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STATE AND TRENDS OF

carbon pricing

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Abbreviations and acronyms

ACCU	Australia Carbon Credit Unit
BP	British Petroleum
CBAM	The EU's Carbon Border Adjustment Mechanism
CCPs	Core Carbon Principles
CDM	Clean Development Mechanism
CERs	Certified Emission Reductions
CFTC	Commodity Futures Trading Commission
CO_2e	Carbon dioxide equivalent
COP28	28th annual Conference of the Parties of the United Nations Framework Convention on Climate Change
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
EMDEs	Emerging market and developing economies
ETS	Emissions trading systems
FCPF	Forest Carbon Partnership Facility
GHG	Greenhouse gas emissions
I4CE	Institute for Climate Economics
ICAO	International Civil Aviation Organization
iCRAFT	Innovative Carbon Resource Application for Energy Transition Project for Uzbekistan
ICVCM	Integrity Council for the Voluntary Carbon Market
IETA	International Emissions Trading Association
IMF	International Monetary Fund
IMO	International Maritime Organization
IPCC	The Intergovernmental Panel on Climate Change
ISDA	International Swaps and Derivatives Association
ITMO	Internationally Transferred Mitigation Outcomes
LoAs	Letters of Authorization
$MtCO_2e$	Metric tons of carbon dioxide equivalent
NDCs	Nationally determined contributions under the Paris Agreement
nECR	Net effective carbon rates
OBPS	Output-Based Pricing System
OECD	Organisation for Economic Co-operation and Development
OTC	Over-the-counter
PoAs	Programmes of Activities
REDD+	Reducing Emissions from Deforestation and Forest Degradation
RGGI	Regional Greenhouse Gas Initiative
SBTi	Science Based Targets initiative
tCO_2e	Tons of carbon dioxide equivalent
TCP	Total carbon price
T-VER	Thailand Voluntary Emission Reduction Scheme
UNFCCC	United Nations Framework Convention on Climate Change
UNIDROIT	Unification of Private Law
USD	United States dollar
VAT	Value-added tax
VCMI	Voluntary Carbon Markets Integrity Initiative
VCS	Verified Carbon Standard

Foreword

Carbon pricing can be one of the most powerful tools available to policymakers to incentivize reducing emissions as part of an integrated policy mix. A decade ago, carbon pricing policies covered only 7% of global emissions. Today, nearly a quarter are covered by these instruments.

There is some cause for optimism as carbon pricing and carbon markets continue to evolve and grow, and as new schemes and instruments are introduced that led to revenues reaching a record $104 billion in 2023. Promisingly, most of the revenues raised went towards climate and nature-related programs.

The total number of implemented instruments also went up: today, there are 75 national carbon pricing instruments in operation – with recent efforts in Australia, Hungary, Slovenia, Taiwan, China, and sub-national schemes in Mexico.

And these policies are also becoming increasingly adaptable to national contexts and new sectors. Large middle-income countries including Brazil, India, Chile, Colombia, and Türkiye are making notable progress towards implementing emissions trading schemes. While the power and industrial sectors still account for the bulk of carbon pricing coverage, there are also advances in other sectors, including international aviation, shipping, and waste. Countries such as China, Vietnam, Thailand and Singapore are also increasingly seeking complementarity between carbon pricing policies and carbon markets by including carbon crediting frameworks in their policy mixes. This approach can support domestic pricing instruments and help the carbon price signal reach uncovered sectors.

Despite the positive trends that are outlined in this year's report, higher pricing and wider coverage are going to be essential to really unlock the potential of carbon pricing. This will require political commitment, stronger global frameworks, and initiatives to share best practices that can help drive ambition. Time is not on our side as countries will need to move further, faster to decisively bend the emissions curve and safeguard a livable planet.

The Annual State and Trends report provides objective and up-to-date information on key developments in carbon pricing, reflecting our efforts to become a world-class Knowledge Bank. It is part of our overall effort to support countries worldwide to understand and develop a full range of carbon pricing policies, including through our Partnership for Market Implementation program.

I hope this year's report, like its predecessors, will inform, influence and incentivize governments, private sector partners, and civil society stakeholders to support policies that put a price on carbon and help decisively bend the emissions curve.

Jennifer Sara

Global Director, Climate Change Group, World Bank

Executive Summary

Executive Summary

Carbon pricing adoption has been limited over the past year, but there are promising signs of uptake in middle-income countries

- There are 75 carbon taxes and emissions trading schemes in operation worldwide.
- There was a net gain of two carbon pricing instruments over the past 12 months.
- Middle-income countries including Brazil, India, and Türkiye have made progress towards carbon pricing implementation.
- Implementation also progressed at the subnational level, despite some setbacks.
- Progress was observed in sector-specific multilateral initiatives for international aviation and shipping.
- The European Union Carbon Border Adjustment Mechanism commenced, requiring importers of specified products to report embedded emissions.

Carbon prices remain insufficient despite a decade of strong growth

- An implementation gap remains between countries' commitments and implemented policies.
- Carbon pricing instruments cover around 24% of global emissions. Carbon taxes and emissions trading systems (ETSs) currently being considered could lift coverage to almost 30%, but this will require strong political commitment.
- While carbon tax rates showed slight increases, price changes within ETSs were mixed with ten systems experiencing price decreases over the past 12 months, including long-standing ETSs in the European Union, New Zealand, and the Republic of Korea.
- Price levels continue to fall short of the ambition needed to achieve the Paris Agreement goals.

Carbon pricing revenue reached new highs

- Carbon pricing revenues in 2023 exceeded USD 100 billion for the first time, driven by high prices in the EU and a temporary shift in some German ETS revenues from 2022 to 2023.
- ETSs continued to account for the bulk of carbon pricing revenues.
- Over half of the revenue collected was used to fund climate- and nature-related programs.
- Despite carbon pricing revenue reaching record highs, its contribution to countries' national budgets remains low.

Emerging flexible designs and approaches reflect the adaptability of carbon pricing to national circumstances

- Governments are increasingly using multiple carbon pricing instruments in parallel to expand coverage or price levels.
- Carbon pricing is mostly applied in the power and industrial sectors, but is increasingly being considered in other sectors, such as maritime transport and waste.
- Governments continue to allow regulated entities to use carbon credits to offset carbon pricing liabilities, which can increase flexibility, lower compliance costs, and extend the carbon price signal to uncovered sectors.
- Carbon pricing continues to offer benefits beyond mitigation, including as a fiscal tool.

Carbon credit markets saw mixed movements

- Governments, particularly in middle-income countries, are increasingly including crediting frameworks in their policy mix, with a view to supporting both compliance and voluntary markets.
- Credit issuances fell for the second consecutive year. Retirements remained substantially below issuances, generating a growing pool of non-retired credits in the market.
- Compliance demand is building but voluntary demand continues to dominate.
- Prices declined across most project categories, except for carbon removal projects, signaling interest in this project category.
- Prices were more resilient in over-the-counter transactions, which allow buyers to pursue specific purchasing strategies.
- Credits with specific attributes—such as co-benefits, corresponding adjustments, or recent vintages—traded at a premium, demonstrating the value these characteristics provide buyers.

The subdued market and reduced confidence emphasize the importance of initiatives to rebuild integrity and credibility

- The integrity of carbon credits remains a critical area of concern for the market.
- On the supply side, the Integrity Council for the Voluntary Carbon Market has established a benchmark for credit quality, with the first tranche of approved credits expected in 2024.
- On the demand side, efforts have focused on the importance of reducing operational and value chain emissions and the potential role for carbon credits to address residual emissions.
- Development and implementation of Paris Agreement Article 6 continues, despite setbacks and delays.

CHAPTER 01

Introduction

CHAPTER 1

Introduction

1.1 Rapid implementation of policies to reduce emissions is critical if the world is to achieve the Paris Agreement goals

Climate change mitigation remains as critical as ever, as global greenhouse gas emissions continue to increase. Temperatures continue their relentless climb, and 2023 was the hottest year on record.[1] The latest data show that global emissions of greenhouse gases hit record highs in 2022,[2] and the concentration of carbon dioxide (CO_2) in the atmosphere hit its highest ever level.[3] Our atmosphere, oceans, and biosphere are showing rapid and widespread changes,[4] and climate-related severe weather events—including heat waves and storms in Europe, hurricanes in the United States, and flooding across Asia—brought the dangers of climate change into sharp focus in 2023.

