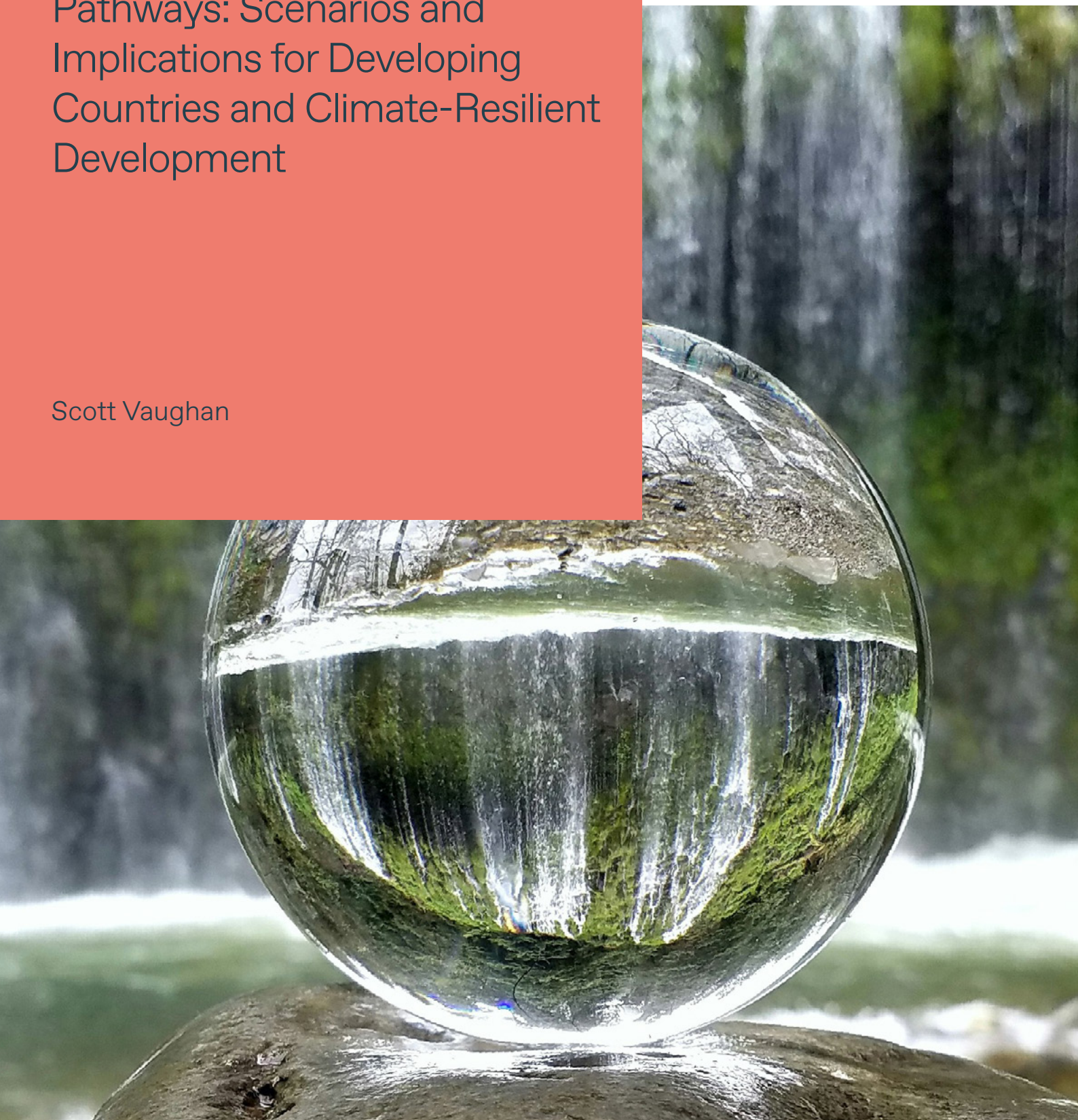


## Carbon Markets

Trade, Climate, and Net Zero  
Pathways: Scenarios and  
Implications for Developing  
Countries and Climate-Resilient  
Development

Scott Vaughan



## About TESS

The Forum on Trade, Environment, & the SDGs (TESS) works to support a global trading system that effectively addresses global environmental crises and advances the sustainable development goals. To foster inclusive international cooperation and action on trade and sustainability, our activities seek to catalyse inclusive, evidence-based, and solutions-oriented dialogue and policymaking, connect the dots between policy communities, provide thought leadership on priorities and policy options, and inspire governments and stakeholders to take meaningful action. TESS is housed at the Geneva Graduate Institute.

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## Disclaimer

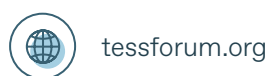
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### About This Series of Sectoral Briefing Notes

This briefing note is part of a series of sectoral notes commissioned by TESS intended to inform a final report on *Trade and climate scenarios on the road to 2050: Implications for developing countries and climate-resilient development*.

The series and the report aim to provide an overview of current and anticipated transformations in trade on the road to 2050 in the context of the unfolding climate crisis and the international community’s climate action agenda, and to discuss potential scenarios and implications for developing countries.

A wider objective of the series is to contribute to a better understanding of emerging trade and trade policy trends and dynamics and their implications within the various sectors, with a focus on supporting developing countries in identifying and advancing their climate and trade-related interests and priorities in international discussions.

