

NAVIGATING CBAM IN CHINA

Exploring Policy Pathways for Guangdong province

APRIL 2025



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Authors

Juliette de Grandpré	NewClimate Institute
Norah Zhang	NewClimate Institute
Mats Marquardt	NewClimate Institute

Design

Yogee Chandrasekaran	NewClimate Institute
Polina Korneeva	NewClimate Institute

Editing

Hyunju (Laeticia) Ock	NewClimate Institute
-----------------------	----------------------

Communications

Victoria Fischdick	NewClimate Institute
--------------------	----------------------

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Citation

NewClimate Institute (2025). Navigating CBAM in China: Exploring Policy Pathways for Guangdong province. Available at: <https://newclimate.org/resources/publications/navigating-cbam-in-china-exploring-policy-pathways-for-guangdong-province>

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Supported by:



on the basis of a decision
by the German Bundestag

Acknowledgements

This report is an output of the Sino-German Cooperation on Climate Change (SGCCC) – NDC Implementation project, which is commissioned by the Federal Ministry for Economic Affairs and Climate Action (BMWK) as part of the International Climate Initiative (IKI) and implemented by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH together with the National Center for Climate Change Strategy and International Cooperation (NCSC) of China, NewClimate Institute for Climate Policy and Global Sustainability (NCI) gGmbH, and Climate Analytics (CA) gGmbH.

The IKI is one of the key instruments of the German Federal Government to support international climate action and biodiversity. Since 2022, the IKI is implemented by Federal Ministry for Economic Affairs and Climate Action (BMWK) in close cooperation with the Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV) and the Federal Foreign Office (AA).

The completion of this report was supported by the insightful reviews of Isadora Wang, Byford Tsang, Simon Göss, and Sarah Jackson. We also extend our gratitude to the China Quality Certification Centre (CQC) – Guangdong Branch for their expertise and contributions, as well as to Franziska Wiedemeyer and Philipp Voss from the Federal Ministry for Economic Affairs and Climate Action (BMWK).

EXECUTIVE SUMMARY

As more countries implement ambitious carbon pricing and border adjustments, carbon constraints are increasingly reshaping global trade. To strengthen its climate ambitions, the European Union launched the Carbon Border Adjustment Mechanism (CBAM), which imposes a carbon price on high-emission imports to prevent carbon “leakage” – where companies relocate their high-emission production to countries with weaker climate regulations to avoid carbon costs. Starting in January 2026, CBAM will enter a new phase, gradually obligating importers to pay a carbon price equivalent to that faced by European producers, based on the embedded emissions in their products.

At the intersection of climate policy and trade, CBAM positions the EU as a pioneer in aligning trade with climate goals. However, concerns persist over its impact on international trade flows, particularly for producers in highly exposed regions. Among the key concerns are disclosure requirements for embedded emissions data they deem confidential, uncertainty over revenue allocation, and alignment with WTO rules and the principle of Common but Differentiated Responsibilities (CBDR).

This report examines CBAM's impact on export-oriented producers in Guangdong, China's top exporting province with the highest GDP. Guangdong is a key hub for processing and exporting carbon-intensive industrial products covered by CBAM, such as iron, steel, and aluminium. In the initial phase, Guangdong industries' exposure to CBAM will be limited due to its diversified export portfolio. In 2022, the province recorded USD 793 billion in total exports, with only USD 2 billion in CBAM-covered commodities exported to the EU. The gradual phase-in of CBAM's financial obligations and its limited initial scope further helps reduce its immediate risks.

The CBAM costs will be paid by importers, who are likely to pass some of these additional costs to EU consumers. However, Guangdong producers—especially in high-emission sectors such as iron, steel, and aluminium—will face increased pressure. The impact will depend on the emissions intensity of exported goods, giving lower-emission producers an advantage. As CBAM expands to cover indirect emissions and additional sectors (e.g., plastics), and as more countries introduce similar carbon border adjustments, the pressure on Guangdong's producers will rise sharply. The expected increase in EU carbon prices will likely further strain the province's export-oriented industries.

To mitigate CBAM's impact and maintain global trade competitiveness, **Guangdong-based companies and policymakers** should consider:

01 Accelerating industrial decarbonisation

- Guangdong's producers should focus on reducing emissions intensity in industrial production and China's power sector to lower CBAM costs and enhance global green competitiveness.
 - Iron & steel: Transitioning from coal-based production to electrification with clean power and green hydrogen is essential, though high costs currently limit large-scale adoption.
 - Aluminium: Expanding the use of renewable energy is key, though the continued reliance on primary aluminium from other provinces remains a challenge.
- Policymakers in Guangdong, and more broadly in China, should provide targeted support to help producers improve the transparency and quality of their Measurement, Reporting, and Verification (MRV) processes to meet CBAM requirements.

02 Establishing a CBAM-compatible (i.e. EU ETS-compatible) carbon pricing system

- Policymakers in Guangdong should align their carbon pricing system with the EU emissions trading system (ETS), ensuring carbon revenues stay within the province to support its green transition. The most effective strategy is to gradually strengthen the regional and national ETS and phasing out the free allocation of emissions allowances.
- In the short term, a higher domestic carbon price could lower CBAM costs for EU-bound exports but may raise production costs for all exports, potentially weakening the competitiveness of Chinese goods in non-EU markets.
- In the long run, aligning with global carbon pricing trends is essential to future-proof exports to both the EU and other markets that may adopt similar policies.

To address the concerns over the potential risks CBAM poses to Guangdong's producers, **EU policymakers** should consider:

- Enhancing dialogue with affected companies and regions to align on key topics, including emissions accounting methodologies, verification standards, and decarbonisation pathways.

- Allocating CBAM revenues to support climate action outside Europe, ensuring that funds help developing economies transition to low-carbon production.
- Strengthening engagement in international platforms (e.g. the Climate Club) to align rules on embedded emissions in traded goods.

While CBAM costs and compliance requirements may challenge Guangdong's export competitiveness, they also present an opportunity for its industries to lead in low-carbon industrial practices. Aligning with global carbon pricing trends and investing in low-carbon technologies will not only mitigate CBAM costs but also strengthen local producers' resilience to evolving international trade regulations, while unlocking opportunities for green growth and innovation. A cooperative approach between Guangdong and the EU will be crucial in easing administrative burdens, building mutual trust, and facilitating smoother integration into the global carbon pricing landscape.

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ABBREVIATIONS

BCA	Border Carbon Adjustment
BDI	The Federation of German Industries
BF	Blast Furnace
BMWK	Federal Ministry for Economic Affairs and Climate Action
BOF	Basic Oxygen Furnace
CAN	Climate Action Network
CBAM	Carbon Border Adjustment Mechanism
CBDR-RC	Common but Differentiated Responsibilities and Respective Capabilities
CCER	China Certified Emission Reduction
CCUS	Carbon Capture, Utilisation, and Storage
CQC	China Quality Certification Center
DIHK	German Chamber of Commerce and Industry
DRI	Direct reduced iron
EAF	Electric Arc Furnace
EEA	European Economic Area
ETS	Emissions Trading System
EU	European Union
GACC	General Administration of Customs of the People's Republic of China
GEM	Global Energy Monitor
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (German Agency for International Cooperation)
ICAP	International Carbon Action Partnership
IISD	International Institute for Sustainable Development
IKI	Die Internationale Klimaschutzinitiative (International Climate Initiative)
IRA	Inflation Reduction Act
MEE of China	Ministry of Ecology and Environment of China
MRV	Monitoring, Reporting, and Verification
NBS of China	National Bureau of Statistics of China
NCSC	National Center for Climate Change Strategy and International Cooperation of China
NDC	Nationally Determined Contribution
NDRC	National Development and Reform Commission of China
PHCER	Tan Pu Hui Certified Emission Reductions of Guangdong Province
SMEs	Small and Medium-Sized Enterprises
WRI	World Resources Institute
WSA	World Steel Association
WTO	World Trade Organisation

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INTRODUCTION: CBAM CONTEXT AND FACTSHEET

1.1	Reasons for the EU to introduce CBAM	2
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The European Union (EU) introduced the Carbon Border Adjustment Mechanism (CBAM) to prevent carbon leakage, replacing the previous system of free allocation of allowances to industries at risk of carbon leakage in the EU Emissions Trading System (ETS). This shift was essential to strengthen the effectiveness of the EU ETS and increase the contribution of European industries in meeting the new emissions reduction targets. The introduction of the CBAM positions the EU as a pioneer in aligning international trade with carbon emissions reduction goals, setting a trend that other countries are expected to follow.

The CBAM entered into force in October 2023, but the financial obligation on importers of CBAM commodities will only start in January 2026. Further pieces of legislation as well as a review in 2025 are expected to specify certain elements of implementation and assess the feasibility of a scope extension after 2026. To dispel various myths and misconceptions surrounding the CBAM, this report provides answers to frequently asked questions.

1.1 REASONS FOR THE EU TO INTRODUCE THE CBAM

The EU introduced the CBAM to ensure the effectiveness of EU climate policy.

In December 2019, the EU adopted a 2050 climate neutrality target (European Commission, 2019). One year later, the EU updated its nationally determined contribution (NDC) and set a new climate target of at least 55% net reduction in greenhouse gas emissions by 2030 compared to 1990. Against this backdrop of increased ambition, the EU revised its ETS to set a higher reduction target for the sectors covered, namely the power, industry, intra-European aviation, and maritime sectors. The new target for the EU ETS is a 62% reduction in greenhouse gas emissions by 2030 (compared to 2005 levels). This translates into a higher linear reduction factor of 4.3% per year from 2024 to 2027 and 4.4% from 2028 to 2030. The linear reduction factor reduces the number of allowances in the EU ETS every year (cap). Maintaining the higher linear reduction factor in the period after 2030 will lead to the so-called “ETS endgame” as there will be no more new allowances for the stationary sectors by 2039 (Pahle et al., 2023).

The industry sector is particularly affected by this higher target, as it has not made a significant contribution to emissions reductions so far. By 2022, the electricity sector in the EU ETS had reduced its emissions by 30% compared to 2010, while emissions in the industry sector only fell by 8% (EEA, 2023). This situation arose primarily from the way allowances are allocated in the system: while the EU introduced auctioning of allowances in the electricity sector early on, free allocation remained the rule in the industry sector. As most allowances are free, however, there is little to no price signal creating incentives to reduce emissions in the industry sector.

