maximum price (CNY 150, approximately USD 20.84).

In the event of persistently high or low average market prices, the local authority is authorised to intervene through auctions or quota buybacks to maintain market stability. The national exchange is managed by the Beijing Green Exchange, and the use of offset credits is limited to a maximum of 5% of each entity's annual emissions; in addition, at least 50% of offset credits must come from the Beijing jurisdiction. For credits from outside the city, preference is given to projects that fall under interregional cooperation agreements related to climate or pollution control.

[6] Emission Trading Worldwide – Status Report 2025, ICAP (International Carbon Action Partnership)

1.1.3 The Guangdong ETS

The Guangdong ETS, launched in December 2013, is China's largest pilot programme in terms of market size and spot trading volume and, prior to the transfer of the energy sector to the national ETS in 2020, was ranked as the fourth largest carbon market in the world.

The system covers approximately 400,[7] s in a wide range of sectors, including steel, cement, paper manufacturing, aviation, petrochemicals, ceramics, textiles, data centres and port transport, and is subject to an absolute cap on emissions, announced annually; part of this cap is reserved by the government to support new entrants to the market and stabilise the market when necessary. Allowances are allocated through a combination of auctions and free allocations, and compliance requires the full surrender of allowances corresponding to verified emissions.

With regard to the MRV mechanism, the ETS requires entities subject to the obligation to prepare monitoring plans and monitor their emissions in accordance with those plans; in addition, they must submit the data collected annually to the authorities, which must be verified by third parties.

To improve market functionality, Guangdong has introduced several innovations in recent years, including advance quota trading mechanisms, and has also been among the first regions to experiment with these financial instruments within the ETS framework.

The use of offset credits, including CCERs and local credits known as PHCERs (Tan Pu Hui Certified Emission Reductions), is permitted, and the use of offset credits is limited to 10% of each entity's annual emissions, with the province imposing an overall quantitative cap on the total volume of credits allowed in the system and at least 70% of the offset credits used by each entity must come from projects within Guangdong province.

[7] Ibidem

1.1.4 The Tianjin ETS

The Tianjin pilot ETS, launched in December 2013, covers 159,[8] s operating in a wide range of sectors.

These include steel, petrochemicals, chemicals, oil and gas exploration, airports, building materials, non-ferrous metals, pharmaceuticals, machinery and equipment manufacturing, agri-food processing, food and beverages, salt extraction, and rubber and plastics industries. The allocation of allowances is primarily based on the grandparenting method, using total historical emissions or emissions intensity as a reference; in addition, auctions are also held, mainly to provide covered entities with additional allowances to meet compliance requirements.

Covered entities must surrender allowances corresponding to any emissions exceeding their annual limit.

With regard to the MRV mechanism, the ETS requires covered entities to prepare monitoring plans and monitor their emissions in accordance with those plans; in addition, annual reporting of emissions to the competent ETS authority is required by the end of March of the following year. Finally, third-party verification of the annual emissions report is mandatory, and entities may not use the same auditors for more than three consecutive years. In the event of non-compliance, a penalty mechanism is applied: companies must forfeit twice the difference from their allocation for the following year and, in addition, non-compliant third-party verifiers are subject to a three-year suspension from market activities.

Following the entry into force of the Provisional Regulation on the Administration of Carbon Emissions Trading in May 2024, emitters in eight sectors, such as energy, petrochemicals, chemicals, building materials, steel, non-ferrous metals, paper production and domestic aviation, producing more than 26,000 tonnes of CO_2 per year will be gradually transferred from the Tianjin ETS system to the national system. The use of offset credits, including CCERs from domestic project activities, is permitted, although limited to 10% of each entity's annual compliance obligation, as well as Tianjin-specific regional forestry credits.

In addition, the use of non-fossil energy purchased through market transactions may be allowed to offset part of an entity's compliance obligation, although details on implementation are still being finalised.

[8] Ibidem

1.1.5 The Shanghai ETS

The Shanghai emissions trading pilot scheme, launched in November 2013, was the second region in China to establish a regional carbon market. By 2023, the scheme covered nearly 380,[9] entities operating in a wide range of sectors, including airports, domestic aviation, chemical fibres, chemicals, commerce, energy and heat production, water supply, hospitality, finance, steel, petrochemicals, ports, non-ferrous metals, construction materials, paper, railways, rubber, textiles, shipping, electronic materials, pharmaceuticals, automotive manufacturing, food production, and, since 2019, data centers and road transport. Shanghai stands out as the only pilot ETS in China to have maintained a 100% compliance rate since its inception.

It is also among the most active systems in the exchange of offset credits and has emerged as a centre of innovation in carbon finance: in fact, various mechanisms have been tested within its framework, including quota repurchases, carbon funds and trusts, CCER-backed loans, green bonds and carbon margin trading.

With regard to the MRV mechanism, the ETS requires entities subject to the obligation to prepare monitoring plans and monitor their emissions in accordance with those plans; in addition, annual reporting of emissions to the Shanghai EEb is required by the end of March of the following year. Finally, third-party verification of the annual emissions report is mandatory, and a fourth-level verification is carried out by government-appointed experts, whose work is in turn evaluated through a specific mechanism. Covered entities must surrender allowances for all verified emissions, and allowances are allocated either through free allocation or auctions, using sectoral benchmarks and grandparenting as allocation methodologies.

For those receiving allowances based on benchmarks or historical intensity, ex-post adjustments are applied, usually based on actual production data. A small portion of the annual cap is auctioned, mainly to provide additional allowances to entities for compliance purposes. From 2014 to 2019, auctions were held on an ad hoc basis, while from 2020 onwards, two regular auctions are held each year. The Shanghai ETS allows the use of offset credits, including national CCERs and local SHCERs.

During the first phase of the programme, the use of CCERs was limited to 5% of verified emissions. In Phase 2 (2016–2018), the limit was reduced to 1% of the annual allocation, while for the 2019 and 2020 compliance years it was increased to 3% of verified emissions, of which at least 1% had to come from the Yangtze River Delta region. Finally, in 2022, the limit was raised to 5% for both CCERs and SHCERs.

[9] Ibidem

1.1.6 The Chongqing ETS

The Chongqing pilot emissions trading system currently regulates approximately 334,[10] s operating in industrial sectors such as electrolytic aluminium, ferroalloys, calcium carbide, cement, caustic soda, steel and other heavy industries. From its inception in 2014 until 2020, the system operated with an absolute emissions cap, applying a fixed annual reduction rate to base year emissions: the cap decreased by 4.13% per year until 2015, and by 4.85% in subsequent years.

In 2021, auctions were introduced to supplement the supply of allowances available to regulated entities, supporting compliance and improving market flexibility. Covered entities must surrender allowances equivalent to their total verified emissions. Allocation is through free allocation or auctioning mechanisms.

In 2022, the Chongqing Ecology and Environment Bureau (EEB) implemented a comprehensive review of the ETS regulatory framework, updating provisions on general management, MRV, quota allocation and registry operations. Following this reform, the system moved from an absolute cap to emission limits determined by aggregating production-based benchmarks for each entity. Since then, production-based allocation methods have been applied to various industrial sectors. Unlike most other Chinese pilots, Chongqing does not pre-determine which sectors fall under its ETS; instead, it establishes a threshold that applies to all entities in the industrial sectors involved in the production of electrolytic aluminium, ferroalloys, calcium carbide, cement, caustic soda, iron and steel, as well as other industrial activities. Entities in these sectors whose emissions exceed the threshold are included in the ETS.

From 2014 to 2020, the allocation of allowances was based exclusively on free allocation according to the grandparenting method, referring to the highest annual emissions in the period 2008–2012. Entities submitted annual allocation requests, which were reduced if they exceeded the historical maximum, using the average between the requested value and the historical value. If the total allocated volume exceeded the system cap, a uniform reduction factor was applied to all participants.

In its 2021–2022 allocation plan, the EEB adopted a mixed approach, including methodologies based on historical intensity and benchmarks: benchmarks for cement clinker and electrolytic aluminium production, historical intensity for other processes in the cement and aluminium sectors, for waste-to-energy plants, shale gas production, new entrants and non-CO_2 emissions, allowances were allocated based on actual verified emissions and grandparenting for all other sectors. Auctions, introduced in 2021, serve as a supplementary source of allowances, allowing compliance entities to acquire additional permits as needed.

So far, auctions have been organised on an ad hoc basis and have involved only a limited portion of the total emissions cap.

With regard to the MRV mechanism, the ETS requires entities subject to the obligation to prepare monitoring plans and monitor their GHG emissions in accordance with those plans; in addition, annual reporting of emissions to the competent authority for the ETS is required by the end of April of the following year.

Finally, third-party verification of the annual emissions report is mandatory. The use of offset credits is also permitted: in fact, in September 2021, Chongqing activated a local offset mechanism that issues CQCER (Chongqing Certified Emission Reduction) credits, which can be used for both compliance and voluntary purposes. From the 2023 compliance cycle onwards, only CQCERs are

[10] Ibidem

allowed to meet up to 5% of an entity's compliance obligation. In addition, entities may offset up to 8% of any quota shortfalls using verified purchases of non-fossil energy from outside the municipal jurisdiction, subject to specific quality restrictions.

1.1.7 The Hubei ETS

Hubei's pilot emissions trading system, launched in April 2014, is one of the most active regional carbon markets in China and plays a significant role at both the provincial and national levels. In 2024, the system covered over 300,[11] s operating in a wide range of sub-sectors, including heat supply, steel, non-ferrous metals, petrochemicals, chemicals, textiles, cement, glass and building materials, pulp and paper, ceramics, automotive and equipment manufacturing, food and beverages, pharmaceuticals, and water supply. Under the system, regulated entities must surrender allowances equivalent to their total covered emissions, with allowances allocated either for free or through auctions.

Unique among Chinese pilot programs, Hubei does not predefine the sectors included in its ETS. Instead, it applies an emissions threshold that extends to all industrial sectors, ensuring that any entity exceeding that threshold is subject to compliance. Hubei has relied primarily on free allocation of allowances, using benchmarking and grandparenting methodologies. For sectors covered by benchmark- or emissions-intensity-based methods, a pre-allocation is made, subsequently adjusted ex-post to reflect actual production in the compliance year.

Typically, entities receive half of their allowances based on verified emissions from the previous year or historical values, with the remainder adjusted according to actual data. With regard to the MRV mechanism, the ETS requires entities subject to the obligation to prepare monitoring plans and monitor their emissions in accordance with those plans; in addition, annual reporting of emissions to the competent authority for the ETS is required by the end of April of the following year. Finally, third-party verification of the annual emissions report is mandatory: auditors may be involved in a peer review of the reports and, in addition, in order to improve data accuracy, government-appointed experts carry out a fourth-party assessment.

In addition to these mechanisms, Hubei applies a market adjustment factor to all covered entities. This factor is determined annually based on the balance between supply and demand in the previous year, taking into account the province's economic and climate development goals.

For example, the adjustment factor for the 2023 compliance year has been set at 0.9706, down from 0.9836 in the previous year.

In addition, Hubei has implemented a limitation rule for compliance obligations: if the difference between a company's verified emissions and its allocation exceeds 20% or 200,000 tonnes of CO_2, the allocation is adjusted to reduce the surplus or deficit. Although auctions play a minor role in the overall allocation process, they have been used periodically to facilitate price discovery and offer greater compliance flexibility. Auctions were held on an ad hoc basis in 2014, 2019, 2020, 2021, 2022 and 2023. In recent years, two auctions have been held annually: the first limited to entities subject to compliance, the second open to all market participants.

The minimum price is calculated as the weighted average of spot market prices over the last two years, and allowances are generally sold at or slightly above that price. Hubei also allows the use of offset credits to meet compliance obligations, including China Certified Emission Reductions (CCERs), green electricity certificates, and credits issued at the city level in Wuhan. However, these credits are subject to quantitative and qualitative restrictions.

The use of CCERs is limited to a maximum of 10% of each entity's initial annual allocation, and only companies with a quota shortfall can use green electricity certificates and local credits, which are also

[11] Ibidem

limited to 10%. Green electricity certificates cannot be accumulated for future use. From a qualitative perspective, offset credits must be generated within the administrative area of Hubei, but outside the perimeter of entities covered by the provincial ETS system. According to the latest compliance rules issued for the 2018 cycle, only CCERs from rural biogas or afforestation projects located in designated poverty reduction counties along the middle reaches of the Yangtze River within Hubei are eligible.

These credits must have been issued for reductions achieved between 2013 and 2015. In addition, green electricity certificates must be verified by both the China Hubei Emission Exchange and the Hubei Electricity Exchange. Hubei has been a pioneer in the Chinese carbon market landscape: in fact, it boasts one of the highest spot trading volumes in the country, second only to Guangdong, and was an early starter in the development of futures trading instruments.

Its influence also extends nationally: in 2017, Hubei was designated to lead the development of the national ETS registry, which has been managed by the China Hubei Emission Exchange since the launch of the national market. In 2022, Hubei further institutionalized its role by establishing China Carbon Emissions Registration and Clearing Co., Ltd. in Wuhan, which is responsible for managing the registry and clearing system for the national ETS.

1.1.8 The Fujian ETS

Fujian Province launched its emissions trading system in September 2016. Currently, the system covers nearly 300[12] entities operating in nine sectors, including power, petrochemicals, chemicals, building materials, steel, non-ferrous metals, paper, aviation and ceramics.

A distinctive feature of Fujian's ETS is its particular focus on carbon sinks, notably through the promotion of forestry offset projects. In 2017, the provincial government introduced a dedicated plan to support such projects, and by the end of 2023, approximately four million forest offset credits had been traded within the system. The Fujian ETS differs from most other Chinese pilots in its institutional origin: while the others were launched under the mandate of the National Development and Reform Commission (NDRC), the Fujian ETS was established through a State Council directive, as part of the 'Implementation Plan for the National Pilot Area for Ecological Civilization (Fujian)'.

Allocation of allowances is primarily based on free allocation methods, using benchmarking or grandparenting, and is calculated based on production levels. Auctions are permitted, although they are used at the discretion of the ETS authorities and have played a limited role to date. Fujian allowances are distributed annually through a pre-allocation, which is subsequently corrected ex-post to reflect actual production in the compliance year. Benchmarking is used for several key sectors, including electricity network operations, cement, ordinary (non-stainless) steel, aluminium, flat glass, chemicals and aviation. Other sectors receive allowances based on historical carbon intensity data.

In some cases, entities can apply for additional allowances as a reward for early mitigation efforts. To limit excessive surpluses or shortages in allocation, specific limits have been introduced. For entities covered by benchmarking, the minimum allocation is set at 80% of verified emissions, while the maximum is limited to 120%.

For sectors using historical emissions intensity, the permitted surplus or shortfall ranges from 3% to 10% of verified emissions, depending on the entity's emissions level. In any case, the maximum permitted deviation, whether in excess or shortfall, is limited to 200,000 tonnes of CO_2 equivalent. Although auctions are not a regular feature of the system, they can be used to increase market liquidity and improve price discovery.

The only auction conducted so far was organised in 2016, when 50,000 allowances from a government reserve were sold in a discriminatory (non-uniform price) auction. The auction prices ranged from CNY 26.50 (£3.68) to CNY 30 (£4.17). No further auctions have been held since then, although up to 10% of the total cap remains reserved for potential market interventions through auctions.

With regard to the MRV mechanism, the ETS requires entities subject to the obligation to prepare monitoring plans and monitor their emissions in accordance with those plans; in addition, annual reporting of emissions to the competent ETS authority is required by the end of February of the following year.

Finally, third-party verification of the annual emissions report is mandatory, and an additional verification is carried out by government-appointed experts to verify the data in 30% of the reports.