The sectors covered in the series include agriculture, border carbon adjustments, carbon markets, critical minerals, digital trade, energy, fisheries, heavy industries, textiles, tourism, and transport, each authored by experts in these respective fields.

## Abbreviations

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CBAM	Carbon Border Adjustment Mechanism
CDM	Clean Development Mechanism
CFTC	Commodities Futures Trading Commission
CO <sub>2</sub> e	Carbon Dioxide Equivalent
COP	United Nations Climate Change Conference
CTE	Committee on Trade and the Environment
ETS	Emissions Trading System
EU	European Union
EU ETS	EU Emissions Trading System
GATT	General Agreement on Tariffs and Trade
NDC	Nationally Determined Contribution
OECD	Organisation for Economic Co-operation and Development
SBTi	Science-Based Targets Initiative
tCO <sub>2</sub> e	Tonnes of CO <sub>2</sub> e
UN	United Nations
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
VCMI	Voluntary Carbon Markets Integrity Initiative
WTO	World Trade Organization



# Introduction

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Carbon markets are expanding. According to the United Nations Framework Convention on Climate Change (UNFCCC, n.d.), over 100 countries have included carbon markets as a climate mitigation tool within their first set of nationally determined contributions (NDCs). Currently, 75 carbon pricing systems are in use worldwide, comprised of 50 national or jurisdiction-wide systems, and another 39 sub-federal systems, some of which overlap with national systems. One indicator of the growing impact of carbon pricing systems is the revenue generated by these systems. According to the World Bank's *State and Trends of Carbon Pricing 2024*, total revenues derived from one form of carbon markets, known as

mandatory or government-led markets, for the first time exceeded \$100 billion in 2023, reaching \$104 billion (World Bank, 2024a).

This briefing note examines three dimensions of carbon markets. Section one examines three types of carbon markets: (i) mandatory or compliance-based carbon markets, (ii) voluntary carbon markets, and (iii) emerging multilateral-based carbon markets under the Paris Climate Agreement Article 6. Section two then examines some trade-related issues, notably competitive effects of carbon markets. Section three discusses recent steps and issues facing developing countries.

## 1. Carbon Markets: Overview and Recent Trends

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### *Compliance-Based Carbon Markets*

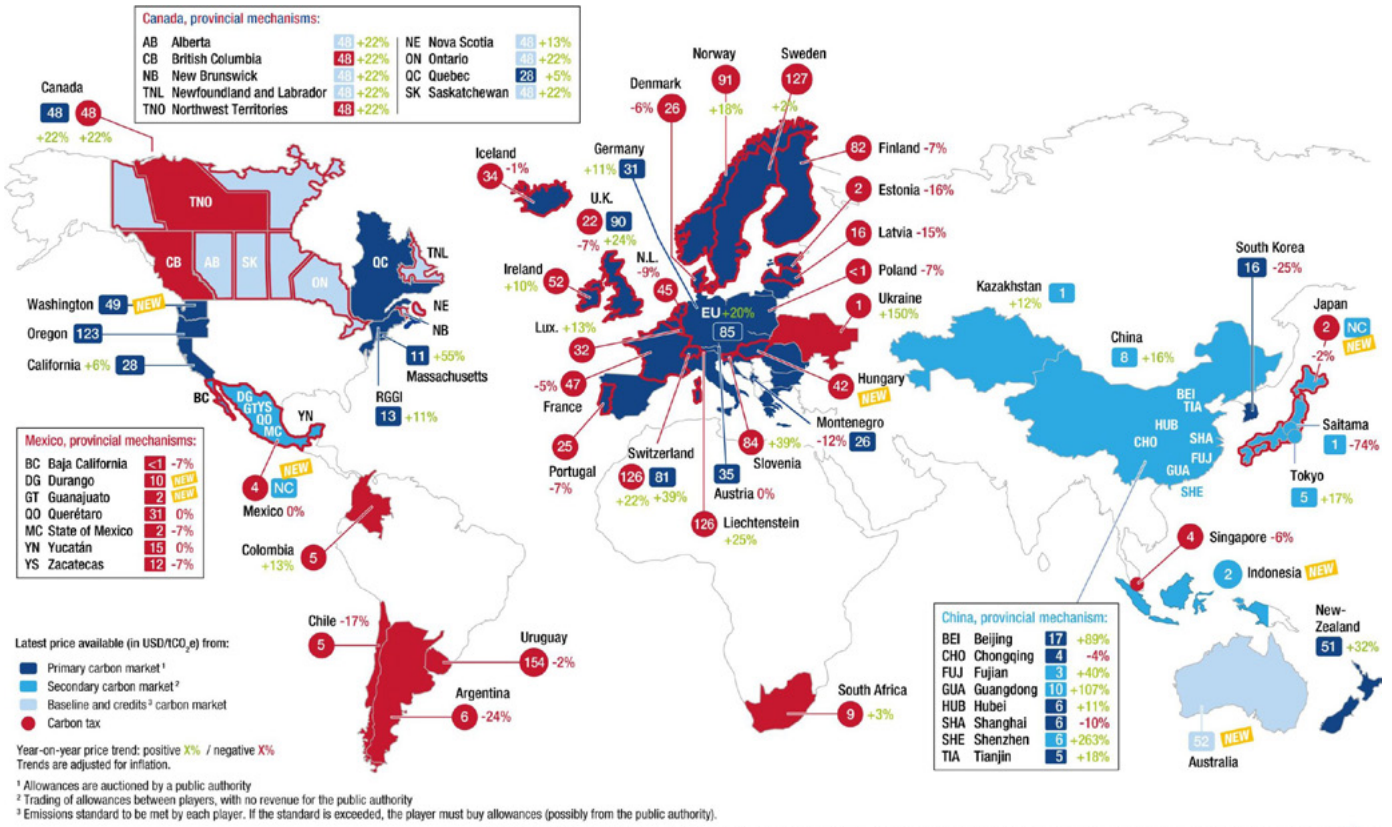
Compliance-based carbon markets fall into two general categories. The first category involves the use of carbon taxes, in which a price, charge of levy, is set for each tonne of CO<sub>2</sub> equivalent (CO<sub>2</sub>e) emitted by a firm or household covered under the tax. By putting a price on emissions, entities subject to the tax are incentivized to reduce their tax burden, starting by switching from more carbon-intensive fuel sources such as large, gas-guzzling automobiles to more efficient hybrid vehicles, or from internal combustion engines to electric automobiles, or in the case of non-transport activities, from conventional heating and cooling to rooftop solar panels and heat pumps (Parry 2019).