From the start of the EU ETS, to address negative spillover effects, policymakers adopted two types of carbon leakage protection mechanisms to safeguard the competitiveness of industries covered under the system. While there are varying definitions of carbon leakage, it is broadly agreed that carbon leakage happens when industries relocate their facilities to other parts of the world where climate policies are less stringent and thus present lower costs to industry. To address direct impacts, the EU introduced free allocation of allowances in the EU ETS for sectors deemed at risk of carbon leakage. The criteria for identifying at-risk sectors are based on both a quantitative assessment (focused on trade and emissions intensity) and a qualitative evaluation, making it largely a political decision (European Union, 2003, p. Article 10b). To address indirect impacts (from rising costs of electricity due to the carbon price), the EU allowed member states to offer indirect cost compensation.

In order to support implementation of the new and more ambitious emission reduction target in the EU ETS, maintaining high levels of free allocation is not possible. As a result, European legislators decided to gradually phase out free allocation and introduced the CBAM as the core instrument to prevent carbon leakage. The CBAM is phased in with a transitional period without financial obligations from 2023 to 2025. Starting in 2026, importers are required to gradually pay for an increasing amount of the embedded emissions in the goods they import, reaching 100% in 2034. As EU industry is subject to the same gradual phase-out of free allowances, this ensures that imported goods and by extension the importers will face the same carbon price.

In December 2022, the EU finalised the revision of the EU ETS for phase 4 (2021-2030) and adopted the CBAM regulation on the same day (European Parliament and Council of the European Union, 2023). With the introduction of the CBAM, three sets of rules apply to industry sectors, covering 37% of emissions of stationary installations in the EU ETS in 2022:

- Sectors such as iron & steel, cement, aluminium, fertiliser, and hydrogen are deemed at risk of carbon leakage and are covered by the CBAM. These sectors generate approximately **50% of industrial emissions** covered by the EU ETS.
- Sectors such as refining, glass, ceramic, pulp & paper, organic chemicals, and polymers are deemed at risk of carbon leakage but not (yet) covered by the CBAM. These sectors generate approximately **45% of industrial emissions** covered by the EU ETS.
- Sectors not deemed at risk of carbon leakage and for which free allocation should end in 2030. These sectors generate approximately **5% of industrial emissions** covered by the EU ETS.

1.2 THE CBAM AND THE INTERNATIONAL CLIMATE AND TRADE NEXUS

At the international level, the introduction of the EU CBAM contributed to a larger debate on the climate and trade nexus. From the outset, the European Green Deal established CBAM as a tool to prevent carbon leakage and to create a level playing field on carbon pricing (European Commission, 2020). During the Green Deal negotiations, political discussions on CBAM among the three EU institutions (EU Parliament, EU Commission, and the EU Council) primarily centred on the design of the new instrument and its implications within the EU. Diplomatic implications and engagement with third countries were not prioritised (Feist et al., 2024).

Parallel to the negotiations on CBAM, several initiatives emerged to address the climate and trade nexus. In 2021, Germany launched its idea of a “Climate Club” as one of the most prominent projects under its G7 presidency (Federal Government of Germany, 2023). The original idea was to create a forum to align carbon pricing mechanisms and approaches. With the concretisation of CBAM as a regulatory instrument, the Climate Club shifted its focus to a broader dialogue space on industry decarbonisation. Leaders officially launched the Climate Club at the end of 2023 at COP28 and it currently comprises 46 members. Its initial focus is on advancing ambitious and transparent climate change mitigation policies, including through a strategic dialogue on spillovers, such as carbon leakage, transforming industries, including through work on common standards in the cement and steel sectors, as well as boosting international cooperation and partnerships, including through launching the Global Matchmaking Platform.

In 2023, 62 countries launched the Coalition of Trade Ministers on Climate as the first ministerial-level forum for trade and climate change (*Coalition of Trade Ministers on Climate*, 2023). The coalition's principles focus on promoting international cooperation on trade policies in favour of climate action and on the importance of multilateralism. The coalition could facilitate the implementation of a global “green trade” agenda (Velasco, 2022).

Given that trade accounts for around a quarter of global CO₂ emissions, these types of initiatives are needed to fill the current gap in multilateral rules and create incentives to address and reduce embedded emissions in traded goods. With the CBAM, the EU is the first region to introduce a price on emissions embedded in imported goods as an instrument to prevent carbon leakage. The UK followed shortly after with its own UK CBAM (starting in 2027) and other countries are expected to do the same. However, harmonisation of the different instruments will be very important to prevent them from becoming trade barriers.

FIG. 1 SUMMARY OF THE KEY ELEMENTS IN CBAM REGULATIONS

SECTORS AND EMISSIONS SCOPES COVERED

The CBAM initially focuses mainly on direct emissions, but the EU plans to extend the mechanism to indirect emissions. Indirect emissions are emissions resulting from the generation of electricity used to produce these goods. Potential expansion to indirect emissions would replace intra-European compensation for indirect carbon costs in these sectors.



TIMELINE OF IMPLEMENTATION

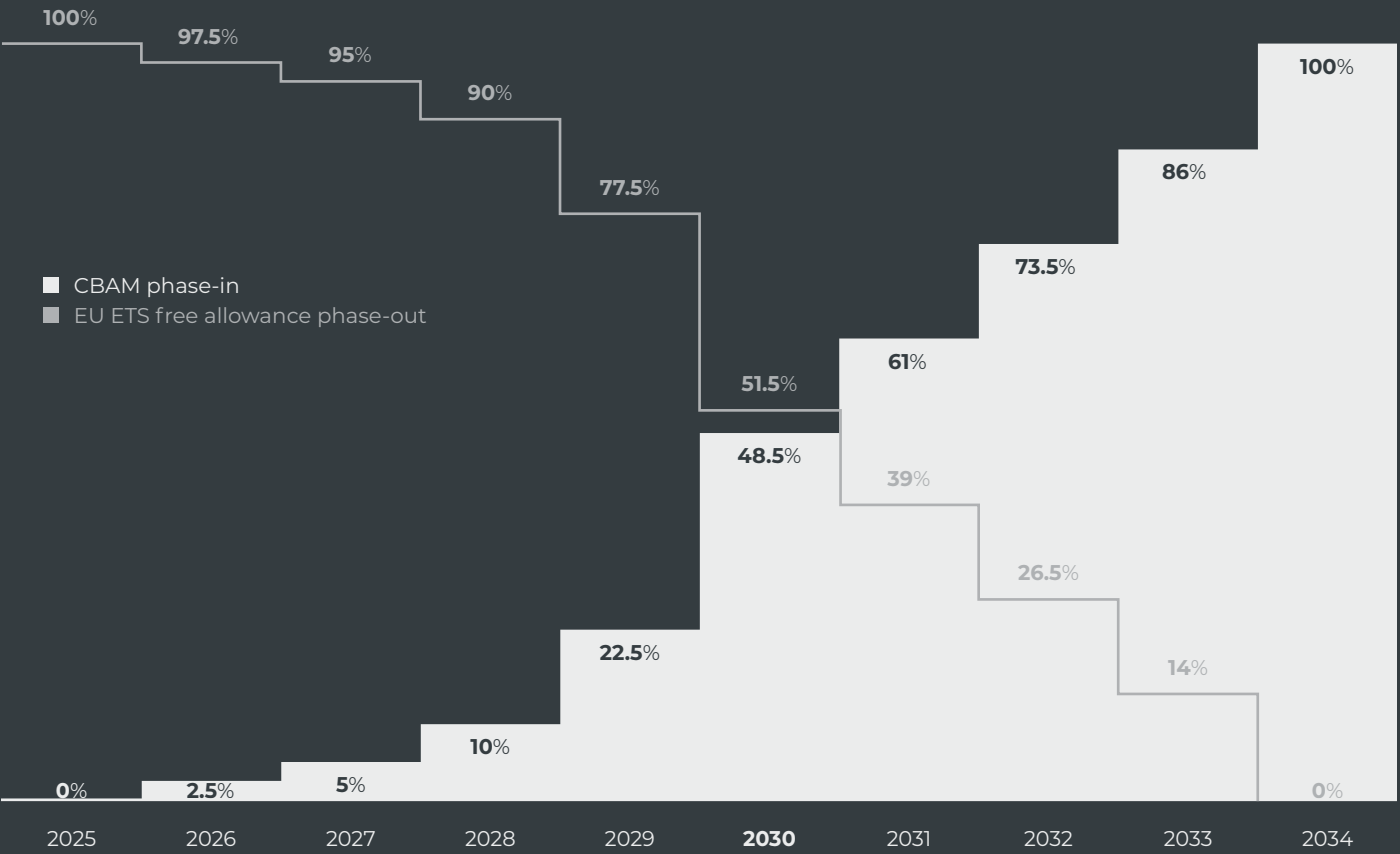
The CBAM entered into force in October 2023 with a transitional period including reporting obligations but no financial obligation. Starting in 2026, importers must submit an annual CBAM declaration and buy CBAM certificates to enter the EU market. In the period 2026-2034, the gradual introduction of the CBAM aligns with the gradual abolition of free allocation for the relevant sectors.



Start of financial obligation



EU ETS FREE ALLOWANCE PHASE-OUT AND CBAM PHASE-IN



Note: EU ETS free allowance phase-out = CBAM factor.

FINANCIAL OBLIGATIONS

The CBAM financial obligation is determined by:

CBAM certificate price — This is calculated based on the weekly EU-ETS auction price, adjusted to account for any carbon price paid in third countries.

Emissions subject to CBAM — These are defined by the level of embedded emissions adjusted by CBAM benchmarks and the CBAM factor. The CBAM factor reflects the gradual phase-out of free allocation within the EU. The CBAM benchmarks are based on emissions intensity and reflect the benchmarks in place in the EU ETS.

1.3 KEY ELEMENTS OF THE CBAM

In the period 2026-2034, the gradual abolition of free allocation for the relevant sectors in the EU ETS aligns with the gradual introduction of the CBAM. The CBAM entered into force in October 2023 with a transitional period including reporting obligations but no financial obligation. From 2026 onwards, the CBAM factor will apply, gradually phasing out free allocation for domestic production to 0% in 2034 and raising the CBAM obligation for imported goods to 100% by 2034 (European Union, 2003).

Emissions and sectors covered under the CBAM are listed in → **Tab. 1**. The CBAM initially applies to direct emissions for most sectors, but the EU plans to extend the mechanism to indirect emissions for all sectors in the future. Indirect emissions are emissions resulting from the generation of electricity used to produce these goods. This is a coherent approach, since the existing mechanisms for addressing the risk of carbon leakage consist not only of the free allocation of EU ETS allowances, but also of financial measures to compensate for indirect emission costs incurred from greenhouse gas emission costs passed on in electricity prices. Potential expansion to indirect emissions would replace intra-European compensation for indirect carbon costs in these sectors.