The Fujian ETS also allows the use of offset credits to meet compliance obligations, and two types of domestic credits are permitted: CCERs and Fujian Forestry Certified Emission Reductions (FFCERs). The use of CCERs alone is limited to 5% of an entity's annual compliance obligation, but this limit is extended to 10% for entities using both CCERs and FFCERs. Eligible credits must

[12] Ibidem

originate in Fujian Province, be generated by entities not subject to ETS, be associated with projects aimed at reducing CO_2 or methane emissions, and not be linked to hydroelectric projects.
FFCERs are only accepted if they come from reforestation, forest management or bamboo management projects started after mid-February 2005, and only if the project developers have independent legal status.
Overall, the Fujian ETS represents an important regional contribution to the broader framework of carbon pricing policy in China, distinguishing itself through the integration of carbon sink initiatives and institutional support from high-level national policies aimed at promoting ecological civilisation. As the national ETS continues to evolve and expand, the Fujian system is positioned to adapt, offering a model for the integration of forest credits and regional innovation into China's climate governance. [13]

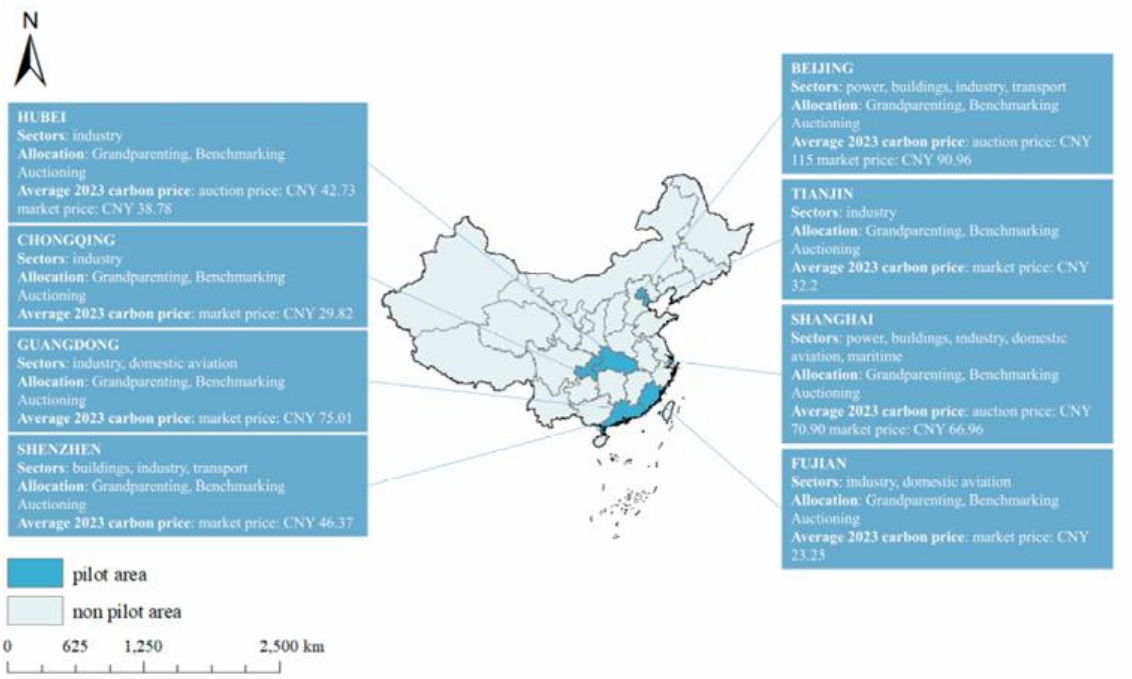


Figure 2. Current status of pilot ETS

	Shenzhen	Beijing	Guangdong	Tianjin	Shanghai	Chongqing	Hubei	Fujian
Start year	June 2013	November 2013	December 2013	December 2013	November 2013	June 2014	April 2014	September 2016
Sectoral coverage	Water, gas and district heating; manufacturing; electronic equipment; waste	Electricity grid, heating, cement, petrochemicals, services, public	Steel, cement, paper, aviation, petrochemicals, ceramics,	Steel, petrochemicals, chemicals, oil and gas, airports, building	Airports, domestic aviation, chemical fibres, chemicals, commerce,	Is established a threshold that applies to all entities	Heat supply, steel, non-ferrous metals, petrochemicals, chemicals, textiles,	Power, petrochemicals, chemicals, building materials, steel, non-ferrous

[13] Qidi Wang, Jinyan Zhan, Hailin Zhang, Yuhan Cao, Zheng Yang, Quanlong Wu and Ali Raza Otho (2025), "China's Carbon Emissions Trading Market: Current Situation, Impact Assessment, Challenges, and Suggestions", Land

	management; ports; metro and public buses; (from 2024) also data centres, solid waste, accommodation and catering, wholesale and retail trade, logistics/postal services, software and IT services, public institutions	transport, domestic aviation	textiles, data centres, port transport	materials, non-ferrous metals	energy and heat production, water supply, hospitality, finance, steel, petrochemicals, ports, non-ferrous metals, construction materials, paper, railways, rubber, textiles, shipping, electronic materials, pharmaceuticals, automotive manufacturing, food production, and, since 2019, data centres and road transport.	in the industrial sectors involved in the production of electrolytic aluminum, ferroalloys, calcium carbide, cement, caustic soda, iron and steel, as well as other industrial activities. Entities in these sectors whose emissions exceed the threshold are included in the ETS	cement, glass and building materials, pulp and paper, ceramics, automotive and equipment manufacturing, food and beverages, pharmaceuticals, and water supply	metals, paper, aviation and ceramics.
Covered entities	737 entities (2023)	882 entities (2023)	391 existing entities (2023)	159 entities (2024)	378 entities (2023)	334 entities (2023)	449 entities (2023)	299.81$MtCO_2$ (2021)
Covered emissions	45.42 $MtCO_2$ (2020)	132.12 $MtCO_2e$ (2020)	693.5 $MtCO_2$ (2020)	183.14 $MtCO_2$ (2021)	243.99 $MtCO_2e$ (2020)	188.1 $MtCO_2e$ (2020)	350.5 $MtCO_2$ (2020)	299.81 $MtCO_2$ (2021)
Cap type	Absolute cap planned from 2027 (implementation plan)	Bottom-up (aggregation of verified emissions)	Absolute cap announced annually	74 $MtCO_2$ (2023)	105 $MtCO_2$ (2023)	Absolute cap (2014–2020); production-based benchmarks since 2022	179 $MtCO_2$ (2023)	116.22 $MtCO_2$ (2022)
Allowance allocation	Benchmarking + grandfathering; almost entirely free; auctions in 2014 and 2022	Free allocation and auctions	Auctions and free allocation	Mainly grandfathering; supplementary auctions	Free allocation and auctions	Free allocation; auctions from 2021	Mainly free allocation	Mainly free allocation
Current allowance price (per t/CO2e)	CNY 47.78 (USD 6.64)	Average auction price: CNY 107 (USD 15) Average secondary market price: CNY	Average secondary market price: CNY 51.37 (USD 7.14	Average secondary market price: CNY 23.66 (USD 3.29)	Average auction price: CNY 77.87 (USD 10.82) Average secondary market price:	Average primary market data: CNY 44.8 (USD 6.22) Average secondary market	Average secondary market price: CNY 40.41	Average secondary market price: CNY 21.52 (USD 2.99)

		102 (USD 14)			CNY 75.45 (USD 10.48)	price: CNY 40.05 (USD 5.56)		
MRV	Monitoring plans; annual report by end of March; differentiated emission factors; third-party verification	Monitoring plans; third-party verification; expert and fourth-party review	Monitoring plans; third-party verification	Monitoring plans; third-party verification	Monitoring plans; third-party and expert review	Monitoring plans; third-party verification	Monitoring plans; third-party and expert review	Monitoring plans; third-party verification
Offsets	CCER + local credits (Tan Pu Hui); up to 20% of the compliance gap	Up to 5% of annual emissions; ≥50% from Beijing	CCER + PHCER; up to 10%	CCER up to 10%	CCER and SHCER (1–5%)	CQCER up to 5%	CCER and other local credits	CCER and forestry credits

Table 1 Comparison table of Pilot ETS

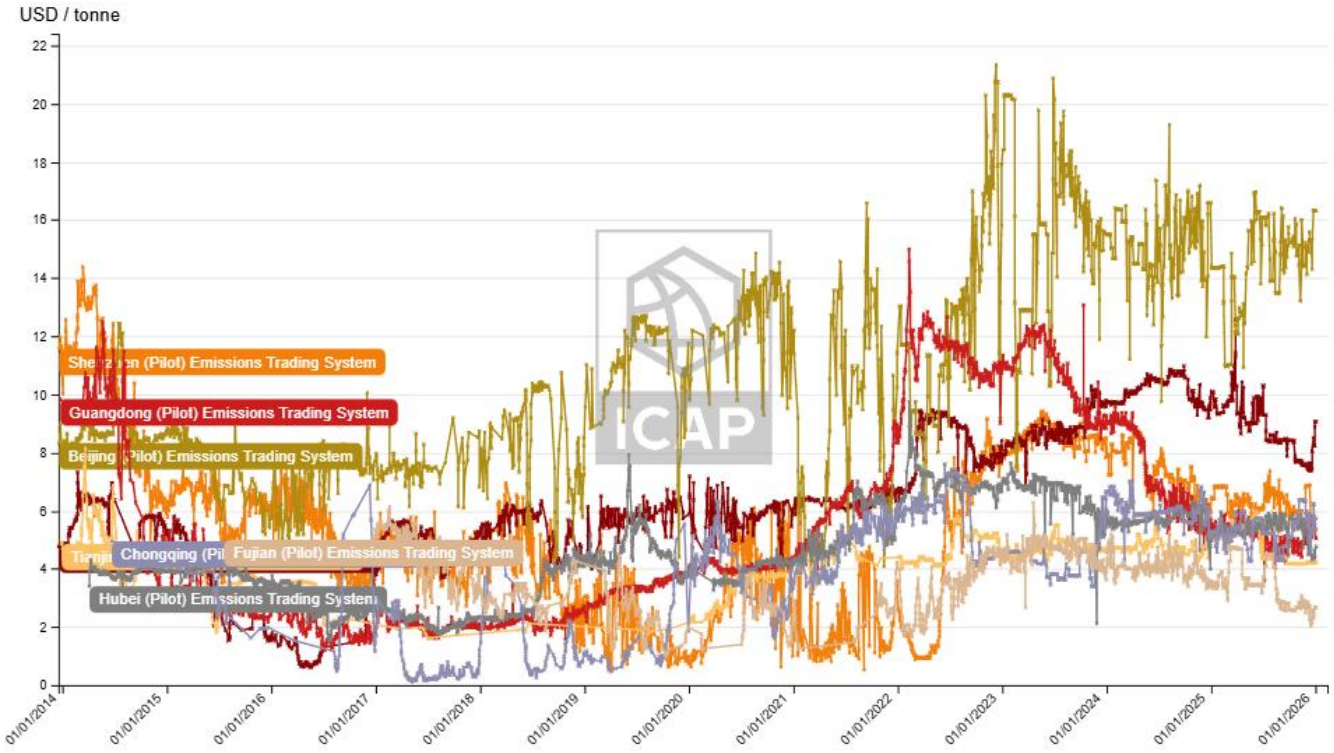


Figure 3. Historical price trends of allowances in the Chinese pilot Emissions Trading Systems (ETS), expressed in USD per tonne, from 2013 to 2025.

1.2 The national system launched in 2021: main features

China's national emissions trading system is currently the world's largest carbon market in terms of emissions covered, comprising approximately 8 billion tonnes of CO_2, equivalent to over 60% of the country's total CO_2 emissions.

The ETS plays a central role in China's broader climate goals: in fact, by 2025, the country aims to reduce carbon emissions per unit of GDP by 18% compared to 2020 levels, in line with the 14th Five-Year Plan. Furthermore, by 2030, China has committed to reaching peak CO_2 emissions and reducing CO_2 emissions intensity per unit of GDP by more than 65% compared to 2005 levels, as set out in its updated National Determined Contribution (NDC)[14] under the '1+N' policy framework[15] . Ultimately, the long-term goal remains to achieve carbon neutrality by 2060.

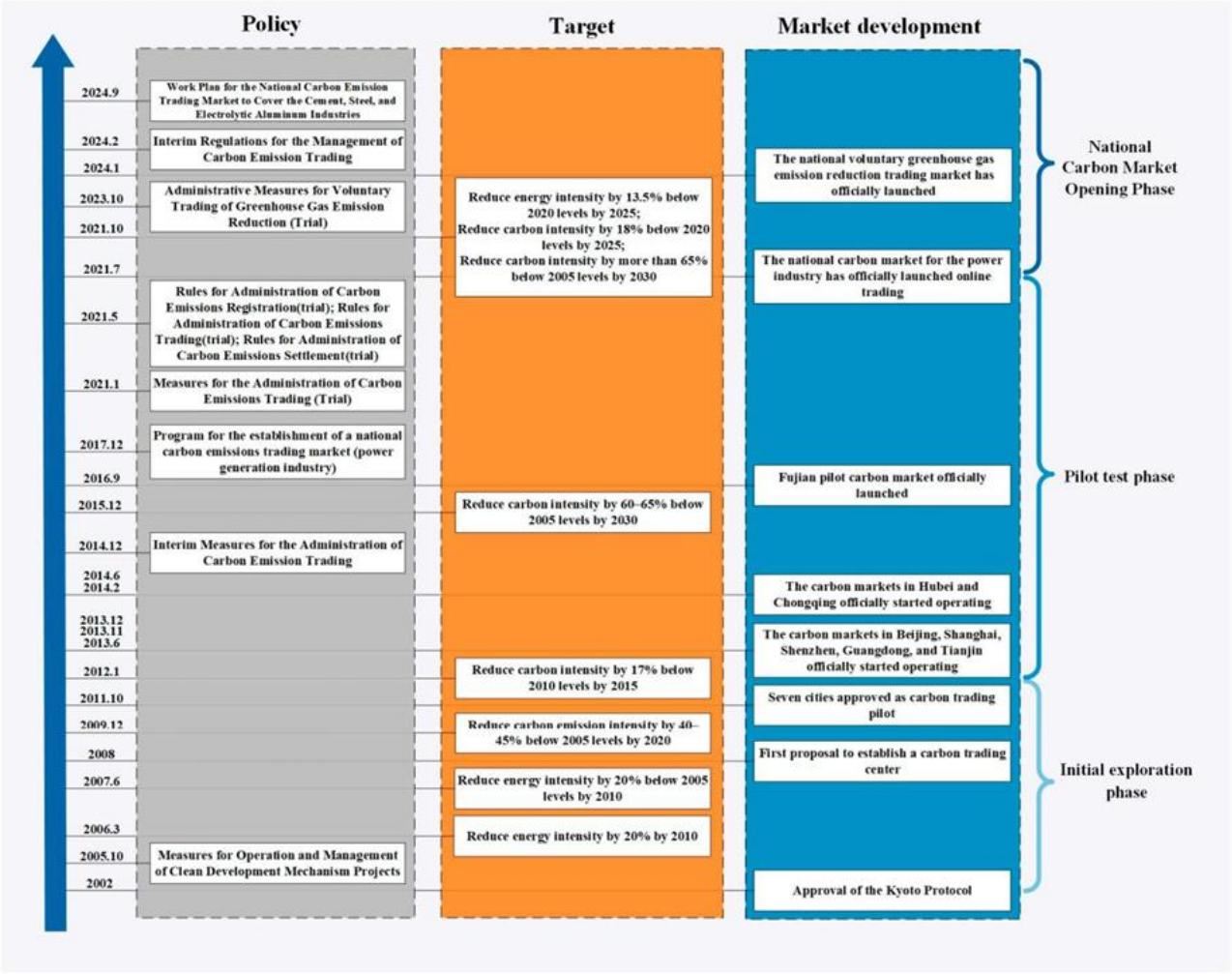


Figure 4. Timeline of policy and target of emission reduction and Carbon Emission Trading Market (CETM) development in China

[14] A First Look at China's 2035 NDC: Headline Targets and Non-CO_2 Action - Institute For Governance & Sustainable Development

[15] The 1+N policy framework consists of overarching guidance: the "1," and action plans and policy measures for key sectors and industries: the "N." These policies prioritise the decarbonisation of the industrial sector, primarily focusing on building materials, metallurgy, and chemical industries

16

An important regulatory milestone was reached in January 2024 with the promulgation by the State Council of the 'Provisional Regulations for the Management of Carbon Emissions Trading', which came into force in May 2024.
These regulations constitute the first comprehensive legal framework for the operation of the national ETS, strengthening enforcement mechanisms and codifying penalties for non-compliance.