The second category involves emissions trading systems (ETSs). A prominent example of an ETS is known as a cap-and-trade system, in which

the government sets a total quantitative limit on emissions for a regulated sector. Each covered entity is allocated emission allowances (also known as emission permits). More efficient firms can sell their excess allowances to less efficient firms through a trading system.

There are variations of emissions trading systems, often to respond to competitiveness concerns from industrial sectors that face international competition. The free allocation of allowance permits is one way to dampen competitiveness concerns, for example, when a firm's allowance rights is calculated based on the average historical emissions of the wider sector. Other options to address competitiveness concerns include the use of emissions-intensity targets as opposed to an emissions cap, and the use output-based carbon pricing systems which function in similar ways to performance standards widely used to control air pollution.

Figure 1. Map of Carbon Pricing Systems (2023)



Source: I4CE – Institute for Climate Economics, with data from ICAP, World Bank, government officials, and public information, September 2023. ©I4CE

These two categories of carbon markets—carbon taxes and emissions trading systems—have different design features, with relative strengths in each. In general, carbon taxes provide greater certainty with regards to market price levels, since like other tax rates are set by government, but provide less certainty with regards the quantity of greenhouse gas emissions that will be reduced or avoided due to the tax. For example, the Canadian<sup>1</sup> and Irish carbon tax systems are based on an annual schedule of carbon price increases to 2030: Canada’s carbon price—currently at CAD\$80/tCO<sub>2</sub>e—will reach \$170/tCO<sub>2</sub>e in 2030. Similarly, Ireland’s carbon price is scheduled to rise by €7/tCO<sub>2</sub>e each year

until 2029, and €6.50/tCO<sub>2</sub>e in 2030, by which time it will reach €100/tCO<sub>2</sub>e. These tax schedules reduce uncertainty, thereby helping companies plan their capital investments in less carbon-intensive methods.

By contrast, emissions trading systems provide greater certainty with regards the total quantity of emissions that will be avoided or reduced, but less certainty regarding the price of emissions. For example, the allowance price of the European Union’s Emissions Trading System (EU ETS)—the world’s largest measured by revenue—the price of emission allowances has swung from nearly €100/tonne in early 2023 to around €70/tonne in the first quarter of 2024.

1. Canada’s carbon market comprises of three different elements. An escalating tax applied to different types of fuels including gasoline, aviation gasoline, heavy fuel oil and other fuels used for heating, electricity or transport (Government of Canada, n.d.); a separate system for industrial emissions, in which an Output Based Pricing System covers heavy industrial sectors like steel, mining and chemicals; and the use of an ETS system in Quebec, which is determined to be comparable or equivalent to the federal approach.

Like all other emissions trading systems, including sub-federal ETSs,<sup>2</sup> the European Commission which administers the EU ETS has deployed different tools to reduce price volatility, including setting floor prices, or reducing the supply of permits by retiring a proportion of total allowances to prevent the collapse of prices. For example, in 2021, the EU launched its Market Stability Reserve, of which the centrepiece was the backloading of as many as 900 million allowance credits in order to correct a surplus of credits attributed to a price drop (European Commission, n.d.).