Tab. 1
Sectors and emissions covered under the EU CBAM

	Direct emissions	Indirect emissions
Electricity	Covered starting in 2026	Set to be covered from 2026 under existing legislation, but new proposals under Omnibus (see below) would remove this if enacted
Cement	Covered starting in 2026	Covered starting in 2026
Iron & steel	Covered starting in 2026	Potential extension after 2026
Fertilisers	Covered starting in 2026	Covered starting in 2026
Hydrogen	Covered starting in 2026	Potential extension after 2026
Aluminium	Covered starting in 2026	Potential extension after 2026
Organic chemical	Potential extension after 2026	Potential extension after 2026
Polymer	Potential extension after 2026	Potential extension after 2026

The CBAM financial obligation is based on two factors: the EU carbon price and the emissions subject to CBAM.

- The weekly EU-ETS auction price defines the price for CBAM certificates. The Omnibus proposals under new article 21 make an exception to the rule, stipulating that in 2026, the price of CBAM certificates will be based on the quarterly EU-ETS average (European Commission, 2025b). If an importer can provide evidence that a carbon price has been effectively paid abroad, this cost will be deducted from the CBAM obligation. Under the so-called Omnibus proposals published by the EU Commission in February 2025 to simplify the CBAM, the Commission is proposing to “introduce a default carbon price which would allow declarants to claim a deduction where it cannot be demonstrated that a carbon price has been effectively paid” (European Commission, 2025b, p. 24). These proposals still need to be confirmed by the co-legislation procedure to become EU legislation.
- The emissions subject to CBAM are defined by the level of embedded emissions adjusted by CBAM benchmarks and the CBAM factor. The CBAM factor reflects the gradual phase-out of free allocation within the EU. The CBAM factor equals to 97.5% in 2026, 95% in 2027, 90% in 2028, 77.5% in 2029, 51.5% in 2030, 39% in 2031, 26.5% in 2032, 14% in 2033, and 0% in 2034. The CBAM benchmarks will be used to adjust for free allocation in the EU ETS. They will be based on emissions intensity and reflect the benchmarks in place in the EU ETS.

Calculating the level of embedded emissions is based on Article 7 and Annex IV of the CBAM Regulation, which differentiates between simple and complex goods. “Simple goods” are goods produced in a production process requiring exclusively input materials and fuels having zero embedded emissions. “Complex goods” means goods other than simple goods, i.e. goods requiring input materials and fuels having embedded emissions. Annex IV lists the equations used to calculate embedded emissions for both types of goods. Embedded emissions in goods other than electricity will be based on default emissions “*where the actual emissions cannot be adequately determined by the authorised CBAM declarant*”. According to the Omnibus proposals published in February 2025, those values would be set at the level of the average emission intensity of the ten exporting countries with the highest emission intensities for which reliable data is available. Furthermore, importers will be able to choose between reporting actual emissions or using default values without needing to justify the choice (European Commission, 2025b). Under current legislation, **starting in 2026, importers of CBAM goods are required to purchase CBAM certificates to fulfil their obligations.** According to the Omnibus proposals, this will start in 2027 for emissions in 2026 (European Commission, 2025b). Any importer must apply for the status of authorised CBAM declarant (Article 5.1). The EU Commission manages a common CBAM registry which contains data on all

authorised CBAM declarants, operators and installations in third countries (Article 14). CBAM declarants must submit a CBAM declaration each year for the preceding calendar year (Article 6.1) and surrender CBAM certificates equal to the number of emissions embedded in the goods they imported during the preceding year. The CBAM declaration must contain the following information (Article 6.2):

- the total quantity of each type of goods imported during the preceding calendar year, expressed in megawatt-hours for electricity and in tonnes for other goods;
- the total embedded emissions, expressed in tonnes of CO_{2e} emissions per megawatt-hour of electricity or, for other goods, in tonnes of CO_{2e} emissions per tonne of each type of goods;
- the total number of CBAM certificates to be surrendered, after the adjustment by the CBAM factor and any carbon costs paid abroad;
- copies of verification reports.

Member states will sell CBAM certificates to authorised CBAM declarants on a common central platform managed by the EU Commission (Article 20).

1.4 FREQUENTLY ASKED QUESTIONS ON THE EU CBAM

01 How are carbon costs paid abroad credited into CBAM?

According to the CBAM regulation, the carbon price paid in the country of origin, i.e. non-EU country can be deducted from the financial obligation. However, Article 9 of the CBAM Regulation insists that *“The reduction may be claimed only if the carbon price has been effectively paid.”* In its proposals published in February 2025, the EU Commission introduces some flexibility in interpreting this rule. It extends the scope to include carbon prices paid in third countries (rather than just the country of origin) and allows the use of default carbon prices (European Commission, 2025b). Some countries including India (Dev and Goswami, 2024) and Brazil (IISD, 2024) have criticised CBAM for potentially undermining their right to determine their own policy mix in favour of carbon pricing. However, this argument is countered by the fact that countries can adopt alternative measures to reduce industrial emissions, which would result in lower financial obligations under CBAM.

The possibility to deduct the carbon price paid in a third country from the financial obligation is potentially relevant to the Chinese context since China has both a national ETS and several regional ETS. China's national emissions trading scheme is an intensity-based, not a cap-and-trade system. It covers the power sector since its creation (2021) and is in the process of including cement and steel. This means that related costs for goods imported into the EU could potentially be deducted. However, allowances in the Chinese national ETS are distributed for free, so that the carbon price is not being effectively paid (ICAP, 2024a). Therefore, these costs cannot be deducted from the CBAM obligation.

Free allocation also remains the rule in the Guangdong ETS (ICAP, 2024c). The regional ETS is a cap-and-trade system which covers the electricity, cement, steel, petrochemical, textile, pulp and paper, ceramics, transportation (ports) and aviation sectors. Starting in phase 3 (2021), some of these sectors have a low share of auctioning, however free allocation remains high (100% free allocation for aviation, 97% for ceramics, ports, and textile, 96% for other sectors, 6% for new entrants (since 2023)). Producers who incur costs under the Guangdong Emissions Trading Scheme may be able to deduct them from their CBAM financial obligations. It is worth pointing out that, as the Chinese system expands to further sectors, regional ETS are expected to evolve and exclude these sectors as they should not be covered in two different systems.

According to the World Bank, 75 countries have implemented an ETS or a carbon tax as of 2024 (World Bank, 2024). For these systems to be eligible for deduction from the CBAM obligation, they must prove that the associated costs are effectively borne. One of the CBAM objectives is to help establish a level playing field internationally

by encouraging all countries to adopt carbon pricing mechanisms with converging carbon prices, thereby preventing carbon leakage. Some countries already reacted to CBAM by adapting domestic carbon pricing tools, including e.g. Brazil, Türkiye, Israel, Japan, Serbia, Morocco, Vietnam, Malaysia, or Indonesia (GMK Center, 2024). In this context, setting an ambitious cap as well as increasing the level of auctioning could strengthen both China's national ETS and Guangdong ETS, while allowing a share of the revenues to remain within the country.

02 How is the EU planning to use CBAM revenues?

The objective of CBAM is to avoid carbon leakage by ensuring an equal playing field for domestic producers and importers, not to generate revenues for the EU. However, the issue of revenue recycling weighs heavily on the perception of CBAM around the world.

During the initial period, CBAM revenues will remain low and are primarily allocated to cover the substantial administrative costs of implementation. The CBAM Impact Assessment anticipates annual revenues of EUR 2.1 billion by 2030 (European Commission, 2021b). The revenues expected from additional auctioning under the EU ETS in the CBAM sectors due to the phase-out of free allowances are significantly higher: EUR 7 billion per year. Revenues are expected to increase after 2030 as CBAM phase-in accelerates. Under the EU Commission's current "own resources" proposal, 75% of CBAM revenues will be directed to the EU budget to repay debts from the Next Generation EU initiative, while the remaining 25% will be allocated to member states (European Commission, 2021a). The European Commission's proposal, approved by the Committee on Budgets, has yet to receive approval from the Council (European Parliament, 2023). The discussion is expected to be revisited during the new cycle of the European Commission. It is also important to point out that the EU already spends significantly more on international cooperation than it will generate revenues with CBAM.

Although initial revenues are expected to be low, the proposal to retain them for internal use has already harmed the EU's reputation, with critics accusing it of protectionism at the expense of Global South countries (Hübner, 2021). Overall, the arguments in favour of recycling revenues outside the EU outweigh those against (Marcu et al., 2024). For example, several organisations are calling on the EU to recycle CBAM revenues outside the EU to anchor the legitimacy of the instrument and counter accusations of protectionism. In 2021, a coalition of European non-government organisations signed a joint statement calling on the EU to earmark all revenues to fund external climate action (CAN-Europe, 2021). The Centre for Science and Environment in India has recently supported this call (Dev and Goswami, 2024). In the upcoming negotiations on the use of CBAM revenues, the EU will need to strike a balance between domestic and international expectations regarding the use of CBAM revenues.

03 How high is the administrative burden associated with CBAM?

Within the EU and its member states, regulatory oversight is provided by the European Commission, National Competent Authorities, and custom authorities. EU Customs Agencies are responsible for collecting and sharing relevant import data to verify alignment with the CBAM reporting obligations of importers. Companies based in the EU need to report about their verified CO₂ emissions since the introduction of the EU ETS in 2005.

For importers, who hold primary responsibility as CBAM declarants, the introduction of CBAM can impose a significant administrative burden, particularly for small and medium-sized enterprises (SMEs). The EU Commission reacted to these concerns in its Omnibus proposals published in February 2025. While the original regulation practically included no exemption from CBAM, the Commission is now proposing to introduce a threshold set at a level of 50 tonnes per year and importer, thereby exempting 90% of importers while maintaining over 99% of embedded emissions in CBAM scope (European Commission, 2025a).

During the transitional period, CBAM declarants are responsible for submitting quarterly reports and, starting in 2026, for providing annual CBAM declarations, as well as purchasing and surrendering CBAM certificates. Industry associations have pointed to the significant administrative burden, particularly due to the complexity of gathering CBAM data and submitting the CBAM reports. They argued that administrative costs could “*exceed the costs of delivery or the CO₂ price*” (BDI and DIHK, 2024, p. 4). To simplify the procedure, the Commission is now proposing that the calculation of embedded emissions can be based on either default values or actual values verified by accredited verifiers. The use of default values does not have to be verified (European Commission, 2025b).