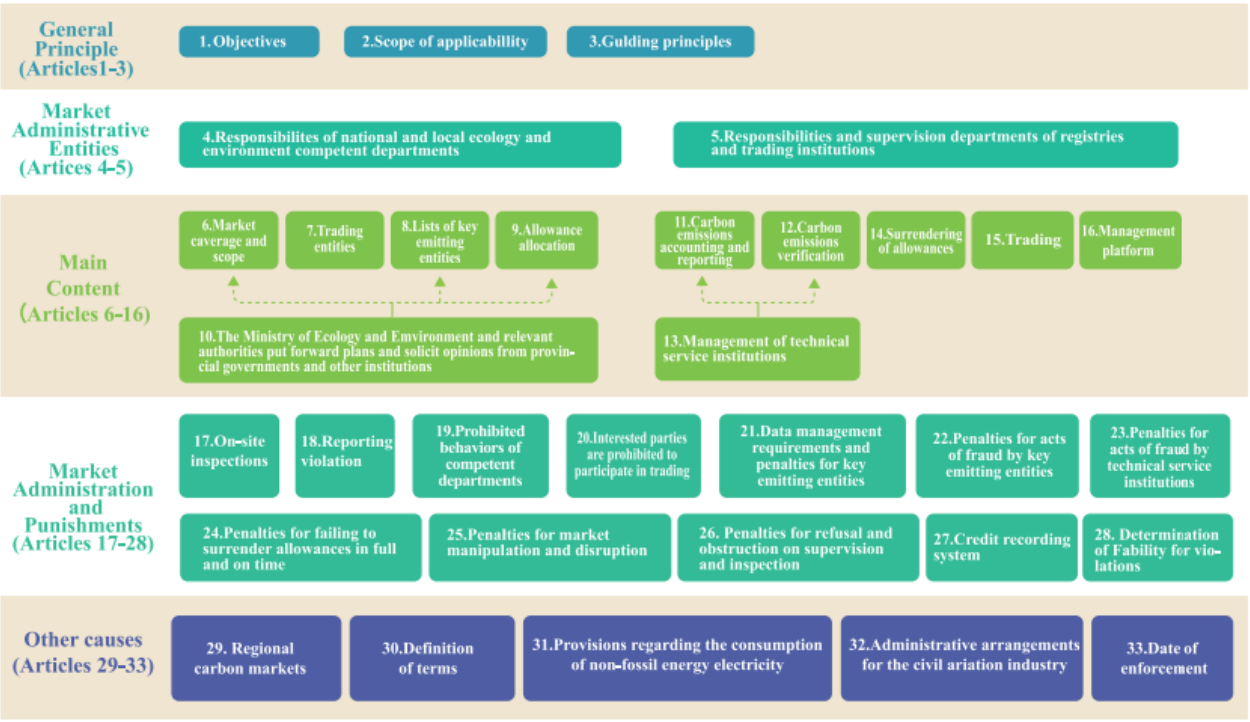


Figure 5. Framework for the Interim Regulations for the Management of Carbon Emission Trading[17]

At the same time, the Ministry of Ecology and Environment (MEE) published updated plans for energy sector allocation and compliance for 2023 and 2024.
The main changes included the revision of benchmarks, the exclusion of indirect emissions, the prohibition of quota lending and the introduction of a limit on quota accumulation (banking).
In addition, the compliance cycle changed from biennial to annual, marking an important step in the institutional maturation of the system. In parallel with these developments, the relaunch of the CCER programme in January 2024 marked the reactivation of the voluntary carbon market in China after six years of suspension and reform: this allows entities to offset their emissions not only through their purchased or allocated emission allowances, but also through these certificates.
By April 2025, five third-party agencies had been accredited for project validation and verification: by that date, more than 70 emission reduction projects had applied for CCER status, and nine of them had received the issuance of 9.48 million tonnes of CO_2 equivalent in verified reductions.

[16] Wang, Q.; Zhan, J.; Zhang, H.; Cao, Y.; Yang, Z.; Wu, Q.; Otho, A.R. (2025) "China's Carbon Emissions Trading Market: Current Situation, Impact Assessment, Challenges, and Suggestions.", Land
[17] Progress Report of China's National Carbon Market (2024)

This renewed offset market has the potential to support the integration of offset mechanisms within the national ETS. From a system design perspective, the national ETS takes a bottom-up approach to setting the cap: the total emissions cap is derived from the sum of allowances allocated to all regulated entities and is adjusted based on actual production data. Estimated annual caps have increased from approximately 4,500 $MtCO_2$ in 2019–2020 to 8,000 $MtCO_2$ in 2024, reflecting the expansion of the system.
[18]

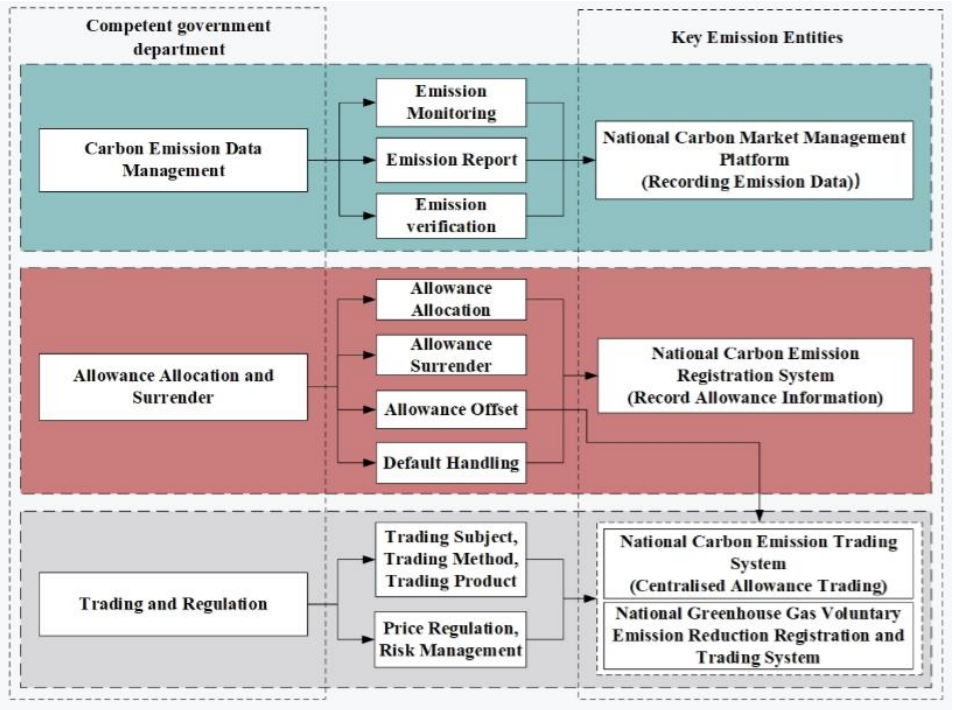


Figure 6. Structure of the national carbon market system

[18] Qidi Wang, Jinyan Zhan, Hailin Zhang, Yuhan Cao, Zheng Yang, Quanlong Wu and Ali Raza Otho, (2025), "China's Carbon Emissions Trading Market: Current Situation, Impact Assessment, Challenges, and Suggestions", Land

1.3 Sectoral coverage and quota allocation criteria

China's national emissions trading system currently regulates over 3,500 entities operating in the electricity, steel, cement and aluminium smelting sectors, each with annual emissions exceeding 26,000 tons of CO_2 equivalent. Compliance with the national ETS requires all regulated entities to surrender allowances corresponding to their total covered emissions.
These allowances are distributed entirely free of charge, according to a production-based benchmarking methodology.
Although compliance obligations are still limited and vary between different types of facilities, the national ETS system is designed to expand progressively to include additional industrial sectors.The development of the national ETS mirrors the broader trajectory of China's climate governance, drawing on the experience gained through the pilot ETS programmes, which continue to operate alongside it. These regional systems cover sectors and entities not yet incorporated into the national scheme, thereby supporting the ongoing transition.

	Benchmark for electricity generation (tonne of CO_2 (tCO_2) per megawatt-hour (MWh))			Benchmark for heat production (tCO_2 per gigajoule (GJ))		
	2022	2023	2024	2022	2023	2024
Conventional coal plants above 300 MW	0.8177	0.7950	0.7910			
Conventional coal plants below 300 MW	0.8729	0.8090	0.8049	0.1105	0.1038	0.1033
Unconventional coal	0.9303	0.8285	0.8244			
Natural gas	0.3901	0.3305	0.3288	0.056	0.0536	0.0533

Figure 7. Benchmark values for the 2022–2024 compliance periods

[19] In the energy sector, allowance allocation is based on an output-based benchmarking system, with distinct benchmarks for different types of power generation: conventional coal below 300 MW, coal above 300 MW, unconventional coal, and natural gas.
An annual pre-allocation mechanism is applied, followed by ex-post adjustments according to actual production.
For 2023 and 2024, entities were allocated quotas corresponding to 70% of their verified emissions from the previous year, subject to adjustments linked to actual generation.

[19] "Different approaches, similar effects? A comparative study of the Chinese and European Union Emissions Trading Systems", Energy Partnership Germany – China, 2025

A production adjustment factor was designed to favour coal-fired plants operating with load factors below 65%, thereby potentially benefiting less efficient units.

Under the current compliance rules, natural gas plants are required to surrender allowances only up to the benchmark level, whereas coal plants whose allocations fall below 80% of verified emissions receive additional allowances to reach that threshold, limiting the maximum compliance deficit to 20%, as in previous years. In contrast, allocation for the steel, cement and aluminium smelting sectors matched verified emissions, and from 2025 the EEE introduced a methodology for these sectors based on production and emissions intensity. Although all allowances are currently distributed free of charge, the Provisional Regulation explicitly provides for the introduction of allowance auctions as the system evolves.

Although no timetable has yet been set, this transition to market-based allocation mechanisms indicates the government's intention to improve the economic efficiency, price discovery and cost-effectiveness of the ETS system over time. In terms of expanding the system, the MEE published a strategic roadmap in March 2025 to extend ETS coverage to other sectors. The plan, which was submitted for public consultation in September 2024, proposes a two-stage integration of the steel, cement and aluminium smelting sectors:

- Phase one (2024–2026): strengthening capacity and improving data quality;
- Phase two (from 2027): reducing emissions intensity and optimising system performance.

The inclusion of these sectors is expected to bring approximately 1,500 new companies under regulation, increasing total emissions coverage by approximately 3 billion tonnes of CO_2 equivalent.

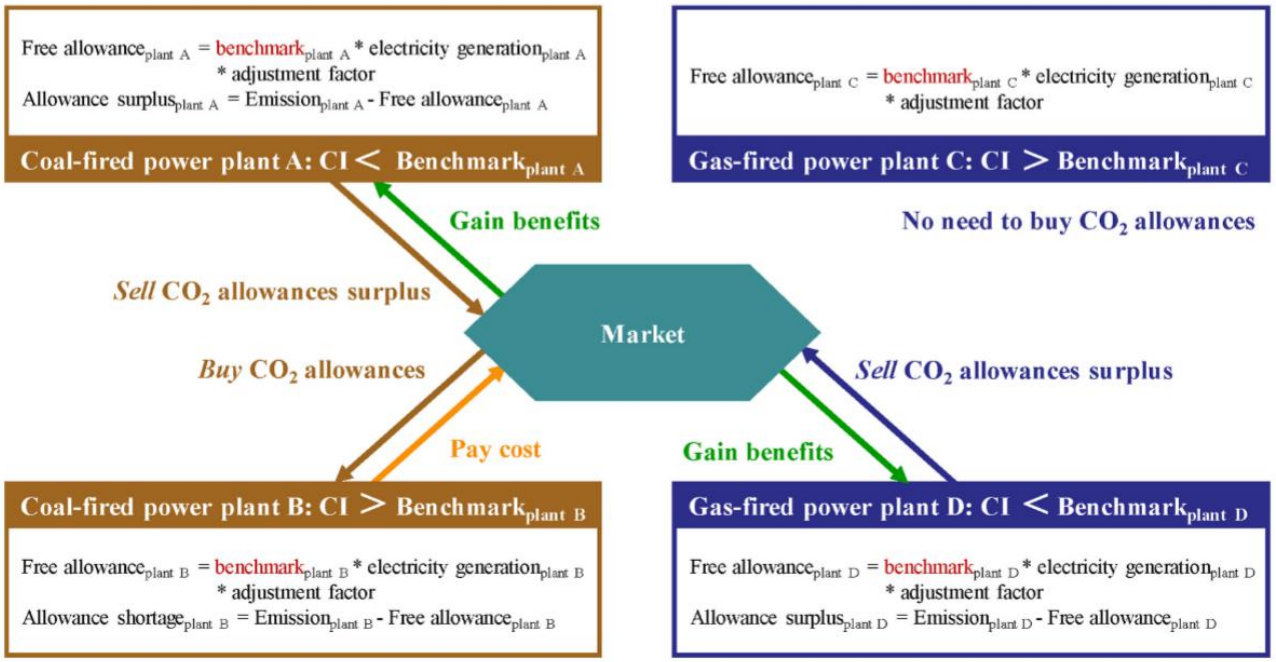


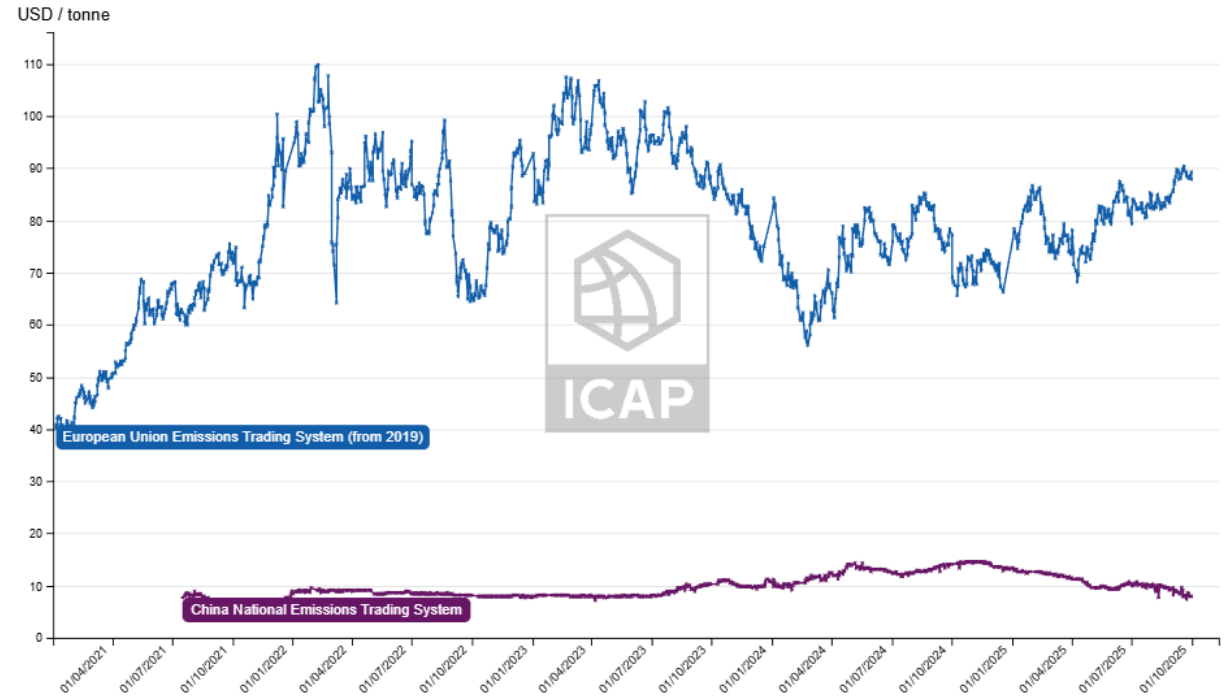
Figure 8. Market structure and involved parties in China's national ETS.

20

[20] Hongyu Zhang, Da Zhang, Siyue Guo, Xiliang Zhang (2024), "Impact of benchmark tightening design under output-based ETS on China's power sector", "Energy",

1.4 Price dynamics and trading volumes: available data and initial assessments

The price of carbon is one of the main factors influencing the effectiveness of China's Emissions Trading Programme (CETP), and many researchers have focused on studying the price of carbon in China, analysing the mechanism that influences it, its forecast, the positioning of the price range and its fluctuations. In recent years, the price of carbon in China has shown fluctuating and rising trends, but it is excessively low compared to other ETSs, especially when compared to the EU ETS.



[21]

Figure 9. Price trends for the Chinese National ETS and the EU ETS

The chart above shows that allowance prices in the China National Emissions Trading System have remained extremely low and stable in the period 2021-2025, fluctuating between approximately 6 and 10 USD/tonne, with slight growth until 2023 and a subsequent decline below 10 USD in 2025. From a dynamic perspective, the China ETS shows very low volatility and a relatively flat trend over time. This reflects a market that is still in its early stages, characterised by low liquidity, limited coverage (mainly the electricity sector) and a large allocation of free allowances, which reduces pressure on prices. In this context, trading is mainly for compliance purposes, making the carbon price more like an administered value than a true market price.

Although the graph shows a significant gap in price trends and volatility compared to the EU ETS, the China ETS should not be interpreted as a 'weak' version of the EU ETS, but as an instrument consistent with the Chinese governance model , based on gradualism, experimentation and central control.

It should be noted, however, that since the China ETS is based on intensity limits rather than absolute

[21] Allowance Price Explorer | International Carbon Action Partnership

caps, companies are not subject to strict total emissions constraints but must comply with an efficiency coefficient. This reduces pressure on the market as companies can continue to grow in terms of output without necessarily purchasing many additional allowances.
Furthermore, as the system uses free allocations for most allowances, it limits effective demand and, consequently, the price. Finally, it should be noted that such low prices are a symptom of excess supply: this is due both to relatively permissive intensity benchmarks and to the limited number of sectors covered by the market.
Ultimately, this surplus reduces the economic incentives for companies to invest in technologies with a lower environmental impact, thus keeping the price of carbon stable and low.

1.5 Structural vulnerabilities and challenges

Although the launch of China's national ETS has the potential to contribute to the achievement of the country's climate targets, it is not without significant structural weaknesses that limit its ability to generate stable prices that are credible on the international stage and high enough to incentivize virtuous behavior.

Firstly, coverage is currently insufficient, as it only covers the electricity, steel, cement and aluminium smelting sectors, excluding many energy-intensive and/or high environmental impact sectors such as petrochemicals and aviation.