While political commitment continues to build, more action to reduce emissions is needed. Over 90% of the 195 parties to the Paris Agreement have adopted quantified emission reduction targets,[5] and more than 95 countries have announced net zero pledges, covering over 85% of global, energy-related CO_2 emissions.[6] Collectively, if met, countries' net zero targets could limit global warming to around 2°C above pre-industrial levels.[7] In 2025 the parties to the Paris Agreement will submit new nationally determined contributions (NDCs) for 2035, and they are expected to reflect an increase in ambition. However, on the whole, countries' mitigation policy instruments are insufficient to meet current NDCs.[8] Policies currently in place are projected to result in global emissions in 2035 that are 36% higher than the level consistent with limiting warming to 2°C, and 55% higher than the level consistent with limiting warming to 1.5°C.[9] Immediate and sustained focus on the implementation of new policies is vital. Carbon pricing instruments have a critical role to play in addressing this implementation gap, as they can incentivize change across economies—promoting decarbonization and improving efficiency—and can be adjusted to align with increasingly stringent targets over time.

A subdued global economic outlook makes for a challenging environment for economic reform.[10] Restrained growth in advanced economies is expected to continue in 2024, while growth in emerging market and developing economies (EMDE) is split. EMDEs with solid fundamentals (e.g., strong credit ratings and moderate debt) are set for growth close to pre-pandemic levels, but others face a more uncertain outlook.[11] While the economic outlook is better than many anticipated following the COVID-19 pandemic and recent energy crisis, 2024 is expected to be the third straight year of slowing global economic growth, following a sharp decline in 2022. Inflation remains an issue around the world, in particular for low- and middle-income economies.[12] Going forward, governments will face difficult choices about where to allocate resources. This includes balancing efforts to address short-term challenges that underpin public acceptance, like cost of living and recession risks, and tackling pivotal long-term issues like climate change, poverty, and income inequality.

Immediate and sustained focus on the implementation of new policies is vital.

Governments progressed a range of climate mitigation policy approaches during 2023, but an implementation gap remains. Large, high-income economies looked to industrial policy reform to boost the green transformation. In the United States, the Inflation Reduction Act marked its first anniversary with announcements of USD 110 billion in new private sector clean energy manufacturing investments.[13] Similarly, the EU is developing the Net Zero Industry Act to support the delivery of affordable, reliable, and sustainable energy. The full impact of these approaches will take time to be realized. Governments continue to support the decarbonization of vehicles and the power sector through phaseouts of internal combustion engines and limiting new fossil fuel power generation (including Colombia, Panama, and Morocco's announcements during 2023 to phase out coal).[14] As of COP28, 24 countries have set zero-emission vehicle standards and more governments are adopting policies to deliver on these goals. In 2023, the EU adopted legislation requiring the sale of only zero-CO_2 emission vehicles starting in 2035.[15] The commencement of reporting obligations for the EU's Carbon Border Adjustment Mechanism (CBAM), which seeks to level the playing field on carbon pricing for emissions-intensive trade-exposed goods, also occurred in 2023. These developments come alongside positive trends in the deployment of renewable energy. Global capacity surged by about a fifth over 2023,[16] and renewable generation including hydro electricity is expected to overtake coal as the world's largest single source of electricity by early 2025.[17] Notwithstanding these developments, it is clear that an implementation gap remains, which requires continued progress across the climate policy portfolio, including comprehensive carbon pricing.

Carbon pricing is a critical part of the policy mix needed to both meet the Paris Agreement goals and support low emissions growth. Global initiatives including the Global Carbon Pricing Challenge (initiated by Canada), the International Carbon Action Partnership, the Coalition of Finance Ministers for Climate Action, the World Trade Organization-led task force on carbon pricing, and the World Bank's own Partnership for Market Implementation continue work to support international cooperation on the development and implementation of carbon pricing around the world. Major progress on potential domestic emissions trading in Brazil and Türkiye occurred in 2023, and existing systems across Asia, North America, and Europe continue to operate, generating record levels of revenue during 2023 despite challenging economic conditions. Efforts to implement international carbon credit markets under Article 6 of the Paris Agreement continue, despite COP28 not reaching decisions on these provisions. With this delay, it appears that voluntary demand will continue to drive carbon credit market activity. However, concerns about voluntary carbon market credibility and questions regarding the role of the credits to support corporate action have dampened momentum. This has emphasized the importance of supply, demand, and market integrity and underscores the role of initiatives currently underway to restore trust and confidence in carbon credit markets.

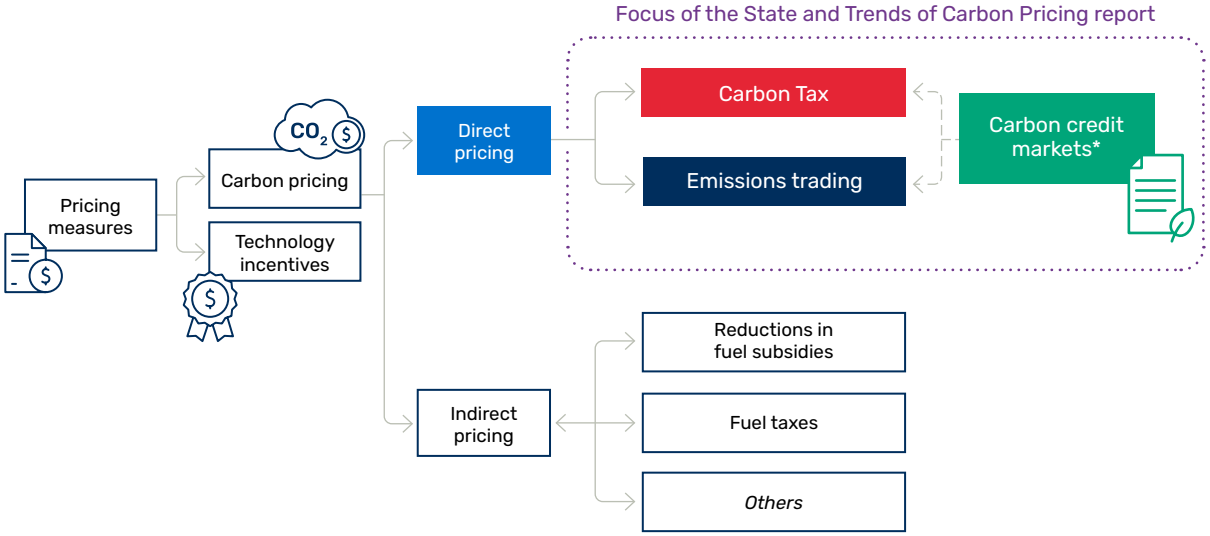
Carbon pricing is a critical part of the policy mix needed to both meet the Paris Agreement goals and support low emissions growth.

1.2 Scope of the State and Trends of Carbon Pricing report

This report focuses on the direct pricing of greenhouse gas emissions through carbon taxes, emissions trading systems, and carbon crediting mechanisms. Direct carbon pricing drives climate action by providing an incentive to reduce emissions. Figure 1 illustrates how these measures fit into the pricing policy ecosystem, and Box 1 highlights the importance of understanding the price signal provided by indirect carbon pricing policies. This year's report covers direct carbon pricing, with a focus on developments between April 2023 and April 2024. Chapter 2 of the report explores trends in carbon taxes and emissions trading systems around the world. Chapter 3 analyzes carbon credit markets and mechanisms, and chapter 4 summarizes key takeaways from this report.

FIGURE 1

Pricing policy ecosystem and report scope



* As highlighted in Box 2, carbon credits can be used for voluntary or compliance purposes. Figure 1 illustrates the interaction between carbon credit markets and domestic compliance markets (ETSs and carbon taxes) whereby carbon credits can be used to offset price liabilities.

BOX 1

Looking beyond direct carbon pricing

By incorporating social costs (i.e., damage caused by greenhouse gas [GHG] emissions) into economic decision-making, carbon pricing is a critical policy intervention that can help address climate change and provide broader environmental, fiscal, and social benefits. Pricing can be implemented through a range of instruments with a spectrum of policy designs to meet domestic objectives and circumstances. This report focuses on direct carbon pricing, particularly emissions trading systems (ETSs) and carbon taxes, which impose a cost expressed as a monetary unit per ton of carbon dioxide equivalent (tCO_2e). Anchored by the polluter pays principle, which states that those responsible for generating pollution should bear its costs, in direct carbon pricing the cost is reflected through the supply chain in the relative prices of products and services.