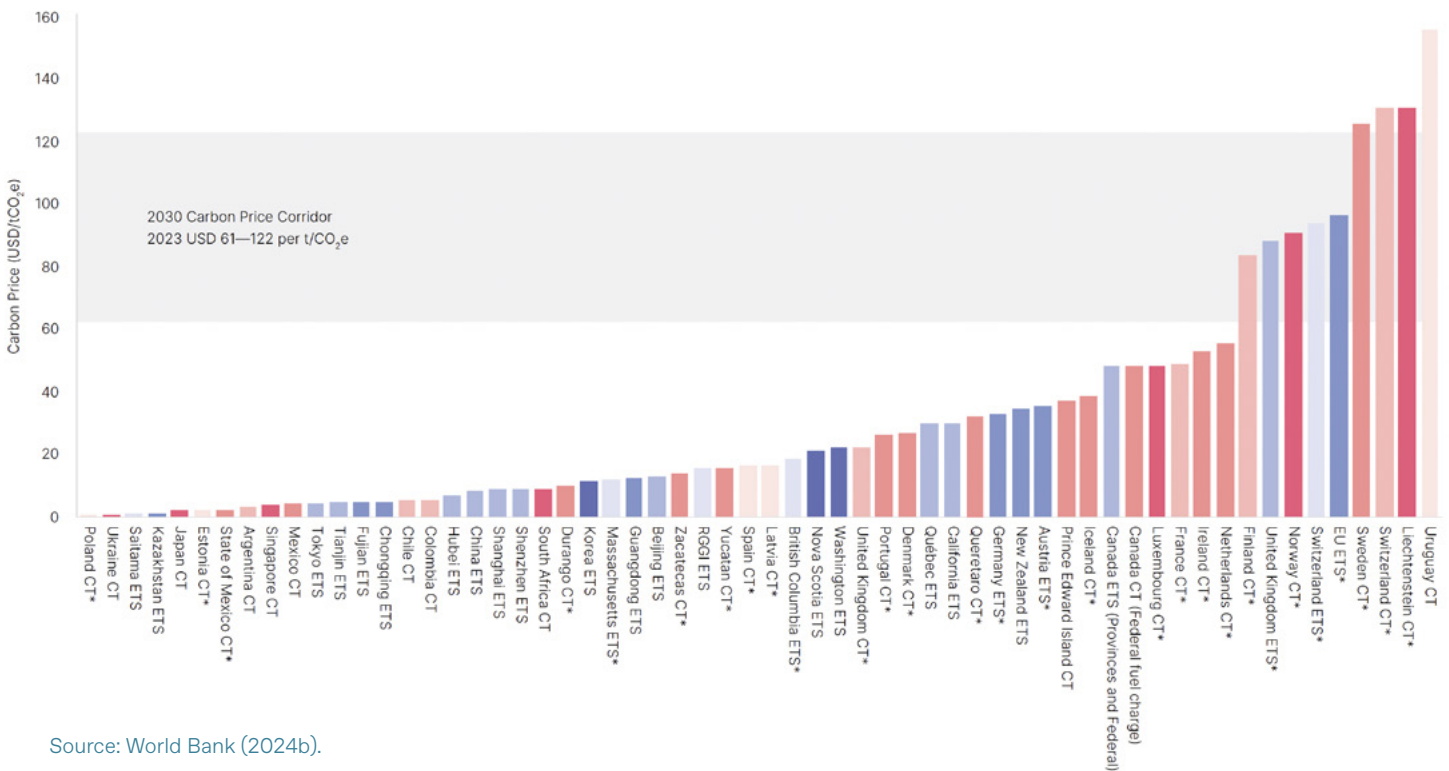
Price levels or stringency: A final word regarding compliance-based carbon markets concerns their price levels. Figure 2 shows the wide range of carbon prices. With few exceptions, current prices are too low to meet the Paris Climate Agreement. The OECD (n.d.) estimates that 58% of the approximately 40 billion tonnes of greenhouse gas emissions covered by

market measures were unpriced (by contrast, 7% of measures were priced above €60/tCO<sub>2</sub>e).

Other estimates for 2023 show 70% of all market-based measures were priced at \$20/tCO<sub>2</sub>e, well below the climate change costs (14CE, 2023). So what should price levels be to meet Paris? The 2017 report of the High Level Commission on Carbon Prices, also known as the Stern-Stiglitz report, recommended a carbon price of \$50–\$100/tCO<sub>2</sub>e (Carbon Pricing leadership Coalition, 2017), while the International Monetary Fund has recommended carbon market pricing levels reaching \$75/tCO<sub>2</sub>e by 2030 (Parry, 2021).

In general, carbon prices tend to be higher in developed countries compared to developing countries. There are however exceptions. For example, the world’s highest carbon price is Uruguay’s, at roughly \$154 tonne, while the world’s lowest price is in Baja, Mexico, at one penny a tonne.

**Figure 2. Prices and Coverage Across ETSs and Carbon Taxes**



Source: World Bank (2024b).

2. In addition to national systems, there are a growing number of sub-federal carbon markets. Precursors to China’s current national carbon market comprises eight sub-state emissions trading systems in Beijing, Shanghai, Shenzhen, and elsewhere. The Western Climate Initiative (WCI) comprises an international ETS between California, Quebec, and other sub-federal jurisdictions, while the Regional Greenhouse Gas Initiative (RGGI) comprises a cap-and-trade system for CO<sub>2</sub> involving 11 states in the United States, including New York state.

## Voluntary Carbon Markets

In contrast to the compliance systems noted above, voluntary carbon markets are private transactions, largely outside of government-regulated markets. While voluntary carbon offsets have existed for well over a decade, they grew sharply in the lead up to and following the Paris Climate Agreement, as hundreds of companies pledged to become net zero or carbon neutral.

The main tools used in these voluntary markets involve the use of carbon offsets based on forests. Science, including through multiple reports of the Intergovernmental Panel on Climate Change (IPCC), confirm that forests (and other ecosystems like peatlands) have the potential to provide up to one-third of cost-effective climate mitigation solutions to reach the Paris Climate Agreement goals. Accordingly, the premise of carbon offsets involves matching or offsetting CO<sub>2</sub> emitted by a firm with projects such as afforestation and conservation. A rough, rule-of-thumb calculation is that it can take as many as 45 trees to offset one tonne of CO<sub>2</sub>. According to the Oxford State of Carbon Dioxide Removal report, the vast majority of activities related to removing CO<sub>2</sub> are natural land-based processes led by forestry, afforestation, reforestation, and related projects (Smith et al., 2024).<sup>3</sup> Since tropical forests are the greatest source of carbon sequestration—that is, the rate at which carbon is absorbed by trees—most carbon offset projects are located in tropical developing countries.