Furthermore, unlike its EU counterpart, China's national ETS is not based on a cap-and-trade system, but on intensity benchmarks that allow production to increase without reducing total emissions. In addition, most allowances are allocated free of charge, with the exception of a limited number of auctions.

In addition, the market suffers from low liquidity, with low trading volumes and minimal volatility: this market design does not generate enough pressure on the market to create scarcity and stimulate the price of allowances, which remains at a very low level.

Another weakness of this ETS is the MRV system due to its incompleteness[22] : this is primarily caused by the lack of a formalised framework defining essential elements such as the responsibilities of participating entities, timelines and technical requirements;

Furthermore, data collection is carried out through company monitoring and public statistics, which do not provide complete and detailed information on emissions. Finally, the penalties for non-compliance are not high enough to provide an adequate incentive for the entities involved to invest in adequate emissions accounting and reporting systems.

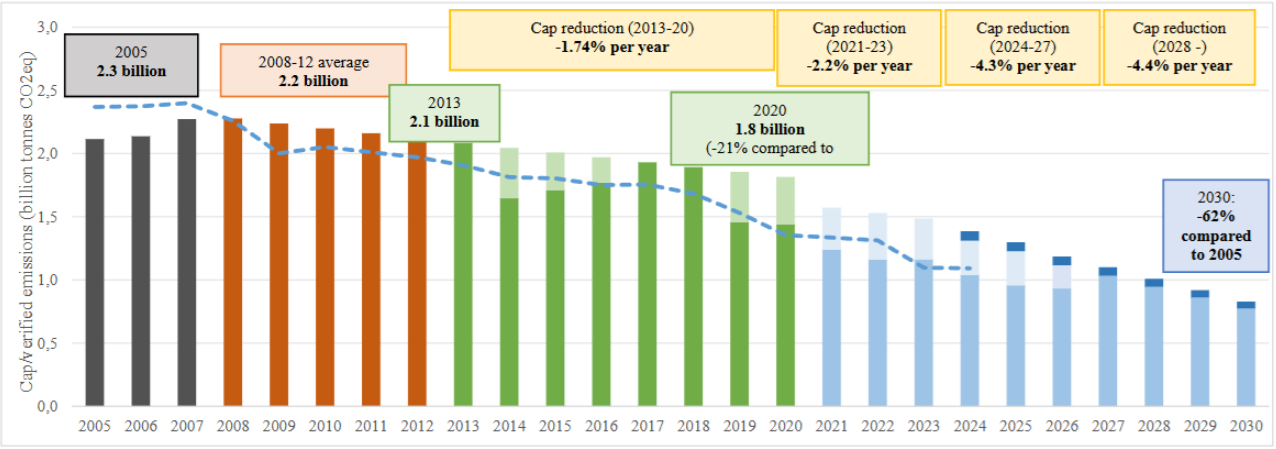
In light of these critical issues, China's national ETS, while representing an important step towards decarbonisation, currently needs major structural reforms to become an effective climate policy tool.

[22] Wenjun Wang, Nina Khanna, Xu Liu, and Jiang Lin, “Measurement, reporting and Verification (MRV) of non-CO2 greenhouse gases: International Best Practices and Suggestions for China”, 2023

Chapter 2 – Comparison with the EU ETS

2.1 EU ETS: brief overview and current structure

Established in 2005, the European Union Emissions Trading System (EU ETS) is the oldest functioning cap-and-trade mechanism and the largest in terms of trading volume and market value. It continues to be a central tool in EU climate policy, designed to tackle global warming and reduce greenhouse gas emissions in a cost-effective manner.



23

Figure 10. Emissions cap in the EU ETS compared with verified emissions

Initially, the system involved 15 Member States and has evolved through four distinct phases: with the current Phase 4 (2021-2030), the ETS is active in the 28 EU countries, plus Iceland, Liechtenstein and Norway, and regulates approximately 40% of the Union's total emissions. Until 2023, the system applied to emissions from electricity and heat production, industrial installations in Europe and airlines operating flights between airports within the European Economic Area (EEA), as well as connections with Switzerland and the United Kingdom. From January 2024, the scope has been further extended to maritime transport and, in the aviation sector, to most flights to and from the outermost regions of the EU, as well as flights departing from those regions to Switzerland and the United Kingdom.

The main method of allocation is auctioning, while free distribution, determined by benchmarks, remains in place to limit the risk of carbon leakage, and each year, regulated entities must surrender allowances corresponding to their verified emissions.

In 2023, the EU ETS was reformed as part of the European Green Deal to align the mechanism with the EU's 2030 target of a net reduction in emissions of at least 55% compared to 1990 levels. This revision, now implemented, introduced several key measures: a higher level of ambition and extension to maritime transport; the creation of a separate trading system for buildings, road transport and additional sectors (ETS 2), planned for 2027 but postponed to 2028 due the economic impact it

[23] REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL on the functioning of the European carbon market in 2024, https://climate.ec.europa.eu/document/download/ddc1b1de-652b-49ed-8f15-d9fa8badd39f_en?filename=com_2025_735_en.pdf

could have on the less well-off sections of the population[24]; the strengthening of the Market Stability Reserve (MSR)[25]; updated provisions for the aviation sector; new monitoring and reporting requirements for maritime transport; the establishment of the Social Climate Fund, starting in 2026, to complement ETS 2. In July 2021, the European Commission presented the 'Fit for 55' reform package, aimed at aligning EU climate and energy policies with the objectives of the Green Deal, in particular the ambitious target for 2030.

The package made significant changes to the EU ETS framework, including a proposal to extend the trading system to additional sectors. In this context, ETS 2 was designed to cover emissions from fuels used in buildings, road transport and smaller industrial sectors not already included in the current scheme, with the aim of reducing emissions by 42% by 2030 compared to 2005 levels. Monitoring and reporting of emissions from the sectors concerned begun in 2025, with full implementation planned for 2027, with the possibility of postponement to 2028 in the event of exceptionally high energy prices.

Allowances under ETS 2 will be allocated exclusively through auctions, with an additional volume anticipated in 2027 to ensure a smooth start.

The system will include a dedicated market stability reserve, operating according to predefined rules to address any imbalances between supply and demand. In addition, Member States will have the option to voluntarily extend the system to other sectors, such as agriculture and forestry, subject to approval by the European Commission. Part of the revenues generated by ETS 2 will be used to support vulnerable households and micro-enterprises through the Social Climate Fund, while the rest will have to be used by Member States to finance climate and social measures.

[24] EU postpones carbon pricing for buildings to 2028 in climate law deal | BUILD UP

[25] Market Stability Reserve - Climate Action - European Commission

2.2 Coverage, allocation of allowances and governance: similarities and differences

Both ETSs cover significant shares of emissions: the EU ETS covers around 40% of EU emissions, equivalent to around 3,374.7 $MtCO_2$ and (excluding LULUCF[26]), including sectors such as electricity generation, domestic aviation, industrial installations and, from January 2024, maritime transport. On the other hand, China's national ETS covers 14,314 $MtCO_2e$ (excluding LULUCF), accounting for approximately 40% of the country's emissions and 15% of global emissions, currently including the energy, steel, cement and electrolytic aluminium sectors.

Furthermore, the EU ETS continues to expand gradually: in fact, in addition to the current coverage of energy, industry and aviation, further extensions to buildings, road transport and, potentially, agricultural sectors are planned, although these will be included in ETS 2 from 2027.

On the other hand, the Chinese ETS is undergoing rapid expansion: following the inclusion of steel, cement and aluminium in 2024, the government has announced that major industrial sectors will be included by 2027, with a full transition to absolute cap-and-trade by 2030. In addition, the government is working to improve market liquidity by expanding access to participants, including financial institutions, and developing new financial products such as carbon pledges and repurchase mechanisms.

Although both the EU carbon market and China's national ETS cover significant sectors of emissions, there are many differences between the two markets, including the allocation of carbon allowances, due to their different development processes.

One fundamental difference concerns the distribution of allowances: the EU ETS uses a mixed approach, with approximately 57% of allowances currently allocated through auction and the remaining 43% distributed free of charge to sectors most at risk of carbon leakage, with a progressive annual reduction in free allowances through a Linear Reduction Factor (LRF) of 4.3%. The use of an auction system, with the European Commission determining the total number of allowances and allocating them to each Member State, ensures the scarcity of carbon allowances. The Chinese market, on the other hand, allocates all emission allowances free of charge, using an approach based on production and sectoral benchmarks.

This generous free allocation is designed to facilitate compliance during the implementation phase (2024-2026) and allow businesses to adapt to market mechanisms.

This mechanism ensures that overall emissions covered by the ETS have fallen by around 47% since 2005 and are on track to meet the 2030 target of a 62% reduction compared to 2005 levels. In contrast, the Chinese ETS currently operates with an intensity-based mechanism, setting emissions per unit of production rather than absolute caps, using a production-based approach and sectoral benchmarks.

This method facilitates compliance during the implementation phase (2024-2026) and allows companies to adapt to market mechanisms; however, this means that even if a company becomes more efficient, it can still increase its total emissions if production grows.

The EU ETS has multi-level governance: it operates on a decentralised model, with the European Commission setting overall policies and targets, while individual Member States draw up national allocation plans and oversee compliance within their territories.

[26] Land Use, Land-Use Change and Forestry (LULUCF) | UNFCCC

This multi-level governance reflects the federal structure of the EU, while require coordination between 27 states with different economic and energy conditions.
On the other hand, China's national ETS operates under the centralised control of the government through the Ministry of Economy and Environment (MEE), with local authorities responsible for data accuracy, quota allocation and local compliance. In conclusion, the main difference is that the EU ETS is a mature system, with high prices, based on auctions and an absolute cap-and-trade model with broad sectoral coverage, while China's national ETS is an emerging, low-price mechanism with 100% free allocation and based on intensity, currently limited to major high-emission sectors. It should be noted that the Chinese system is gradually evolving towards characteristics similar to those in Europe, such as paid allowances, absolute caps and broader coverage, but it remains significantly less rigorous in promoting emissions reductions due to generous allocation policies and lower carbon prices.
Both systems are key components of their respective climate strategies, but their structural differences reflect different policy philosophies: the EU focuses on price signals and market efficiency, while China favours a managed transition and state coordination.

2.3 Carbon prices and market depth: comparative analysis

[27]The carbon markets in Europe and China represent two fundamentally different stages of market maturity, with stark contrasts in terms of prices, trading activity and structure.
These differences reflect not only different policy objectives, but also different levels of market sophistication and financial integration.

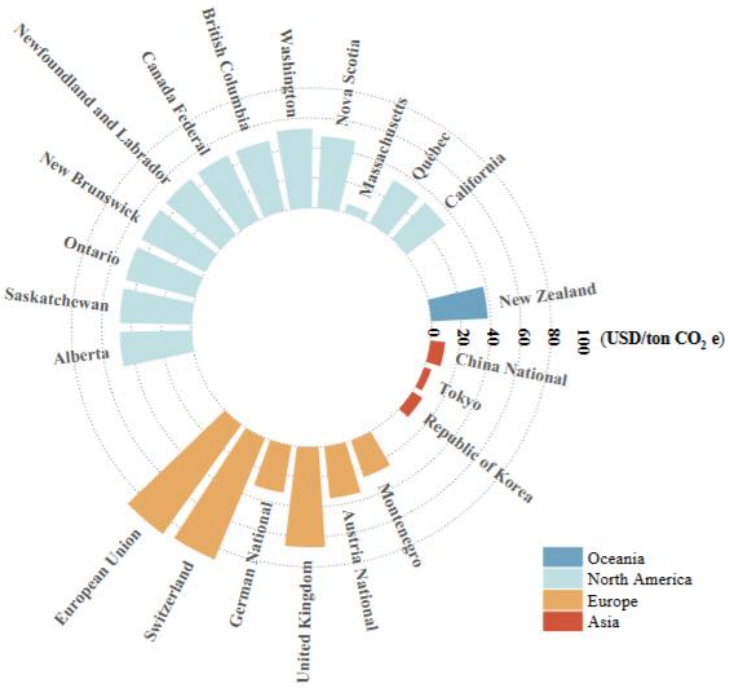


Figure3 Carbon market carbon price comparison

The most obvious difference between the two systems concerns the price of carbon: in fact, the EU ETS has consistently maintained significantly higher prices than the Chinese national ETS. This price difference, which is around 5-10 times, reflects the fundamental structural differences between the two markets.
This difference is mainly determined by higher prices in the EU caused by absolute cap mechanisms, aggressive reduction targets and auction-based quota distribution, which create real scarcity. Conversely, lower prices in China result from the free allocation of all allowances, which generates a surplus and minimal incentives for scarcity.
The EU ETS also dominates global carbon trading in terms of volume and value: in 2024, it traded approximately 11.8 billion units (EUAs) with a total market value of €781 billion, down slightly from €881 billion in 2023.
The high turnover reflects the maturity of the market: each allowance is traded on average 10 times a year, generating significant activity on the secondary market.
By comparison, China's national ETS traded approximately 5.2 billion tonnes of CO_2 equivalent in

[27] Qidi Wang, Jinyan Zhan, Hailin Zhang, Yuhan Cao, Zheng Yang, Quanlong Wu and Ali Raza Otho, "China's Carbon Emissions Trading Market: Current Situation, Impact Assessment, Challenges, and Suggestions", Land, 2025

2024, with a total market value of only RMB 18.1 billion (approximately €2.3 billion).
This represents a huge disparity: in fact, the EU ETS generated 340 times more market value than the Chinese ETS in 2024, which can be attributed to both lower prices and limited trading frequency.
It should also be noted that the EU ETS is characterised by exceptional liquidity across multiple trading venues: transactions take place on four main exchanges, including the European Energy Exchange (EEX), ICE Futures Europe, Nasdaq and ENDEX, and there is also an active over-the-counter (OTC) market.
The market supports daily spot trading of around €3 billion in EUAs, with around ten times as much in derivatives (futures and options); in addition, the primary market (auctions) involved around 20 bidders in 2023, with around 15 winning bids per auction and 2.4 million allowances issued each day.
On the other hand, China's national ETS operates on a single platform, the Shanghai Environment and Energy Exchange (SEEE): this concentration eliminates competition between exchanges and may limit market development; moreover, the market is illiquid, with most transactions concentrated in compliance periods rather than continuously throughout the year.
Outside these periods, daily trading volumes often fall below significant levels, and the market exhibits strong seasonality linked to regulatory compliance cycles.
The EU ETS shows moderate volatility, typical of a mature market with diversified participants: in 2024, EUA prices recorded annual volatility of around 36.83%, fluctuating in a relatively stable range between €50 and €75, reflecting fundamental dynamics such as industrial activity, renewable energy production, policy announcements and financial positioning.
The size and liquidity of the market allow for efficient price formation, with financial participants mitigating compliance-related demand spikes.
In contrast, China's national ETS exhibits extreme volatility and unpredictable price spikes linked to compliance deadlines and regulatory uncertainty. For example, CEA prices rose to RMB 83.33 in March 2024 as companies rushed to meet deadlines, then collapsed after the compliance period ended this pattern reflects the absence of incentives for continuous trading outside compliance windows and the market's vulnerability to sudden supply-demand imbalances.
The EU ETS has sophisticated derivatives markets, including futures, options and forward contracts. These instruments are essential for price risk management and allow financial investors to take positions without physically holding allowances.
China's national ETS, on the other hand, does not have developed derivatives markets: currently, no futures, options or forward contracts are traded on the SEEE platform. Furthermore, participants cannot easily hedge price risk or take leveraged positions.
The government has proposed the development of financial products as part of market reforms, but implementation is still in its early stages.
Furthermore, the relaunch of CCERs has created an alternative source of credits that influences the dynamics of the compliance market.
However, CCER prices have recently fluctuated between 72 and 107 yuan per tonne, competing directly with compliance allowances and potentially compressing CEA prices.

2.4 Lessons from the EU ETS and their applicability in China

China's national emissions trading system is currently at a crucial stage: launched in 2021, it is undergoing rapid expansion, and the EU ETS, with 20 years of operational experience, can offer valuable lessons that can accelerate the development of the Chinese market and improve its effectiveness.

However, a direct replication is neither possible nor optimal due to the socio-economic differences between the EU and the People's Republic of China: China must therefore adapt the European lessons to its own political, economic and institutional context. First and foremost, the longevity of the EU ETS stems in part from its anchoring in the binding Directive 2003/87/EC[28] , which ensures legal certainty and enforceability in all Member States.

The early phases suffered from weaker regulatory frameworks, but Phase 3 (2013-2020) significantly strengthened the legal provisions. China, on the other hand, has recently strengthened its regulatory framework with the Provisional Regulations on Carbon Emissions Trading Management[29] (effective from May 2024): although this is a positive step, it is nevertheless a provisional regulation, not permanent legislation; moreover, the regulation offers flexibility but leaves room for ad hoc policy changes.

China should therefore move from provisional regulations to permanent and binding legislation with long-term credibility. In addition, the current penalties are more severe than in the past, but should be clearly codified at the legislative level: EU experience shows that a stable legal basis is essential for market operators to make investment decisions with confidence.