The CBAM regulation includes penalties for non-compliance with reporting requirements, which mirror those in the ETS directive, to ensure equal treatment between domestic producers and importers. After the transitional period, the penalty for CBAM declarants will be EUR 100 per tonne of unreported emissions, along with the obligation to purchase the equivalent amount of CBAM certificates. Heavier penalties apply for non-authorised importers (Article 26).

04 Is the EU's CBAM compatible with WTO?

Some countries, including South Africa (Rumble and Gilder, 2023) and China (Hübner, 2021), have expressed concerns over the compatibility of the EU's CBAM with the rules of the World Trade Organisation (WTO). More specifically, this focuses on the key principles of the WTO regarding discriminatory treatment.

For the EU, ensuring WTO compatibility was crucial in designing CBAM to secure its legitimacy and international acceptance, especially for member states like Germany that are heavily reliant on exports. To comply with WTO standards, it is essential that CBAM does not treat domestic producers preferentially or discriminates against

specific countries. To address these issues, the EU has designed a system that mirrors the EU ETS, ensuring that importers and domestic producers face equivalent rules and financial obligations. CBAM certificate prices are aligned with the weekly EU ETS auction prices, carbon prices effectively paid abroad can be deducted from the CBAM obligation, and CBAM considers actual embedded emissions values, which reduces costs for companies that have lowered their emissions. One area where the mirroring falls short is the use of revenues. In the EU ETS, a portion of auctioning revenues is channelled back to energy-intensive industries e.g. through the Innovation Fund, but this feature is missing in CBAM. Theoretically, it is possible to finance this via the European contribution to international climate finance, which is partly generated by revenues from the EU ETS. No official ruling has been made on the WTO compatibility of the CBAM, and such a decision is anticipated to be years away. As several countries follow the EU in implementing similar measures, carbon-constrained trade is becoming a new reality that will need to be addressed in future international trade regulations.

05 Is the EU's CBAM compatible with the CBDR-RC principle?

Developing countries have voiced concerns about the compatibility of CBAM with the Common but Differentiated Responsibilities and Respective Capabilities (CBDR-RC) principle because CBAM imposes the same obligation on developed and developing countries. The CBDR-RC is a principle enshrined in the UNFCCC convention and in subsequent implementation of the Convention such as the Kyoto Protocol and the Paris Agreement. Article 3.1 of the Convention states that *“the Parties should protect the climate system for the benefit of present and future generations of humankind, on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities. Accordingly, the developed country Parties should take the lead in combating climate change and the adverse effects thereof”*.

Developing countries criticise that the EU has historically already used up a large part of the global carbon budget and is now imposing a new burden. According to the EU, the substantial increase in its 2030 NDC will enable it to take the lead in the fight against climate change (European Commission, 2020) and achieving higher targets in the EU ETS is only feasible through the introduction of CBAM. Furthermore, CBAM targets companies that are competing on international markets instead of countries, covering specific products that are assessed based on their “own merits.” Consequently, CBAM is aligned with the polluters pay principle formulated in the Rio Declaration (1992). For instance, a company with a lower carbon footprint and higher domestic carbon costs would incur lower CBAM costs. Going forward, measures such as CBAM will be less necessary if all countries reduce their emissions in line with the Paris Agreement. For the EU, the stakes are high: it needs to engage with developing countries if it wants to use CBAM effectively to establish a global level playing field. The issue of revenue recycling does not affect the design of the instrument itself and appears to be the easiest way to engage with developing countries.

06 Are manufactured products such as cars covered under CBAM?

CBAM applies only to carbon-intensive raw materials and basic commodities (cement, electricity, fertilisers, iron & steel, aluminium, and hydrogen) as well as very few downstream products such as screws but not to finished products such as cars. The steel used in cars manufactured in China and imported into the EU is not covered by CBAM. The CBAM regulation foresees an extension of the scope to other downstream goods at risk of carbon leakage in the future.

An initial assessment by the EU Commission on the inclusion of further downstream products is expected to be published by the end of 2025. The European Green Deal requires massive emissions reductions in all sectors and the EU is already imposing stricter regulations and standards on finished products that also apply to imports to the EU, e.g. Batteries Regulation and Ecodesign for Sustainable Product Regulation. Therefore, it cannot be ruled out that the EU would adopt similar types of carbon border adjustments on other products in the future.

07 How is a decarbonised power system expected to play into CBAM?

The decarbonisation of the power sector plays an important role for determining the long-term impact of CBAM on countries. In the medium to long term, decarbonising China's power sector would lower embedded emissions in Chinese exports to the EU, thereby reducing the financial obligations under CBAM.

The current coverage of CBAM includes indirect emissions for the electricity, cement and fertiliser sectors in the calculation of total embedded emissions. An implementing act provides guidance on how to calculate the emissions related to electricity (European Union, 2023). By 2026, the European Commission will review whether to expand the scope to indirect emissions in the iron & steel, aluminium and hydrogen sectors as well. This expansion would likely have to replace the existing compensation for indirect costs provided to these sectors in some EU member states. The potential extension to indirect emissions in 2026, in particular to aluminium, would be highly relevant in the Chinese context.

Accounting for actual indirect emissions in the CBAM emission calculation is possible if a direct technical connection or a power purchase agreement is in place. The EU Commission specifically states that “[m]arket-based specific emission factors, determined for example by Guarantees of Origin or Green Certificates cannot be used to justify the use of actual emission factor” (European Commission, 2024a, p. 32).

08 Are other parts of the world introducing similar systems?

The EU has taken the lead in carbon border adjustments, but other countries are following. The UK is in the process of establishing a system that is closely aligned with the EU's CBAM set to take effect in 2027 (UK Department for Energy Security

and Net Zero, 2023). The US Congress was discussing four types of border carbon adjustment (BCA) instruments in 2023 (WRI, 2023). Canada is also exploring such an instrument (Government of Canada, 2021) as well as Australia which is assessing the feasibility of a CBAM in the context of its Carbon Leakage Review, particularly in relation to steel and cement (Australian Government, 2023). This means that carbon-constrained trade will become the rule, not the exception.

With similar measures arising in several countries, there is a high risk that global trade becomes increasingly segmented or divided. To prevent trade fragmentation, it is essential to harmonise rules, particularly those related to carbon accounting, as well as monitoring, reporting, and verification (MRV) systems. The International Institute for Sustainable Development (IISD) underlines the need for international cooperation on key design features such as coverage of trade flows, geographic scope and exemptions, emission scope, calculation methods of embedded emissions, crediting for foreign policies and carbon prices, and the use of revenues. International agreement on principles and rules could limit the administrative burden on importers and help focus on the ultimate objectives of BCAs: limit carbon leakage, decarbonise production processes around the world, and create a level-playing field (Cosbey, Aaron; Baršauskaitė, 2023). This highlights the importance of international trade and climate forums and the necessity of creating opportunities to exchange ideas and experiences on these topics. In the interests of all, countries should commit to contributing constructively to these exchanges to find common solutions.

In fact, this international trend not only applies to border carbon adjustments but also to other types of measures such as clean fuel standards, standards on green procurement, or regulations on deforestation-free products. These measures impact products such as building materials, petrol and diesel, and forest products, serving as a response to the pressure on governments to address carbon leakage and other environmental harms.

09 What are the differences between the EU's CBAM and US Inflation Reduction Act (IRA)?

The EU's CBAM and US IRA differ significantly in their approaches and mechanisms. The EU's CBAM focuses on preventing carbon leakage by imposing costs on imports from countries with less stringent climate policies, ensuring EU producers are not disadvantaged on the EU market as they face increasing carbon prices under the EU ETS. In contrast, the IRA focuses on domestic investments, offering extensive subsidies and tax credits to encourage clean energy development, electric vehicles and energy efficiency across a wide range of sectors. While CBAM aims to level the playing field, the IRA aims to transform the US economy through financial incentives. The IRA also includes provisions to support the development of green jobs and address environmental justice. The differences reflect the distinct political and economic contexts of the EU and US approaches to climate policy.

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CBAM RELEVANCE AND READINESS ASSESSMENT: COMPANIES IN THE GUANGDONG PROVINCE

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Guangdong province is one of China's foremost economic and industrial powerhouses. For its expansive industrial base, Guangdong leads the nation in key sectors such as electronics, textiles, and machinery manufacturing. The province boasts the highest GDP in China, exceeding USD 1.83 trillion in 2023 (Xinhua, 2024). Strategically located along the South China Sea, Guangdong enjoys access to international markets, enhancing its export capabilities and reinforcing its status as an economic hub in China. In 2022, the province's export value reached USD 800 billion, representing 23% of China's total exports (GACC Guangdong, 2023a; GACC, 2024). The EU is one of Guangdong's top four destinations for exports, accounting for USD 107 billion, alongside Hong Kong, the United States, and ASEAN countries (GACC Guangdong, 2023b). Among all commodities covered by the EU's CBAM regulation in Guangdong province, the iron & steel and aluminium sectors face the highest exposure.

2.1 GUANGDONG PROVINCE'S IRON & STEEL INDUSTRY

China has the world's largest steel-making capacity, exceeding 1 billion tonnes and accounting for more than half of global crude steel production (WSA, 2023). The top five steel-producing provinces—Hebei, Jiangsu, Shandong, Liaoning, and Shanxi—together account for half of China's crude steel production (NBS of China, 2023). **In 2023, Guangdong ranked as China's 6th largest producer of steel products and 8th in crude steel production** (AskCI, 2024). Its substantial production capacity, strong demand, and strategic role in national and global markets reinforce its importance in the iron & steel industry.

Under CBAM, Guangdong exports minimal amounts of pig iron, 5% of crude steel, and 95% of processed iron and steel products. The province does not export sintered ore, ferroalloys, or direct reduced iron (DRI). In 2023, Guangdong province produced 36.9 million tonnes of crude steel and 63.2 million tonnes of steel products, with around 3% exported to the EU (NBS of China, 2023). Construction steel is the product with the largest capacity in Guangdong, accounting for over 50% of the province's total steel production capacity. In 2022, Guangdong had 34 construction steel manufacturers, including five long-process producers that make primary steel from iron ore, and 29 short-process producers that recycle steel from scrap. Together, they had an annual capacity of approximately 28.5 million tonnes.

CO₂ emissions from the steel sector in China are primarily driven by the heavy reliance on fossil fuels, particularly coal, as the main energy sources. Currently, 90% of China's steelmaking capacity uses the Blast Furnace to Basic Oxygen Furnace (BF-BOF) route, which runs on coal-derived coke. China holds 59% of the global BF-BOF steelmaking capacity, accounting for over 60% of emissions in the steel industry worldwide (Jie et al., 2021; Domenech et al., 2022; Swalec and Grigsby-

Schulte, 2023). Electric arc furnaces (EAFs), if powered by renewable energy, offer a sustainable alternative. They process scrap steel or DRI made from zero-carbon feedstocks, such as green hydrogen (NewClimate Institute, 2024).