Most market forecasts from 2015 (when the Paris Climate Agreement was signed) until late 2022 anticipated the steady growth of voluntary markets. The report of the Taskforce on Scaling Voluntary Carbon Markets (2021) captured the optimism of the time. Chaired by former Bank of England Governor Mark Carney, the report forecast a global carbon offset market set to exceed \$50 billion by 2030. Actual investments in 2021 increased by

60% by market value, reaching \$748 million in new transactions for a cumulative market value of \$6 billion by early 2022.

One of the perceived strengths of voluntary markets was their reliance on private standards as opposed to regulations. Four private, third-party certifiers—Verra, Climate Action Reserve, the American Carbon Registry, and the Gold Standards—determine the standards for private carbon offset markets in similar fashion as the Forest Stewardship Council (FSC) and other bodies set sustainable forestry standards. In addition to these four bodies, which use differing definitions and weighting criteria, there are dozens of private bodies working on net zero projections and standards, including the Sustainability Accounting Standards Board (SASB), Climate Disclosure Standards Board (CDSB), CDP (formerly Carbon Disclosure Project), International Integrated Reporting Council (IIRC), Global Reporting Initiative (GRI), Science-Based Targets Initiative (SBTi), Impact Measurement Project, and Capitals Coalition as well as international third-party certifiers. Under these, there are thousands of companies worldwide offering consulting and other support services associated with calculating and verifying carbon credits.

Practical challenges with this proliferation of private standards have included materially different criteria, definitions, and weightings, leading to standards that were not comparable or interoperable. Rather than moving towards standards convergence, private voluntary markets were dubbed the “wild west” for their lack of clarity (The Guardian, 2023). These concerns were crystalized in early 2023, when The Guardian (2023) newspaper released the results of an investigation that concluded that more than 90% of carbon offset credits issued by the world’s largest carbon credit certifier (Verra), comprised almost entirely of carbon offset projects located in tropical forests, were “worthless.” Other reviews and assessments reached similar conclusions.<sup>4</sup>

3. A tiny proportion, less than 0.1%, comes from novel or engineered carbon dioxide removal activities such as direct air capture systems, which withdraw CO<sub>2</sub> from the atmosphere, or carbon capture, utilization, and storage.
4. Such concerns were hardly new. Reviews of the integrity of carbon offset credits issued through the Kyoto Protocol’s Clean Development Mechanism (CDM) similarly uncovered exactly the same kind and degree of problems, with one review finding that 80% of all CDM credits overstated their climate mitigation effects, or were unfounded altogether.



Suddenly, the term “greenwashing”—a term long-used to describe unsubstantiated or exaggerated company claims about the environmental attributes of their products and services<sup>5</sup>—became widely synonymous with voluntary carbon markets. Other assessments pointed to similar gaps between voluntary carbon markets claims and the actual performance of carbon offset projects. A report of the United Nations’ High-Level Expert Group on the Net Zero Emissions Commitments of Non-State Entities (2022) established by the Secretary-General recommended steps to “prevent dishonest climate accounting and other actions designed to circumvent the need for deep decarbonization.”

In 2023, the Voluntary Carbon Markets Integrity Initiative (VCMI) released its Claims Code of Practice (VCMI, 2024). Subsequent work by VCMI and other bodies have tried to restore market confidence by listing higher-level principles as well as detailed procedures. At the 2023 United Nations Climate Change Conference (COP28), various private sector initiatives have taken steps to restore market confidence in voluntary markets—including the creation of a new senior advisory group by Verra (2023).

Despite these and other steps, the private sector has stepped away from voluntary carbon markets for fear that they will be associated with greenwashing. Since 2023, investments have dropped by over 60%, while the price of carbon offset credits shrank by more than 70% to \$3.50/tCO<sub>2</sub>e. An August 2024 independent scientific assessment conducted by SBTi flatly concluded that carbon offsets are “ineffective,” adding that their use could delay wider climate mitigation actions and pose legal and other risks to companies using them (Beyond Fossil Fuels, 2024).

The future of voluntary markets is therefore highly uncertain. One recent step has seen greater government oversight of these private markets, in the same way government financial bodies supervise financial markets. At COP28, the environment ministers of Austria, Belgium, Finland,

France, Germany, the Netherlands, and Spain released a statement recommending specific steps to bolster the integrity and transparency of voluntary carbon markets (Government of the Netherlands, 2023). In May 2024, the Biden White House issued principles for voluntary carbon markets, including guidance to determine additionality (White House, 2024). Also in May 2024, under the 2022 Canadian Greenhouse Gas Offset Credit System Regulations, Canada issued a new protocol covering carbon offsets derived from privately-held forests (Government of Canada, 2024). In September 2024, the US Commodities Futures Trading Commission (CFTC) introduced new guidelines aimed at more closely aligning voluntary carbon markets assurance standards with other market standards (CFTC, 2024).