Chinese legislation should therefore include explicit deadlines for the transition to absolute caps by 2030, allocation methodologies and stricter penalties for non-compliance, and more precise procedures for sectoral expansion. It should also be noted that the EU has always operated with absolute cap-and-trade mechanisms, in which the total quantity of allowances decreases continuously through a linear reduction factor; this absolute scarcity is what drives carbon prices: in fact, when the LRF increased from 1.74% to 2.2% in Phase 3 and to 4.3-4.4% in Phase 4, prices rose significantly.

On the other hand, China's national ETS, as discussed earlier, currently operates on an intensity-based system, where allowances are linked to emissions per unit of production rather than total emissions. This means that companies that increase production can legitimately increase their total emissions without constraints. It is therefore clear that, although this design has facilitated initial compliance, it limits the environmental effectiveness of the system.

China has correctly identified this critical issue and has committed to transitioning to a full cap-and-trade system by 2030, a fundamental policy change. However, implementing this transition requires careful planning.

The EU did not move from intensity to absolute caps, but adopted them from the outset. Furthermore, the EU ETS started with 95% free allocation in Phase 1, recognising that immediate full auctioning would meet political resistance and potentially damage industrial competitiveness. However, the EU has progressively increased the share of auctions: Phase 2 introduced partial auctions, Phase 3 moved to 50%, and Phase 4 further increased this proportion.

From 2026, Phase 4 will eliminate free allocations at a rate of 2.5% per annum for sectors not exposed to carbon leakage risk. Conversely, China currently allocates all allowances for free, using

[28] Directive - 2003/87 - EN - EUR-Lex

[29] Provisional Regulations on the Administration of Carbon Emissions Trading_Others_Chinese Government Website

production-based parameters, although the government plans to introduce 'paid and free allocations' around 2027, with an increasing proportion of paid allowances.
It is clear that China should accelerate the timetable for phasing out free allocations compared to current plans: although immediate full auctioning (as the EU target for 2030-2034) would be destabilising in the Chinese context, introducing a percentage of paid allowances for new entrants by 2027 (rather than 2030) would generate revenue for climate investment and early price signals; Furthermore, for sectors exposed to carbon leakage risk, China could maintain higher percentages of free allocation for longer.
It should also be noted that the EU ETS is based on rigorous MRV systems with explicit legal requirements, standardised methodologies, independent third-party verification and IT infrastructure for data management.
The EU MRV Guidelines, established in Commission Decision 2007/589/EC30 (MRG2007), set out detailed procedures for emissions monitoring, verification quality assurance and corrective actions. The principle is clear: a tonne must be a tonne everywhere, which guarantees the integrity of the system.
On the other hand, Chinese MRV systems present well-documented challenges: ambiguous legal status of monitoring standards, unclear requirements for monitoring plans, inconsistent methodologies across provinces and sectors, limited integration of IT infrastructure, and concerns about data quality.
Although pilot ETSs have provided experience, the national transition has created scalability issues. China must consider MRV a strategic priority, not a secondary infrastructure: its legal status must be elevated and requirements made binding at the legislative level, going beyond simple administrative guidelines. Methodologies need to be standardized and detailed sector-specific monitoring guidelines developed, equivalent to the EU's MRG2007, with clear templates for monitoring plans.
Furthermore, it is essential to build verification capacity and establish a system of independent verifiers with accreditation standards, similar to the European regime. China should not rely primarily on government officials for verification.
It is essential to invest in IT infrastructure to create an integrated system covering the entire compliance cycle: monitoring plans, emissions reporting, verification and enforcement, avoiding fragmented systems at provincial level. Consistency must be ensured: pilot ETSs operate with variable MRV standards, while the national system must impose unified standards, allowing only sector-specific adjustments.
European experience shows that MRV accuracy improves over time: Phase 1 (2005-2007) had data quality issues, which were gradually resolved. China should accept that initial quality will be imperfect, but commit to cycles of continuous improvement, as was the case in the EU's phase transitions.
Finally, the EU ETS adopts a decentralised model in which the European Commission defines general policies, while the 27 Member States implement allocation plans and manage compliance in their respective territories.
Member States have discretion over which installations to include, how to calculate allocation and verification procedures, in accordance with EU guidelines.
This flexibility allows for adaptation to heterogeneous economic structures while maintaining market unity.

[30] Decision - 2007/589 - EN - EUR-Lex

China, on the other hand, faces a complex situation: pilot ETSs continue to operate with different rules, prices and methodologies alongside the national system, creating fragmentation and opportunities for arbitrage.
Provincial governments have historically influenced allocation and implementation, leading to inconsistencies.
A direct replication of the European model is impossible given China's centralised political structure, but the lessons on managing heterogeneity remain valid. The national system should establish binding standards for MRV, benchmarking, enforcement of penalties and cap reductions, while maintaining flexibility for regional adjustments related to sectoral composition.
It is also necessary to phase out regional pilots within 3-5 years, consolidating them into the national system to avoid inefficiencies and regulatory arbitrage. To manage technical differences, China should adopt sectoral benchmarks, as the EU does, applying uniform rules for caps and trading, but with specific parameters for each sector.
Finally, the model of centralised caps with decentralised implementation, already in place in China, should be strengthened, not abandoned.

2.5 The Chinese ETS: adaptive imitation or a global relaunch?

China's national emissions trading system is neither a simple replica of existing carbon markets nor a fully autonomous innovation, but rather an adaptive process modelled on both external references and internal constraints.

The Chinese ETS selectively draws on design elements introduced by previous systems, particularly the EU ETS, such as mandatory compliance and allowance surrender obligations, while deviating from them through an intensity-based allocation system and an almost total reliance on free output-based benchmarks.

This hybrid architecture reflects lessons learned from China's regional pilot programmes, in operation since 2013, which have explicitly served as experimental platforms to reduce regulatory risk at the national level.

At the same time, the unprecedented size of the national ETS, which covers several billion tonnes of CO_2 emissions per year despite limited sectoral coverage, positions China not only as a "rule-taker" but as a potential "agenda-setter" in the global governance of carbon markets.

Although relatively low carbon prices, limited sectoral coverage and the absence of an absolute cap on emissions may cast doubt on the environmental stringency of the system, the most recent regulatory developments, such as the strengthening of the legal basis and the planned sectoral expansion, suggest an incremental strategy geared towards long-term institutional consolidation rather than immediate emissions reductions.

From this perspective, China's ETS can be interpreted less as a simple imitation and more as an adaptive relaunch that reconfigures emissions trading in a manner consistent with China's political and economic structure, with the potential to redefine the future evolution of market-based climate policies beyond the original Western models.

Chapter 3 – The Chinese ETS and relations with the EU

3.1 Strategic dialogue between China and the EU on carbon pricing

The strategic dialogue between China and the European Union on carbon pricing currently focuses on the exchange of experiences between the two ETS systems, the updating of the Memorandum of Understanding (MoU) on emissions trading, and the management of cross-effects between the ETS and the European CBAM and the Chinese national system.

The main political channel is the EU-China High Level Environment and Climate Dialogue (HECD), established in 2020, a platform that brings together leaders from both sides annually to discuss climate cooperation and carbon market policies. In this context, during the 6th HECD[31] held in Beijing on 14 June 2025, the EU and China approved joint declarations that include commitments on carbon markets, support for a just energy transition and implementation of the Paris Agreement.

[32]Furthermore, in June 2024, the European Commission and the Chinese Ministry of Ecology and Environment signed an updated MoU on the China-EU Climate Dialogue to strengthen cooperation on emissions trading, replacing the 2018 agreement.

The MoU provides for annual policy dialogue, seminars, workshops and joint research on topics such as market design, sectoral expansion, monitoring and supervision of ETS markets.

The dialogue on carbon pricing is intertwined with the European CBAM[33], an instrument that aims to set a fair price for carbon emitted during the production of carbon-intensive goods entering the EU and to encourage cleaner industrial production in third countries. In China, this is perceived both as a 'green barrier' and as an incentive to expand and strengthen its own carbon market. It should be noted that the entry into force of the CBAM risks significantly damaging Chinese exports, as the EU is the Asian country's largest trading partner.

34

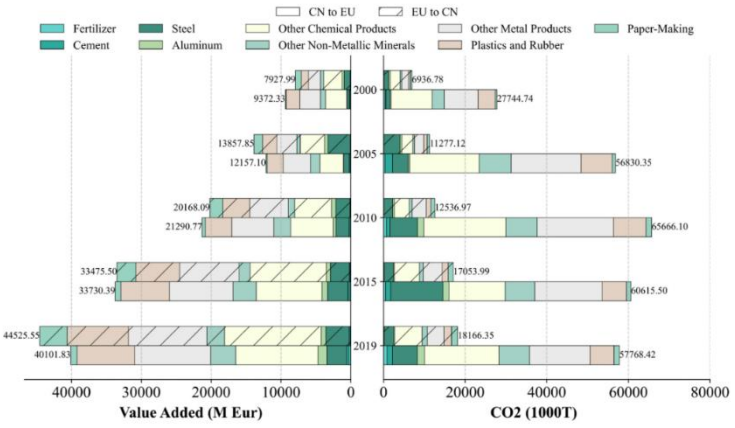


Figure 12. Bilateral trade-related value added and CO2 emissions between China and the EU from 2000 to 2019

[31] Readout from the 6th EU-China High-Level Dialogue on Environment and Climate - Climate Action

[32] climate.ec.europa.eu/document/download/9d1329c1-45e5-460a-8013-ad73c75c96f5_en?filename=policy_carbon_international_mou_en.pdf

[33] Carbon Border Adjustment Mechanism - Taxation and Customs Union

[34] Muhua Li a, Yan Sun b, Yan Xia b,a, Zhaofu Yang a, Chuxin Chen b, Yongna Yuan a, Pu Wang , "The impacts of Carbon Border Adjustment Mechanism (CBAM) on international trade and policy responses: from an economic and environmental equity perspective", Energy Policy (2026)

[35] [36]Taking into account the goods currently subject to CBAM, such as cement, products, aluminium, fertilisers, electricity and hydrogen, it can be seen that this instrument has had different impacts depending on the industries affected: the most energy-intensive and carbon-intensive sectors, such as aluminium and fertilisers, have been more significantly affected, while sectors with lower export volumes, such as cement and hydrogen, have been relatively less affected, although they are still showing a downward trend.

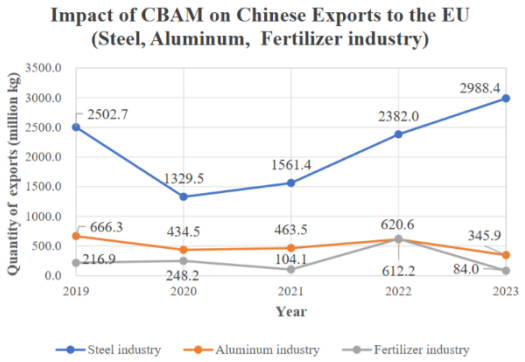


Figure 13. Impact of CBAM on Chinese exports to the EU (steel, aluminium, fertiliser industry)

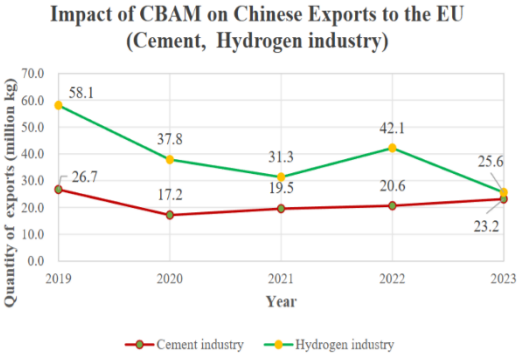


Figure 14. Impact of CBAM on Chinese exports to the EU (cement and hydrogen industries)

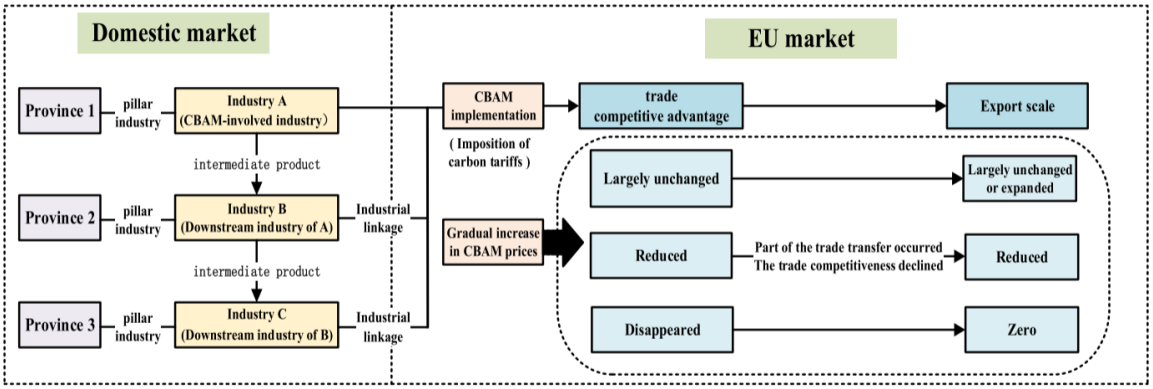
[35] Geng, R.; Cai, Q.; Wang, H., "The Impact of the EU's CBAM on China's Carbon Emission Policy.Climate", 2025
[36] Ibidem

3.2 The role of the Chinese ETS in the context of the EU CBAM

The adoption of the CBAM by the European Union marks a significant shift in the intersection of global trade and climate policy. As the world's first carbon border adjustment mechanism, the CBAM sets a precedent that other areas, such as the UK, Canada and Japan, are already beginning to follow. The Chinese ETS is becoming a key tool for reducing China's exposure to the European CBAM and, at the same time, a factor pushing Beijing to strengthen its carbon pricing in order to remain competitive in EU markets. Under the CBAM, importers must pay the difference between the carbon price in the producing country and the price of allowances in the EU ETS; a more robust Chinese ETS with higher prices therefore reduces the gap to be bridged at European borders, creating a direct incentive for China to develop its ETS beyond the electricity sector in order to demonstrate a credible domestic price on exported goods subject to the CBAM.

Recent analyses indicate that China considers strengthening the ETS to be one of the main policy responses to the CBAM, in parallel with the criticisms expressed at the WTO, and the 2024-2025 ETS reforms, surplus limitation, annual compliance cycles, and expansion to energy-intensive sectors are also interpreted as a way to gradually align the rules with those of the EU ETS and mitigate CBAM costs for sectors such as steel, cement, and aluminium. Some studies on exporting provinces such as Guangdong[37] show that stricter carbon pricing and a possible extension of the ETS to CBAM sectors can reduce the burden of CBAM certificates on Chinese exporters; However, the price of carbon in China remains significantly lower than in Europe, so in the medium term, Chinese companies will continue to bear an additional cost when entering the EU market until greater convergence in prices or methodologies is achieved.

For the EU, a more developed Chinese ETS is seen as a tool to bridge the gap between the two systems and make the CBAM more politically acceptable by demonstrating that it rewards countries with effective climate policies. In bilateral dialogue, think tanks and institutions propose using the Chinese ETS as a basis for forms of partial recognition in the CBAM, for example on the method of accounting for emissions and verification, without going as far as a full market linkage.



38

Figure 15. CBAM impact mechanisms on China's provincial industries' exports to the EU.

[37] Navigating CBAM in China: Exploring Policy Pathways for Guangdong province | NewClimate Institute

[38] Lijun Ren, Jingru Wang, Luoyi Zhang, Xiaoxiao Hu, Yan Ning, Jianhui Cong, Yongling Li, Weiqiang Zhang, Tian Xu, Xiaoning Shi, "Quantitative Assessment of the Carbon Border Adjustment Mechanism: Impacts on China–EU Trade and Provincial-Level Vulnerabilities", "Sustainability" (2025)

3.3 Chinese responses to the Carbon Border Adjustment Mechanism

Since the European Commission presented its CBAM assessment report in March 2020, numerous countries have expressed concern that this mechanism is, rather than a system to mitigate carbon leakage, a tool to hinder trade.

Despite these concerns, the negotiations have made many actors, particularly the more advanced countries, more willing to modify their emissions policies in order to mitigate the effects of the new mechanism, although hostility remains on the part of developing countries such as India and China.

