China Council for International Cooperation on Environment and Development

Carbon Pricing

Scoping Study 2024

Cover letter from facilitator of the study: Canada's Ambassador for Climate Change

Carbon pricing continues to gain momentum worldwide, as underscored by the World Bank's 2024 State and Trends of Carbon Pricing report, which highlights the total number of operational carbon pricing mechanisms globally at 75, with nearly one quarter of global emissions covered by a carbon price.

Putting a price on carbon pollution is widely recognized as the most efficient means to reduce greenhouse gas emissions. Adopting carbon pricing can align economic incentives with low-carbon objectives and drive investment in clean innovation and technology. Furthermore, carbon pricing is flexible and can adapt to the unique circumstances of each jurisdiction by tailoring and addressing affordability, income distribution, and competitiveness impacts.

Several countries, including Brazil, India, and Türkiye, three emerging economies, have made notable progress toward introducing additional carbon pricing systems. The World Bank analysis suggests that these three nations alone could extend carbon pricing coverage to an additional 3% of global emissions, raising the total to approximately 27%. China's plans to expand its national Emissions Trading System (ETS) to new sectors represent a significant opportunity to further enhance carbon pricing coverage. While this progress is encouraging, it highlights why Canada launched the Global Carbon Pricing Challenge (GCPC) to advance towards a goal of 60% global emissions coverage, sharing collective expertise and experiences to support these efforts.

This independent study aims to capture lessons learned in the design and implementation of market-based mechanisms for reducing greenhouse gas emissions. Canada's experience with domestic carbon pricing serves as a valuable case study. Since introducing its comprehensive carbon pricing approach in 2019, Canada has made it a cornerstone of its climate change mitigation strategy. I extend my sincere thanks to Scott Vaughan and Meizhen Wang for their leadership in drafting this study and express my gratitude to the exceptional team of international experts who have contributed to its recommendations. Your dedication to this initiative enriches our discussions and strengthens our collective efforts.

Informed policymaking hinges on a robust foundation of expertise from diverse fields and jurisdictions. I am honoured to have helped facilitate the collaborative dialogue that has helped to shape this study. I look forward to seeing how the China Council for International Cooperation on Environment and Development advances this important work.

Sincerely,

Catherine Stewart
Ambassador for Climate Change
Canada

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**The lead and members of this Scoping Study serve in their personal capacities. The views and opinions expressed in this Scoping Study report are those of the individual experts participating in the team and do not represent those of their organizations and CCICED.*

Executive Summary

China's national carbon market is undergoing significant reforms, including the widening of its sector coverage, a shift from an intensity-based to a cap-based system, and a gradual transition from a free allowance allocation to an auction-based system. This CCICED study examines some recent trends in carbon markets, noting their increased uptake globally. As the United Nations (UN) global stocktake and other assessments confirm, more ambitious climate mitigation actions are needed to meet the Paris Climate Agreement, including for carbon markets raising carbon prices, ending fossil fuel subsidies, identifying and offsetting the potential negative or regressive effects of carbon pricing through equity-oriented exemptions and rebates, enhancing predictability and ensuring flexibility within and between systems.

This CCICED Special Study benefited from invited experts, who generously shared their views and advice. Minutes of two meetings are included in the Annex. Part 1 of this study underscores the urgency of enhanced climate mitigation action, noting recent climate science and attributed impacts, the widening gaps between domestic actions and the Paris Climate Agreement goals, and the need for more stringent and comprehensive climate mitigation measures. Part 2 outlines the relative benefits of carbon pricing, notably in incentivizing demand shifts toward lower-carbon substitutes, improving material and energy efficiencies, and improving certainty in long-term investment pathways toward carbon-neutral capital investments. Parts 3 and 4 examine some design features of carbon pricing, including distributional effects and complementary support systems to bolster equity, matching balancing emission reduction certainty with various flexibility mechanisms. Part 5 reviews some recent developments in China's national carbon market, in particular, design options as it transitions from the power sector to wider coverage, from a free allocation to an auction-based system, and most importantly, from an intensity-based to an emissions-cap system. Part 6 examines lessons from Canada's national carbon pricing system, noting lessons related to price predictability, distributional effects, and system flexibility.

Recommendations: This study makes four recommendations:

- **Strategic:** China's carbon pricing system can play a greater role in the green transition. As the dual control goals move from carbon peaking to carbon neutrality, carbon pricing should become one of the primary measures to enable low-carbon pathways at the economy-wide and sector-specific levels.

- **Price levels:** Carbon prices should rise over time to narrow rising climate-related externalities and become closer to optimal levels needed to meet the Paris Climate Agreement.

- **Equity:** As the carbon market widens in sector coverage, equity objectives should be at the forefront of design considerations. Design options include earmarking eventual carbon price revenues to support disproportionately affected households, as well as green innovation funds, among others.

- **Complementary measures:** Ensure comprehensive and coherent policy approaches, particularly between promoting green channels in ongoing energy market reforms and rolling out the next phase of the national carbon market. Adjust the current carbon pricing system based on an emitter-based performance standard to also cover allowances for renewable energy. Complementary policies should also include renewable portfolio standards.

Part 1: Missing the Paris Targets

Mounting Impacts, Widening Gaps: Climate science unambiguously concludes that more ambitious climate mitigation action is needed at scale to meet the UN Paris Climate Agreement goals. The initial UN global stocktake (2023) confirmed a "huge mitigation gap" that makes those goals more likely to be missed. The Intergovernmental Panel on Climate Change (IPCC) confirmed in 2022 that it is "almost inevitable" that the Paris objective of 1.5°C will be exceeded.

Global greenhouse gas (GHG) emissions increased by 1.1% in 2023 to their highest level ever recorded, measuring 37.4 billion tonnes of CO_2 equivalent ($GtCO_2e$), with 65% of that increase coming from coal (International Energy Agency [IEA], 2024).[1] The *State of the Global Climate 2023* (WMO, 2024) reported that 2023 was the warmest year on record, with average global temperatures of 1.45 ± 0.12°C above pre-industrial levels in that year and the long-term global average ranging from 1.22 to 1.41°C (Hausfather, 2023).

In the first half of 2024, China experienced severe flooding in Guangdong, Fujian, Henan, and Hunan provinces. Extreme climate-related events are raising the risk of reaching global tipping points: the *Global Tipping Points Report 2023* cautions that five global tipping points are at risk of being crossed (University of Exeter, 2023). Once crossed, the risk of non-linear, cascading, and irreversible shocks that lay outside of climate scenarios may accelerate quickly, underscoring the unknowns of fat-tailed climate risk[2].

The UN Environmental Programme (UNEP) (2023) reports that China's cumulative historical CO_2 emissions between 1850 and 2021 comprised 13% of global GHG emissions. In 2021, reflecting the rapid increase in manufacturing and other capacities, China accounted for 30% of global GHG emissions—they are the largest national source of carbon emissions. Between 2020 and 2023, China's energy consumption growth more than doubled to 4% per year. The largest sources of emissions increases in the past 5 years include coal and heavy industry, including steel and intermediary steel inputs for industrial machinery (Myllyvirta, 2024).

Recommendations: China's carbon pricing system can play a greater role in the green transition. As the dual control goals shift from carbon peaking to carbon neutrality, carbon pricing should become a primary tool used to accelerate the green transition to low-carbon pathways at both economy-wide and sector-specific levels.

[1]According to the IEA (2024), emissions from China in 2023 grew by 565 million tonnes (Mt), of which one third were associated with a decline in hydroelectric power output due to drought and floods.
[2]A "fat tail" indicates that the likelihood of very large impacts is greater than what typical statistical assumptions would predict.

Part 2: The Growing Role of Carbon Pricing

Measures to close the GHG emissions gap that have been formally adopted at various multilateral levels include the transition away from fossil fuels, the tripling of renewable energy, the doubling of energy efficiency, further increases in climate finance—notably, private sector financing for the next generation of green technologies and innovation—and demand-side consumer actions.

Carbon pricing systems play a pivotal role in supporting these multilateral measures by incentivizing the transition away from fossil fuels and fostering innovation in green technologies.

The Benefits of Carbon Pricing: Carbon pricing systems have several key benefits. By assigning a cost to carbon emissions, carbon pricing generates economic incentives that promote investments in renewable energy, energy efficiency, and low-carbon technologies. Additionally, carbon pricing can influence consumer behaviour toward more sustainable choices, thereby advancing comprehensive climate mitigation agendas.