While there is an advantage to pricing carbon consistently and directly in proportion to the GHG emissions generated by a given product or activity, indirect carbon pricing policies also influence the price signal.[18] The most obvious examples of indirect carbon pricing are fuel excise taxes and fossil fuel subsidies, which increase and decrease the net carbon price signal respectively. Accordingly, these fiscal policies provide a carbon price signal, even though they are often primarily adopted to achieve other (non-climate mitigation) objectives, such as raising revenue or financing road infrastructure. For example, fossil fuel subsidies can dilute the price signal provided by an ETS or a carbon tax. This is particularly important given their prevalence and magnitude globally, with the International Monetary Fund (IMF) estimating that explicit fossil fuel subsidies were around USD 1.3 trillion in 2022, which dwarfs the amount of revenue collected from carbon taxes and ETSs.[19] Phasing out fossil fuel subsidies, where they exist, is an essential step toward implementing effective carbon pricing. At the same time, opportunities exist to reform existing tax systems, such as fuel excise taxes, to better address the unpriced carbon externality. For instance, by broadening the fuels covered and/or aligning their rates with the carbon content of the fuels, these indirect carbon prices could leverage existing tax frameworks to apply a strong and consistent price signal. Implementing carbon pricing by reforming existing fiscal frameworks can minimize the strain on administrative capacity while improving environmental incentives and boosting government revenue.

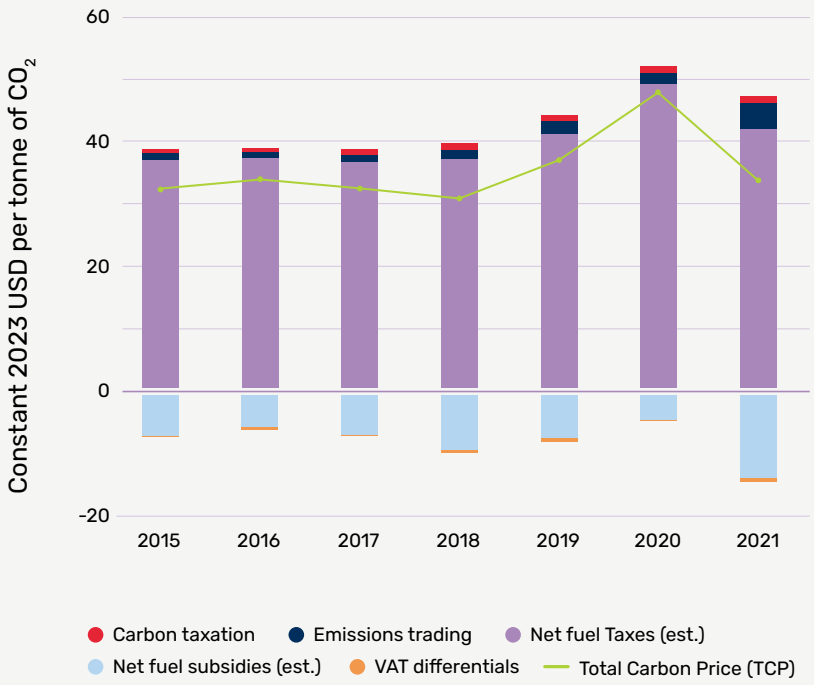
Broader carbon pricing metrics confirm the need for increased ambition in carbon pricing levels and coverage. The Organisation for Economic Co-operation and Development (OECD) has been instrumental in developing a holistic carbon pricing metric. In 2022, the OECD published its net effective carbon rates (nECR), which incorporate indirect (which OECD terms "implicit") carbon pricing (by way of fossil fuel taxes and subsidies) in addition to direct ("explicit") carbon pricing. The nECR provides a comprehensive bottom-up estimate for 71 countries for two years: 2018 and 2021. To complement this effort, the World Bank has developed an approach for estimating a total carbon price (TCP), which is similar in concept to the OECD's nECR, but includes value-added tax (VAT) differentials[i] and applies a top-down approach, using IMF data, to infer the existence of a net positive or negative carbon price. While a top-down approach reduces the granularity provided by a detailed bottom-up approach, it allows for a significantly broader application, with a time horizon of up to 30 years and covering over 140 countries, including many lower-income countries. More comprehensive carbon pricing metrics (like nECR and TCP) aim to shed light on the broader carbon price incentives within an economy. Importantly, these metrics (like direct carbon pricing metrics) do not intend to measure the level of mitigation efforts, particularly because they do not account for non-pricing policies (such as technology mandates or energy efficiency

[i] VAT differentials occur where the VAT rates on fossil fuels are below the standard VAT rate.

standards). Other measures are available to help estimate and compare mitigation effort, including "converting" mitigation policies into a carbon pricing equivalent. However, there are challenges with converting non-pricing policies, largely because they are not primarily aimed at internalizing the social cost of emissions and such conversions cannot easily account for the role these policies provide in addressing other market failures and barriers. This includes, for example, support to ensure cost-effective mitigation technologies are accessible and investments to improve public infrastructure, which can improve the effectiveness and efficiency of carbon pricing. For example, promoting access to public transport systems can significantly increase the price elasticity of transport emissions.[20] Figure 2 provides a summary of the global total carbon price since 2015 using a combination of collected and estimated data. It highlights the influence of fuel taxes on the carbon price incentive, but also the negative impact of fossil fuel subsidies. These more comprehensive metrics, as well as others, such as the IMF's effective carbon price,[21] provide a consistent overarching message: existing carbon price incentives, even if they include indirect carbon pricing, are insufficient to deliver the transformational changes needed to meet the Paris Agreement goals.

FIGURE 2

Global total carbon price for the period 2015-2021 (USD 2023)



Source: World Bank estimates based on the total carbon price working paper, [a]drawing on International Energy Agency energy balances for fuel consumption and on IMF fossil fuel subsidies data for fuel prices.

Net fuel taxes and net fuel subsidies are complementary components. The TCP infers the presence of a net fuel tax or net fuel subsidy, based on the IMF's price-gap approach.[b] A net fuel tax reflects where supply costs are lower than retail prices, while a net fuel subsidy reflects where supply costs are higher than retail prices.

[a] Paolo Agnolucci, et al., "Measuring Total Carbon Pricing," *The World Bank Research Observer*, September 27, 2023, https://doi.org/10.1093/wbro/lkad009
[b] Ian Parry, S. Black, & N. Vernon. "Chapter 6 Measuring Fossil Fuel Subsidies—A Global and Country View." In Data for a Greener World: A Guide for Practitioners and Policymakers. USA: International Monetary Fund. April 2023, from https://www.imf.org/en/Publications/Books/Issues/2023/04/04/Data-for-a-Greener-World-A-Guide-for-Practitioners-and-Policymakers-522462

CHAPTER 02

Carbon taxes and emissions trading systems

CHAPTER 2

Carbon taxes and emissions trading systems

While positive progress on carbon pricing continues on many levels, more is required to meet the goals of the Paris Agreement. The number of carbon taxes and emissions trading systems (ETSs) now stands at 75 globally. Middle-income countries and subnational governments are increasingly considering and implementing carbon taxes and ETSs. Over the past 12 months, progress was made on sector-specific multilateral initiatives for aviation and maritime emissions, and the EU Carbon Border Adjustment Mechanism (CBAM) entered into operation. Despite this progress, the level of global emissions covered by carbon pricing is unlikely to reach 30% in the short term. Changes to carbon price levels show a mixed picture, with some instruments experiencing increases and others decreases over the past year, but prices in most jurisdictions remain below the levels required to meet the Paris Agreement goals. Revenues in 2023 increased slightly compared to 2022, passing the USD 100 billion threshold for the first time. Governments are exploring opportunities to cover nontraditional sectors like maritime transport and waste, implementing multiple carbon pricing instruments in parallel, and pursuing their own individual approaches to the use of carbon credits to offset carbon pricing liabilities.

The number of carbon pricing instruments in operation worldwide is now 75.