The European Commission (2024b) is likely to take the most comprehensive regulatory approach. The Corporate Sustainability Due Diligence Directive sets the stage by bluntly noting that “voluntary action does not appear to have resulted in large scale improvement.” A new Carbon Removals Certification Framework proposes a new verification system for all EU-based carbon credit claims (European Commission, 2024a).

### *Paris Article 6*

A third category of carbon pricing is anchored in Article 6 of the Paris Climate Agreement. In 2015, governments agreed on the broad principles intended to enable international cooperation for climate mitigation. It took another six years of negotiations for a first set of rules to be settled, although negotiations continue to decide on critical questions such as methods covering avoided greenhouse gas emissions, that is, the technical methods such as baselines used to calculate whether an additional climate mitigation method leads to avoided or lower-than-usual emissions.

Article 6 is successor to the Kyoto Protocol, with one overarching difference: while the Kyoto Protocol set carbon emission reduction targets for developed countries only, the Paris Climate Agreement covers all

5. The European Commission conducts regular reviews of sweeps of company green claims. The most recent found Paris that 59% of green claims reviewed lacked substantiation (European Commission, 2021).

countries. The Kyoto Protocol’s Joint Implementation provision allowing cooperation between governments is succeeded roughly by Article 6.2, while the Clean Development Mechanism (CDM) has transformed into Article 6.4.<sup>6</sup> Of the two, the CDM was the main international platform for international carbon markets.

*The three Article 6 pillars:* Article 6 comprises three relatively distinct mechanisms:

- A decentralized, direct government-to-government agreement under Article 6.2 to cover bilateral carbon market cooperative agreements.
- A centralized mechanism by which governments and others propose international carbon markets that in turn are subject to the guidance and approval of the UN Article 6.4 Supervisory Body under Article 6.4.
- A third mechanism under Article 6.8 intended to facilitate non-market international carbon cooperation, including technology transfer, ecosystem services, and others.

These are briefly described below.

To date, there have been a small handful of Article 6.2 deals, all involving Switzerland as the buyer of carbon credits—known as Internationally Transferred Mitigation Outcomes (ITMOs)—with Ghana, Thailand, and Vanuatu as sellers. These early deals have covered agriculture, avoided methane emission from waste, cookstoves, and electric buses.

Article 6.2 is poised to grow. Roughly 140 pre-feasibility project agreements involving bilateral government cooperation agreements have been signed to date (Figure 3).<sup>7</sup> Most involve bilateral agreements between an OECD country (Japan is heavily engaged) and emerging economy governments on potential joint projects.

Article 6.4 continues to elaborate the principles, standards and procedures by which its Supervisory Body (SB) will review and approve carbon market deals.

The objective of Article 6.4 rule-making is to build high-integrity carbon markets and to avoid the pitfalls that have hampered the reputation of voluntary markets. Progress has been made on several issues, including accounting standards regarding how a buyer and seller can record carbon market transactions and the creation of a central electronic project registry to track all deals. As of June 2024, working groups at the 2024 Bonn UNFCCC annual meetings continued to clarify a number of technical rules related to project baselines—that is, the reference point against which forecast avoided emissions can be calculated—additionality, leakage, permanence, and the all-important rules for avoided emissions.

Work is also proceeding in creating a new sustainable development procedure, so that all Article 6.4 projects will be evaluated not only within the narrow context of carbon emissions avoided or reduced, but also in relation to how projects align with the UN Sustainable Development Goals. In May 2024, parties also adopted a new Appeals and Grievances Procedure to empower communities and vulnerable groups affected by Article 6.4 projects with legal recourse mechanisms (UNFCCC, 2024).

The third pillar of Article 6 is the least examined. Several developing countries, including Brazil, led negotiations in Paris to include non-market cooperation. Among the provisions included in Article 6.8 are references to technology transfer, climate adaptation, finance, and capacity building. Subsequent work by the UNFCCC subsidiary body identified additional cooperative areas such as payment for ecosystem services and leveraging Article 6.8 to link carbon credits with sovereign debt in so-called debt-for-climate swaps.

A long-standing concern of environmental taxes and charges has been their competitiveness effects, especially on industries and sectors that are energy intensive as well as trade exposed. This is especially pertinent with regards compliance carbon markets, in which firms are required to pay a price for carbon pollution.

6. According to UNFCCC (2018), since the CDM was launched in 2001, roughly 8,000 CDM projects were implemented, with a combined project value of roughly \$300 billion, leading to the avoidance of roughly 2 billion tCO<sub>2</sub>e.