China aims to peak its CO₂ emissions from the iron & steel industry by 2030, in line with the economy-wide target outlined in its latest NDC. To support this goal, Guangdong province set specific goals for its iron & steel sector in its Implementation Plan for Carbon Dioxide Peaking (People's Government of Guangdong Province, 2023). The plan targets a reduction in carbon intensity of BF-BOF steelmaking by over 8% by 2030 compared to 2020 levels, focusing on advancements in non-blast furnace ironmaking, hydrogen smelting, and carbon capture, utilisation, and storage (CCUS) technologies. It also encourages scrap recycling with EAFs.

In line with these targets, Baosteel Zhanjiang, a leading producer in Guangdong, began operating China's largest hydrogen-ready DRI plant in December 2023, with an annual capacity of 1 million tonnes. The DRI plant is designed to utilise natural gas enriched with hydrogen, which could reduce at least 500,000 tonnes of CO₂ emissions compared to traditional blast furnace methods, according to the company (Baowu Steel, 2023; Tenova, 2024).

2.2 GUANGDONG PROVINCE'S ALUMINIUM INDUSTRY

China, the world's largest aluminium producer, accounted for 59% of global primary aluminium production in 2023, with an output of 42 million tonnes (International Aluminium Institute, 2024). Guangdong is China's third-largest aluminium-producing province. Together with Shandong and Henan, the top three provinces accounted for nearly half of the country's aluminium output (NBS of China, 2023).

In 2023, Guangdong province produced 5.7 million tonnes of aluminium, around 6% of which was exported to the EU, accounting for 9% of total production in China (NBS of China, 2023). The aluminium industry in Guangdong primarily consists of processing companies, with limited involvement in upstream activities such as bauxite mining, alumina production, or aluminium smelting. Guangdong is home to 4,785 aluminium-related enterprises, accounting for one-fifth of China's total. Foshan, a major city in southern Guangdong, is China's largest aluminium hub, hosting 2,590 aluminium-related enterprises and five of the country's top ten aluminium factories (Fengchi, 2023).

The production of primary aluminium relies exclusively on the electrolysis process, meaning the emissions from the aluminium industry are closely tied to the electricity mix. Globally, 60% of the sector's emissions are indirect emissions from electricity consumption, which are not covered by the current EU's CBAM regulations (International Aluminium Institute, 2024). In 2022, the aluminium

industry in China consumed over 6% of the country's total electricity, leading to approximately 550 million tonnes of CO₂ emissions annually. Over 75% of these emissions were generated from coal-fired power used specifically for aluminium electrolysis, particularly from captive power plants operated by aluminium producers (Yang, 2021; Yin and Tang, 2024).

The main sources of non-electricity-related emissions in the aluminium industry include fuel combustion, smelter anode consumption, auxiliary raw materials, and transportation. Technologies such as inert anodes and CCUS are unlikely to be widely deployed before 2030 due to high costs, retrofitting requirements, and substantial upfront investments. Therefore, electrification and the transition to green hydrogen represent the most viable decarbonisation pathways in the near term. Additionally, increasing aluminium recycling rates can significantly reduce emissions. Improved scrap sorting and the prevention of pre-consumer scrap loss are key measures. Recycled aluminium requires only 5% of the energy needed for initial extraction and processing (International Aluminium Institute, 2021; Al-Alimi et al., 2024).

The Chinese government issued a special action plan for decarbonising the aluminium industry, aiming to increase the proportion of renewable energy used in the sector to more than 25% and to boost the production of recycled aluminium to 11.5 million tonnes within the year of 2025 (NDRC, 2024b). By the end of 2023, the sector had already achieved an average renewable energy usage of 24.4%, positioning it close to the national target. Guangdong province set specific targets for the aluminium electrolysis industry, aiming for 29.5% green electricity consumption in 2024 and 30.56% in 2025 (NDRC, 2024a). However, it remains unclear whether this progress is due to adding new renewable capacity or reallocating existing capacity to the sector. If CBAM extends to cover indirect emissions in the aluminium sector after 2026, simply reallocating renewable energy to the sector would not be counted in the calculation of embedded emissions, as reallocation does not change China's average electricity mix. The EU's CBAM obligation calculations are based on the national electricity mix. Individual companies' efforts to transition to renewable energy are only considered unless a direct technical connection or a power purchase agreement is in place.

2.3 GUANGDONG'S CARBON PRICING SYSTEMS

In Guangdong, China's National ETS and the Guangdong pilot ETS operate in parallel, each covering different sectors. Launched in 2013, the Guangdong pilot ETS initially covered the iron & steel, petrochemical, power, cement, paper, and domestic aviation sectors. In 2020, with the introduction of the national ETS, the power sector in Guangdong was transferred to the national system. The expansion of iron & steel, cement, and electrolytic aluminium sectors into the national ETS was announced in 2024 and Guangdong's entities in these sectors will then gradually

transition from the regional system to the national system. In 2023, the Guangdong pilot ETS expanded to include ceramics, ports, and data centres. Airports and textile companies exceeding certain emissions threshold will also be covered, though participation remains voluntary. Only companies with annual emissions of over 10,000 tonnes of CO₂ or energy consumption over 5,000 tonnes of coal equivalent per year will be included in the Guangdong pilot ETS. In 2023, this amounted to 391 eligible companies, covering 40% of the province's emissions (ICAP, 2024c).

Guangdong is one of the few pilot regions in China that publishes an annual absolute cap, which sets the limit to the emissions permitted within the system. Within this annual cap, the government reserves a portion for new entrants and to maintain market stability. Prior to the transfer of the power sector to the national ETS, the emissions cap was set at 465 MtCO₂ in 2019 and 2020, which included 27 MtCO₂ in reserves. In 2023, the cap was 297 MtCO₂, with 14 MtCO₂ allocated as reserves (People's Government of Guangdong Province, 2024).

In the Guangdong pilot ETS, allowances are predominantly distributed through free allocation, with a small proportion allocated via auctioning. Free allowances are allocated using either grandparenting or benchmarking methods, depending on the sector. As of 2023, the free allocation ratio is 96% for the iron & steel, petrochemical, cement, and paper sectors. The aviation sector receives 100% free allocation, while ceramics, ports, data centres, and textiles receive 97%. New entrants into the system receive only 6% free allocation. Additionally, the Guangdong pilot ETS conducts a limited number of auctions. The last auction took place in April 2020, with 400,000 allowances sold at a price of USD 3.98.

The carbon price in Guangdong in the secondary market is around USD 10. In 2023, the total trading volume of carbon emissions allowances in the province reached 224 MtCO₂, with a total transaction value of USD 923 million. Both figures rank first among regional carbon markets in China (Guangzhou Daily, 2024).

The China Certified Emission Reduction (CCER) program was established at the national level, while Guangdong has implemented its own Tan Pu Hui Certified Emission Reductions (PHCER) scheme. Both programs allow for emissions offsets. Covered entities can use offset credits for up to 10% of their annual emissions. At least 70% of the offset credits used by each entity must originate from within Guangdong. Eligible projects must primarily focus on reducing CO₂ and CH₄ emissions, with a minimum requirement of over 50%.

Tab. 2

**Comparison of
emission trading
schemes: China,
Guangdong, and
the EU**

	China's National ETS	Guangdong pilot ETS	EU ETS
Start of operation	2021	2013	2005
Sectoral coverage	<ul style="list-style-type: none"> - Power - Industry (iron & steel, cement, and electrolytic aluminium) to be included 2024-2026 	<ul style="list-style-type: none"> - Domestic Aviation - Iron & steel - Cement - Paper - Petrochemicals - Data centre, ceramics, and ports (since 2024) 	<ul style="list-style-type: none"> - Power - Industry (oil refineries, iron & steel, aluminium, metals, cement, lime, glass, ceramics, pulp, paper, cardboard, acids and bulk organic chemicals) - Intra-EU Aviation - Maritime (since 2024) - Building and road transport to be included in a second ETS ("ETS 2") starting in 2027
Allowance cap	<p>The cap is dynamic: It is the sum of the bottom-up allowance allocation to all individual entities.</p> <p>The annual cap amounted to ~5,000 MtCO_{2e} in 2021 and 2022</p>	<p>The absolute emission cap is set by the provincial government on an annual basis</p> <p>The cap amounted to 297 MtCO_{2e} in 2023</p>	<p>The cap targets a 62% reduction by 2030 (compared to 2005 levels)</p> <p>Following the 2023 ETS revision, the cap in 2024 amounted to 1,386 MtCO_{2e}</p>
Allocation	Free allocation through tradable performance standards (benchmarking)	Free allocation (benchmarking and grandfathering) 95-97% Auctioning 3-5%	<p>Auctioning only (power sector) and free allocation based on sector-specific performance benchmarks (industry sectors, aviation, shipping)</p> <ul style="list-style-type: none"> - Free allocation will be gradually phased out for the CBAM sectors - Manufacturing industry received approximately 50% of its allowances for free in 2023 (DEHSt, 2024)
GHGs covered	<p>CO₂</p> <p>For upcoming industrial sectors:</p> <ul style="list-style-type: none"> - CO₂ for cement and iron & steel - CO₂ and PFCs (CF₄ and C₂F₅) for electrolytic aluminium 	CO ₂	<p>CO₂, HFCs, N₂O, PFCs, SF₆</p> <p>For CBAM sectors:</p> <ul style="list-style-type: none"> - CO₂ for all CBAM commodities - N₂O for some fertiliser goods - PFCs for aluminium goods
Allowance price (2023)	Average secondary market CNY 68.35 (USD 9.65)	Average secondary market CNY 75.01 (USD 10.58)	<p>Average auction price EUR 83.24 (USD 90.00)</p> <p>Average secondary market EUR 83.47 (USD 90.25)</p>
Revenue	The Chinese national ETS does not generate revenue as the companies trade with each other	Total revenue since beginning CNY 815.5 million (USD 115.1 million) (ICAP, 2024c)	Total revenue since beginning EUR 184 billion (USD 206 billion) (ICAP, 2024b)
Carbon offsets allowed as flexibility	CCER	CCER+PHCER	Not allowed