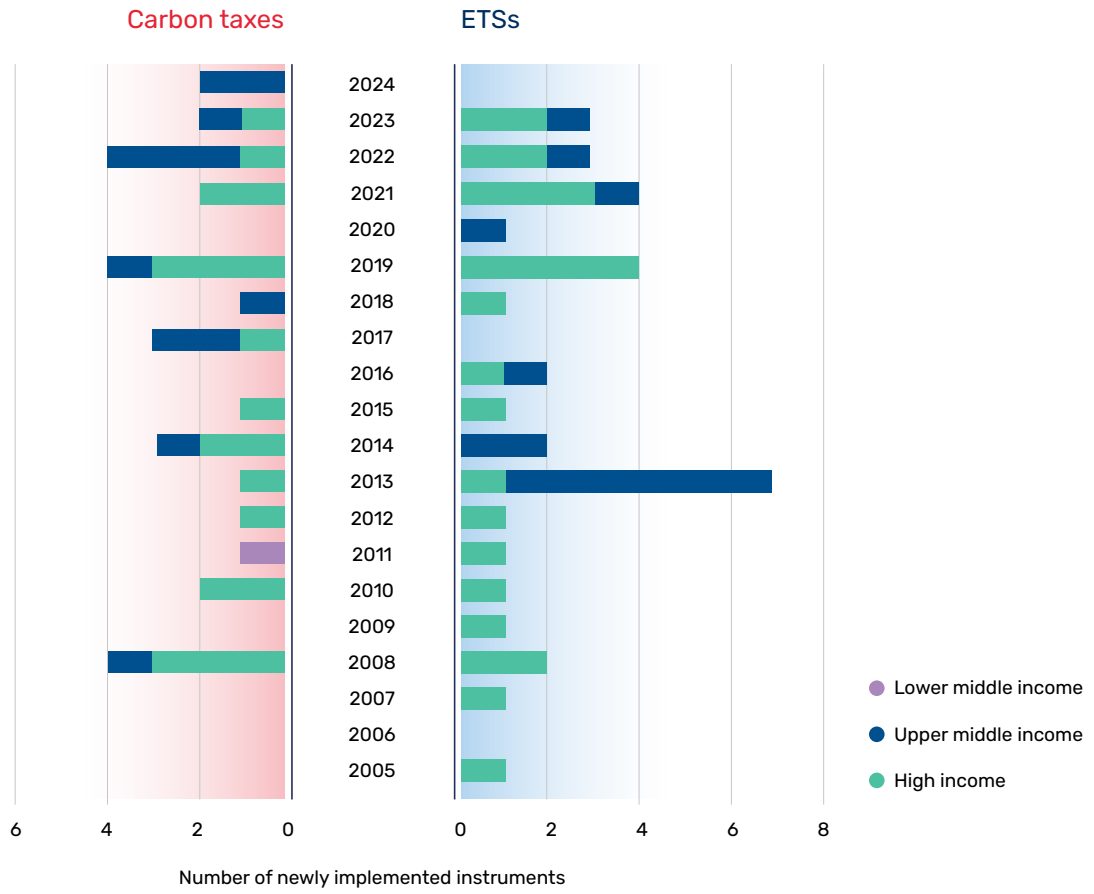
2.1 Carbon pricing adoption has been limited over the last year, but there are promising signs of future uptake in middle-income countries

Carbon pricing continues to be implemented in new jurisdictions, albeit at a slow pace. The number of carbon pricing instruments in operation worldwide is now 75—a net gain of two since April 2023 (Figure 4). There are now slightly more carbon taxes in operation than ETSs. (39 taxes versus 36 ETSs). Newly implemented instruments include Australia's reform of its Safeguard Mechanism, which aligns its ambition with the country's Nationally Determined Contribution and transformed it into an intensity-based ETS, and Hungary's new carbon tax, which applies to EU ETS participants receiving at least half of their allowances for free. Slovenia reinstated its carbon tax while new carbon taxes were introduced in Taiwan, China, and the Mexican state of Guanajuato. In addition to the new mandatory instruments listed previously, Japan created a new voluntary ETS, the GX ETS, which has been operational since October 2023 and is expected to transition into a mandatory ETS in 2026. Consolidation in Canada saw the cessation of individual provincial carbon taxes in New Brunswick, Newfoundland and Labrador, and Prince Edward Island, where the Canadian federal fuel charge now applies.

Carbon pricing gained momentum in middle-income countries. Indonesia launched its ETS for coal-fired power plants in the beginning of 2023.[22] Türkiye announced at COP28 that it plans to launch the two-year pilot phase of its ETS for the energy and industry sectors in October 2024 once the enabling legislation is in effect.[23] Market operations are due to commence early in 2025. India adopted the legal basis for a carbon market (including an ETS) in 2022, and it established the institutional framework for the system over the past year, outlining roles and responsibilities of the different governing authorities. The intensity-based ETS will build on an existing scheme for energy efficiency in emission-intensive industrial sectors, with the potential to evolve into a compliance carbon market.[24] Legislation that would create an ETS with a pilot phase toward the end of the decade is under consideration by Brazil's Congresso Nacional.[25] Argentina is considering the establishment of an ETS for the energy sector. The initiative was first considered as part of an omnibus law, which introduced a broader package of economic reform measures.[26] Efforts for other ETSs in Latin America are also underway, including in Chile and Colombia. Figure 3 shows the number of carbon taxes and ETSs entering into force each year since 2005 and the continued momentum for both instruments in middle-income countries throughout the past decade.

FIGURE 3

ETS and carbon tax uptake by countries' income group over time (2005-2024)



Year of implementation is based on month and year the instrument was originally implemented.

Despite some setbacks, there is steady momentum for carbon pricing at the subnational level. Half of all carbon pricing instruments established over the last three years were at a subnational level. Mexico had five subnational systems in 2022 and is expected to have eight by the end of 2024 (see details in Table 1), reflecting states' continued interest in carbon taxes as a new source of revenue. The Malaysian State of Sarawak passed legislation to introduce a carbon tax aimed at reducing emissions and promoting carbon capture and storage.[27] Subnational carbon pricing in Canada saw a consolidation with the federal carbon pricing backstop now being applied in an additional four provinces. In the United States, a number of states suspended or withdrew from carbon pricing, while other states made progress to enact new or expand existing carbon pricing instruments.