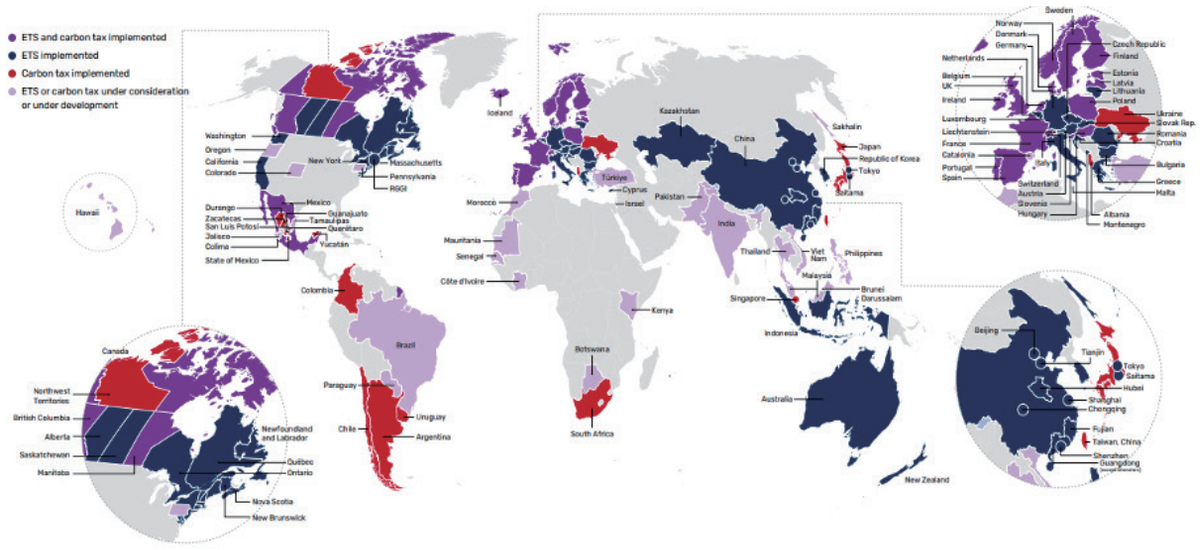
Carbon pricing systems may be applied to larger or smaller emitters across various sectors, including transport, heavy industry, buildings, and households. This broad coverage can promote the substitution away from fossil fuel use and carbon-intensive processes to renewable energy, zero-emission transportation, and other low-carbon pathways.

Moreover, carbon pricing is more cost-effective compared to command-and-control regulations (Flues & Van Dender, 2020).

Underscoring these and other benefits, the High-Level Commission on Carbon Prices report (2017) concluded that “a well-designed carbon price is an indispensable part of a strategy for reducing emissions in an effective and cost-efficient way.”

A Growing Number of Carbon Pricing Systems: Due to these attributes, a growing number of countries have already implemented or are preparing to implement carbon pricing systems. For example, the United Nations Framework Convention on Climate Change (UNFCCC) reports that over 100 countries include carbon pricing in their nationally determined contributions (NDCs). The World Bank’s Carbon Pricing Dashboard (2024a) reports that as of April 2024, 75 compliance carbon pricing instruments have been implemented worldwide, roughly divided between 39 carbon taxes and 36 emissions trading systems (ETSs). Among the largest carbon pricing systems are China’s national carbon market, which was launched in 2021 following a few regional pilots, and the European Union (EU) ETS, which was launched in 2005.

Figure 1. Map of carbon pricing instruments



Source: World Bank, 2024b.

The number of implemented carbon pricing systems is increasing across Organisation for Economic Co-operation and Development (OECD) countries and emerging economies. Notable developments in 2023 included the launch of a national ETS in Indonesia covering the electricity sector, the introduction of a carbon tax at the Mexican sub-federal levels in Durango and Guanajuato, a voluntary ETS in Japan, and a sub-federal ETS in Washington State. Additionally, Australia revised its ETS, and Hungary updated its carbon tax. Brazil and India made progress toward introducing enabling legislation for carbon pricing, while Malaysia, Thailand, the Philippines, and Vietnam took steps to establish carbon markets (World Bank, 2024b). Moreover, the EU announced plans to include buildings and transport into its ETS.

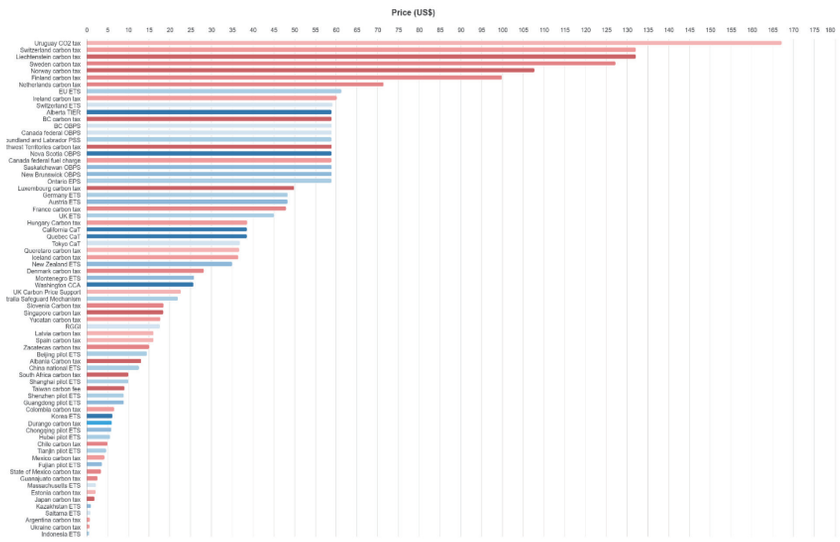
One barometer of the widening use of carbon pricing is their annual revenues: the World Bank (2024b) reported in its *State and Trends in Carbon Pricing 2024* that for the first time, the combined revenues from carbon markets exceeded USD 100 billion.

Climate Externalities: Carbon markets can help internalize some substantial and increasing externality costs associated with climate change, including flooding, drought, heat waves, wildfires, and other impacts. As noted, science is warning of the crossing of global tipping points.

One proxy to estimate climate-related externalities is through the social cost of carbon dioxide (SC-CO_2) methodologies, which estimate the net harm to society resulting from each additional tonne of CO_2 emissions. Recent estimates of the SC-CO_2 typically range from USD 200 to USD 400/tonne, with some outliers reaching USD 1,000/tonne. Rennert et al. (2022) estimate a global SC-CO_2 of US$185/tonne. In November 2023, the U.S. Environmental Protection Agency (EPA) released a working technical paper with an SC-CO_2 price of USD 190/tonne (EPA, 2023).

Price Levels:

Figure 2. ETSs and carbon tax pricing in 2024



Source: World Bank, 2024b.

Prices Differ Widely: As Figure 2 illustrates, there are wide price variations among different carbon pricing systems, ranging from the upper end of USD 167/tonne in Uruguay to well below USD 1/tonne in Baja California, Mexico. Data assessments by the OECD (2024) show that since 2015, carbon prices have diverged, raising leakage risks. Experts of this study have noted that the lack of price convergence complicates international carbon pricing coalitions and suggested developing key parameters for comparing systems and establishing mutual recognition (Delbeke, 2024). Several experts also noted the importance of this kind of international cooperation work in the context of the EU's Carbon Border Adjustment Mechanism (CBAM). They also noted that the stringency of carbon pricing is more nuanced than the marginal price level alone; it must also consider factors such as the coverage of emissions and compliance flexibilities that lower average costs, such as the allocation of free allowances.

It should be noted that the level of carbon prices is an important—but not the sole—measurement of a carbon market's stringency. Other determinants include the coverage of different sectors or, in the case of ETSs, whether allowances are freely allocated.

Prices Are Weakened by Fossil Fuel Subsidies: Fossil fuel subsidies function in the opposite direction of carbon pricing by magnifying environmental externalities, compounding market failures, and weakening the intended price signals and associated investment signals emulating from putting a price on carbon emissions. There are different methods to calculate these subsides: the International Monetary Fund's (IMF's) assessment (Parry et al., 2023) includes direct and indirect subsidies coupled with their externality costs, which together were estimated at USD 7 trillion in 2022. The OECD (2023) estimates covering 82 countries concluded that despite calls for greater climate mitigation ambition, fossil fuel subsidies almost doubled in 2022, reaching USD 1.48 trillion. At the 2009 G20 summit, countries pledged to identify and eliminate inefficient fossil fuel subsidies. Yet little progress has been made to date.

Optimal Price Levels: The High-Level Commission on Carbon Prices report (2017) recommended that carbon prices need to be set between USD 50 and 100/tCO_2e by 2030 to be consistent with the Paris Climate

Agreement's upper-bound 2°C target. The IMF notes that measures equivalent to a carbon price of USD 75/tonne or more by 2030 are needed (Black, Parry, Zhunoussova et al., 2022).

Work by the OECD (2023) in measuring the average stringency of carbon pricing systems underscores the wide gap between these targets and currently applied rates. The World Bank (2024b) concluded that in 2024, less than 1% of GHG emissions covered by a direct carbon price are at or above the recommended inflation-adjusted minimum level of USD 63/tCO_2e. Another estimate found that 70% of all carbon pricing systems were priced at USD 20/tCO_2e or less (Institute for Climate Economics, 2023).

China's annual average marginal price for its emissions allowances was around USD 9.6/tCO_2e at the close of 2023. Although this marks an increase of 23% from 2022 levels, it is still well below the carbon price levels needed to shift from carbon-intensive to greener pathways set out in the Paris Climate Agreement. Surveys conducted by Environmental Defense Fund China (2023) show expectations that China's carbon price will increase to around USD 12.5/tCO_2e by 2025 and to USD 18.1/tCO_2e by 2030.

Recommendations: Carbon prices should rise over time to address increasing climate-related externalities and approach the optimal levels needed to meet the Paris Climate Agreement goals.

Many international jurisdictions, including the EU's ETS, earmark a portion of carbon market revenues into green technology innovation funds. In anticipation of future carbon market revenues from allowance auctions, China should consider establishing green technology innovation funds for specific purposes, such as awarding prizes for clean technology innovation or subsidizing the deployment of new technologies.

Part 3: Public Support and Equity

Public Acceptance and Political Economy: Setting a carbon price level high enough to deliver substantial GHG emissions set by the Paris Climate Agreement while buffering the effects on competitiveness, related leakage risks, and households has been termed the "design trilemma" of compliance carbon markets (Böhringer, Fischer, & Rivers, 2023).