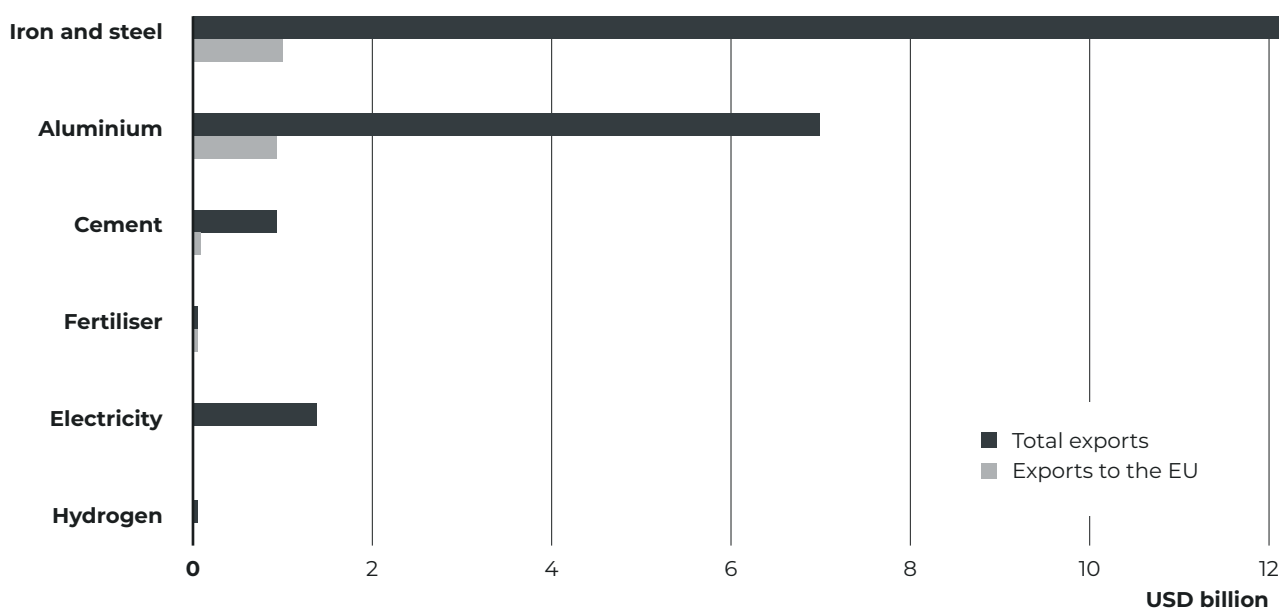
Source: (ICAP, 2024b, 2024c, 2024a).

2.4 HOW IS CBAM RELEVANT FOR PRODUCERS IN GUANGDONG?

While Guangdong exports substantial volumes of iron, steel, and aluminium covered by the EU's CBAM—amounting to nearly USD 2 billion in 2022—this exposure is relatively modest compared to the region's total exports and industrial production.

The EU is not Guangdong's primary market. Among all products listed under Annex I of the CBAM regulation exported from Guangdong, only around 10% are traded to the EU. The province exports significantly larger volumes to other regions, such as Southeast Asia, Japan, and Korea, with just 8% of its iron and steel exports and 14% of its aluminium exports destined for the EU (→ Fig. 2). Furthermore, these CBAM products represent a small portion of Guangdong's highly diversified export portfolio, which is dominated by products like televisions, cell phones, shoes, toys, and light fixtures—none of which fall under the EU's CBAM (Jiang et al., 2023).

Fig. 2
Value of exports of
products covered
by CBAM in
Guangdong in 2022



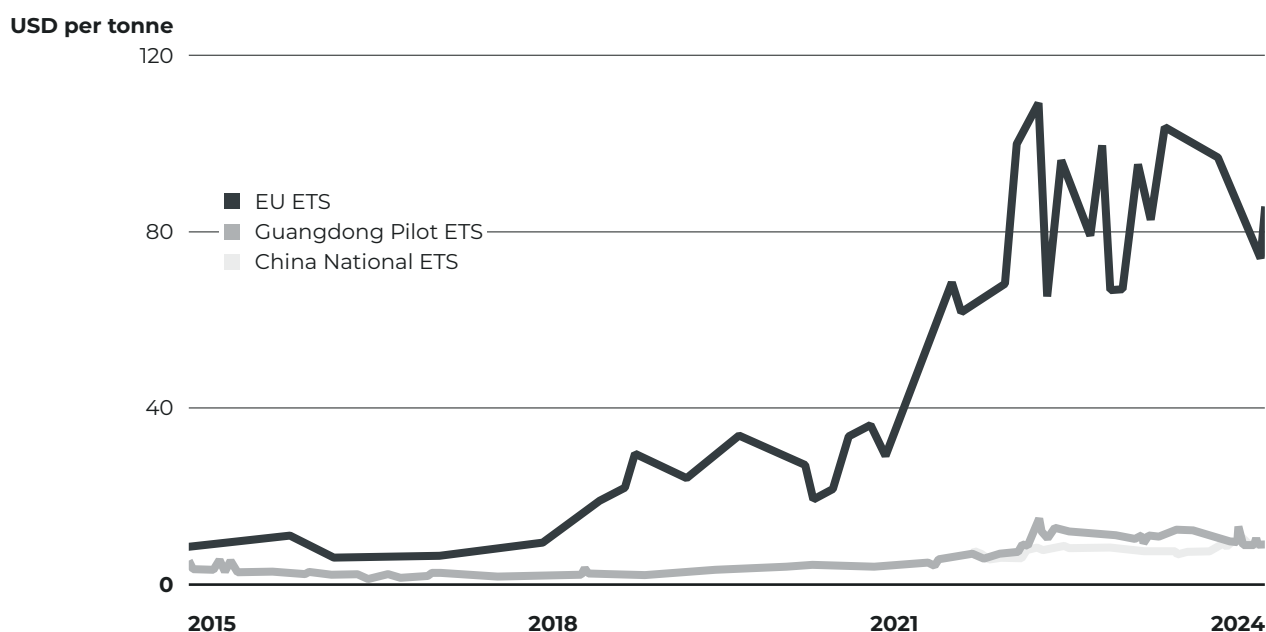
Source: General Administration of Customs of the People's Republic of China (GACC).

As China's most populous province and the one with the highest GDP, Guangdong produces vast quantities of industrial products for domestic consumption besides export. In 2023, only around 3% of the crude steel and steel products produced in Guangdong were exported to the EU, while the figure was 6% for aluminium. This highlights that the majority of Guangdong's industrial output serves its domestic market and other provinces, with a relatively small share directed toward the EU and thus impacted by CBAM.

Guangdong's manufacturing industries, particularly in iron, steel, and aluminium, are overall highly emission-intensive, although various companies range from the cleanest to the heaviest. While CBAM-covered industries represent a smaller portion of Guangdong's overall export portfolio, companies with the highest carbon intensity, such as those relying on traditional blast furnaces for steelmaking, will face significant CBAM-related costs. However, a competitive disadvantage in the EU market arises only if a company's CO₂ intensity exceeds the EU average. Companies adopting advanced, clean technologies that achieve lower emission intensity than the EU average will incur no CBAM costs, potentially gaining a competitive edge in the EU market, such as the hydrogen-ready DRI plant in Zhanjiang, Guangdong.

Guangdong's carbon price signal remains significantly lower than that of the EU (→ Fig. 3). The national ETS currently only covers the power sector while Guangdong's ETS covers a few manufacturing sectors (iron and steel, cement, petrochemicals, papermaking, ceramics, textiles). However, in both systems, allowances are allocated for free, which is unlikely to provide an effective price signal required to qualify for a CBAM deduction. Even if recognised, the low carbon prices in China would only marginally reduce costs associated with CBAM.

Fig. 3
Secondary market allowance price trends: China, Guangdong, and EU ETS (2015–2023)



Source: ICAP.

2.5 KEY FACTORS INFLUENCING CBAM'S IMPACT ON GUANGDONG PRODUCERS

The implementation of CBAM presents both challenges and opportunities for Guangdong's producers as they navigate the evolving landscape of global carbon regulations. The extent of CBAM's impact on companies is influenced by six key factors, as illustrated in → Fig. 4. Some of these factors are tied to the design of the EU's CBAM, a dynamic policy still in its initial implementation phase, while others are rooted in the characteristics of the exporting companies and their regional context. Understanding these factors is crucial for developing effective response strategies to mitigate risks and leverage potential opportunities.

The financial obligation of CBAM will gradually increase from 2026 to 2034, with the intensity of the price signal being determined by the CBAM factor.

Initially, the impact on Guangdong producers will be more limited, as importers of goods are required to pay only for a fraction of their emissions as adjusted by the CBAM factor, while EU domestic producers continue to benefit from significant free allocations under the EU ETS. However, as CBAM is fully implemented by 2034, both domestic and foreign producers will be required to pay the full price, leading to a stronger price signal and increased financial obligations for Guangdong's producers.

As the CBAM regulation expands to cover more products, related financial obligations are expected to rise. As CBAM in its initial phase only covers six commodities, accounting for only about 50% of industrial emissions covered under the EU ETS, it is expected that CBAM will evolve further to effectively prevent carbon leakage across most relevant commodities, such as plastic.

The CBAM cost will rise significantly if the emission scope expands to include indirect emissions, especially for the aluminium sector. The current CBAM regulation only covers direct emissions in the iron, steel, and aluminium sectors and excludes indirect emissions from electricity production, regardless of its source. While this approach captures most embedded emissions in the iron and steel sector—where coke consumption in blast furnaces accounts for the majority of emissions—it overlooks over 60% of aluminium production emissions, which stem from electricity use. In China, aluminium producers generate 65% of this electricity on-site from coal power plants, with aluminium electrolysis alone responsible for nearly 9% of all coal power generation in the country (GEM, 2021; Yang, 2021).