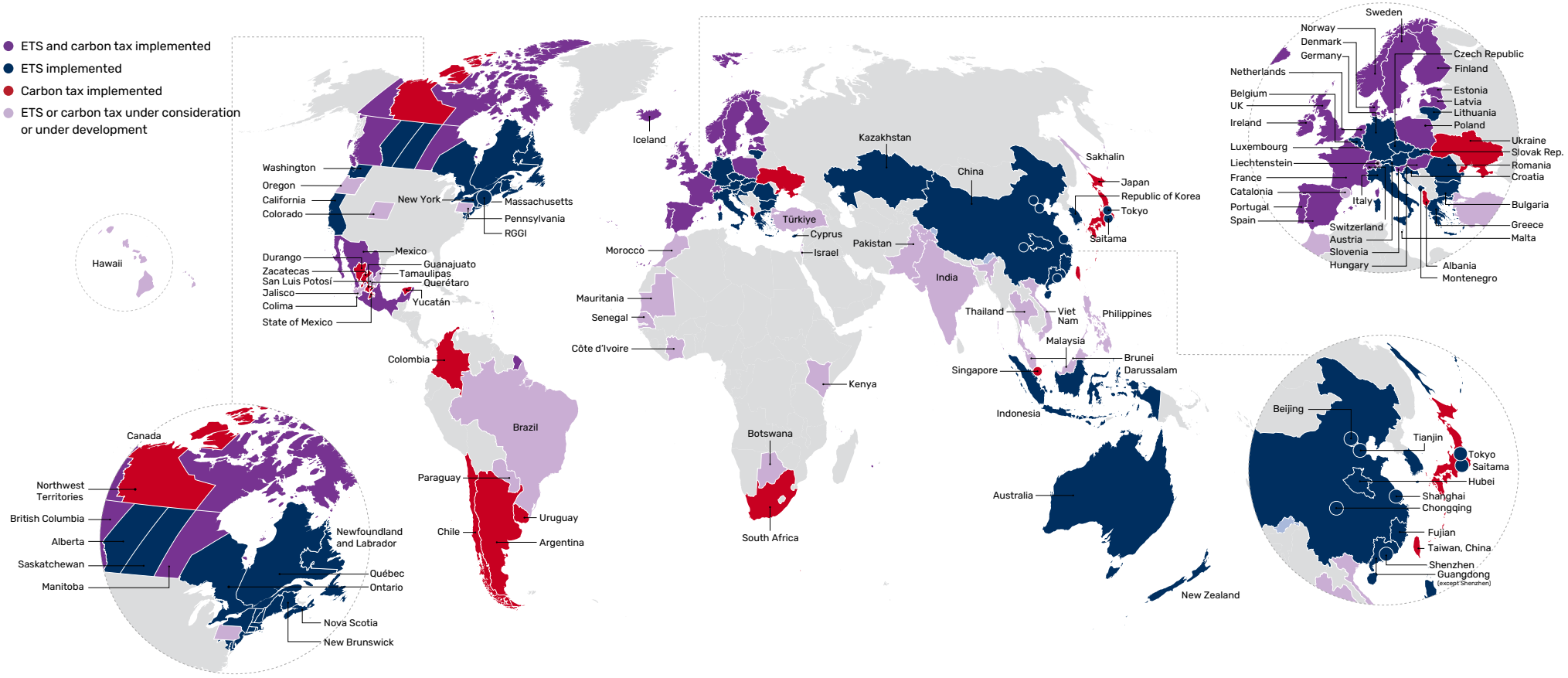
TABLE 1

Key carbon pricing developments at the subnational level in the past year

Canada	
Nova Scotia, New Brunswick, Prince Edward Island, Newfoundland and Labrador	Opted to apply the federal levy as an alternative to reforming their provincial systems.[28]
British Columbia	Increased the scope of its ETS to comply with federal regulation.
Malaysia	
Sarawak	Passed legislation for the introduction of carbon pricing policies to support the achievement of net zero by 2050. Industrial emitters passing mandatory emission-intensity benchmarks will become subject to a carbon tax.[29]
Mexico	
Tamaulipas	Plans to reinstate its carbon tax in 2024 after the Mexican Supreme Court declared the constitutionality of the instrument.[30]
Guanajuato	Introduced its carbon tax in the past year.[31]
Durango	The tax entered into force in 2024 after being introduced to the legislation in 2023
San Luis Potosí	Plans to introduce its carbon tax have been delayed until June 2024.[32]
Colima	Is considering introducing a carbon tax. [33]
United States	
Colorado	ETS will enter into force in December 2024 with an expanded scope covering 18 industrial facilities in addition to the four that were originally covered by the program.[34]
State of New York	Advanced the development of an economy-wide cap-and-invest program.[35]
RGGI/Maryland	Is considering an economy-wide program for industrial sector emissions in addition to power sector emissions, which are already covered under the Regional Greenhouse Gas Initiative (RGGI).[36]
RGGI/North Carolina, Virginia, Pennsylvania	Decided not to join the RGGI, withdrew from the process, or court ruling on withdrawal is pending.[37]
Oregon	Actively developing regulations to reinstate the Carbon Protection Program, including an ETS, after the Oregon Court of Appeals invalidated it in December 2023.[38]

FIGURE 4

Map of carbon taxes and ETSs

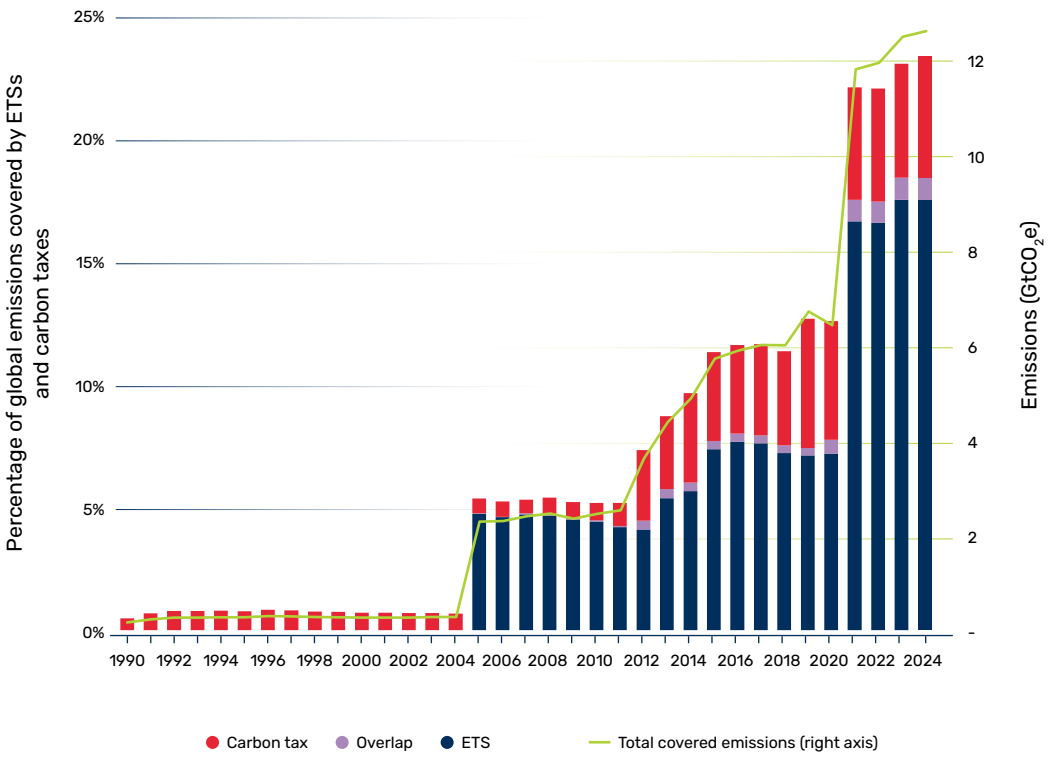


Instruments "under development" are where a government is actively working toward the implementation of a carbon pricing instrument and this has been formally confirmed by official government sources. This includes, for example, where a mandate has been established, but regulated entities do not yet face compliance obligations. If a government has announced its intention to work toward the implementation of a carbon pricing instrument and official government sources formally confirm that intention, the instrument is "under consideration." For those countries with multiple instruments that have both "under development" or "under consideration" and "implemented" instruments, the map will show the status of the latter. The status of instruments in subnational jurisdictions is also reflected in the map.

A stable share of global GHG emissions covered by carbon taxes and ETSs masks a number of important changes. As of April 1, 2024, ETSs and carbon taxes in operation covered almost 13 gigatons of carbon dioxide equivalent, around 24% of global GHG emissions. While the share remained largely unchanged over the past year, the level of covered emissions rose by over 400 million metric tons of carbon dioxide equivalent ($MtCO_2e$) in 2023 (see Figure 5).[39] This includes additional emissions covered by Australia's new ETS as well as new (and reinstated) carbon taxes at the national and subnational levels across other countries. While newly implemented and expanded carbon pricing instruments increase the share of global covered emissions, this effect can be reduced, or potentially reversed, as carbon pricing instruments deliver on their objective of reducing emissions. Indeed, for many jurisdictions the level of covered GHG emissions declines over time. This is demonstrated, for example, by a declining cap in an ETS. This is expected, given that the intended purpose of carbon pricing is to drive down emissions. All other things being equal, the presence of a successful carbon pricing policy will reduce emissions, which results in a declining share of globally covered emissions. For instance, emissions in the EU, California, and South Africa have been steadily decreasing since the introduction of carbon pricing instruments in those jurisdictions.[40] The "Fit for 55" reforms to the EU ETS provide a good example of how policy changes to increase ambition can either decrease or increase covered emissions. The EU ETS scope was expanded to include maritime transport in 2024, increasing coverage (and the ETS cap) by 78 $MtCO_2e$. At the same time, to increase the level of ambition reflected in the EU ETS, the cap was reduced by almost 180 $MtCO_2e$. While both of these policy changes reflect an increase in ambition, they have opposite effects on the level of covered emissions.