Public opinion surveys across many countries broadly show widening support for climate mitigation action. A key finding from multi-country surveys (Dechezleprêtre et al., 2022) is that support for carbon pricing depends largely on revenue use. Carbon pricing revenues that went into general revenues are unpopular. In contrast, when revenues are earmarked for specific purposes, such as funding green infrastructure and low-carbon technologies, and redistributed to support specific households, notably low-income households or more carbon-dependent households, public support increases. In addition to revenue uses, surveys suggest that public support for policies that are viewed as effective and equitable garner more public support.

Gender Equity and Wider Fairness Considerations: Environmental pricing can incentivize consumers and businesses to consider their environmental impact or footprint. However, Gloor et al. (2022) have pointed out a troubling trend in which environmental policies and initiatives inadvertently disadvantage women and other marginalized groups. Chalifour (2010) examined the gender implications of carbon taxes in British Columbia and Quebec, finding that women are disproportionately affected, mainly due to lower disposable incomes and unpaid caregiving burdens. Women, on average, have less income to pay the additional costs created by the

tax. In addition, household and caregiving burdens on women translate into reduced non-working time and flexibility, which limits their ability to change behaviours, such as using less energy-intensive transportation, to reduce tax impacts. Nonetheless, it is worth noting that individual consumption patterns may not accurately reflect the gender impact of consumption taxes, as the individuals may be purchasing goods on behalf of the family (OECD, 2022).

Given these implications, gender-responsive budgeting is a crucial tool for advancing gender equality. OECD countries have increasingly adopted gender budgeting, with participation rising from 44% in 2015 to over 60% in 2023 (OECD, 2023). The OECD report highlights the impact of Canada's system, which enacted the Canadian Gender Budgeting Act in 2018 to ensure all tax and resource allocation decisions consider gender and diversity impacts. Despite progress, UN Women (2023) reports that only 26% of 105 countries have comprehensive systems to track gender equality allocations. Strengthening public finance management is recommended to enhance transparency and accountability.

Recommendation: Price stringency should be complemented with equity considerations in which eventual carbon price revenues and price pass-throughs are augmented through revenue recycling, rebates, and other schemes that support lower-income and other affected households and groups.

Part 4: Comprehensive Frameworks, Complementary Policies

Comprehensive Policies: Effective carbon pricing systems need to function and interact with a number of complementary climate mitigation measures. Work by D'Arcangelo, Kruse, and Pisu (2023) examined 120 different climate mitigation instruments across 50 countries. Instruments include carbon pricing; regulations such as bans, subsidies, standards; and other measures. Countries were grouped into four clusters: Canada, China, Japan, and New Zealand, for example, are grouped together under category 2, described as relatively diverse measures, with varying stringency levels. By contrast, category 4 countries, described as having diverse and stringent measures, include France, Germany, Sweden, Finland, and Denmark. Several jurisdictions, such as the EU and Canada, have positioned carbon markets at the centre of comprehensive, whole-of-government[3] measures to achieve carbon neutrality. Three findings are worth noting from this work: (a) well-designed interaction of a limited number of measures can be more effective than dozens of measures with little policy alignment; (b) more stringent measures are associated with lower emissions; and (c) clusters that include carbon pricing are more effective on average compared to those without.

[3]Various governance practices continue to emerge to support policy coherence, including the UK Climate Change Committee carbon budget and France's screening of government-wide budget proposals to determine their compatibility with environmental and net zero goals.

Methane Emissions: While carbon pricing can play a primary role in climate mitigation packages, it cannot be the only measure. Therefore, an important design question is the role of complementary measures that work in tandem with—and ideally, unlock—synergies. For example, Canada is developing oil and gas regulations to eliminate routine venting and flaring and enhance leak detection and repair that are hard to price within its carbon pricing system because the extent and emission effects of leaks are difficult to measure, among other factors (Environment and Climate Change Canada, 2023). [4]

Complementary Measures: This study's experts also examined complementary mitigation measures to carbon pricing and noted the intentional overlapping of carbon pricing with complementary measures. For example, California's ETS is complemented by other non-market measures led by its low-carbon fuel standard, which in turn has reduced carbon prices in the California market.

Experts underscored the importance of complementary measures to enhance synergies across different instruments. In the case of output-based pricing systems applied in China and Canada, the absence of an emissions cap presents several complex design challenges. For example, one sub-federal system implemented various measures, such as investment tax credits for carbon capture and storage, cheap electricity rates, and specific electricity regulations. These measures have made it easier to generate compliance credits, leading to the potential for an overcapacity of credits that risk glutting the market and undermining the carbon price.

China's current carbon market system is similar to an emitter performance standard in which four benchmarks are applied to the electricity sector. However, no provisions are provided for renewable energy, thereby missing incentives that encourage the shift from fossil fuels to renewable energy sources. Experts noted the role of renewable portfolio standards as an example of an optimal complementary measure. [5]

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[4]Detecting methane emissions including from fugitive sources, such as from pipeline leaks, continues to improve. UNEP's International Methane Emissions Observatory (IMEO) and its Methane Alert and Monitoring System (MARS) identified over 120 major methane plumes or sources of leaks from the oil and gas sector in 2023. In March 2024, the Environmental Defense Fund launched MethaneSat, to improve the real-time detection of methane emissions from the oil and gas sector. CCICED has made a number of recommendations, including in 2024, for the urgent need to reduce methane emissions.

[5]An OECD paper examines outcomes across various emissions trading systems, including cap-and-trade and tradable performance standards, alongside overlapping policies like renewable subsidies and electricity taxes. The study finds that renewable subsidies lower emission prices across all trading systems but have different effects on emissions depending on the performance standard design. Taxing electricity reduces both emission prices and outputs across all systems. With cap-and-trade, overlapping policies like renewables subsidies or electricity consumption taxes can reduce cost-effectiveness. However, under certain tradable performance standards, these measures can decrease distortions and improve overall cost efficiency. The analysis specifically highlights China's system, showing that current policy overlaps can reduce abatement costs by 20–30%, with further 10% savings possible through optimized renewable standards and uniform benchmarks. While cap-and-trade without overlapping policies remains the most cost-effective approach, this underscores the importance of considering the interplay between emissions trading systems and overlapping policies in policy reforms (Fischer, Qu, & Goulder, 2024).

Administrative Complexity and Information Requirements: Compared to carbon taxes, ETSs, especially output-based and performance standards, involve complexity that demands detailed administrative support. They require intensive product knowledge to compare the marginal abatement costs of like products or an apples-to-apples comparison. For example, within the same sector, the average marginal abatement cost could be as high as USD 80/tonne for 20% of the sector's combined emissions but as low as USD 5/tonne for other goods within the same sector. This price differentiation makes benchmarking complex and vulnerable to manipulation, gaming, and capture by firms (Canadian Climate Institute, 2024). Experts suggested that building one or two large net-zero cement or steel plants could flood the market with surplus credits, potentially leading to a price collapse.

Recommendations: Ensure comprehensive and coherent policy approaches, particularly between green energy market reforms and the next phase of the national carbon market. Adjust the current carbon pricing system, which is based on emitter performance standards, to include allowances for renewable energy. Additionally, complementary policies such as renewable portfolio standards should be integrated.

Part 5: China's National Carbon Market

China's national carbon market was launched in mid-2021, following a decade of pilot markets implemented at the provincial or city levels.

ETS Pilots: In 2013, China began ETS pilots in Beijing, Chongqing, Guangdong, Hubei, Shanghai, Shenzhen, Fujian, and Tianjin. These pilots evolved from covering roughly 5% of total emissions at their outset to roughly 15% by 2017 (Oppermann et al., 2017). As the national ETS coverage expands to additional sectors, it is expected that the pilot schemes will be integrated into the national system.

National Market: In December 2017, China issued the *National Carbon Emissions Trading Market Construction Plan (Power Industry)* (National Development and Reform Commission [NDRC], 2017), with the national carbon market officially operating since July 2021. So far covering only the power sector, the national market accounts for approximately 5.1 billion tonnes of annual CO_2 emissions and represents over 40% of the nation's total emissions.

Governance: The Ministry of Ecology and Environment of China (MEE) is the lead national/state authority responsible for issuing opinions, guidance, and rules, as well as overseeing ETS implementation in conjunction with other regulatory authorities. As in other areas of environmental management, provinces are responsible for overseeing the ETS implementation, with provincial departments responsible for identifying entities that are subject to the system, establishing and implementing a monitoring, reporting, and verification (MRV) system that meets MEE state-level specifications, managing provincial registries, and overseeing compliance.

Policy Coherence: To date, China's national carbon market has played a relatively limited role in its climate mitigation efforts. The primary drivers of the green transition have been an unprecedented expansion in renewable energy, particularly led by solar and wind, along with regulations and reforms aimed at reducing air pollutants from the transport sector through the adoption of low-cost electric vehicles. Other key measures include energy emission performance standards, feed-in tariffs for renewable energy, green incentives and

subsidies, targets for green finance, evolving climate-risk disclosure rules, and the increasing role of public litigation.

In support of China's dual-carbon control goals, approximately 700–800 policies are being implemented at different levels to advance China's green and low-carbon transition. Such comprehensive policies create their own challenges in ensuring policy coherence. There are various examples of policy incoherence—that is, in which differing policies work at cross-purposes. One example of good practice in aligning carbon pricing policies is so-called "feebates," in which taxes applied to carbon-intensive goods such as internal combustion engine automobiles are complemented with rebates or tax incentives to make electric vehicle purchases more affordable (Parry, 2021)

Next Steps in the National Carbon Market: The planned next steps include the expansion[6] of sector coverage from the current power sector to other industrial sectors (as set out in Phase 3 of the carbon market plan)[7]; the standardization of GHG MRV requirements for firms; the gradual shift or augmentation of the current system of free allocation of allowances to an auction-based system that will generate public revenues for the first time; and most importantly, the shift from the current intensity-based system to the adoption of an absolute cap.