The financial obligations tied to carbon emissions for exporters in Guangdong are expected to increase as more economies implement similar carbon border adjustment measures. The EU is not alone in implementing CBAMs to counter carbon leakage associated with domestic carbon pricing. The UK has announced

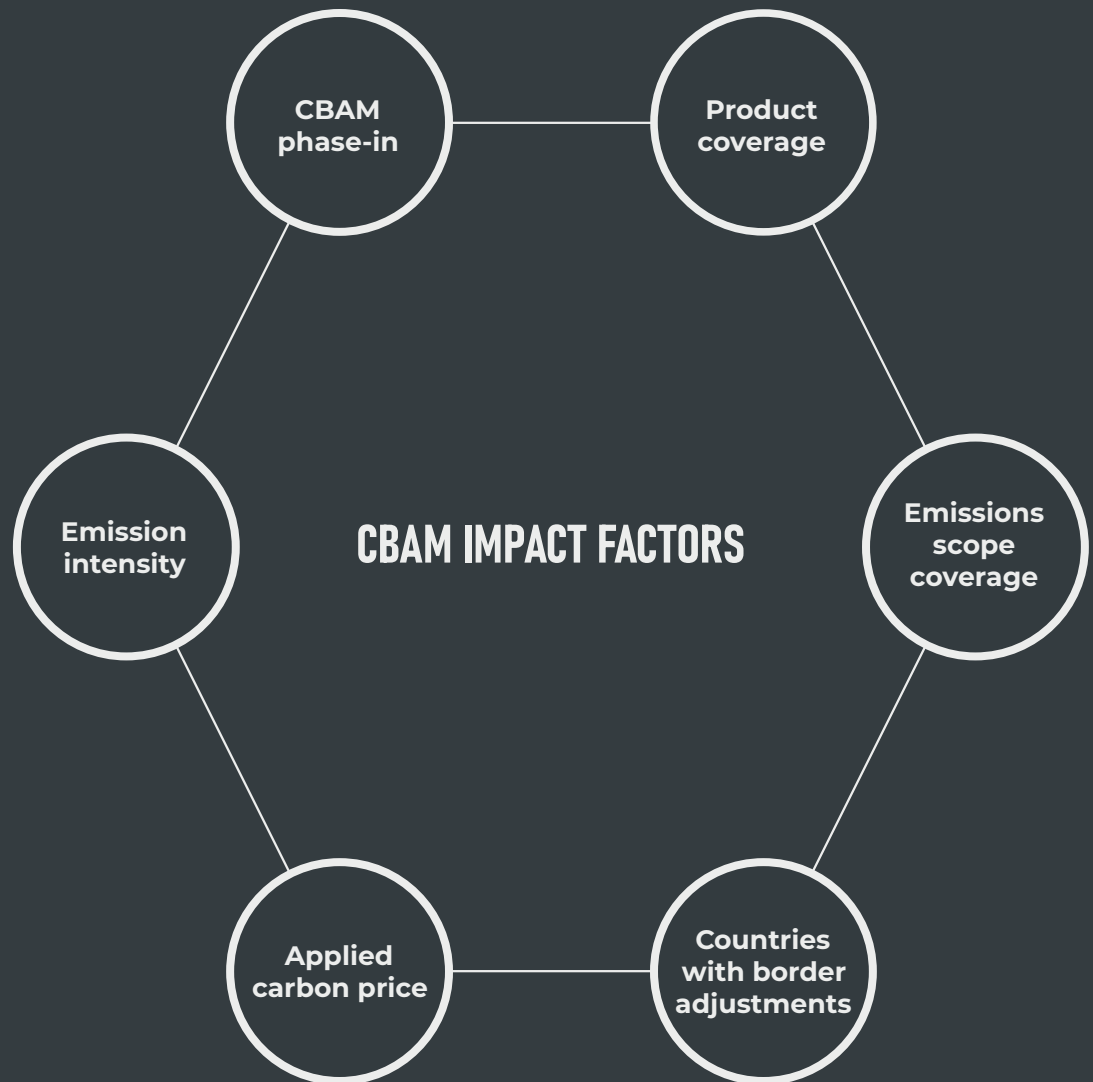
plans to introduce its own CBAM by 2027, which will impose tariffs on imports of high-carbon goods from countries with less stringent emissions regulations. Similarly, Australia (Australian Government, 2023), Canada (Government of Canada, 2021), the United States (Rasool, Sanam; Reinsch, William Alan; Denamiel, 2024) and Türkiye (Weise, 2021) are considering the introduction of CBAMs, with discussions underway in their respective governments. These developments indicate a growing trend where more jurisdictions are likely to follow the EU's lead in using border adjustments to align international trade with carbon reduction goals. Therefore, economic risks associated with emissions intensive production systems are likely to increase, as a larger share of Guangdong's export markets become subject to carbon border adjustments, underscoring the need for proactive preparations today.

Another factor influencing the CBAM cost for EU importers is the EU ETS carbon price and the carbon price, if any, in exporting countries. Market analysts project that the allowance price in the EU ETS may reach up to USD 210 by 2030, a considerable increase from approximately USD 95 in 2024 (Pahle, 2024). As the EU ETS carbon price rises, EU producers face higher production costs associated with emissions, necessitating higher CBAM costs for importers to maintain a level playing field. Given the ambitious cap set by the EU ETS, the carbon price within the EU is considerably higher than that in regions such as Guangdong, where carbon prices remain low and often misaligned with EU standards. Meanwhile, if Guangdong were to enhance its carbon pricing mechanism by setting more ambitious targets and reducing free allowances, it could theoretically retain a portion of the revenues that would otherwise be lost to the EU.

Producers' emission intensity is a key determinant of CBAM financial obligation as CBAM directly targets the emissions embedded in imports from third countries. One of the most effective strategies for mitigating the impact of CBAM on Guangdong's producers is therefore to reduce the emissions intensity of their production systems. Any reduction in emissions directly translates into fewer CBAM certificates required, thereby lowering costs. If Guangdong's producers can achieve greater reductions in emissions intensity than their competitors, both domestic and international, they may gain a competitive advantage in the global market. Moreover, if an exporting company achieves an emission intensity lower than the CBAM benchmark set by the EU through clean production, it incurs no CBAM cost under the current regulation. This is already evident with a company in Guangdong specialising in electrified scrap steel recycling. Since indirect emissions from power generation are not yet covered by the EU's CBAM, the company reported near-zero emissions during the transition period.

Stakeholder Workshop:
the Implications of the
EU's CBAM on Guangdong
Province, 29/10/2024,
Guangzhou, China.

Fig. 4
Overview of CBAM
impact factors



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POLICY PATHWAYS FOR GUANGDONG

- 3.1 Long-term strategy: transferring to a CBAM-compatible carbon pricing system 27
- 3.2 Short- and mid-term strategy: reducing emission intensity and fostering collaboration 28

The two primary strategies to adapt to CBAM are for Guangdong’s government officials to adopt a CBAM-compatible carbon pricing system and for producers of CBAM-covered commodities to decarbonise their production. The first strategy helps retain a portion of revenues in the province that would otherwise flow to the EU by increasing the domestic carbon price effectively paid. The second reduces emission intensity, thereby requiring fewer CBAM certificates for compliance and lowering overall costs.

In principle, countries can also try to challenge CBAM through the WTO, or producers could attempt to circumvent CBAM by shifting emission-intensive exports to markets without carbon border adjustments (Byiers and Medinilla, 2024). The European Commission defines this practice—where only lower-carbon goods are exported to the EU while more carbon-intensive products are sent elsewhere—as resource shuffling, a form of circumvention. The CBAM Regulation prohibits circumvention (article 27) and the new thresholds presented under the Omnibus proposals will reduce the risk of circumvention through artificial splitting of imports (European Commission, 2025b). Meanwhile, CBAM or similar measures are also being considered by other major economies, including Japan, the US, the UK, and Canada, reflecting the global trend toward increasingly carbon-constrained trade. As more economies adopt similar mechanisms, challenging the EU policy and shifting exports away from the EU market will become unsustainable in the long term. Therefore, this report will not look into the “challenge” and “avoid” strategies in detail.

3.1 LONG-TERM STRATEGY: TRANSFERRING TO A CBAM-COMPATIBLE CARBON PRICING SYSTEM

One way of adapting to the EU’s CBAM is for Guangdong regulatory authorities—and other regions and countries—to introduce an effective carbon pricing system with a price comparable to the EU ETS. By ensuring that producers pay for the emissions embedded in their exports within China, revenues generated from such a system would remain in the domestic economy. This approach offers a significant advantage: the proceeds can be strategically reinvested to support the transition of the affected industries, facilitating technology upgrades, efficiency improvements, and low-carbon innovation. In contrast, if emissions costs are paid at the EU border under CBAM, these revenues are effectively transferred to Europe, offering no direct benefit to Guangdong’s local economy.

However, aligning Guangdong’s carbon pricing with the EU ETS poses significant challenges. The EU ETS is far more mature, with a well-established market and a much higher carbon price. Even if Guangdong transitions away from free allocation of allowances toward full auctioning, it is unrealistic to expect prices in the province

to rapidly match the EU's carbon price levels. As demonstrated by the EU's own experience, building a functional carbon market is a gradual process. National and regional market designers need time to reduce high—if not 100%—free allocation and gradually expand sector coverage to establish an effective system that aligns with national climate ambitions. Meanwhile, market participants need time to adjust to new costs, develop mitigation strategies, and build confidence in the system before higher climate targets can lead to increased carbon prices.

A more effective carbon trading system would not only limit carbon emissions but also generate revenue that could be reinvested to support industrial decarbonisation. But in the short to medium term, Guangdong faces limited economic incentives to make its ETS significantly more stringent. Increasing climate targets and removing free allocation would improve Guangdong local companies' competitive position under CBAM for exports to the EU. However, this would simultaneously erode the competitiveness of their much larger export flows to non-EU markets, which are not yet subject to carbon pricing or CBAM-like measures. Given Guangdong's—and China's overall—dependence on exports for economic growth, there is little political or economic appetite to impose carbon costs that could compromise broader export competitiveness.

Nonetheless, as a long-term strategy Guangdong should continue to gradually scale up its ETS. Guangdong should build on its existing efforts by progressively phasing out free allocation and improving system transparency and efficiency. Over time, as more global markets introduce carbon pricing systems, CBAMs, or similar measures, the incentive for Guangdong to align its carbon prices with global benchmarks will grow. Doing so would not only improve the green competitiveness of its exports and also ensure that carbon-related revenues remain within the province—providing vital resources to support Guangdong's green transition.

3.2 SHORT- AND MID-TERM STRATEGY: REDUCING EMISSION INTENSITY AND FOSTERING COLLABORATION

Industrial decarbonisation aligns with China's mid- to long-term policies for carbon peaking and neutrality, while also reducing potential CBAM costs for exporters. China has set its carbon peaking targets for steel and aluminium sectors for the year 2030, in line with the industry sector's peaking timeline outlined in the country's 2030 NDC. Additionally, the 14th Five-Year Plan for Green Industry Development supports economy-wide energy and emission intensity reduction targets, further reinforcing China's commitment to decarbonisation (Climate Action Tracker, 2024). While the trend towards industrial decarbonisation is clear, the impact of the EU's CBAM on the decarbonisation pace of export-oriented steel and aluminium producers remains uncertain.