FIGURE 5

Global GHG emissions covered by ETSs and carbon taxes



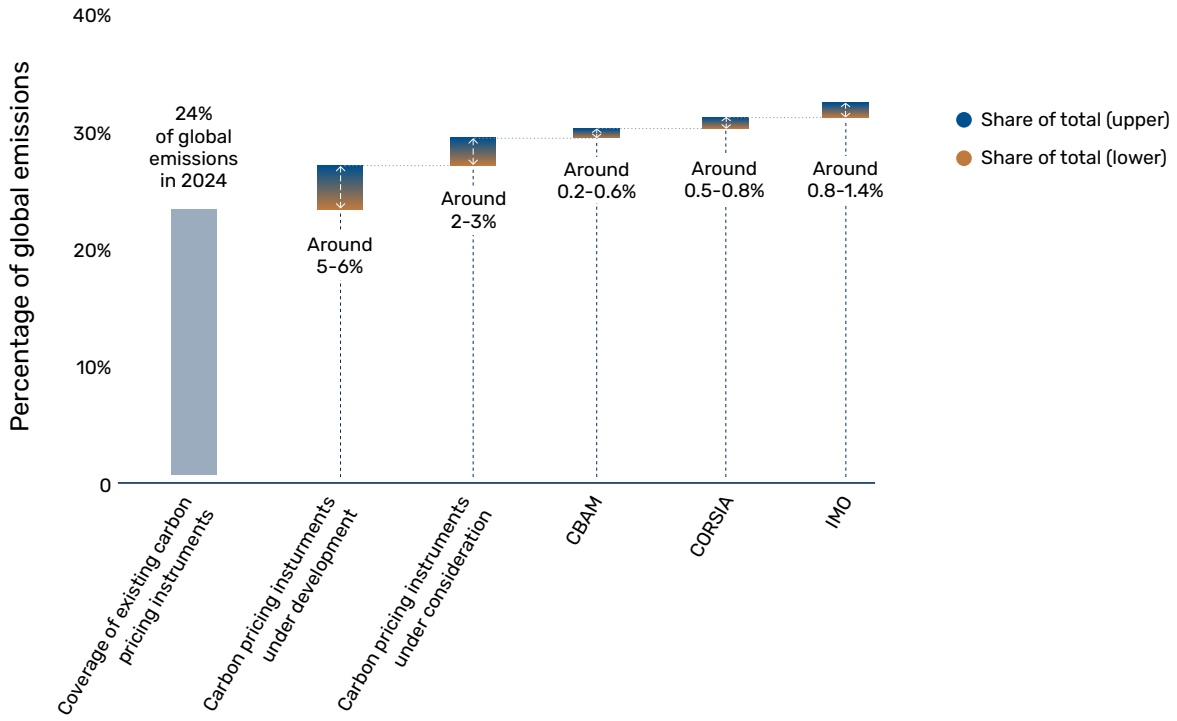
Carbon taxes and ETSs currently being considered would boost global coverage, but are unlikely to exceed 30% in the short term. ETSs currently under consideration and development in Brazil, India, and Türkiye could cover approximately 3% of global GHG emissions based on current emissions profiles and depending on final coverage rules. Therefore, even with the implementation of carbon pricing in these large and strategically important economies, global emissions coverage may remain under 30% in the near future. This highlights the level of ambition and scale of action required to meet the Global Carbon Pricing Challenge, which was announced at COP26 with a goal of covering 60% of global GHG emissions by 2030. Higher coverage levels (i.e., covering a larger portion of the economy) in existing or planned instruments can also help achieve this goal. However, there are often practical limits on policy coverage. For example, even a broadly applied ETS like the Washington Cap-and-Invest Program, which applies to the power, industry, building, and transport sectors, only covers around 70% of Washington State's emissions.

The commencement of the EU Carbon Border Adjustment Mechanism represents a significant shift in the global carbon pricing landscape, adding a strong driver for carbon pricing. The EU CBAM is designed to apply a direct carbon price on imports that is equivalent to the EU ETS. This is intended to level the carbon pricing playing field between domestic producers covered by the ETS and producers in countries that export to the EU. It does this by effectively applying a carbon price to emissions embedded in imports of covered goods. Based on the current scope of the EU CBAM, this represents between 0.15% and 0.6% of global emissions (see Figure 6).[41] The transitional phase of the EU CBAM started in October 2023, requiring EU importers to report the embedded emissions of products including specified imports of iron and steel, aluminum, hydrogen, fertilizers, cement, and electricity. The European Commission has highlighted the potential to expand the CBAM to other industrial products in Article 30 of the CBAM Regulation. Payments will be required from 2026, which has spurred governments to consider implementing carbon pricing to reduce potential CBAM costs. Countries including India, Indonesia, Morocco, Türkiye, Ukraine, Uruguay, and Western Balkan countries, have implemented, adjusted, or are considering implementing direct carbon pricing to reduce CBAM compliance costs and to capture revenue that would otherwise be paid to the EU.[42] Australia, Canada, and Japan are also weighing the implementation of their own domestic border carbon adjustments.[43] The UK has announced it will introduce a CBAM with a scope broadly comparable to the EU's in 2027.[44] Without due consideration, the introduction of new reporting requirements to facilitate border carbon adjustments (or other measures mandating reporting or certification) can increase administrative and transaction costs. This could unintentionally restrict participation in global markets, particularly for smaller or less sophisticated businesses. This risk can be minimized by streamlining and harmonizing reporting requirements to minimize costs and avoid imposing unintentional barriers to trade.

Australia, Canada, and Japan are also weighing the implementation of their own domestic border carbon adjustments.

FIGURE 6

Indicative estimates of the potential GHG emissions covered by different carbon pricing instruments and international initiatives

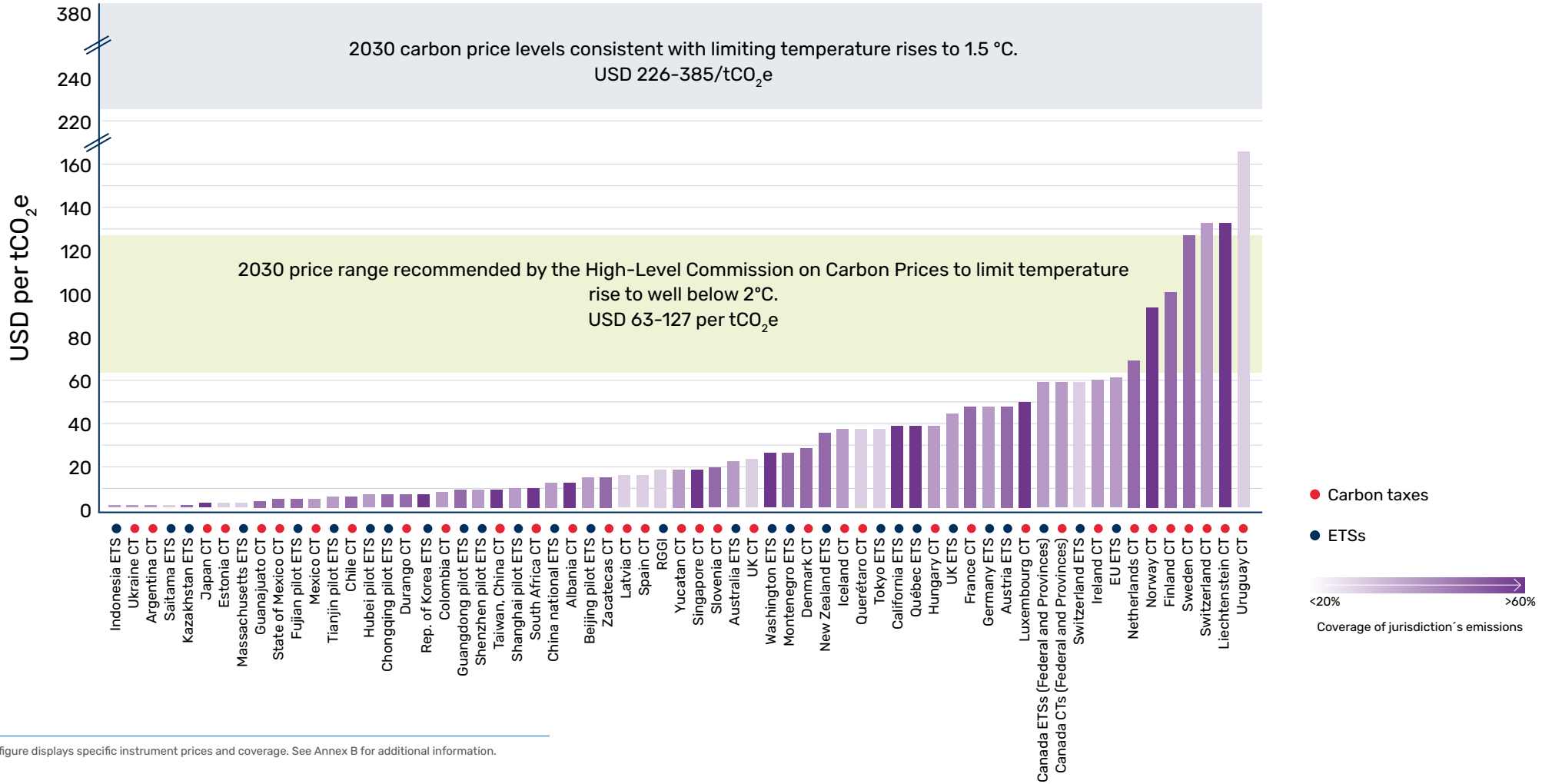


The upper bounds of the estimates are presented as blurred colors. All emissions data are based on GHG emissions from the Emissions Database for Global Atmospheric Research (EDGAR version 8.0, https://edgar.jrc.ec.europa.eu/), or are from domestic inventories in the case of subnational jurisdictions. Additional information on the methodology and sources is provided in Annex B.

Sector-specific multilateral initiatives for carbon pricing are also growing. The Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) led by the International Civil Aviation Organization (ICAO) aims to stabilize CO_2 emissions from international aviation. It uses a baseline-and-offset approach that requires airlines to buy carbon credits to offset emissions above their baseline. CORSIA has three implementation phases, with evolving participation requirements and criteria for units eligible for compliance. The pilot phase concluded in early 2024, beginning the first (voluntary) phase, and a compliance phase will begin in 2027.[45] In July 2023, the International Maritime Organization (IMO) adopted a revised strategy to reduce GHG emissions from international shipping that includes the development of a GHG emissions pricing instrument. It is intended to enter into force by 2027.[46] While multilateral initiatives for sectoral carbon pricing are slow in making progress and in reaching the necessary level of ambition, they can incentivize mitigation in sectors not covered by the Paris Agreement and those generally beyond the reach of domestic carbon pricing systems. In this way, these international transport initiatives can contribute to the proportion of global GHG emissions facing carbon price incentives. Taken together, CORSIA and the IMO carbon pricing efforts represent around 1.5% of global GHG emissions (see Figure 6).