Revised Energy Law: In addition to changes underway in the MEE-directed national carbon market, China's energy market, led by the NDRC and the National Energy Agency (NEA), is simultaneously undergoing a series of important reforms. In May 2023, the NDRC introduced a next round of reforms intended to create a unified national power market that would be green, safe and economical by furthering electrification: the 2024 target is to increase renewable energy capacity by 200 GW, which is likely to again be exceeded. The NDRC reforms further call for "reasonable profits" (NDRC, 2023) in allowable costs by introducing several market measures. In April 2024, the draft Energy Law was issued for public comment.

These reforms are described as the adoption of a new, more market-oriented system with green power at the centre, increased inter-jurisdictional grid transmission and increased spot trading between jurisdictions, and electricity price reforms that reflect different uses, such as capacity reserves and ancillary services. For 2023–2026, features affecting all industrial and commercial users will include linking feed-in tariffs with feed-in grid loss tariffs and system operating costs; steps toward a flexible national spot market, including a capacity-tariff scheme intended to increase the proportion of renewable energy during non-peak periods compared to tariffs for coal-pricing peak loads; a new peak-shaving market; the introduction of ancillary renewable energy pricing levels; and other measures.

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[6]China's 2024 *Report on the Work of the Government* listed expanding sectorial coverage of the national ETS as a government task of the year. During a recent interview at the China Carbon Market Conference held in Wuhan in July 2024, Xia Yingxian, Director General of the MEE climate change department, mentioned that the ministry is actively promoting the expansion of China's carbon emissions trading market as soon as possible and the drafting of relevant technical documents is nearly complete.

[7]The NDRC Guidelines identified eight sectors that will eventually be covered under China's carbon market: electricity (including power generation, power and heat cogeneration, and grid distribution), building materials, iron and steel, non-ferrous metal processing, petroleum refining, chemicals, pulp and paper, and aviation. The wider system is expected to regulate 6,000 companies (Pizer & Zhang, 2018).

This ongoing shift toward more market-oriented energy prices, intended to favour green electricity, coupled with the next phase of China's national carbon market presents unique opportunities to align these two systems as a primary means to achieve the dual-carbon targets.

Elevating Carbon Pricing to a Critical Enabler: Embracing the New Paradigm of Green Development—an important 2023 report co-authored by Min ZHU, Nicholas Stern, Joseph Stiglitz, Shijin LIU, Yongsheng ZHANG, and others—concluded that carbon pricing should become the primary policy to realize the dual-carbon climate goals, noting: "A strong and predictable carbon price or its equivalent has a particularly critical role to play in the efficient management of the transition process. Due to the complexity of carbon pricing and multiple market failures, it is important to build a multi-dimensional market mechanism for carbon pricing, including a combination of carbon taxes, carbon emissions trading, carbon derivatives trading, and carbon offset markets."

Uneven Progress in Climate Targets: China has set out a number of targets within its dual-carbon control framework. In addition to the overarching goal of carbon peaking by 2030 and carbon neutrality by 2060, other targets to be achieved by 2030 include: reducing CO_2 emissions per unit of GDP by 65% based on the 2005 level; reaching 25% of non-fossil fuel primary energy; and increasing installed solar and wind energy to 1,200 GW. Some of these targets have been exceeded. For example, China's solar and wind capacity increased by 63% in 2023, adding 297 GW (IRENA, 2024). Some analysts expect carbon peaking to be reached well before scheduled, as early as 2025. However, the mid-term evaluation of progress published by NDRC in December 2023 identified energy and carbon intensity as two out of four indicators that were off track, along with a key air quality target.

Tradeable Performance Standards: China's national ETS is based on an output-oriented emissions intensity standard, in which free allowances are allocated based on a facility's verified emission multiplied by the corresponding benchmark factor. Firms can trade emission allowances among covered entities, allowing them to exceed their emission target at low costs. Thus, it more closely resembles a tradeable performance standard (TPS) (Fischer, 2001) than a cap-and-trade system, and more specifically, an emitter-based performance standard with differing benchmarks within the power sector.

Benchmarks and Allocation: Four distinct benchmarks were employed for the 2021–2022 compliance period: conventional coal plants below 300 MW; conventional coal plants above 300 MW; unconventional coal; and natural gas (MEE, 2023). In general, coal-fired power plants (both conventional and unconventional) have less stringent benchmarks than natural gas sources.

China's provincial/municipal development and reform commissions noted that setting "reasonable and fair" grandfathering allowance allocation levels was difficult during the pilot periods, given marked increases in the scale of electricity generation (Pizer & Zhang, 2018). MEE further adjusted allowances to meet fairness criteria.

Allowances Trading: Regulations stipulate that only covered entities are permitted to trade allowances through agreement transfer, one-way bidding, or other spot transactions, serving as further price control measures. According to the *2022 China Carbon Pricing Survey* (Slater et al., 2023), very few covered entities suggested that the benchmarks were "too generous" when asked about their adequacy in encouraging GHG emission reduction. The survey was conducted in October 2022, shortly after the announcement of updated benchmarks for the 2021–2022 compliance cycle, where smaller installations were facing stricter tightening

compared to larger ones.

The ETS currently does not allow banking or borrowing. The MEE has indicated that it will gradually introduce a system of banking.

Intensity-Based System: The output-based system encourages relative per unit of output efficiency gains but does not encourage wider shifts in fuel choices—for example, from coal to solar, wind, or green hydrogen. While Goulder et al. (2024) estimated that the environmental benefits of China's TPS could exceed its cost by a factor of five over the 2020–2035 interval, and these benefits are greater when human health benefits are included, the authors also noted that the cost becomes comparatively greater over time, compared to ETSs based on cap-and-trade features.[8]

In addition, experts of this study have noted that the transition to an auctioning system coupled with more stringent benchmarks and/or the adoption of an emissions cap would help stabilize market expectations and play a key role in carbon price discovery, which in turn could help convey important signals to green technology investments.

Shift From Free Allocation to Auctioning: While a specific timeline is not provided, the recently released *Interim Regulations on Carbon Emissions Trading Management* (State Council of China, 2024) indicates a gradual transition[9] in allocation toward a combined method of both free and paid allowances. It underscores the importance of considering market regulation needs[10] in determining the amount of carbon emission allowances and allocation plans.

Anticipating a possible tightening of emission allowances and forward prices, enterprises may be reluctant to sell allowances during this transition period, which may affect trading activities in the national ETS and, in turn, may impede price discovery.

Price Levels: S&P Global data showed the annual average trading price for China's emission allowances reached USD 9.48/tCO_2e in 2023, up 23.24% on the year. The allowance trade volume was 212 million tCO_2e for the year, jumping 316%.

Goulder et al. (2024) noted that the stringency of China's carbon market is below an efficiency-maximizing level, in which optimal efficiency is defined as the marginal abatement cost equal to the marginal environmental benefit.

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[8]Among the reasons for this widening cost gap, according to the authors, is that the current free-allowance allocation, intensity-based system implicitly provides a subsidy based on planned production output, since entities are allocated free allowances for each additional unit of production, offering no incentives to reduce production and output. Compared to cap-and-trade systems, as the output-based system increases its stringency, the implicit subsidy characteristic becomes more pronounced, widening the gap between marginal abatement costs and environmental benefits.

[9]During the China Carbon Market Conference in July 2024, Zhao Yingmin, Vice Minister of Ecology and Environment, highlighted the focus on exploring and implementing a mix of free and paid carbon quota allocation methods, with a gradual increase in the proportion of paid allocations.

[10]In the events of abnormal price fluctuations, the Ministry of Ecology and Environment may take measures such as conducting open market operations and adjusting the use of Chinese Certified Emissions Reductions (CCERs).

Stringency and Compliance Flexibility: China's ETS continues to undergo important developments, including the tightening of disclosure standards, the introduction of carbon offsets, and some tightening of stringency. For example, Guangdong's ETS 2022 updated plan widened the coverage of regulated entities by lowering the threshold from 20,000 tCO_2/year or energy consumption of 10,000 tonnes of coal equivalent (tce)/year to 10,000 tCO_2/year or energy consumption of 5,000 tce/year, while the Shanghai exchange lowered emission factors of power and heat consumption (World Bank, 2023).

At the same time, in March 2023, MEE proposed that benchmark values for the 2021 to 2022 compliance period be tightened significantly compared with 2019 to 2020, particularly for coal-fired power plants.

Coverage and Regulatory Framework on Potential Expansion: China's national carbon market currently covers approximately 2,250 power sector entities, including electricity generation and industrial cooling.

In March 2021, MEE released the *Notice on Strengthening the Management of Enterprise Greenhouse Gas Emissions Reporting,* establishing key actions and timelines on MRV for key emitting entities, not only in the power sector but also petrochemicals, chemicals, building materials, steel, non-ferrous metals, papermaking, and aviation, a necessary precondition for expanding the sectoral scope.

In February 2024, the State Council of China released the *Interim Regulations on Carbon Emissions Trading Management* (effective on May 1, 2024), which provides a legal framework for the operation of China's national ETS. It signals a potential near-term expansion to more key emitting industries soon, by mentioning carbon accounting in the aviation sector.