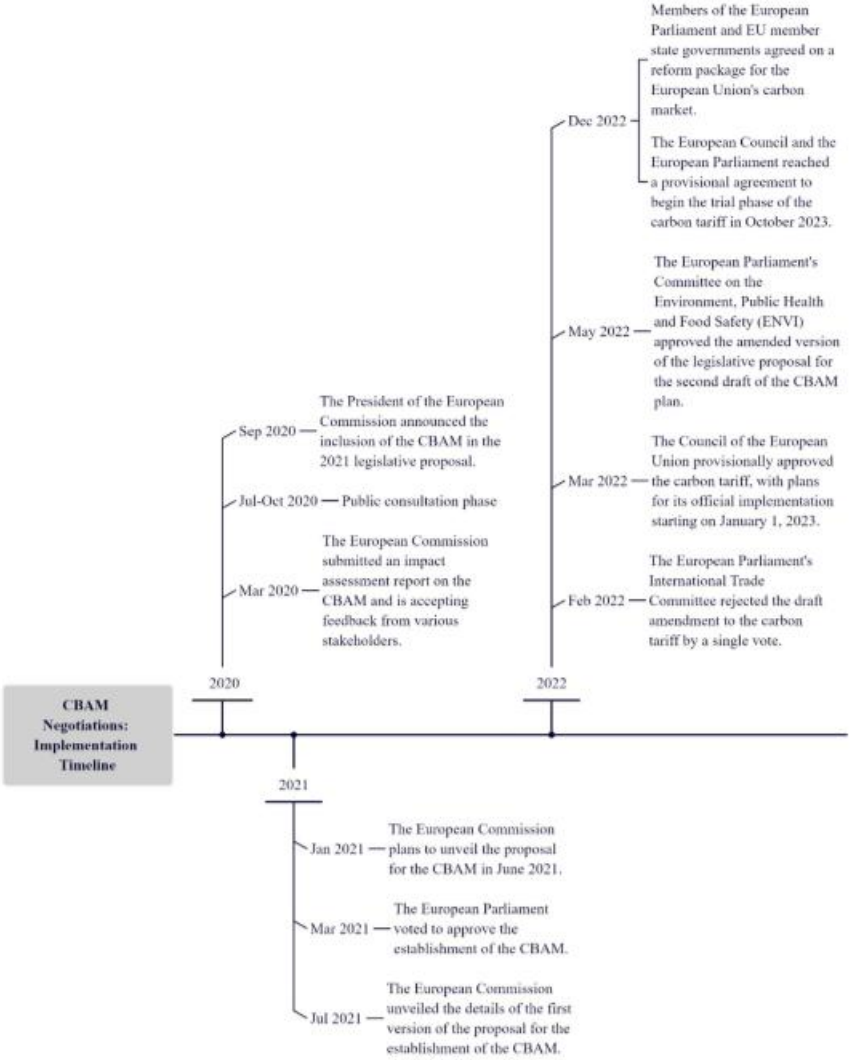


Figure 16. CBAM Negotiations: Implementation Timeline

39

The People's Republic of China has expressed strong criticism of the CBAM, which came into full effect on 1 January 2026, calling it unfair, discriminatory and contrary to World Trade Organisation (WTO) rules and the principle of common but differentiated responsibilities.

[39] Geng, R.; Cai, Q.; Wang, H. "The Impact of the EU's CBAM on China's Carbon Emission Policy", Climate, 2025

The Chinese authorities particularly contest the adoption of high default carbon intensity values applied to Chinese products, arguing that these parameters do not take into account the environmental progress made by China and that they place an excessive burden on high-emission exports such as steel and aluminium.

[40]In response to the EU measures, Beijing has announced its willingness to take 'all necessary measures' or countermeasures to protect its interests, while calling on the EU to renounce unilateral and protectionist practices. The Chinese Ministry of Commerce (MOFCOM) also reported that European plans to extend the CBAM, starting in 2028, to approximately 180 downstream products, including machinery and motor vehicles, exceed the stated climate objectives and encourage protectionist dynamics[41]. Moreover, from the Chinese perspective, the CBAM is regarded as an act of mere protectionism rather than an instrument of energy transition, also in light of the European Commission's revocation of the ban on producing petrol and diesel cars, which is interpreted as a measure aimed at protecting European manufacturers.

Among the critical issues raised are the risk of trade distortions, estimated welfare losses of $231 million for marginal emissions reductions[42], and potential repercussions on national dual carbon reduction targets. China's position emphasises the need for international cooperation in the fight against climate change and rejects measures that are inconsistent with the country's specific conditions and stages of development.

Despite this, pressure from the CBAM has led China to intensify its efforts on emissions: in fact, prior to the negotiations on the mechanism, the Asian player's efforts were mainly focused on conventional high-emission industries, such as the steel industry and the energy sector. Following the implementation of the CBAM, the country has accelerated its efforts in the green transition of its highest-emitting industries, both through new emission reduction directives and through the use of new technologies aimed at the same goal.

[43]

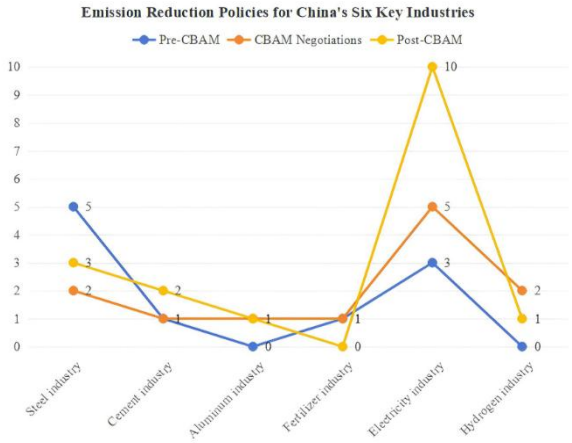


Figure 4 Emission reduction policies for China's six key industries

[40] EU 'carbon tariffs': China will take necessary measures to respond to unfair trade restrictions

[41] https://www.globaltimes.cn/page/202601/1352006.shtml

[42] Zhe-Yi Chen , Lu-Tao Zhao, Lei Cheng, Rui-Xiang Qiu, 2025, "How does China respond to the Carbon Border Adjustment Mechanism? An approach of global trade analysis", Energy Policy

[43] Geng, R.; Cai, Q.; Wang, H., 2025, "The Impact of the EU's CBAM on China's Carbon Emission Policy", Climate

3.4 Opportunities for coordination and mutual recognition

Coordination between China's national ETS and the EU ETS is one of the most pivotal strategic areas in international climate governance. Such cooperation should no longer be limited to sharing technical expertise and best practices, as has been the case until now, but should promote more advanced forms of integration, such as linking carbon markets.

The main argument in favour of such integration is that it increases market liquidity and stability, while reducing the risk that individual operators can significantly influence prices by increasing the number of participants. Market expansion also allows for the optimisation of emissions reductions across a wider range of territories and abatement options, promoting a more efficient distribution of costs. In particular, regions with untapped mitigation potential, such as China, can help alleviate economic pressures in areas already subject to stringent constraints, such as the European Union. In addition, a link between the two ETSs would lead to harmonisation and convergence on emission calculation methods, MRV and penalties. As discussed above, the price difference between the two markets is currently very marked, and this gap highlights the opportunity to achieve significant efficiency gains through a linked system whereby China, a net exporter of allowances, would benefit from selling at higher prices than domestic ones, while the EU would benefit from lower compliance costs.

Furthermore, on the geopolitical chessboard, the link between ETSs takes on a certain strategic importance, as it sends a positive signal to the international community, encouraging further countries to join, and reduces the risk of carbon leakage and Chinese concerns about competitiveness and CBAM.

However, it should be borne in mind that a direct link between the two ETSs currently presents critical issues that make it difficult to implement: in fact, the difference in the definition of the emissions cap, as the intensity-based method used by the Chinese national ETS makes the market more uncertain and less predictable, discouraging long-term investment. Furthermore, given the price difference between the two ETSs, it would drastically lower the price of EU emission allowances, making it more difficult to achieve climate targets.

3.5 ETS as a tool for climate diplomacy and economic positioning

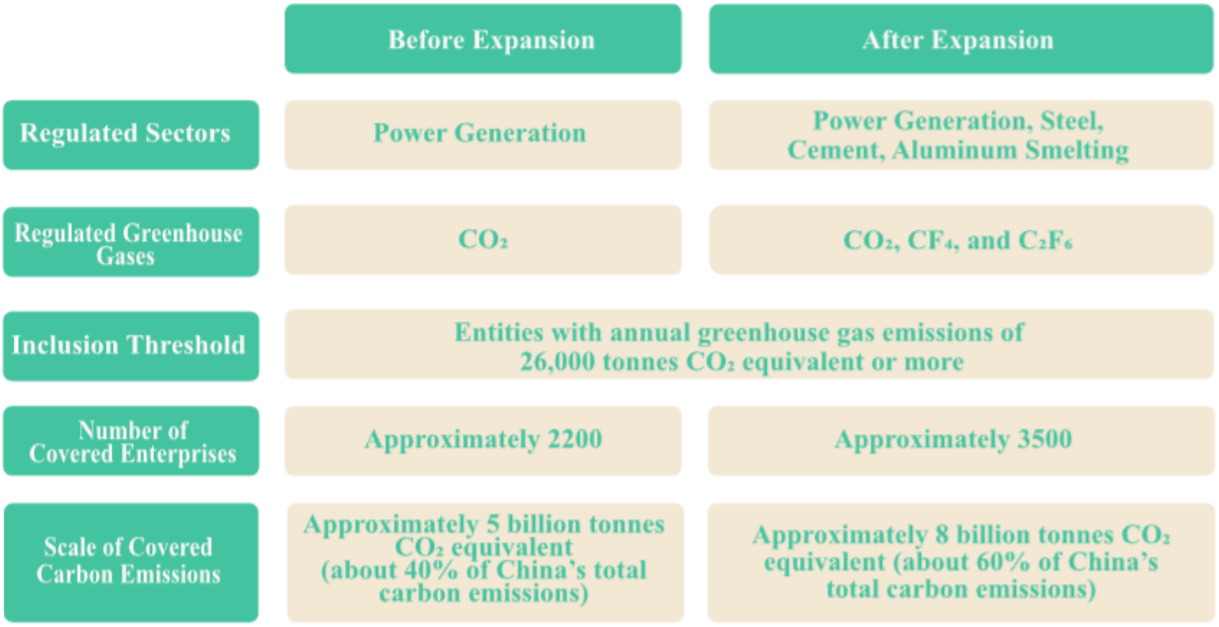
Following the US withdrawal from the Paris Agreement, the EU and China have emerged as leaders in the sustainable transition. However, this event has undermined the credibility of international institutions and reduced incentives for other actors to strengthen their commitments.
In this context, China's ambivalent nature as an actor is evident: despite standing as a technological and diplomatic leader, it remains flexible in terms of financial responsibilities and multilateral commitments.
This is also evident in the Asian country's continued self-classification as a 'developing country', which allows it to avoid contributing to major international funds such as the Green Climate Fund (GCF)[44] .
In this scenario, China's national ETS is not only an internal mechanism for reducing emissions, but also a strategic lever for climate diplomacy and global economic positioning.
First and foremost, it serves as a tool through which China promotes the narrative of the 'Green BRI', integrating market mechanisms for decarbonisation into transnational infrastructure projects and encouraging partner countries to adopt standards compatible with its ETS, thereby promoting regulatory convergence and climate cooperation.
Furthermore, in its dialogues with the Global South, Beijing uses the ETS as a model of climate governance, offering technical training and financial support to develop institutional capacity in developing countries, thus consolidating its leadership in the Global South.
This mechanism allows China to position itself as a hub for green finance and technology transfer, mobilising resources for low-emission projects and strengthening its soft power through climate cooperation.
It also serves as a geo-economic tool, as it creates opportunities for China to set international standards and influence carbon trading rules, with potential benefits for Chinese companies in emerging markets.
This strategy, consistent with the objectives of the United Nations 2030 Agenda, emphasises the need for global partnerships to address climate change and promote sustainable development, allowing China to position itself as one of the leading countries in the sustainable transition on the international stage.
Climate policy has thus become a new form of soft power to reinforce its image and influence global norms: in this context, the ETS serves not only as a tool to mitigate the effects of international policies, such as the CBAM, but also as a means to fill the void left by the US as the new leader of the green transition alongside the EU, even though their interests, especially from a commercial point of view, are often in stark contrast to each other.

[44] Homepage | Green Climate Fund

Chapter 4 – Future Prospects of the Chinese ETS

4.1 Planned sectoral expansion

Since its introduction in 2021, China's national emissions trading system has been explicitly designed as a gradually expanding system, both in terms of sectoral coverage and regulatory stringency. At launch, the ETS covered only the power generation sector, which accounts for a significant share of national CO_2 emissions and was chosen as a starting point due to the relatively mature availability of data and centralised oversight structures. On 26 March 2025, following the publication by the MEE of the "Work Programme for the Coverage of the National Carbon Emissions Trading Market for the Steel, Cement and Aluminium Smelting Industries", the sectoral coverage of the ETS was expanded to include these sectors.



45

Figure 18. Comparison before and after the expansion of sectoral coverage in the National ETS

In addition to these, a broader set of energy-intensive activities, such as petrochemicals, chemicals, paper, aviation and other energy-intensive manufacturing, will be potential components of the ETS in future phases following the EU ETS model. However, there are currently no confirmed commitments in this regard, nor is there an official roadmap of the sectors that will be included in the future, so it is highly unlikely that this expansion will take place in the short to medium term.
Nevertheless, it should be noted that, in the 2025 Progress Report of China's National Carbon Market, the General Office of the CPC Central Committee and the General Office of the State Council called for a planned and gradual expansion of sectoral coverage and the range of participants, promoting a more equitable, accessible and transparent market environment in order to promote green and low-carbon development.

[45] Progress Report of China's National Carbon Market (2025)

It is therefore clear that, although no future expansion plan has yet been announced, it can be inferred that the ETS will gradually increase its sectoral coverage to all energy-intensive activities.

4.2 Strengthening institutional capacity and MRV (Monitoring, Reporting, Verification)

Strengthening institutional capacity and MRV systems is one of the cornerstones of the evolution of China's national ETS and is an essential prerequisite for sectoral expansion and increased carbon market credibility.

MRV systems are particularly important due to the size of the country, the technological heterogeneity of installations and regional differences in administrative capacities. The launch of the national ETS limited to the electricity sector is described as a functional choice for these objectives, as this sector has relatively concentrated corporate structures, more standardised emission calculation methodologies and greater historical data availability than other industrial sectors. In this initial phase, the strengthening of MRV has been treated as an institutional learning process rather than a mechanism fully geared towards immediate maximisation of emission reductions.

The experience of regional pilot ETS systems shows that these programmes played a central role in developing the administrative and technical skills necessary for a national system: in fact, the pilot ETSs made it possible to test monitoring procedures, reporting standards and independent verification models, highlighting critical issues related to data quality and methodological consistency. These lessons were subsequently incorporated into the design of the national ETS, which adopts more uniform MRV guidelines and greater central coordination, while leaving local authorities with a significant operational role.

Furthermore, the strengthening of MRV is linked to the strategy of gradual expansion of the system: in fact, more complex industrial sectors have less homogeneous emission profiles and complex production chains, making the application of standardised MRV methodologies more costly. In this sense, the decision to delay the inclusion of these sectors appears to be a prudent measure aimed at avoiding the risks of under-reporting, information asymmetries and regulatory disputes.

Overall, strengthening institutional capacity and MRV systems is a structural priority of China's national ETS, rather than an ancillary measure. This approach reflects a view of the ETS as an institution under construction, whose success depends on data quality, procedural consistency and the ability of the authorities to enforce the rules in a credible and uniform manner. Although there is no evidence directly and verifiably linking these efforts to specific environmental results in the short term, strengthening MRV is the foundation on which the future evolution of the system rests, including its sectoral expansion and its potential role in global climate governance.

4.3 Integration with financial instruments and international carbon markets

The introduction of more advanced financial instruments within China's national ETS could be a possible factor in transforming the market, but not as an automatic or risk-free development.

Firstly, the introduction of instruments such as futures, options or other carbon derivatives could help increase market liquidity and improve the price formation process: in fact, markets with more sophisticated financial instruments, such as the EU ETS, tend to offer more continuous and informative price signals, facilitating investment planning by regulated operators.

In the Chinese context, this development is potentially relevant for energy-intensive companies, which could use these instruments to manage their exposure to carbon price risk over longer time horizons. However, it is not verifiable that the current structure of the domestic market is already capable of supporting such functions without generating instability.

A second possible effect concerns risk management and the predictability of compliance costs: advanced financial instruments could allow companies to hedge against the volatility of allowance prices, reducing the uncertainty associated with annual compliance obligations. In the absence of such instruments, the market would remain predominantly spot-based, limiting the possibilities for strategic planning. However, the effectiveness of these mechanisms depends on the quality of MRV, market transparency and the credibility of enforcement, conditions that are still being consolidated in China.

A third area of potential impact concerns the involvement of the financial sector and the integration of the ETS with broader green finance strategies: greater financialization of the carbon market could foster links between the ETS, green credit instruments and capital allocation decisions, helping to incorporate the price of carbon into the financial valuations of projects and companies. However, in the Chinese context, the authorities have not yet shown any signs of wanting to assign the ETS an explicit financial channel function.

Alongside these potential benefits, it is important to highlight the risks and trade-offs associated with the introduction of more advanced financial instruments: premature financialization could increase price volatility, encourage speculative behaviour and weaken the perception of the ETS as a climate policy tool rather than a financial asset. These risks are particularly relevant in a system where participation is currently limited to those required to comply and where carbon market supervisory institutions are still being strengthened.