FIGURE 7

Prices and coverage across ETSs and carbon taxes, as of April 1, 2024



The figure displays specific instrument prices and coverage. See Annex B for additional information.

2.2 Carbon prices remain insufficient despite a decade of strong growth

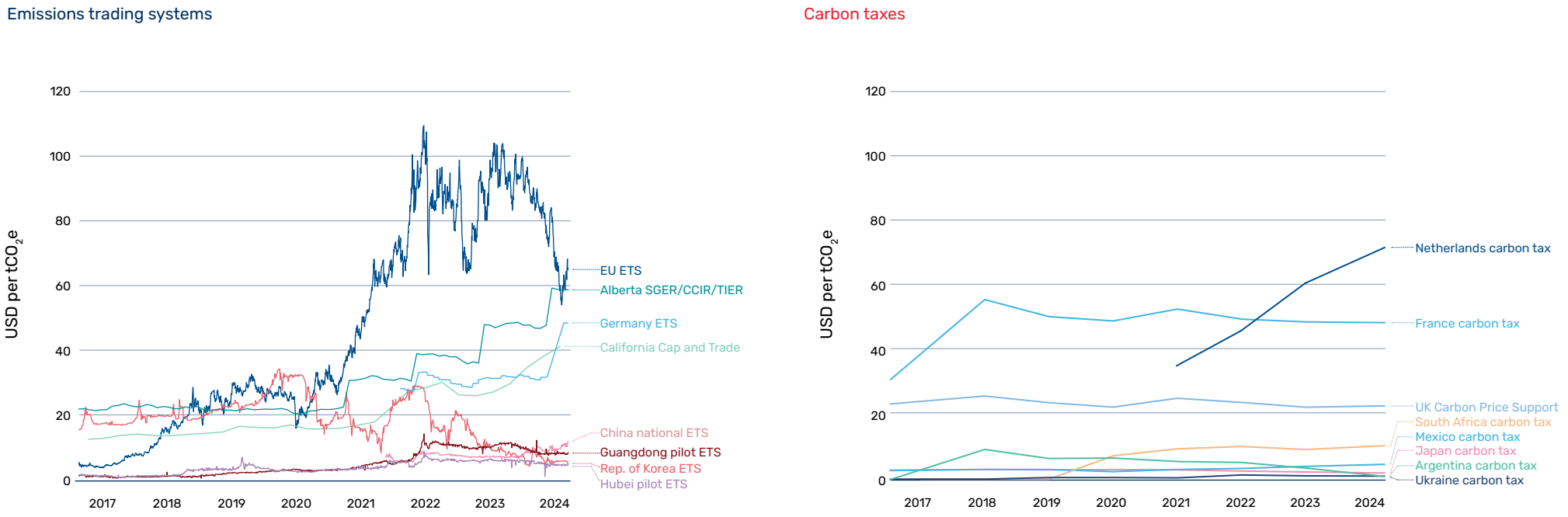
More ambition in ETSs and carbon taxes is necessary to attain a 1.5°C pathway. In 2017, the High-Level Commission on Carbon Prices concluded that carbon prices needed to be USD 40-80/ton of carbon dioxide equivalent (tCO_2e) in 2020 and reach USD 50-100/tCO_2e by 2030 to be on track to limit temperature rises to well below 2°C.[47] In 2024, only seven carbon pricing instruments, covering less than 1% of global GHG emissions, reached price levels at or above the inflation-adjusted minimum level of USD 63 per tCO_2e (in 2024 USD). Further, all existing carbon prices are below the lower carbon price bound set by the Intergovernmental Panel on Climate Change (IPCC)—the IPCC estimates that the marginal abatement cost to limit warming to 1.5 °C is USD 170 to 290 per tCO_2e (226 to 385 in 2024 USD terms). While coverage with carbon taxes and ETSs has been continuously increasing and new initiatives are being developed, the majority of these carbon pricing instruments are not ambitious enough to drive the level of change required to meet the Paris Agreement's temperature goals.

Direct carbon prices have increased over the last decade, but the past year saw mixed developments. Most instruments saw increasing prices in nominal terms. More than half of the carbon taxes in operation increased the nominal tax rate over the past year as the result of scheduled increases or tax reforms and the remaining taxes have retained existing tax rates (see Figure 8). While carbon tax levels are by design more stable than ETS prices, the picture on ETS prices was particularly heterogeneous over the past year. Ten ETSs, covering around 5% of global emissions, saw nominal price decreases, including significant price falls in large long-standing systems like the New Zealand ETS, the ETS in the Republic of Korea, the EU ETS, and the UK ETS. While short-term fluctuations in ETS prices are not necessarily a reason for concern, persistent price falls and volatility have the potential to undermine the longer-term price signal and therefore investment certainty. The drivers for the price reductions experienced during 2023 varied across jurisdictions. In the EU, economic stagnation and reduced consumption of fossil energy in the aftermath of the energy price crisis contributed to reducing industrial and power sector emissions, putting downward pressure on EU ETS prices.[48] In New Zealand, a key driver was market expectations caused by uncertainty surrounding the potential for excess allowances in the coming years, which saw prices fall.[49]

The majority of these carbon pricing instruments are not ambitious enough to drive the level of change required to meet the Paris Agreement's temperature goals.

FIGURE 8

Nominal prices in the largest ETSs and carbon taxes in operation since 2017[i]



[i] The Indonesia ETS, the Mexico ETS, and the Kazakhstan ETS have a high absolute coverage of GHG emissions. However, they are not presented in the graph due to insufficient data availability.

2.3 Revenues from carbon pricing continue to climb

Carbon pricing revenues continued to increase in 2023, exceeding the threshold of USD 100 billion for the first time. Total revenues from carbon taxes and ETSs in 2023 was USD 104 billion, representing an increase of around 4% in real terms. The largest single contributor to global carbon revenue, the EU ETS, saw inflation adjusted revenue in 2023 increase by around 4% compared to the previous year, largely driven by higher allowance prices. Real revenues from the German ETS increased by almost 60%, despite a suspension of a planned price increase (as part of the ETS's initial fixed-price phase). This increase was largely due to firms postponing their allowance purchases to early 2023 for their 2022 compliance obligations, temporally shifting revenues for the country. The new cap-and-invest program in Washington State generated USD 1.8 billion. The revenue increases from these three instruments outweighed lower revenues in other jurisdictions. This includes the UK ETS, which collected around 36% less revenue (in real terms) compared to 2022 as a result of a decrease in allowance prices, and New Zealand where no auction revenues were collected from the ETS during 2023. However, recent price drops in the EU ETS, which is the largest contributor to global carbon revenues, suggests global carbon pricing revenues may fall in 2024.

ETSs continue to generate the majority of direct carbon pricing revenue with higher revenues possible if free allocations are reduced. ETSs accounted over 70% of global government carbon pricing revenues, primarily due to the greater amount of emissions they cover, and because of the high price levels in large ETSs, like the EU ETS (see Figure 9). However, the high share of freely allocated ETS allowances, which can be viewed as foregone revenue, reduces the revenue potential from ETSs. While auctioning has advantages in terms of revenue generation, price discovery, and preserving incentives for cost-effective abatement, jurisdictions often introduce accompanying measures to manage social and economic impacts and build broader community acceptance. All but four ETSs (Austria, Germany, Massachusetts, and RGGI) freely allocate allowances to varying degrees, mostly as a way of easing the transition to a carbon-constrained world and protecting the competitiveness of domestic industries while still providing a price signal to incentivize emission reductions. More than a third of ETSs freely allocate 100% of allowances, while others use a combination of auctioning and free allocation. For example, California, the EU and New Zealand all allocate roughly half of their allowances for free. Some carbon tax regimes also include small rebates and exemptions.