7. The United Nations Environment Programme (UNEP) regularly updates Article 6 deals (UNEP-CCC, n.d.)

**Table 1. Bilateral Agreements and Projects Between Countries on Article 6 of the Paris Agreement**

Buying Country	Region	Sub-region	Host Country	Project	
Australia	Oceania	Melanesia	Fiji	-	
			Papua New Guinea	-	
Japan	Africa	Eastern Africa	Ethiopia	-	
			Kenya	2	
		Northern Africa	Tunisia	-	
			Western Africa	Senegal	-
	Americas	Central America	Costa Rica	2	
			Mexico	-	
	South America	Chile	3		
		Asia	Central Asia	Uzbekistan	-
	Kyrgyzstan			-	
	Kazakhstan		Mongolia	6	
			Cambodia	5	
	Eastern Asia		Indonesia	35	
			Laos	5	
			Myanmar	2	
			Philippines	5	
	Southeast Asia		Thailand	24	
			Vietnam	18	
			Southern Asia	Bangladesh	4
				Maldives	2
	Western Asia		Sri Lanka	-	
			Azerbaijan	-	
		Georgia	-		
		Saudi Arabia	1		
	Europe	Eastern Europe	United arab Emirates	-	
			Moldova	-	
	Oceania	Melanesia	Ukraine	-	
			Papua New Guinea	-	
			Micronesia	Palau	5
Kuwait	Africa	Eastern Africa	Rwanda	-	
Liechtenstein	Africa	Western Africa	Ghana	-	
Monaco	Africa	Northern Africa	Tunisia	-	
Norway	Africa	Northern Africa	Morocco	-	
			Western Africa	Senegal	-
	Asia	Southeast Asia	Indonesia	-	
Singapore	Africa	Eastern Africa	Kenya	-	
			Rwanda	-	
		Northern Africa	Morocco	-	
			Western Africa	Ghana	-
	Americas	Caribbean	Senegal	-	
			Dominican Republic	-	
		Central america	Costa Rica	-	
			South America	Chile	-
		Colombia	-		
		Perù	-		
		Paraguay	-		

**Table 1. (continued)**

Buying Country	Region	Sub-region	Host Country	Project
Singapore	Asia	Eastern Asia Southeast Asia	Mongolia	-
			Cambodia	-
			Indonesia	-
			Laos	-
			Philippines	-
			Thailand	-
			Vietnam	-
	Oceania	Southern Asia Melanesia	Bhutan	-
			Sri Lanka	-
			Fiji Papua New Guinea	- -
South Korea	Africa	Middle Africa Western Africa	Gabon	-
			Ghana	-
	Asia	Central Asia  Eastern Asia Southeast Asia	Uzbekistan	1
			Kazakhstan	-
			Mongolia	-
			Cambodia	-
			Indonesia	-
			Laos Vietnam	- -
Sweden	Africa	Eastern Africa Western Africa	Zambia Ghana	- -
	americas	Caribbean	Dominican Republic	-
	Asia	Southern Asia	Nepal	-
Switzerland	Africa	Eastern Africa	Kenya	-
			Malawi	1
		Northern Africa	Morocco	2
			Tunisia	-
		Western Africa	Ghana	9
			Senegal	4
	Americas	Caribbean	Dominica	1
			Chile	-
		South America	Peru	2
			Uruguay	-
	Asia	Southeast Asia	Thailand	1
		Western Asia	Georgia	-
	Europe	Eastern Europe Northern Europe	Ukraine	-
			Sweden	-
			Iceland	-
			Norway	-
Oceania	Melanesia	Vanuatu	1	
United Arab Emirates	Americas	South America	Paraguay	-
<b>Grand Total</b>				<b>141</b>

Note: Blank cells mean that UNEP-CCC have no knowledge of any dedicated Article 6 pilot projects between the two countries. Some countries that signed bilateral agreements do not yet publicly provide information on Article 6 pilot activities.

Source: UNEP-CCC (n.d.).



## 2. Competitiveness and Trade Issues

Different compliance carbon markets have differing sector coverage. For example, China's national carbon market currently applies to approximately 2,200 power sector facilities. That coverage is poised to expand in 2025 and beyond to include other energy-intensive, trade-exposed sectors including aluminum, steel, chemicals, and other heavy industries. The EU ETS covers CO<sub>2</sub> emissions from electricity and heat generation, energy-intensive industry sectors, including oil refineries, steel works, and production of iron, aluminium, metals, and others, aviation, and maritime transport as well as some sources of nitrous oxide (N<sub>2</sub>O) and perfluorocarbons (PFCs). France's carbon tax has varying rates for road transport, industry, buildings, and electricity, the United Kingdom's ETS covers electricity, power, and aviation operators, while Germany's includes the transportation and buildings sectors.

Governments use different design features to reduce direct and indirect competitiveness arising from carbon markets. For example, both China and Canada use output-based pricing systems, which operate in similar fashion to air pollution performance standards intended to reduce emissions as opposed to the output of a firm. The EU has relied on the free allocation of allowance permits as a main tool to address competitiveness concerns, by which the amount of emissions that a firm is allowed is calculated by historical sector-wide baselines and allocated freely to each firm. The EU's shift from a free allocation to auctioning system is one of the main triggers for their use of the Carbon Border Adjustment Mechanism (CBAM). The key rationale provided by the EU's CBAM is the risk of the offshoring of carbon-intensive producers as they seek to avoid the cost of a rising ETS allowance by moving production to jurisdictions with lower or no carbon pricing measures, also known as leakage.

Other instruments are used to address possible indirect effects stemming from carbon markets. Many compliance markets use some form of tax breaks and revenue recycling to smooth the effects on both households and regulated industries. Typically, these include tax exemptions for lower-income households, affected regions, and firms that may be disproportionately affected, such as within the coal sector. Other measures include direct tax rebates, in which firms and households receive a regular payment to cushion the effects of a compliance market. For example, under Canada's carbon tax, roughly 80% of households receive a direct carbon rebate to offset some or all of the costs of the carbon tax.

One of the most prevalent types of revenue recycling involves public financing support for innovative, next generation green technologies. Analysis by I4CE (2023) of 2023 carbon pricing systems found that 58% of total revenues were earmarked in such areas as low-carbon technology development, 32% were directed to general government revenues, and 10% were for direct and indirect transfers. Of note, the European Commission recycles annually a portion of the roughly €55 billion generated annually through its ETS to provide public financing for green technology research and development and deployment at scale. In late 2023, the European Commission awarded €3.45 billion to support 36 low-carbon projects across various sectors including cement, chemicals and others.