To decarbonise, the iron & steel sector needs to transition its primary energy input from emission-intensive coal to cleaner energy sources, such as renewable power and green hydrogen. In the aluminium sector, decarbonisation can largely be achieved through the electrification of production processes, with a focus on decarbonising the electricity supply. Enhancing recycling rates for both scrap steel and scrap aluminium can further reduce energy consumption and lower the carbon footprint of both sectors.

At least in the short term, the price signal of the EU's CBAM is not yet robust enough to incentivise decarbonisation. Decarbonising the steel industry in China has proven to be a costly endeavour. The most emission-intensive BF-BOF route remains the lowest-cost steel production method worldwide. While the scrap-based EAF powered by renewables and the green hydrogen DRI-EAF routes can achieve near-zero emissions, they come with additional costs of USD 100 and USD 425 per tonne of steel, respectively. The unit decarbonisation cost for scrap-EAF and green hydrogen DRI-EAF is around USD 75/tCO₂ and USD 89/tCO₂. Reforming the BF-BOF route by incorporating biomass, zero-carbon electricity, and CCUS technologies adds USD 150 per tonne but does not achieve full decarbonisation (Transition Asia, 2023a, 2023b; Zuo et al., 2023). Although scrap EAF is relatively more energy-efficient and less expensive, its production is limited by the availability and cost of steel scrap, and the recycled steel often does not meet the quality standards needed for higher-grade products (NewClimate Institute, 2022, 2024; Transition Asia, 2023a).

The current cost of reducing emissions from steel production in China exceeds the CBAM cost, thus the relatively low financial impact of the CBAM at this stage does not provide sufficient incentive for large-scale investments in cleaner technologies or processes. In the long term, technological advances could shift this landscape. A domestic think tank in China predicts that by 2030, low-carbon initiatives in primary steelmaking could reduce CBAM costs by USD 7 per tonne but would incur an additional abatement cost of USD 33 per tonne (iGDP, 2024).

Decarbonising the aluminium industry relies on decarbonising the power sector. In Guangdong, where coal dominates the power supply and an additional 46 GW of coal power capacity is under development as of 2022, reducing the carbon footprint of aluminium production is particularly challenging (Zhang, 2023). The province's reliance on electricity imports from other coal-dependent regions further complicates the issue.

A key strategy to decarbonise the aluminium sector involves selectively using clean power for electrolysis. China has already begun relocating electrolytic aluminium production capacity from the east to provinces like Yunnan and Sichuan, where abundant hydropower resources offer a more sustainable energy mix (MEE of China, 2023). Export-oriented producers in Guangdong can still mitigate potential CBAM risks by enhancing aluminium scrap recycling and selectively choosing renewable-powered primary aluminium for processing. Upstream producers

outside Guangdong could secure clean power through corporate PPAs (with the grid handling dispatch), install their own solar panels, or focus on recycling more aluminium instead of relying on electrolysis. But these decisions are dependent on other cost and strategies than CBAM itself, as the additional cost imposed by CBAM is unlikely to prompt these decisions.

Accurate emissions reporting and verification is a key component of CBAM compliance and governments should consider targeted support for producers on improving the transparency and quality of their MRV processes, which are not fully aligned with CBAM requirements. Under Guangdong ETS, emissions are accounted for at the factory level without breakdown by process or production unit. In contrast, CBAM requires emissions to be disaggregated by product. While China's ETS does not account for embedded emissions from purchased inputs or intermediate products, CBAM incorporates these emissions throughout the production chain. Currently, there is no unified emission factor in China for precursors required under CBAM. In the absence of actual production data, companies must use CBAM default values, which can significantly impact businesses that rely heavily on precursor materials. Additionally, emission factors and heat values for emission calculation under China's ETS are mainly based on domestic literature, while CBAM uses methodologies from the EU ETS MRV system, with potential use of IPCC guidelines for specific sectors.

A hypothetical calculation conducted by the Guangzhou branch of China Quality Certification Centre shows that the emissions intensity varies under different MRV regulations: for a steel company producing slag tanks in EAFs, the reported emission intensity (direct and indirect combined) ranges from 0.67 t CO₂ per tonne of product under CBAM, to 0.68 t CO₂ under national ETS, and up to 0.73 t CO₂ under Guangdong ETS (CQC Guangzhou, 2024). As CBAM moves into its implementation phase, companies in Guangdong must align with the MRV standards of the EU ETS while enhancing data transparency, which also brought additional verification costs. Government-led capacity-building initiatives, financial support for MRV alignment, targeted guidance on CBAM reporting, as well as strengthened dialogue with the EU on CBAM compliance and carbon accounting can offer more effective solutions to help enterprises navigate the reporting challenges.

CBAM highlights the global challenge of carbon emissions, underscoring the need for strengthened international cooperation and alignment. It reinforces the importance of sustaining and deepening EU-China dialogue on emissions trading, industrial decarbonisation, and broader climate action. Since 2014, the EU and China have collaborated on emissions trading, with the EU supporting Chinese authorities in implementing and developing their ETS (EEAS, 2018), followed up by two Memorandums of Understanding to Enhance Cooperation on Emissions Trading in 2018 and 2024 (European Commission, 2018, 2024b). Their broader climate change cooperation encompasses multiple bilateral dialogues and initiatives, including the EU-China High Level Environment and Climate Dialogue (HECD), Sino-German cooperation projects funded by IKI, the Track II Dialogue (T2D) on

Climate Change and Sustainable Development, and industry-level collaboration between the EU Chamber of Commerce in China and the China Chamber of Commerce to the EU (MEE of China et al., 2024). Amid the increasing complexity of global trade dynamics and the growing significance of carbon emissions in international commerce, it is imperative for China and the EU to build upon existing communication and cooperation channels. Continued and strengthened dialogue on CBAM implementation and compliance, industrial decarbonisation, and data transparency can help enhance mutual understanding and create opportunities for further collaboration in achieving climate ambitions.

/^ 04

CONCLUSIONS

The introduction of the EU's CBAM represents a significant shift in the intersection of international trade and climate policy. As the world's first carbon border adjustment system, CBAM establishes a precedent that other regions, including the UK, Canada, and Japan, are already beginning to follow. For producers in the Guangdong province, a key industrial and export powerhouse, CBAM poses both challenges and opportunities. While Guangdong producers' diversified export portfolio and relatively low reliance on CBAM-covered commodities reduce their immediate exposure, key sectors such as iron & steel and aluminium remain vulnerable due to high carbon intensity, and the fact the domestic carbon price signal is relatively weak.

Our analysis has demonstrated that the initial economic impacts of CBAM on Guangdong's producers are relatively small, thanks to the gradual phase-in of financial obligations and the current limited sectoral and emissions scope of CBAM. However, these impacts are projected to increase significantly over time. As financial obligations under CBAM progressively increase, as indirect emissions or additional sectors such as plastics are included, and as more countries adopt similar carbon border adjustment measures, the exposure of Guangdong's producers will rise sharply. Furthermore, the expected increase in the EU carbon price will compound these effects, if Guangdong's producers do not decarbonise. These findings highlight the importance of proactive policy measures and strategic planning to minimise long-term economic risks.

Therefore, government representatives and producers in Guangdong cannot afford to adopt a passive stance. The global trend toward carbon-constrained trade is gaining momentum, and reliance on avoiding or circumventing CBAM will become increasingly unsustainable as more jurisdictions introduce similar measures. They should pursue a multi-track strategy that balances economic competitiveness with long-term sustainability:

01 Guangdong province should gradually strengthen its pilot ETS:

Guangdong must continue building on its pilot ETS by progressively phasing out free allocation, improving market transparency, and enhancing compliance mechanisms. While immediate alignment with EU carbon price levels is unrealistic, incremental improvements will strengthen Guangdong's carbon pricing signal and help reduce financial outflows associated with CBAM. Ensuring that carbon pricing revenues stay within the province will allow Guangdong to channel these funds into low-carbon technologies, efficiency upgrades, and research and development. This approach not only mitigates financial outflows but also provides critical funding for the industrial transformation required to achieve long-term decarbonisation goals.

02 Guangdong's producers should invest in the decarbonisation of key sectors:

Reducing emission intensity in industries such as iron & steel and aluminium is the most effective way to mitigate CBAM costs, the dominant strategy. In the iron & steel

sector, transitioning to EAFs powered by clean electricity and adopting technologies such as green hydrogen and CCUS will be essential. In the aluminium sector, decarbonising the power supply for electrolysis and increasing aluminium recycling rates will be critical steps. These measures will not only reduce CBAM compliance costs but also enhance Guangdong's global competitiveness. Initially, the CBAM's price signals are likely too low to incentivise investments in decarbonisation, and thus, additional support may be required to ensure investments are not delayed.

03 The Guangdong province should strengthen data transparency and reporting mechanisms:

Accurate emissions reporting and verification mechanisms are critical for CBAM compliance. Guangdong's producers need to improve data transparency and MRV systems to meet CBAM verification standards, while addressing concerns about disclosing sensitive commercial information. This will require government support through technical assistance, capacity building, and financial incentive.

04 The EU should enhance its dialogue with China and Guangdong on carbon pricing, CBAM, and industrial decarbonisation:

CBAM reflects a global challenge that necessitates international cooperation and alignment, which is becoming increasingly crucial in today's world with more complex trading dynamics. China and the EU have a solid foundation in climate and carbon pricing cooperation. As CBAM's full implementation approaches, strengthening and expanding communication channels is essential, along with deepening collaboration on emissions accounting, verification standards, and decarbonisation technologies. A shared understanding and cooperative approach can reduce administrative burdens, build mutual trust, and facilitate smoother integration of Guangdong's efforts into the global carbon pricing landscape. The dialogue should extend beyond government channels and include industry stakeholders, technical experts, and research institutions from both sides.

Aligning with global carbon pricing trends and adopting low-carbon production technologies will not only mitigate the costs associated with CBAM but also position Guangdong producers as leaders in sustainable industrial practices. This alignment will improve local producers' resilience to evolving international trade regulations while unlocking opportunities for green growth and innovation.

While the path ahead is complex, Guangdong's producers have the economic strength, industrial capacity, and policy tools needed to navigate the challenges posed by CBAM. By adopting a balanced and forward-looking strategy, the province can transform CBAM compliance from a potential burden into a catalyst for sustainable industrial transformation and long-term competitiveness on the global stage.

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**NewClimate – Institute for
Climate Policy and Global
Sustainability gGmbH**

Cologne Office
Waidmarkt 11a
50676 Cologne, Germany

Berlin Office
Schönhauser Allee 10-11
10119 Berlin, Germany

Phone: +49 221 999 83 300
Email: info@newclimate.org
Website: www.newclimate.org

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