Reporting and Registries: Carbon information disclosure can help enterprises manage their carbon assets and identify risks, including stranded-asset risks. Effective reporting is a cornerstone of effective government regulation and policy-making.

Multiple stipulations regarding information disclosure are set out in the *Interim Regulations on Carbon Emissions Trading Management*. The policy requires regular disclosure of annual GHG emission reports of key emitters. Firm-level reporting is an important pillar in ensuring the transparency of the national ETS, including providing a guarantee for fair and transparent carbon prices.

System registries, including the national carbon emission allowance registry and clearing platform, are administered by China Carbon Emissions Registration and Clearing Co., Ltd., while the Shanghai Environment and Energy Exchange maintains the allowance trading platform.

The trading and clearing platform for the relaunched carbon offset system, the CCER system, is operated by the Beijing Green Exchange, while the CCER registry is maintained through the National Center for Climate Change Strategy and International Cooperation (NCSC).

In addition, those enterprises that are or will be required to undertake full-scale climate information disclosure can align their MRV systems with the evolving climate-related financial risk disclosure standards and mandatory rules.

Carbon Offsets: Following a 6-year pause, the CCER market was relaunched in January 2024. The CCER's initial coverage is forestation, mangrove cultivation, solar thermal power, and grid-connected offshore wind power projects. As of January 2024, entities under the ETS are permitted to offset up to 5% of emissions

under the CCER. Various guidelines have been issued related to MRV and other carbon offset characteristics. One question will be the average price of carbon offsets vis-à-vis the price of allowances. Rules regarding the classification of a carbon offset as a financial product are pending. The first certified carbon offset credits tied to the ETS are expected in 2024.

Currently, only spot allowances are allowed to be traded. However, MEE has identified carbon derivatives as a likely product in the future.

Market Stability Measures: A common feature of most ETSs, including China's, is the use of various direct measures, such as floor and ceiling prices, and indirect measures, such as allowance withdrawals and retirements, to smoothen price volatility.

In 2021, MEE announced the option of cushioning large swings in trading prices with stability mechanisms such as permit buybacks, auctioning, or adjusting the rules related to carbon offsets under its CCER. Under the Beijing pilot ETS, the Beijing Green Exchange limited price increases and decreases when they exceeded or fell below 20% of a reference price. The Shanghai pilot ETS introduced rules whereby day-trading could be suspended if prices exceeded set parameters (10% and 30%), as well as an annual auction reserve (ICAP, 2023)

Distributional Effects: Carbon pricing can affect households, regions, firms, and others differently, and extensive literature exists on measuring impacts and options to offset potentially negative effects.

To date, China's carbon market does not pass forward costs to households, while energy and electricity prices are set separately by NDRC. A recent IMF study examined how imposing a USD 50 per tonne carbon price[11] could lead to price hikes in coal, electricity, natural gas, and road fuel, observing that the burden on average households' consumption would predominantly stem indirectly from increased prices for general goods and services, rather than directly from energy prices. The study noted that recycling carbon pricing revenues could alleviate roughly 85% of the burden on households. The study compared various policy options for protecting low-income households, emphasizing the effectiveness of targeted income support while discussing the challenges and trade-offs associated with other approaches, such as broad-based income support or compensating for energy price increases.

Additionally, strategies for mitigating the impact on firms' competitiveness were outlined, including revenue recycling to provide industrial rebates, tradeable emission rate standards, border carbon adjustments, or, ideally, international coordination among major emitters.

[11]Source: IMF staff using Climate Policy Assessment Tool

Part 6: Canada's Carbon Pricing System

Carbon pricing is a key component of meeting Canada's targets of reducing GHG emissions to 40-45% below 2005 levels by 2030 and reaching net-zero by 2050. The policy aims to put a price on GHG emissions across Canada as an efficient way to incentivize emissions reductions and spur innovation across the economy. Some 78–80% of Canada's emissions are covered by a carbon price. Environment and Climate Change Canada's energy and economic modelling estimates that up to one third of projected emissions reductions to 2030 would come from carbon pricing.

Canada's approach to carbon pricing is complex, primarily because of the flexibilities afforded to subnational jurisdictions to implement their own carbon pricing systems but also because of the interaction of the instrument with the hundreds of non-pricing climate change policies and measures at play across the country (e.g., vehicle efficiency and emissions regulations, a clean fuel standard, clean electricity regulations, etc.).

One component of Canada's system, the federally regulated Output-Based Pricing System (OBPS), may provide relevant insights for China. Given its design, the OBPS has an output-based design that differs from ETSs that set an absolute cap on emissions across specific sources. The OBPS could serve as a useful example for China to look at when considering carbon pricing expansion to sectors susceptible to carbon leakage.

The OBPS sets specific output-based standards for a given activity (i.e., a set level of GHG emissions per unit of output). Compliance obligations reside only on emissions that exceed these performance standards. By limiting compliance costs to emissions above a facility's output-based standard, the OBPS helps maintain international competitiveness and minimize carbon leakage. This is particularly important given that Canada and the United States—a jurisdiction with no carbon pricing at the federal level—share one of the largest trading relationships in the world.

However, some trade-offs must be considered. These trade-offs include the lack of an absolute cap and therefore emissions reduction certainty from the program, one of the principal advantages identified in the literature for a quantity-based—rather than a price-based—approach. This type of approach also has implications for exemptions or rebates from carbon border charges, which are generally based on the explicit carbon price paid per tonne of embedded emissions within exported goods compared to the domestic effective carbon price. Carbon pricing policies designed to mitigate carbon leakage through free allowance allocation or benchmarking result in lower carbon costs per tonne of embedded emissions than the headline marginal carbon price. Meanwhile, the effective carbon price for emissions-intensive, trade-exposed goods within the EU will converge on its marginal carbon price as free allowance distribution is phased out between 2026 and 2034. This will increase the delta (i.e., border charge) with carbon pricing policies that result in lower average carbon prices.

Price Predictability: At the federal level, Canada has looked to address "price predictability" issues through a minimum national carbon price schedule, applicable to all carbon pricing systems in Canada. As early as 2020, the government proposed carbon price increases of CAD 15/tonne CO_2e, rising from CAD 65/tonne CO_2e in 2023, and by CAD 15/year to CAD 170 in 2030. This price trajectory was confirmed in August 2021.

Canadian systems must set their minimum carbon pollution price according to this schedule. For example, Canada's fuel charge rises in accordance with the price schedule each April, recently hitting CAD 80 per tonne of CO_2e. The maximum compliance price under OBPSs must also be at least equal to the minimum national carbon price, which sets a consistent price signal across the country for large industrial emitters. Cap-and-trade systems must have declining annual GHG emissions caps that correspond, at a minimum, to the projected emissions levels that would result from the application of a price-based system using this schedule.

Legislating and publishing the price trajectory in advance gives businesses and households the opportunity to estimate future costs and make informed decisions on investments such as low-carbon technologies, zero-emissions vehicles, heat pumps, or business/home energy efficiency improvements. It also serves to limit economic impacts where the economy can adjust more readily to gradual and predictable price changes.

In addition to publishing the carbon price schedule through 2030, the government is committed to publishing information about how revenues collected in the federal carbon pricing systems are recycled.

In provinces and territories where the federal benchmark applies, and the federal fuel charge is collected at the federal level, revenues are returned to households through the Canada Carbon Rebate. The amount of the Canada Carbon Rebate that households will receive is also published ahead of time on the Canada Revenue Agency webpage. The quarterly rebate values for 2024–2025 were announced in February 2024.

While the carbon price schedule helps ensure transparency and predictability, total carbon costs are much more difficult to predict for large industrial emitters in Canada, where output-based pricing applies. The price of complying with the policy is determined by market dynamics, given the policy parameters, with the minimum national carbon price only providing certainty regarding the highest-value compliance option. Market dynamics—determining the price of compliance units—are specific to each industrial carbon pricing system. Though all systems are modelled to have a net demand for compliance units, market factors may differ in individual markets, thereby affecting total compliance costs (e.g., banking, market liquidity, policy interactions).

Moreover, in industrial pricing systems, the marginal carbon price is not representative of the average cost of emitting, whereas Canadian output-based pricing systems and cap-and-trade systems are designed to lower average costs to prevent carbon leakage for emissions-intensive and trade-exposed industrial sectors. Given the flexibilities noted above, variation in average cost, both across and within jurisdictions, may impact cost projections. Predictability around average costs is important for long-term capital decisions as well as inter-provincial carbon leakage.

Some stakeholders have noted that Canada's pricing systems are unlikely to spur the types of large-scale clean investments needed to decarbonize industry if longer-term price predictability is not strengthened (Clark et al., 2022). The government is aware of price predictability concerns for large industrial emitters in Canada's carbon pricing landscape (recognized in Canada's Emissions Reduction Plan for 2030), including the federal OBPS. The 2023–2030 update to Canada's federal benchmark commits to an interim review of the policy by 2026, which may include consideration related to carbon price predictability.

Canada is concurrently considering mechanisms such as carbon contracts for difference (CCfDs) for large low-carbon infrastructure projects. CCfDs can be designed to support low-carbon projects by guaranteeing a

certain carbon price, essentially subsidizing any delta between an agreed future "strike price" and the market price of compliance units. The 2023 Fall Economic Statement announced that the Canada Growth Fund will allocate CAD 7 billion to investment offerings for industrial decarbonization, including contracts for difference as well as other forms of price assurance/support.