Other systems also use green subsidies to accelerate the discovery and deployment of net zero technologies and systems. Since many of these goods and services are in turn exported, various trade policy issues, including the scope of the World Trade Organization (WTO) Agreement on Subsidies and Countervailing Measures, may be further tested in the coming years. Trade cases involving subsidies to

green technologies began with the so-called Trump tariffs imposed on solar panels in 2018, and have expanded to include electric vehicles as a major source of trade friction.

Stepping back, discussions regarding the use of taxes have been underway for over three decades. In 1991, when the General Agreement on Tariffs and Trade (GATT) Working Group on Environmental Measures and International Trade was revived, governments examined the possible effects of environmental protection policies like taxes on GATT rules. The first mandate of the WTO Committee on Trade and the Environment (CTE), under Item 3(a), explicitly focused

on the intersection between trade policies and rules and environmental taxes and charges. The earliest CTE discussions examined the possible use of border tax adjustment, raising questions of non-product-related process methods and the challenge facing the trade regime's customs codes to differentiate like-products based on their production processes. Discussions have also examined how CBAM aligns with GATT Article II and the use of internal charges. There have been some WTO cases involving both the use of taxes for tobacco products, automobiles, and some agricultural products and for the extra-jurisdictional application of domestic environmental measures.

### 3. Opportunities and Challenges for Developing Countries

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As noted, a growing number of developing country governments have or are on track to introduce compliance carbon markets. Today, Uruguay has the world's highest carbon price, at \$154/tCO<sub>2e</sub>. Indonesia recently launched a national ETS covering the electricity sector, the Mexican states of Durango and Guanajuato recently launched carbon markets, while legislative steps are underway in Brazil. Carbon markets are also in the process of adoption in India, Malaysia, Thailand, the Philippines, Vietnam, and other jurisdictions (World Bank, 2024b).

More countries have indicated through their existing NDCs that they plan, at some point in the future, to introduce carbon markets as part of their wider climate mitigation tools. The updated package of NDCs, to be formally submitted at COP29 in November 2024, contain more ambitious climate mitigation targets involving a large number of developing countries (World Resources Institute, 2024), including Colombia, Peru, Chile, Brazil, Paraguay, Uruguay, Mexico and Costa Rica in Latin America, Kenya, South Africa, Ethiopia, Senegal, Nigeria, and others in Africa, and Indonesia, Malaysia, Thailand, Sri Lanka, and others in Asia. Following COP29, more developing countries are likely to

include within their updated NDCs more specific details with regards the intended use of carbon markets.

At the same time, this is a precarious period for many developing countries to introduce new fiscal measures in general, and climate taxes or ETS systems in particular. For many countries, the structural effects of COVID, inflation, and higher interest rates has seen the significant outflow of foreign capital coupled with higher sovereign debt servicing, which has jumped from \$99 billion annually before COVID to more than \$136 billion in 2023. A special task force recently concluded that development finance is a “disaster” (G20 Independent Experts Group, 2024)

The prospects for voluntary carbon markets as a new source of external finance for developing countries is at best unclear. In June 2024, governments of ten African countries—Burkina Faso, Cape Verde, Ivory Coast, Gambia, Guinea-Bissau, Guinea, Liberia, Mali, Senegal and Togo—signed a letter supporting carbon offsets and discounting “misguided activists” for their criticism of carbon offset markets that have been buffered by greenwashing charges (The EastAfrican, 2024). They argue that carbon offset markets

represent the single best means of attracting private climate finance to developing countries. However, the report of SBTi (2024), noted above, is significant in calling into the efficiency of carbon offset markets. Other reports, including an investigative report by the Washington Post (2024) also published in July 2024, have examined the dubious practices of private carbon market investors and brokers, noting that few actual benefits remain in developing countries while climate benefits are at best uncertain.

One alternative to these voluntary markets involves Article 6. Assuming the ongoing UN negotiations can resolve uncertainties involving the reliability, durability, and equity of international transactions, Article 6.4 in particular could be an important new source of international cooperation and transactions-based financing for developing countries.<sup>8</sup> As the successor to the UN Kyoto Protocol’s CDM, the aim of ongoing Article 6.4 negotiations is to learn both from past CDM practices as well as the current challenges facing voluntary carbon markets.

## Conclusions

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A key conclusion from the UN global stocktake adopted at COP28 is the gap between current and proposed actions to meet the Paris Climate Agreement goals and the widening climate change crisis (UNFCCC, 2023). Meeting the 2050 carbon neutrality goals will require greater ambition at scale, involving a mix of regulations, subsidies, and market-based measures likely to include the widening use of carbon markets. As domestic carbon markets

continue to expand, they are especially exposed to political economy opposition in several countries. While international carbon markets hold promise, especially to tap additional and private sector funding to developing countries, considerable work is needed to address market integrity and quality assurance concerns. As both areas of carbon markets advance, questions involving trade policy will also continue to evolve.

8. Article 6 differs from the new round of international climate financing targets to succeed the Paris target of an additional \$100 billion per year to developing countries, being held under the New Collective Qualified Goal discussions going into COP29.

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