Finally, the possible introduction of advanced financial instruments is linked, on an analytical level, to the possibility of future integration with international carbon markets: in fact, more liquid markets with standardised instruments could facilitate forms of cooperation or linkage with other ETS systems or with mechanisms provided for in Article 6 of the Paris Agreement. However, currently there is no evidence to support that the introduction of more advanced financial instruments would automatically lead to greater international openness, nor that this is considered a priority by the Chinese authorities.

4.4 Reform paths and future scenarios: ETS as a driver for climate neutrality?

In the debate on the trajectory of China's national ETS reform, the crucial question is not only whether the carbon market can "work" in a technical sense, but what political and economic role it can play in China's long-term strategy towards peak emissions and climate neutrality.
The ETS is part of a broad portfolio of policies, highlighting that its ability to become an autonomous driver will depend on design choices, enforcement and consistency with other instruments.
In this context, the evolution of the Chinese ETS appears to be characterised by an incremental approach: first consolidating the scope and institutional infrastructure, in particular MRV and the legal basis, then extending coverage and, potentially, tightening quantity and price constraints.
A first dimension of reform relates to the legal foundation and institutional capacity.
In 2024, the State Council's adoption of dedicated regulations on carbon trading management strengthened the regulatory framework, placing emphasis on administrative responsibilities, market rules, the fight against data falsification, and sanctions that are more stringent than those applied in the previous phase. This legal reinforcement is crucial because, for the ETS to function as a credible decarbonisation instrument, it must rely not only on trading rules and registries but, above all, on robust control systems and enforcement mechanisms perceived as effective, ensuring data integrity and compliance discipline.

A second, particularly decisive dimension for determining the potential scale of impact concerns sectoral expansion. In this regard, expansion is not merely a quantitative increase in coverage; it requires adapting benchmarks, MRV methodologies, and compliance procedures to "hard-to-abate" value chains characterised by complex industrial processes and more heterogeneous emission profiles. Looking forward, the ETS's capacity to shape the pathway towards climate neutrality will depend heavily on how rapidly and coherently additional major industries are incorporated and on how regulatory parameters (allocation, benchmarks, penalties, and banking/borrowing rules) are calibrated.

Taken together, these reforms point to different scenarios for the role of the ETS in relation to climate neutrality. A first scenario can be defined as administrative consolidation, in which the ETS maintains a predominantly intensity control logic, with large free allocation and objectives focused on MRV, compliance and market stabilisation. In this case, the ETS would act as a tool for management modernisation and efficiency benchmarking, with limited capacity to impose an absolute emissions reduction trajectory, leaving the main burden to other policies (energy planning, standards, public investment).
A second, more ambitious scenario is that of a move towards a true cap and trade system: stable expansion to all large industries, progressive introduction of absolute caps and reduction of the degree of free allocation (with recourse to partial auctions), accompanied by market stability instruments and strengthened enforcement, based on the EU ETS model.
In this scenario, the ETS could contribute more directly to climate neutrality through a stronger price signal and a clearer quantitative constraint.
A third, intermediate scenario is that of hybridisation: the coexistence of intensity-based components and absolute caps for selected sectors, with gradual tightening of benchmarks and complementary administrative measures. This scenario is compatible with the gradual approach outlined in the industrial expansion work plan, which provides for phases of familiarisation and strengthening of

data quality (2024–2026) and a subsequent tightening from 2027 onwards, while maintaining a production-linked allocation rather than an absolute cap in the initial phase.

In light of these trajectories, the question of ‘ETS as a driver for climate neutrality’ must be framed in conditional and institutional terms: ETS can become a significant driver if and only if coverage is permanently extended to the main industrial emission sources, the system credibly moves to absolute constraints (at least for some sectors) and/or reduces the generosity of free allocation. MRV and enforcement guarantee data integrity and effective deterrence, and the ETS signal is consistent with electricity market reforms and industrial policies.

It follows that, rather than determinism, the evidence supports a scenario-based interpretation: the Chinese ETS therefore appears to be an evolving institution that can move along a continuum from a tool for efficiency and data governance to a quantitative pillar of decarbonisation, depending on the reforms actually implemented and their level of stringency.

Conclusion

China's National ETS is emerging as an institution that is consolidating but still relatively immature: in recent years, significant progress has been made in strengthening its regulatory structure, improving its functioning, and gradually expanding its coverage; however, these developments are not yet sufficient to ensure an effectiveness fully comparable to that of more mature systems. Despite the evolution of the regulatory framework, the market continues to display structural weaknesses that limit its ability to act as a genuine decarbonization tool, and the current configuration of the mechanism does not allow the ETS to generate a sufficiently strong and stable price signal.
These vulnerabilities drastically undermine not only its internal usefulness for achieving the country's national climate goals, but also its credibility on the international stage. The system, in fact, struggles to express a carbon price that is robust and coherent enough to effectively guide industrial behaviour and investment decisions toward lower-emission technologies. The still-limited sectoral coverage, combined with price levels well below those of consolidated markets such as the EU ETS, hinders China's ability to present itself as a promoter of a carbon pricing approach that is globally recognized and legitimized.

The weakness of the price signal represents, in this sense, one of the most critical elements: an ETS in which allowance values remain marginal is unable to convey the notion of scarcity, a fundamental premise of the mechanism, nor to credibly incentivize emissions reductions. This results in a substantial weakening of its capacity to influence operator behaviour and, more generally, to establish itself as a strategic tool in international relations.

In a geopolitical context in which carbon pricing is assuming an increasingly important role in commercial and diplomatic dynamics, as demonstrated by the introduction of the European CBAM, the Chinese ETS's inability to express a solid and European-comparable price significantly reduces its weight on the global chessboard. The EU ETS, thanks to its ambition, regulatory solidity, and price stability, now represents the international benchmark: the gap between the two systems therefore limits China's ability to shape global carbon-pricing rules and to position itself as an alternative hub of climate governance.

It is also necessary to consider that if the reform process were to slow down or encounter internal political and industrial resistance, these critical issues could become entrenched over time, risking to trap the market in a dynamic of inefficient equilibrium, in which low prices, reduced liquidity and weak expectations reinforce one another, making any future reform more difficult and widening the gap with more advanced systems.

In conclusion, unless the Chinese ETS succeeds in structurally expanding its coverage, increasing market liquidity, and, above all, raising the carbon price level, it will continue to be perceived as a predominantly administrative and domestic mechanism rather than one capable of truly influencing global dynamics or supporting Beijing's ambitions for climate and energy leadership. Only through a substantial strengthening of the price signal, an expansion of the sectors involved, and a tightening of compliance mechanisms will the ETS be able to acquire the weight necessary to become both an

internal driver of decarbonization and a strategic asset of China's climate policy in the global arena.

Within this framework, the CBAM itself could prove to be the external push China needs to accelerate the strengthening of its ETS, progressively transforming it from a gradual and experimental system into a tool fully integrated into its climate strategy and competitive in the international landscape. The growing pressure exerted by the European mechanism forces Beijing to confront the need to align, at least partially, the effectiveness of its carbon market with the standards of its trading partners. Higher domestic carbon prices, broader sectoral coverage, and strengthened MRV infrastructures thus become not only environmental objectives but also essential conditions for protecting the competitiveness of Chinese exports to Europe.

At the same time, the CBAM compels China to confront a new paradigm of international climate governance, in which the carbon price is no longer merely a domestic variable but a real factor in trade relations. For this reason, the ETS could also assume a strategic role as an industrial-policy tool: a more credible price signal would, in fact, incentivize not only emissions reductions but also technological innovation, production modernization, and the expansion of low-carbon value chains, all key elements for China's positioning in the global markets of the energy transition.

Moreover, a more solid ETS would allow China to present itself as a more authoritative actor in international climate negotiations, strengthening its capacity to influence global carbon-pricing standards and to interact on equal footing with the EU and other states introducing similar mechanisms.

Ultimately, the CBAM may therefore act as a catalyst pushing the Chinese ETS beyond its current configuration, accelerating a qualitative leap that would otherwise take much longer to materialize. If China manages to seize this opportunity, transforming external pressure into internal reform, the ETS may finally fulfil the dual function for which it was designed: to guide national decarbonization and to consolidate China's role as a key player in global climate governance. Conversely, should such reforms advance too slowly, the ETS risks remaining an incomplete instrument, lacking the strategic strength China increasingly seems to need within a rapidly changing international system.

Bibliography and sitography

- *2024-scoping-study-carbon-pricing*
- *2035 年中国国家自主贡献报告*.
- Affandi, R. A., & Adrian. (2024). China environmental economics: A political authority approach and neo-marxist perspective in the emission trading system (ETS) implementation. *Heliyon*, *10*(23). https://doi.org/10.1016/j.heliyon.2024.e40633
- Bai, J., Ma, W., Wang, Y., & Jiang, J. (2024). Political incentives in market-based environmental regulation: Evidence from China's carbon emissions trading scheme. *Heliyon*, *10*(4). https://doi.org/10.1016/j.heliyon.2024.e25730
- Boldizsár, A. (2024). The European Union's Global Goods Transport and Trade Relations and their Implications. *Periodica Polytechnica Transportation Engineering*, *52*(4), 382–387. https://doi.org/10.3311/PPtr.25681
- Brewer, T. (n.d.). *Climate Change*.
- *CARBON MARKET BUSINESS BRIEF CHINA Beijing Shanghai Shenzhen Guangdong Hubei Chongqing Tianjin Fujian*. (n.d.-a).
- Chai, S., Sun, R., Zhang, K., Ding, Y., & Wei, W. (2022). Is Emissions Trading Scheme (ETS) an Effective Market-Incentivized Environmental Regulation Policy? Evidence from China's Eight ETS Pilots. *International Journal of Environmental Research and Public Health*, *19*(6). https://doi.org/10.3390/ijerph19063177
- Chai, S., Yang, X., Zhang, Z., Abedin, M. Z., & Lucey, B. (2022). Regional imbalances of market efficiency in China's pilot emission trading schemes (ETS): A multifractal perspective. *Research in International Business and Finance*, *63*. https://doi.org/10.1016/j.ribaf.2022.101758
- Chen, M., & Chung, L. (2025). Effect of unpredictability in economic and energy policy on China's emission trading programme pilots' volatility. *Energy Strategy Reviews*, *58*. https://doi.org/10.1016/j.esr.2025.101676
- Chen, S. (2023). Dependency ratio and emission trading scheme: a case study in China. *Climatic Change*, *176*(12). https://doi.org/10.1007/s10584-023-03651-9
- Chen, S., & Wang, C. (2023). Inequality impacts of ETS penalties: A case study on the recent Chinese nationwide ETS market. *Energy Policy*, *173*. https://doi.org/10.1016/j.enpol.2022.113399
- Chen, Z. Y., Zhao, L. T., Cheng, L., & Qiu, R. X. (2025). How does China respond to the Carbon Border Adjustment Mechanism? An approach of global trade analysis. *Energy Policy*, *198*. https://doi.org/10.1016/j.enpol.2024.114486
- *China Belt and Road Initiative (BRI) Investment Report 2024 Christoph Nedopil*. (2025). https://doi.org/10.25904/1912/5784
- *China Council for International Cooperation on Environment and Development Special Policy Report Global Climate Governance and Green and Inclusive Transition 2025 Annual General Meeting of the China Council for International Cooperation on Environment and Development*.
- *China MRV System and Enforcement China Quality Certification Centre (CQC) October,2020 2. MRV enforcement 3. Characteristics of China MRV system and suggestions Content*.
- *CHINA NATIONAL ETS AT A GLANCE Years in operation*.
- *China National ETS General Information*.
- *China's Emissions Trading Designing efficient allowance allocation*. (n.d.-a).
- Chinese：, I., Zheng, L. I., & Wang, J. (n.d.-a). *Special Policy Study Members Chinese： Special Policy Study Members*.
- *convergence,-not-alignment_-eu-china-climate-relations-ahead-of-cop30-11373_0 (1)*. (n.d.).

- Dai, C., & Pollitt, M. G. (2024). *CAMBRIDGE WORKING PAPERS IN ECONOMICS From Local Carbon Emissions Pilots to the National Carbon Emissions Trading Scheme in China* www.econ.cam.ac.uk/cwpewww.jbs.cam.ac.uk/eprg
- Dai, C., & Pollitt, M. G. (2025). Aligning China's local and national carbon markets under global carbon pricing. *Energy and Climate Management*, *1*(3), 9400017. https://doi.org/10.26599/ecm.2025.9400017
- Dong, F., Li, Z., Cui, J., Zhang, Y., Lu, B., Fan, K., Xu, K., Li, J., & Sun, J. (2024). Analysis of market risk volatility and warning in carbon trading market. *Journal of Cleaner Production*, *452*. https://doi.org/10.1016/j.jclepro.2024.142014
- *EMISSIONS TRADING WORLDWIDE*. (n.d.).
- Energy Agency, I. *Enhancing China's ETS for Carbon Neutrality: Focus on Power Sector Co-ordinating climate and renewable energy policy*. Retrieved www.iea.org/t&c/
- Erdogdu, E. (2025). The Carbon Border Adjustment Mechanism: Opportunities and Challenges for Non-EU Countries. *Wiley Interdisciplinary Reviews: Energy and Environment*, *14*(1). https://doi.org/10.1002/wene.70000
- *European Commission FINAL EVALUATION OF THE "SUPPORT THE PLATFORM FOR POLICY DIALOGUE AND COOPERATION BETWEEN EU AND CHINA ON EMISSION TRADING" PROJECT* (2021).
- Fang, K., Zhang, Q., Song, J., Yu, C., Zhang, H., & Liu, H. (2021). How can national ETS affect carbon emissions and abatement costs? Evidence from the dual goals proposed by China's NDCs. *Resources, Conservation and Recycling*, *171*. https://doi.org/10.1016/j.resconrec.2021.105638
- Feng, Y., & Mohsin, M. (2025). Promoting climate-compatible Approaches: Managing carbon neutrality and evaluating China's energy impact on global economic development. *Energy Strategy Reviews*, *59*. https://doi.org/10.1016/j.esr.2025.101716
- Gao, G. (2022). *The Impact of Carbon Border Adjustment Mechanism (CBAM) on China*.
- Gao, Q., Zeng, H., Sun, G., & Li, J. (2023). Extreme risk spillover from uncertainty to carbon markets in China and the EU—A time varying copula approach. *Journal of Environmental Management*, *326*. https://doi.org/10.1016/j.jenvman.2022.116634
- Geng, R., Cai, Q., & Wang, H. (2025). The Impact of the EU's CBAM on China's Carbon Emission Policy. *Climate*, *13*(1). https://doi.org/10.3390/cli13010005
- Gershon, O., & Asekomeh Smith Azubuike, A. I. *The Palgrave Handbook of Carbon Trading in Africa*.
- Gong, Z., Chen, Y., Zhang, H., & Chen, F. (2024). Tail risk connectedness in the Carbon-Finance nexus: Evidence from a quantile spillover approach in China. *Finance Research Letters*, *67*. https://doi.org/10.1016/j.frl.2024.105803
- Gopinath, K., & Won, K. J. *China's National Emissions Trading System: Lessons from Regional Pilots and the Way Forward*.
- Hader-Weinmann, P., Bayer, T., Rützel, K., & Barnitzke, T. *China and the EU – a comparison of two Emissions Trading Systems*.
- Harnisch, J. (2006). *Changing the Scope of the Directive: Monitoring, Reporting & Verification Issues ECCP Meeting Brussels, 8 March 2007*.
- Heggelund, G., Stensdal, I., & Duan, M. (2022). China's Carbon Market: Potential for Success? *Politics and Governance*, *10*(1), 265–274. https://doi.org/10.17645/pag.v10i1.4792
- Huang, W., Wang, Q., Li, H., Fan, H., Qian, Y., & Klemeš, J. J. (2022). Review of recent progress of emission trading policy in China. *Journal of Cleaner Production*, *349*. https://doi.org/10.1016/j.jclepro.2022.131480
- Iges. *The progress and prospects of China's national emissions trading scheme*.