Flexibilities: Subnational flexibilities: In 2016, Canada's federal, provincial, and territorial First Ministers agreed to a pan-Canadian approach to reducing GHG emissions, including carbon pricing. At the time, several Canadian provinces already had carbon pricing in place, and the Canada-wide approach committed to recognizing these existing systems. For example, the province of British Columbia implemented a broad-based carbon tax in 2008, and the province of Quebec implemented an economy-wide cap-and-trade system in 2013, which linked the following year to the state of California through the Western Climate Initiative.

To expand the application of carbon pricing across the country, the Government of Canada introduced a federal "benchmark" to set minimum national stringency standards, with this stringency increasing over time. Provinces and territories are required to implement an explicit price-based system—such as a carbon levy on fossil fuels or a hybrid system with an OBPS for industry—or a cap-and-trade system.

The federal government, at the same time, designed a federal backstop, a carbon pricing system that applies in provinces/territories that request it or that do not implement a system that meets the federal benchmark. The federal pricing system has two parts: a regulatory charge on fossil fuels, known as the fuel charge, and a performance-based system for industries, known as the OBPS. This approach saw economy-wide carbon pricing applied across Canada by 2019, providing flexibility for a variety of different approaches.

The federal standard aims to ensure that all systems in Canada are comparable and effective while giving subnational jurisdictions the flexibility to design their own systems tailored to their unique regional circumstances. The benchmark requires that carbon pricing be applied to a broad set of emission sources across the economy and that carbon price increases should occur according to a minimum national carbon price schedule. (see Price Predictability above).

Sectoral flexibilities: The output-based standards under the federal OBPS are mostly set according to the production-weighted average emissions intensity of all facilities producing similar products across Canada, adjusted for the level of carbon leakage risk. Producers are liable for their emissions above the standards and receive tradeable credits when their emissions are lower than the standard. These credits can be banked or sold to other producers for compliance purposes. Provinces and territories looking to align with the federal approach have the flexibility to set these standards according to their own preferences and unique circumstances as long as the marginal carbon price signal is maintained. This ensures a flexible pricing approach, with the various standards reflecting the current status of emissions intensity for the product/activity.

One drawback to this approach is that it promotes improvements in plant efficiency but does not promote shifting to new manners of production. For example, while the federal output-based standard for coal-fired power plants promotes more efficient practices, it does not incentivize switching over to a lower-emitting fuel such as natural gas. Instead, Canada is developing a Clean Electricity Regulation to help transition toward a net-zero electricity grid (Government of Canada, 2024). Another drawback to the approach is that regional and sector-specific flexibilities add to the significant complexity of the policy. The standards are determined

in a similar way as regulatory development, requiring significant sectoral knowledge.

Revenue flexibilities: Where the federal system applies, revenues remain in the jurisdiction of origin. Jurisdictions with their own systems or that request the federal system can use carbon pricing proceeds according to their needs, including to address impacts on vulnerable populations and sectors, and/or to support climate change and clean growth goals. More specifically, 90% of revenue collected through Canada's federal fuel charge is returned to households through the Canada Carbon Rebate as direct payments. Most households receive more money back in rebate payments than they pay directly through the fuel charge. Lower-income households benefit the most, as these households traditionally spend less on energy while receiving the same rebate.

The federal OBPS chooses an approach that foregoes revenue collection on emissions under the specific standards described above, instead choosing to mitigate the risk of carbon leakage and adverse competitiveness impacts for emissions-intensive and trade-exposed industries. Compliance obligations arise on the portion of emissions above specific benchmarks—and where compliance units are not surrendered—and proceeds are transferred to subnational governments, including through funds that support industrial decarbonization and clean electricity. Other policy design options for the use of revenues may be more appropriate in other national contexts, such as the establishment of social programming or the lowering of distortionary taxes, such as income taxes.

Conclusion

After 4 years, China's national carbon market will enter its next critical phase, notably with the introduction of emission caps for covered sectors, as well as the gradual phase-in of an allowance auctioning system. According to the Work Plan for Accelerating the Establishment of a Dual Control System for Carbon Emissions published by the State Council of China in August 2024, China will set targets for total emission volumes in the 15th Five-Year Plan period, beginning in 2026. Initially, these total volume targets will be secondary to intensity targets. However, after China reaches its peak emissions—currently expected before 2030—total emissions will become the primary focus. The carbon market will function within a wider context of the transition from carbon peaking to the beginning of carbon reduction measures toward achieving carbon neutrality by 2060. The study envisages a greater role of carbon pricing, a market-based approach to incentivize the shift to carbon-neutral pathways at the firm level and among private investors. As this shift in carbon markets continues, the study highlights several observations and findings, particularly the importance of identifying distributional effects among households, sectors, and regions and designing the early use of carbon pricing revenues from allowance auctioning to support equity outcomes.

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Annex 1: Carbon Pricing Scoping Study Kick-off Meeting Notes

**The notes are prepared in accordance with the Chatham House Style and are intended for internal reference only; they have not been reviewed by speakers.*

Introduction/Context

The World Bank's ongoing monitoring dashboard of global carbon pricing initiatives was briefly discussed. The speaker mentioned that carbon pricing initiatives are growing in volume and raised questions about the stringency of these measures.

Canada's Role and Experience

The speaker emphasized the timeliness of the scoping study, particularly in light of recent developments in China's carbon markets. Canada's dedication to carbon pricing, both at home and abroad, was highlighted, alongside the crucial role of sharing knowledge and experiences among jurisdictions. The initiation of the Global Carbon Pricing Challenge (GCPC) by Canada was noted as significant for supporting global carbon pricing implementation and knowledge exchange. The speaker also noted the opportunity presented by this CCICED scoping study to learn from international experts, intending to leverage these insights to advance global carbon pricing efforts.

Overview of the Scoping Study

The speaker noted that the scoping study intends to inform China's approach to carbon pricing policy development, building on previous recommendations from the CCICED regarding China's Emissions Trading Scheme (ETS) and drawing insights from Canada and other international experiences, alongside international expertise. The speaker noted that the scope of the study has been refined to three key areas: price predictability, affordability, and flexibility. The speaker provided slides related to the importance of each area, including factors such as economic efficiency, rational decision making, policy longevity, and public support.

Lessons from Canada

The speaker briefly outlined the related Canadian context. Canada's federal benchmark minimum national carbon price was discussed, which sets a minimum national price trajectory from 2023 to 2030 for carbon pricing systems across Canada. The speaker noted the trade-offs between price-based policy design and market-based policy design, where carbon price predictability is inherent to the former rather than the latter. The speaker mentioned Canada's approach to mitigating the regressive impacts of carbon pricing by using most federal fuel charge proceeds to provide direct carbon rebates to households. The expert also pointed out that Canada's output-based pricing systems for industry are designed to lower leakage risk by lowering the average cost of emissions, with indirect impacts on affordability. Lastly, the expert underscored the significance of regional and sectoral flexibility in Canada's carbon pricing system, noting that subnational governments can choose to implement their own pricing policies as long as they meet minimum national stringency standards.

Expert Interventions

One expert acknowledged the success of the EU ETS in reducing emissions and noted the changing global context. The expert noted that carbon price fluctuations in the EU ETS are understandable, particularly as more renewables come online and economic factors fluctuate, but that these price fluctuations can nevertheless cause concerns around predictability for stakeholders. The expert noted that there is tension globally regarding differentiation in carbon price levels, where stakeholders have pointed out risks related to carbon leakage and deindustrialization. Subsidy-based policies that "push in the opposite direction" add to these concerns. The expert noted that price differentials also prevent the formation of clubs that include the mutual recognition of carbon pricing systems. The expert suggested how this study could help identify key parameters for recognizing and comparing different carbon pricing systems. Concerning flexibility and the use of carbon credits in the Chinese carbon market, the expert noted the EU experience with allowing international credits into the EU ETS and noted the need to pay attention to transparency as well as new requirements emerging under Article 6 of the Paris Agreement. The expert advocated for establishing a registry for carbon removals, drawing on experience from the Clean Development Mechanism (CDM). Additionally, the expert discussed the redistribution of carbon pricing revenues in Europe, mentioning the establishment of the Innovation Fund and Social Climate Fund to support lower-income EU member states. The expert indicated trends toward funding structural measures in households, such as installing solar panels or improving energy efficiency.

An expert highlighted the potential affordability impacts of carbon pricing in China. The analysis outlined how imposing a USD50 per tonne carbon price could lead to price hikes in coal, electricity, natural gas, and road fuel. The study revealed that the burden on average households' consumption would predominantly stem indirectly from increased prices for general goods and services, rather than directly from energy products. However, the expert underscored that, utilizing revenues generated from carbon pricing, which could represent over 2% of China's GDP, could alleviate roughly 85% of the burden on households. The expert compared various policy options for protecting low-income households, emphasizing the effectiveness of targeted income support while discussing the challenges and trade-offs associated with other approaches, such as broad-based income support or compensating for energy price increases. Additionally, strategies for mitigating the impact on firms' competitiveness were outlined, including revenue recycling to provide industrial rebates, tradeable emission rate standards, border carbon adjustments, or, ideally, international coordination among major emitters.

One expert highlighted three key aspects regarding the status and prospects of China's carbon market. First, he emphasized the significance of the extensive preparation China has undertaken for more than two decades, emphasizing benefits such as continuous emissions monitoring, reporting, and verification (MRV), which have improved data quality and the accuracy of emissions accounting. Second, the expert noted the robust foundation for the carbon market, which has remained resilient through transitions in environmental management in China. Last, the expert highlighted the readiness for expansion beyond the power sector, citing relaunches of programs like the China Certified Emission Reduction (CCER) and a cautious approach to methodological updates. They pointed out the potential pathways for future development, including alignment with international climate efforts in ETSs, both in response to CBAM and to leverage the market's role in China's green investments abroad and connectivity to other countries.

One expert noted that there is a large and growing body of empirical evidence (from the EU in particular)

that demonstrates that carbon pricing is effective in meeting its reduction targets. The expert emphasized that while certain studies found limited emission reductions, the policies were designed to meet these targets, although policy targets may not have been sufficiently ambitious. Regarding carbon leakage, they noted that ex-post studies have shown low levels of carbon leakage but that carbon leakage levels could increase as carbon pricing systems become more ambitious. The expert referred to the CBAM in the EU, highlighting the importance of phasing out free allocation and addressing emissions pricing discrepancies between countries. The expert stressed the need to consider emissions pricing on the margin versus on average. Referring to China's ETS, the expert discussed the incentives associated with benchmark allocations and setting appropriate levels of output-based rebates to address leakage and distributional issues. The expert noted that there are trade-offs to output-based carbon pricing approaches, including limiting conservation-based emissions cuts (by limiting cost pass-through) and limiting the incentive for dirtier sources of emissions from switching to cleaner methods/technologies with less lenient benchmarks. The expert underscored the importance of overlapping policies for renewables and the necessity of comprehensive approaches beyond just carbon pricing, including electricity sector reform and complementary climate policies.

One expert examined the factors influencing the need for flexibility in carbon pricing policies and whether they should be tailored to regional circumstances. The expert echoed the importance of situating carbon pricing within the broader context of all other policies, particularly for long-term consistency and predictability, which are crucial for investment in low-emission facilities. The expert underscored the importance of considering absolute regional welfare impacts, especially in the absence of compensation mechanisms, and highlighted the significance of sectoral and regional differences, suggesting the implementation of adjustable pricing mechanisms to address these variations. The expert noted that while price certainty is important in early market measures, quantity certainty becomes more relevant in major economies in achieving net-zero goals, thereby underscoring the importance of adaptative approaches to carbon pricing mechanisms. Additionally, the expert suggested considering tradeable performance standards to work alongside carbon pricing systems.

One expert provided insights into the Canadian carbon pricing system, addressing key issues such as predictability, affordability, and flexibility. They mentioned the minimum national price trajectory that provincial systems must meet. Post-2030 challenges include pricing certainty, the need for additional policies to meet emission targets due to trade-offs between price predictability and quantity certainty, and concerns about fairness between regions. The expert also raised concerns about political and policy certainty and market risks, such as the likely oversupply of credits in output-based pricing markets. Regarding affordability, the expert noted the focus on rebates, with rural households receiving larger rebates. Additionally, the expert addressed communication challenges, highlighting difficulties in effectively explaining the effects or concepts to the public. Finally, the importance of flexibility in the Canadian approach was emphasized, allowing tailored strategies at the provincial level without revenue transfer to other provinces. This flexibility has enabled the continuation of pre-existing systems, some based on quantity and others on price.

One expert provided insights into China's ETS flexibility and pricing mechanism. The expert discussed EDF surveys, showing expected carbon price increases to about CNY 90/$MtCO_2e$ by 2025 and CNY 130/$MtCO_2e$ by 2030. Notably, industrial and non-industrial respondents had different expectations, but survey results show that regional and national trends are aligned. Factors affecting prices, like macroeconomics and ETS design, were examined. The expert also highlighted policy influences, such as China's shift towards carbon control and the 2030 peak emissions target. Other factors mentioned were diverse products like

CCER, trading rules, and enterprise decisions on disclosure and compliance. The expert suggested research to inform the Chinese government on price control and influencing factors. Regarding flexibility, they noted a recent State Council management decree taking effect on May 1, 2024. The decree stipulates that no new local carbon emissions trading market will be implemented and excludes sectors covered by the national carbon market from local markets. The proposed research directions included learning from Canada about aligning regional and sectoral targets with national goals. Additionally, the expert discussed the importance of international initiatives and carbon markets in achieving climate targets.

One expert discussed the OECD's focus on evaluating climate change strategies across countries. The expert highlighted the OECD's efforts in compiling a comprehensive and harmonized climate policy mitigation database covering 130 policy variables in 50 countries and four sectors, allowing comparisons of policy strictness and understanding of different strategies. The expert then presented findings from these recent empirical exercises, categorizing countries into clusters based on their strategies. They noted the divergence in policy stringency across countries since 2005 and the concerns over leakage. Furthermore, the study also found that countries with more comprehensive policy mixes tend to have greater emission reductions, highlighting the importance of combining policies. The expert suggested room for research on understanding what could be a good mix of policy instruments going forward. Additionally, they mentioned the impact of policy uncertainty on firm investments, stressing the need for predictable policies to support climate action.

Discussion

One comment acknowledged the importance of including carbon pricing alongside other policies but emphasized the importance of carbon pricing. Suggestions included mutual recognition of carbon pricing systems, using evidence from organizations like the OECD to enhance discussions on CBAM. The response emphasized the gradual phase-out of free allocation under CBAM, providing time until 2030 to align carbon pricing systems for mutual recognition.

The response acknowledged the challenges of comparing the stringency or effectiveness of carbon pricing policies, particularly when extending beyond pricing policies. It referenced a new OECD initiative, the Inclusive Forum on Carbon Mitigation Approaches (IFCMA), which aims to map the stringency of various countries' mitigation strategies in greater detail.

Another commenter suggested that focusing solely on the price may not reflect the market's true impact on emissions reduction or financial channelling, particularly in the early stages of ETS implementation. The commenter suggested researching the rationale behind setting price targets and understanding the relationship between market mechanisms and price levels. In the case of China, they emphasized that the market's role in achieving climate goals is more critical than the initial price level.

Annex 2: Carbon Pricing Scoping Study Second Expert Meeting Notes

**The notes are prepared in accordance with the Chatham House Style and are intended for internal reference only; they have not been reviewed by speakers.*

Opening/Context

The speaker outlined promising developments in the global carbon pricing landscape, noting an increase of two instruments over the past year, bringing the total to 75. New mechanisms include Australia's reformed Safeguard Mechanism and Hungary's national carbon tax. Brazil, India, and Turkey are progressing towards additional systems, potentially raising global coverage from 24% to 27%, though this still falls short of the 60% goal by 2030 set by the Global Carbon Pricing Challenge (GCPC). China's planned expansion of its national ETS is seen as a significant opportunity to enhance global coverage and reduce GHG emissions. The speaker also referred to Canada's experience with carbon pricing, which has covered 80% of emissions since 2019 and is undergoing continuous and independent review and assessment to ensure the effectiveness and improvement of Canada's systems.

The speaker emphasized the importance of this collaborative dialogue for informing policymaking, with lessons anticipated for both Canada and China. The next steps involve reviewing the study's status and refining expert-led recommendations related to revenue use, price predictability, and addressing distributional impacts.

Study Updates

Emphasizing the importance of today's comments, the speaker focused on the main findings and recommendations from the study. Noting that the study reiterates crucial existing literature and case studies rather than conducting original empirical work, the speaker divided recommendations into three key groups.

First, strategic messages include positioning carbon markets as central to China's climate mitigation plan, with China likely to peak carbon emissions before 2030 and potentially by 2025, necessitating a shift towards carbon neutrality and reduction. This includes expanding the national carbon market to new sectors like aluminium, iron, steel, and cement by 2025 and updating China's NDC while preparing for the 15th Five-Year Plan.

Second, design issues involve benchmarking related to permit allocation and the shift from free allocation to auctioning, the interaction of carbon pricing with other measures such as tax measures and renewable energy and finding an optimal design for intensity-based output pricing systems considering trade-offs and specific design recommendations.

Third, effects issues cover the competitiveness and distributional impacts of carbon pricing, including on low-income households, women, and vulnerable communities. The speaker noted another working group focusing on just transition in coal-intensive provinces by exploring job changes and social safety net measures. Lastly, the speaker raised the question of whether to incorporate carbon offsets into the discussion, noting China's recent relaunch of its voluntary carbon market, which allows for the offsetting of 5% of emissions.

Experts Interventions: Moving Carbon Markets to the Policy Centre

One expert emphasized the importance of centring carbon pricing to achieve emissions reductions, noting its cost-effectiveness and potential to drive innovation if implemented with a certain and strong future price. They highlighted the necessity of increasing coverage and stringency of carbon pricing, drawing on examples from Canada, the EU, and California to illustrate practical feasibility. However, political challenges, particularly in Canada, were acknowledged, stressing the need to address these issues head-on to ensure policy durability.

The expert also discussed the importance of complementary policies to address market failures that carbon pricing alone cannot manage, citing Canadian regulations for hard-to-price emissions and support for early-stage innovations. They highlighted the impact of policy interactions on emissions reductions, noting that California's overlapping policies to lower the price have been at least implicitly a response to address political and affordability concerns. While cap-and-trade systems like California's can redistribute emissions reductions without altering the overall cap, systems lacking a hard cap, such as in Canada and China, risk flooding the market with credits, undermining carbon pricing effectiveness. The expert stressed ongoing monitoring, evaluation, and adjustment of carbon pricing systems to maintain efficacy and ensure certainty in future carbon prices.

Output-Based Performance Systems (OBPS) – What are the Trade-Offs?