- Institute, N. (2025). *Navigating CBAM in China: Exploring Policy Pathways for Guangdong province*. https://newclimate.org/
- Jin, L., Choi, J. H., Kim, S., & Yang, D. H. (2021). Government environmental pressure and market response to carbon disclosure: A study of the early chinese ets implementation. *Sustainability (Switzerland)*, *13*(24). https://doi.org/10.3390/su132413532
- Jindřichovská, I., & Uğurlu, E. (2021). E.U. and China Trends in Trade in Challenging Times. *Journal of Risk and Financial Management*, *14*(2). https://doi.org/10.3390/jrfm14020071
- Kaplan Donmez, N. F. (2026). Policy Instruments Against Climate Change: A Panel Data Analysis of Carbon Taxation and Emissions Trading in OECD Countries. *Economies*, *14*(1), 12. https://doi.org/10.3390/economies14010012
- Kardish, C., Li, L., Hellmich -Adelphi, M., Duan, M., & Tao, Y. (2021). *The EU carbon border adjustment mechanism (CBAM) and China Unpacking options on policy design, potential responses, and possible impacts*. www.adelphi.de
- Kim, Y.-C. *Understanding China China and the Belt and Road Initiative Trade Relationships, Business Opportunities and Political Impacts*. Retrieved https://link.springer.com/bookseries/11772
- Lagouvardou, S., & Psaraftis, H. N. (2022). Implications of the EU Emissions Trading System (ETS) on European container routes: A carbon leakage case study. *Maritime Transport Research*, *3*. https://doi.org/10.1016/j.martra.2022.100059
- Li, K., Qi, S. Z., Yan, Y. X., & Zhang, X. L. (2022). China's ETS pilots: Program design, industry risk, and long-term investment. *Advances in Climate Change Research*, *13*(1), 82–96. https://doi.org/10.1016/j.accre.2021.11.002
- Li, M., Sun, Y., Xia, Y., Yang, Z., Chen, C., Yuan, Y., & Wang, P. (2026). The impacts of Carbon Border Adjustment Mechanism (CBAM) on international trade and policy responses: from an economic and environmental equity perspective. *Energy Policy*, *210*. https://doi.org/10.1016/j.enpol.2025.115014
- Li, M., Weng, Y., & Duan, M. (2019). Emissions, energy and economic impacts of linking China's national ETS with the EU ETS. *Applied Energy*, *235*, 1235–1244. https://doi.org/10.1016/j.apenergy.2018.11.047
- Li, W., Liu, X., & Lu, C. (2023). Analysis of China's steel response ways to EU CBAM policy based on embodied carbon intensity prediction. *Energy*, *282*. https://doi.org/10.1016/j.energy.2023.128812
- *Linking the EU and Chinese ETS: Policy Pathways and Economic Implications for Climate Cooperation*. (n.d.). Retrieved https://youtu.be/6dfKY3TKk0o
- Liu, F., van den Bergh, J., & Wei, Y. (2024). Testing mechanisms through which China's ETS promotes a low-carbon transition. *Energy Economics*, *132*. https://doi.org/10.1016/j.eneco.2024.107494
- Liu, J., Hou, J., Fan, Q., & Chen, H. (2022). China's national ETS: Global and local lessons. *Energy Reports*, *8*, 428–437. https://doi.org/10.1016/j.egyr.2022.03.097
- Ma, G., Qin, J., & Zhang, Y. (2023). Does the carbon emissions trading system reduce carbon emissions by promoting two-way FDI in developing countries? Evidence from Chinese listed companies and cities. *Energy Economics*, *120*. https://doi.org/10.1016/j.eneco.2023.106581
- Marcu, A., Coker, E., Bourcier, F., Caneill, J.-Y., Schleicher, S., Fernando López Hernández, J., Caruana, N., Chawah, P., & Finlayson, R. (n.d.). *2025 State of the EU ETS Report*.
- Org, A., Policyinstitute, /, & Org | @asiapolicy, P. *BY DUAN MAOSHENG THE TRANSITION FROM AN INTENSITY TO AN ABSOLUTE EMISSIONS CAP IN CHINA'S NATIONAL EMISSIONS TRADING SYSTEM*.
- Pan, C., Shrestha, A. K., Wang, G., Innes, J. L., Wang, K. X., Li, N., Li, J., He, Y., Sheng, C., & Niles, J. O. (2021). A linkage framework for the china national emission trading system (Cets):

Insight from key global carbon markets. *Sustainability (Switzerland)*, *13*(13). https://doi.org/10.3390/su13137459

- Pauw, P., van Schaik, L., Cretti, G., & Shutterstock, *The CBAM Effect: how the world is responding to the EU's new climate stick MAY 2022*.
- *Progress Report of China's National Carbon Market (2025) Ministry of Ecology and Environment of the People's Republic of China*. (2025).
- *Progress Report of China's National Carbon Market (2024)*. (n.d.).
- Ren, L., Wang, J., Zhang, L., Hu, X., Ning, Y., Cong, J., Li, Y., Zhang, W., Xu, T., & Shi, X. (2025). Quantitative Assessment of the Carbon Border Adjustment Mechanism: Impacts on China–EU Trade and Provincial-Level Vulnerabilities. *Sustainability (Switzerland)*, *17*(4). https://doi.org/10.3390/su17041699
- Ren, Y. S., Huynh, T. L. D., Liu, P. Z., & Narayan, S. (2024). Is the carbon emission trading scheme conducive to promoting energy transition? Some empirical evidence from China. *Energy Economics*, *134*. https://doi.org/10.1016/j.eneco.2024.107629
- Shen, H., Yang, Q., Luo, L., & Huang, N. (2023). Market reactions to a cross-border carbon policy: Evidence from listed Chinese companies. *British Accounting Review*, *55*(1). https://doi.org/10.1016/j.bar.2022.101116
- Song, X., Wang, D., Zhang, X., He, Y., & Wang, Y. (2022). A comparison of the operation of China's carbon trading market and energy market and their spillover effects. *Renewable and Sustainable Energy Reviews*, *168*. https://doi.org/10.1016/j.rser.2022.112864
- *SPS-Climate-Change-Governance*. (n.d.-a).
- Sun, A. (2022). *East Meets West: Linking the China and EU ETS's*.
- Tan, X., Liu, Y., Dong, H., & Zhang, Z. (2022). The effect of carbon emission trading scheme on energy efficiency: Evidence from China. *Economic Analysis and Policy*, *75*, 506–517. https://doi.org/10.1016/j.eap.2022.06.012
- Tang, K., Zhou, Y., Liang, X., & Zhou, D. *The effectiveness and heterogeneity of carbon emissions trading scheme in China*. https://doi.org/10.1007/s11356-020-12182-0/Published
- Teng, F., & Wang, P. (2021). The evolution of climate governance in China: drivers, features, and effectiveness. *Environmental Politics*, *30*(sup1), 141–161. https://doi.org/10.1080/09644016.2021.1985221
- Tian, H., Lin, J., & Jiang, C. (2022). The Impact of Carbon Emission Trading Policies on Enterprises' Green Technology Innovation—Evidence from Listed Companies in China. *Sustainability (Switzerland)*, *14*(12). https://doi.org/10.3390/su14127207
- Verde, S. F., Galdi, G., Alloisio, I., & Borghesi, S. (2021). The EU ETS and its companion policies: any insight for China's ETS? In *Environment and Development Economics* (Vol. 26, Issue 3, pp. 302–320). Cambridge University Press. https://doi.org/10.1017/S1355770X20000595
- Wang, A., Khanna, W., & Liu, N. (2023). *UC Berkeley Previously Published Works Title Measurement, reporting and Verification (MRV) of non-CO2 greenhouse gases: International Best Practices and Suggestions for China Publication Date*. https://escholarship.org/uc/item/76j3p5df
- Wang, P., Liu, L., Tan, X., & Liu, Z. (2019). Key challenges for China's carbon emissions trading program. *Wiley Interdisciplinary Reviews: Climate Change*, *10*(5). https://doi.org/10.1002/wcc.599
- Wang, Q., Zhan, J., Zhang, H., Cao, Y., Yang, Z., Wu, Q., & Otho, A. R. (2025). China's Carbon Emissions Trading Market: Current Situation, Impact Assessment, Challenges, and Suggestions. In *Land* (Vol. 14, Issue 8). Multidisciplinary Digital Publishing Institute (MDPI). https://doi.org/10.3390/land14081582
- Wang, Z., & Paavola, J. (2023). Emissions trading in China: New political economy dynamics. *Environmental Policy and Governance*, *33*(5), 504–516. https://doi.org/10.1002/eet.2046

- Winkler, M. B. J., Peterson, S., & Thube, S. (2021). Gains associated with linking the EU and Chinese ETS under different assumptions on restrictions, allowance endowments, and international trade. *Energy Economics*, *104*. https://doi.org/10.1016/j.eneco.2021.105630
- Wirdyansyah, D. M. (2025). Carbon Border Adjustment Mechanism (CBAM) and Its Implications for Developing Economies: A Systematic Literature Review. *Indonesian Journal of Energy*, *8*(2), 162–176. https://doi.org/10.33116/ije.v8i2.292
- Wu, L., Zhang, S., & Qian, H. (2022). Distributional effects of China's National Emissions Trading Scheme with an emphasis on sectoral coverage and revenue recycling. *Energy Economics*, *105*. https://doi.org/10.1016/j.eneco.2021.105770
- Wu, Q. (2022). Price and scale effects of China's carbon emission trading system pilots on emission reduction. *Journal of Environmental Management*, *314*. https://doi.org/10.1016/j.jenvman.2022.115054
- Xu, Y., & Salem, S. (2021). Explosive behaviors in Chinese carbon markets: are there price bubbles in eight pilots? *Renewable and Sustainable Energy Reviews*, *145*. https://doi.org/10.1016/j.rser.2021.111089
- Ying, J. J., & Sovacool, B. K. (2021). A fair trade? Expert perceptions of equity, innovation, and public awareness in China's future Emissions Trading Scheme. *Climatic Change*, *164*(3–4). https://doi.org/10.1007/s10584-021-02961-0
- Yue, T., Tong, J., Qiao, Y., & Chen, L. (2024). Carbon governance or trade gaming: China's approach to addressing the EU's carbon border adjustment mechanism. *Journal of Cleaner Production*, *484*. https://doi.org/10.1016/j.jclepro.2024.144359
- Zhang, H., & Liu, Y. (2022). Can the pilot emission trading system coordinate the relationship between emission reduction and economic development goals in China? *Journal of Cleaner Production*, *363*. https://doi.org/10.1016/j.jclepro.2022.132629
- Zhang, H., Zhang, D., Guo, S., & Zhang, X. (2024). Impact of benchmark tightening design under output-based ETS on China's power sector. *Energy*, *288*. https://doi.org/10.1016/j.energy.2023.129832
- Zhang, S. (2024). The impact of emission trading schemes and government pressure on corporate climate change disclosure in China. *Environmental Challenges*, *16*. https://doi.org/10.1016/j.envc.2024.100979
- Zhang, X., Yu, R., & Karplus, V. J. (2025). The development of China's national carbon market: An overview. *Energy and Climate Management*, *1*(2), 9400015. https://doi.org/10.26599/ecm.2025.9400015
- Zhao, M., Ning, Y., Bai, S., & Zhang, B. (2024). Embodied Carbon Transfer in China's Bilateral Trade with Belt and Road Countries from the Perspective of Global Value Chains. *Energies*, *17*(4). https://doi.org/10.3390/en17040969
- Zhu, R., Li, L., & Guo, C. *Research on the Stable Operation Strategy of Carbon Emission Trading System under 2 Dual Carbon Goals: An Evolutionary Game Analysis from the MRV Perspective*. Retrieved https://ssrn.com/abstract=5208262
- ICAP, ICAP Allowance Price Explorer, Allowance Price Explorer | International Carbon Action Partnership
- European Commission, EU postpones carbon pricing for buildings to 2028 in climate law deal, EU postpones carbon pricing for buildings to 2028 in climate law deal | BUILD UP
- European Commission, Market Stability Reserve, Market Stability Reserve - Climate Action - European Commission
- United Nations Climate Change, Land Use, Land-Use Change and Forestry (LULUCF), Land Use, Land-Use Change and Forestry (LULUCF) | UNFCCC
- European Commission, EUR-Lex, Directive 2003/87/EC of the European Parliament and of the

Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC (Text with EEA relevance), Directive - 2003/87 - EN - EUR-Lex

- english.gov.cn, Interim Regulations on the Administration of Carbon Emission Trading, 碳排放权交易管理暂行条例 其他 中国政府网
- European Commission, EUR-Lex, 2007/589/EC: Commission Decision of 18 July 2007 establishing guidelines for the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council (notified under document number C(2007) 3416) (Text with EEA relevance), Decision - 2007/589 - EN - EUR-Lex
- European Commission, Readout from the 6th EU-China High-Level Dialogue on Environment and Climate, Readout from the 6th EU-China High-Level Dialogue on Environment and Climate - Climate Action
- climate.ec.europa.eu/document/download/9d1329c1-45e5-460a-8013-ad73c75c96f5_en?filename=policy_carbon_international_mou_en.pdf
- European Commision, Carbon Border Adjustment Mechanism, Carbon Border Adjustment Mechanism - Taxation and Customs Union
- New Climate Institute, Navigating CBAM in China: Exploring Policy Pathways for Guangdong province, Navigating CBAM in China: Exploring Policy Pathways for Guangdong province | NewClimate Institute
- CGTN, "Dazi sul carbonio" dell'UE: la Cina adotterà le misure necessarie per rispondere alle ingiuste restrizioni commerciali, "Dazi sul carbonio" dell'UE: la Cina adotterà le misure necessarie per rispondere alle ingiuste restrizioni commerciali
- Global Times, EU's CBAM provisions targeting China are unfair and discriminatory; China to take all necessary measures to safeguard interests, MOFCOM says, EU's CBAM provisions targeting China are unfair and discriminatory; China to take all necessary measures to safeguard interests, MOFCOM says - Global Times
- Homepage | Green Climate Fund
- EUI – Florence School Regulation, EU Emission Trading System (EU ETS), EU Emission Trading System (EU ETS) - Florence School of Regulation
- IARI – Istituto Analisi Relazioni Internazionali, CHINA EMISSIONS TRADING SYSTEM. L'APPROCCIO CINESE AL CAMBIAMENTO CLIMATICO, CHINA EMISSIONS TRADING SYSTEM. L'APPROCCIO CINESE AL CAMBIAMENTO CLIMATICO - IARI
- ESG NEWS, Mercato dei crediti di CO2: perché guardare alla Cina, Mercato dei crediti di CO2: perché guardare alla Cina - ESG News
- European Commission, Use of international credit, Use of international credits - Climate Action - European Commission
- ADM – Agenzia delle Dogane e dei Monopoli, CBAM – Carbon Border Adjustment Mechanism, CBAM – Carbon Border Adjustment Mechanism - Agenzia delle dogane e dei Monopoli
- Climate Cooperation China, EU and China Enhance Cooperation on Emissions Trading, EU and China Enhance Cooperation on Emissions Trading - Sino-German Cooperation on Climate Change
- European Commission, Final Evaluation of the "Support the Platform for Policy Dialogue and Cooperation between EU and China on Emission Trading" project (2021), Final Evaluation of the "Support the Platform for Policy Dialogue and Cooperation between EU and China on Emission Trading" project (2021) - International Partnerships
- CCIED – China Council for International Cooperation on Environment and Development, Impressive Progress in China's 1+N Policy Framework, Impressive Progress in China's 1+N Policy Framework - CCICED

- QualEnergia.it, La Cina vola sulle rinnovabili e studia un Ets sul modello europeo, La Cina vola su rinnovabili e studio nuovo ETS
- English.gov.cn, China releases carbon emissions trading regulations, China releases carbon emissions trading regulations
- Ministry of Ecology and Environment of the People's Republic of China, Administrative Measures for Carbon Emission Trading (Trial), Administrative Measures for Carbon Emission Trading (Trial)
- BRI Green Development Institute, CCICED SPS Report on Green South-South Cooperation Released, CCICED SPS Report on Green South-South Cooperation Released
- Stratheia, China's BRI 2.0: A Greener Path towards Global Climate Governance, China's BRI 2.0: A Greener Path towards Global Climate Governance - Stratheia
- Materia Rinnovabile, Il dragone verde: la Cina ora ha la leadership sul clima, Il dragone verde: la Cina ora ha la leadership sul clima Materia Rinnovabile | Renewable Matter
- China Development Brief, 177 Billion Climate Funds | China's Actions in South-South Cooperation to Address Climate Change, 177 Billion Climate Funds | China's Actions in South-South Cooperation to Address Climate Change – China Development Brief
- Ministry of Ecology and Environment of the People's Republic of China, Pathways for Achieving Carbon Neutrality and China's Role in Global Climate Governance, Pathways for Achieving Carbon Neutrality and China's Role in Global Climate Governance - CCICED
- United Nations – Office for South South Cooperation, Global Report on South-South and Triangular Cooperation, Global Report on South-South and Triangular Cooperation - South-South Galaxy
- South China Morning Post, What is the China Certified Emission Reduction scheme and why is it important for Beijing's carbon neutral goal?, Explainer | What is the China Certified Emission Reduction scheme and why is it important for Beijing's carbon neutral goal? | South China Morning Post
- Urban Planning Society of China, China Certified Emission Reduction, China Certified Emission Reduction
- European Commission, China, EU trade relations with China
- Derrick Energia, Green Deal e Protezionismo, Derrick Energia: 2026
- Commissione Europea, Patto per l'industria pulita, Patto per l'industria pulita - Commissione europea
- United Nation Climate Change, China's 2035 National Determined Contributions, China's 2035 National Determined Contributions | UNFCCC
- CGTN, China's 14 Five-Year Plans in Numbers, China's 14 Five-Year Plans in Numbers
- RSI, Cina contro i dazi UE: "Protezionismo sleale", Cina contro i dazi UE: "Protezionismo sleale" - RSI