One expert examined the challenges and trade-offs that the Output-Based Pricing System (OBPS) entails. They discussed the difficulties of differentiating benchmarks within and between differing sectors, particularly in Canada and China, and impacts on emission reduction incentives. This differentiation can hinder fuel-source shifting and reduce incentives for consumers to use less energy. The expert suggested removing benchmark differentiation and phasing out allocation in the long term to maximize efficiency gains and promote fair competition among energy sources.

Additionally, they noted the need for complementary policies in OBPS to ensure a smooth transition towards cleaner energy sources. They proposed implementing a renewable portfolio standard, which creates an implicit tax on electricity to fund subsidies for renewables. In China, there's a proposal to include indirect emissions prices when the trading system expands to industrial sectors, creating a price pass-through signal. However, the expert indicated that switching to a cap-and-trade system would be the most cost-effective solution.

The expert also discussed the motivations behind differentiation in China and suggested less distorting approaches. Finally, they noted that tradeable performance standards lack price transparency and price discovery compared to auctions. They recommended introducing auctioning into tradeable performance standards or adopting a consignment option for better price transparency and liquidity. This approach could also facilitate the transition toward stricter emissions caps in the long run.

Another expert discussed the strengths and shortcomings of OBPS and tradeable performance standards (TPS). They emphasized the need for these systems in the absence of low-cost substitutes to trigger demand shifts, material, and energy efficiency, and fuel switching. The OBPS in Canada was referenced to alleviate competitiveness concerns by applying higher marginal prices on a subset of product intensity while maintaining lower average costs.

However, both OBPS and TPS are data and administratively intensive. Additionally, OBPS marginal prices can quickly drop to zero if compliance credits flood the market, thereby disincentivizing transformative low-emissions projects. Unless preannounced, OBPS does not provide a clear long-term goal, which is crucial for guiding investments toward net-zero emissions. The expert noted that border carbon adjustments (BCA) could help address competitiveness concerns, allowing for broader carbon price coverage. The ultimate goal should be reflected in a robust price or reduction schedule supported by policies to expand mitigation technologies. Moreover, they proposed considering separate markets for industrial commodities with widely differing marginal prices of transformation.

For China, the expert recommended emphasizing the role of carbon pricing and complementary policies to drive innovation and commercialization. They suggested expanding carbon pricing coverage to as many sectors as possible, including both heavy and light manufacturing, supported by flexible regulations for sectors less responsive to pricing. The expert argued for leading the transition with cheap, clean electricity, which is critical for encouraging investment in full electrification. They concluded that while OBPS is suitable for varying climate policy stringency, it could eventually transition to a quantity-based instrument as part of the move toward net-zero emissions.

One expert provided insights from China's perspective on OBPS and outlined several key points. They emphasized its flexibility for economic development in developing countries like China by imposing fewer constraints on production outputs with capped allowances and maintaining incentives for emission reduction and energy efficiency. However, they also highlighted the shortcomings of free allocation, noting concerns about carbon leakage and the lack of effective control over overall emissions. To address these issues, the expert recommended regular benchmark revisions and the implementation of phased and more stringent sector-specific standards. They also advocated for transitioning to a synchronous benchmark design and a mass-based system with an absolute cap in the long term.

Regarding price predictability, they stressed improving data quality and transparency, suggesting establishing mechanisms like a market stability reserve in the short term and a carbon price index in the long term for price signals.

Lastly, the expert underscored the importance of clear policy integration and international cooperation, recognizing that carbon markets are not a one-size-fits-all solution. This includes exploring synergies, setting clear interim targets aligned with global milestones, considering broader sectoral coverage, and, in the long run, considering how China will cooperate under Article 6 to address leakage concerns after China peaks.

Revenue Uses

One expert shared insight from a comprehensive study across 20 high-income and emerging/developing countries, including Canada and China, assessing the public acceptability toward revenue use, with a focus on carbon pricing. They highlighted that while most respondents across countries recognized climate change as a significant issue requiring government action, support for carbon pricing varied depending on the proposed use of tax revenues. Specifically, policies earmarking revenue for green infrastructure or redistribution to low-income households garnered greater public support.

The expert also explained three key predictors of public support: perceptions of policy effectiveness, concerns/perceptions about inequality, and self-interest. They stressed the importance of providing clear

and accessible information about climate policies, particularly regarding carbon pricing, to address misconceptions and increase support.

Distributional Effects

One expert outlined the distributional impacts across households, sectors, and regions. Regarding household impacts, the expert echoed the necessity of strong and clear communication strategies to shape public perceptions positively. They noted the increasing relevance as China contemplates broader carbon pricing policies, such as aligning them with changes in the electricity market. They stressed the importance of early evaluation of how these policies affect different groups and regions. Drawing from Canada's experience, they cited the practice of providing differentiated lump-sum payments to different groups and using transparent communication methods like Proceeds Recycling. Additionally, they advocated for early analysis of alternative revenue utilization options, such as investments in clean innovation, to facilitate well-informed policy decisions.

Regarding sector-related impacts, the expert noted the complexities involved in setting performance standards for specific sectors and advocated for policy designs aligned with long-term clean investment objectives, including considering alternative approaches, such as BCA. But they noted that calculating carbon costs paid as they align with border fees within intensity or output-based systems could be an important area for future work.

Lastly, the expert recognized the challenges posed by differences in regional and industrial characteristics and advocated for consistent policies while allowing for some regional variation. They underscored the importance of ensuring that policies equitably address regional impacts without compromising the efficacy and fairness of emission reduction efforts.

Another expert highlighted two significant aspects regarding China's ETS and carbon pricing policies. Firstly, they discussed the potential for China to reach its emissions peak earlier than expected, citing intensified domestic efforts such as increased adoption of renewable energy and electric vehicles. They also underscored the importance of global commitments, such as the updated NDC and evolving international perspectives on climate change, which could expedite China's emission reduction goals.

Secondly, the expert explored the implications of the CBAM on China's climate strategy, noting a proactive response and evolving policy directions. They noted a potential faster-than-expected shift from intensity-based to cap-based allocation schemes, driven by the potentially expanding carbon market and observed a transition toward product-focused policies to counter CBAM impacts.

Furthermore, the expert commended China's adaptive approach to the changing carbon landscape, especially in facilitating more cooperation between developed and developing countries and the idea of redirecting CBAM proceeds to support their climate efforts. This innovative strategy reflects China's commitment to navigating the complexities of the global carbon market while addressing both domestic and international climate objectives.

Discussions

In discussions concerning market differentiation across industrial sectors with varying marginal abatement

costs, such as cement, iron, and steel, one expert proposed the creation of isolated markets for high-cost, low-emission technologies, similar to California's Zero Emissions Vehicle (ZEV) standard. This approach incentivizes early adopters by allowing over-compliance to be traded as credits, thus facilitating the transition to near-zero emissions. The expert highlighted that the initial transformation costs for sectors like cement and steel are significantly higher, making a general carbon pricing market insufficient without distorting the economy. They emphasized the need for both targeted sectoral policies and broad carbon pricing to address diverse policy challenges. Furthermore, managing the interaction of isolated markets with the broader market is crucial to ensure smooth integration as technologies mature and costs decrease.

In terms of integrating the current OBPS with a Renewable Portfolio Standard (RPS) to bridge existing gaps, experts emphasized the importance of an integrated approach that aligns policies with the overall direction of the ETS. Unlike a fixed cap, the OBPS target should be responsive to economic shifts, offering flexibility. Effective management of embodied carbon cost pass-through is essential, and flexibility in policy design, such as intensity-based caps, can mitigate macroeconomic uncertainties. While the European Market Stability Reserve (MSR) offers one solution, simpler alternatives like auction price adjustments and banking and borrowing mechanisms were proposed. Experts stressed the need for a flexible design that accommodates adjustments based on economic conditions and sector-specific requirements, ensuring effective policy implementation.

The discussion on climate data emphasized the critical importance of reliable climate data, drawing attention to initiatives by the Ministry of Ecology and Environment to enhance data quality and coverage, including the implementation of continuous monitoring systems. This data is vital for supporting climate action and ensuring the effectiveness of policy measures like the national ETS.

Additional Written Comments

One expert highlighted the varying impacts of carbon pricing revenue uses: Reducing personal income taxes boosts work incentives but may not help low-income households who do not pay much tax. Payroll tax cuts benefit low-income households with formal jobs but not informal workers. Corporate tax cuts can increase investment, mostly aiding labour but favouring the better-off. Lowering consumption taxes improves incentives and benefits low-income households, including those without formal jobs, proportionally. Public investment can efficiently aid lower-income groups if focused on essential services such as basic education, health, and infrastructure. Earmarking revenues for environmental projects is efficient if well-managed but may divert funds from better uses. Deficit reduction slightly lowers future tax needs, but household benefits it offers are more opaque than immediate tax cuts/spending increases. Universal lump-sum transfers favour the poor but lack efficiency gains. Productive revenue use can potentially reduce emissions at negative costs, though this is less likely with deeper decarbonization. Revenues are not used productively, but the overall costs of carbon pricing are positive and potentially significant.

Another expert highlighted five key issues for China's ETS: (1) Emphasizing data quality and the role of penalties, noting European experience shows data improvement is crucial. (2) Addressing the dominance of free allocation and lack of market exchanges, including the absence of a secondary market. (3) Moving toward an absolute cap while managing the potential inflation from the CCER credit market, ensuring its quantity is capped. (4) Proactively easing power market regulations to improve relations between Beijing and the provinces. (5) Extending the ETS scope to benefit from the EU CBAM, particularly by including steel and aluminium.