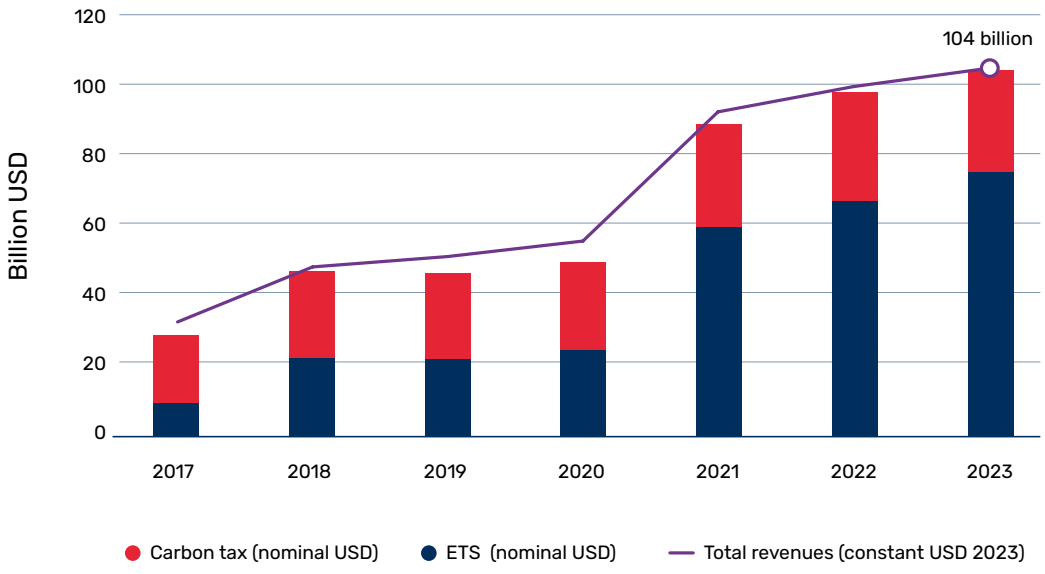
Total revenues from carbon taxes and ETSs in 2023 was USD 104 billion.

The contribution of carbon pricing revenue to jurisdictions' overall budgets remains small. Despite increases (see Figure 9), revenue from carbon pricing remains a small part of countries' total budgets. The largest contribution of carbon pricing to a national budget was seen in Germany, where the national ETS and the EU ETS together made up around 4% of government revenue in 2023.[50] This suggests that there is an opportunity for reforms to help achieve fiscal, economic, social, and environmental goals. Environmental fiscal instruments like carbon taxes and ETSs (with auctioning) can raise revenue with a lower negative impact on employment and can cover the informal sector better than conventional taxes, such as labor or corporate taxes.[51] This becomes increasingly relevant at higher levels of taxation. The adoption of carbon pricing in Ireland, where a carbon tax was implemented in 2010 in response to the global financial crisis, demonstrates how embedding carbon pricing into broader tax reforms may increase acceptance as its benefits beyond climate mitigation can be highlighted.

The majority of jurisdictions use carbon pricing revenues to either fund climate-related programs or to support the general budget. There are many potential uses of carbon revenue to meet a range of policy objectives, and as with all fiscal instruments revenue decisions for carbon taxes and ETSs can be challenging given the competing priorities across economic, social, and environmental objectives. Different ministries within a single government often take a different view, such as when the Czechia's environment and industry ministries favored earmarking, while the finance and transport ministries argued for using revenues to support the country's general budget and consolidate its debt.[53] Data from the Institute for Climate

FIGURE 9

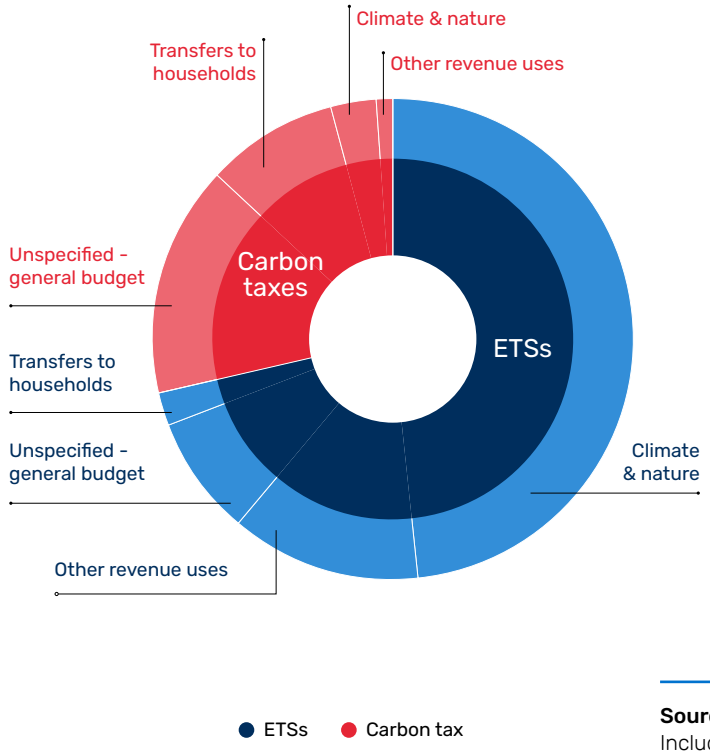
Evolution of global revenues over time



Economics (I4CE) presented in Figure 10 shows that the majority of revenue has historically been channeled either toward green and development projects or to the general budget.[49] The green and development project channel accounts for more than half of global carbon revenue collected in 2022. For example, the EU requires its member states to dedicate at least half of allocated ETS revenues for climate and energy purposes, which resulted in large government expenditures directed toward green transport (20%), energy efficiency (17%), and renewable energy (12%). The general budget channel accounts for around a quarter of global carbon revenue. For instance, in France and the UK, revenues from their national carbon prices feed into their respective general budgets. Households and businesses that may be disproportionately affected by carbon pricing receive 10% of global carbon revenue in redistributions.[54] For instance, Austria and Canada return a larger portion of the revenue from carbon pricing to households. In Canada, approximately 8 out of 10 households receive more money back than the total amount spent on the carbon tax.[55]

FIGURE 10

Revenue usage from carbon taxes and ETSs in 2022



Source: Based on I4CE Data.[56]
Includes revenue usage from largest carbon pricing instruments by revenue in 2022

2.4 Flexible policy designs and approaches continue to emerge, reflecting the adaptability of carbon pricing to national circumstances

Governments are increasingly using multiple carbon pricing instruments in parallel to increase coverage and ambition and to deliver greater flexibility. While some jurisdictions have implemented a single carbon pricing instrument to apply a domestic price incentive (e.g., ETSs in California and New Zealand and carbon taxes in Singapore and South Africa), around 70% of jurisdictions with carbon pricing have more than one carbon pricing instrument in place. About a quarter of these jurisdictions introduced a second instrument within the past three years. While establishing a second instrument can potentially increase administrative and transaction costs and regulatory complexity (e.g., through overlapping reporting requirements), it can support the expansion of coverage, help to increase the level of the carbon price, and be used to trial new approaches. In most cases, including in EU member states and Mexican states, the coexistence of two instruments stems from different levels of government having different carbon pricing policy objectives. In Canada, the federal government provides implementation flexibility to subnational governments. In the EU, some national governments use a second instrument to extend carbon pricing policy coverage to sectors that are not covered by the EU ETS such as road transport. While most examples are in the form of carbon taxes (e.g., Denmark and Portugal), second ETSs have also been implemented in Austria and Germany. Other jurisdictions apply a second instrument to the same sectors at different governance levels. Hungary's carbon tax, introduced in 2023, applies to EU ETS participants that receive a majority of allowances for free. Netherlands has a carbon tax which is intended to promote decarbonization by topping up the carbon price incentive provided by the EU ETS. China has a national ETS, but also has regional pilot ETSs that were set up to experiment with design options and draw lessons for the national ETS. There are fewer examples of two instruments being implemented at the same governance level in a jurisdiction. Current examples include the UK (which, like Netherlands, uses a tax to top up the ETS price incentive), Canada, and Mexico. The EU ETS 2, covering buildings and transport, will result in separate ETSs in the EU being applied to different emission sources. Thailand is also exploring, among other options, the potential to introduce an ETS and a carbon tax to operate simultaneously.

Governments are increasingly exploring carbon pricing in new sectors, but carbon pricing remains most common in the power and industry sectors. More than half of all ETSs and carbon taxes cover the power sector (Figure 11). [ii] More than three quarters of all ETSs and carbon taxes cover industry (including mining). These sectors tend to be covered more by ETSs than taxes because ETSs with point-source regulation offer more intertemporal flexibility for big emitters as the instruments allow trading and hedging. In contrast, road transport and buildings tend to be covered more by carbon taxes, which are more often applied upstream (e.g., at the point fuel enters the economy), allowing coverage of fuel combustion emissions from small sources like vehicles. Governments are increasingly looking to

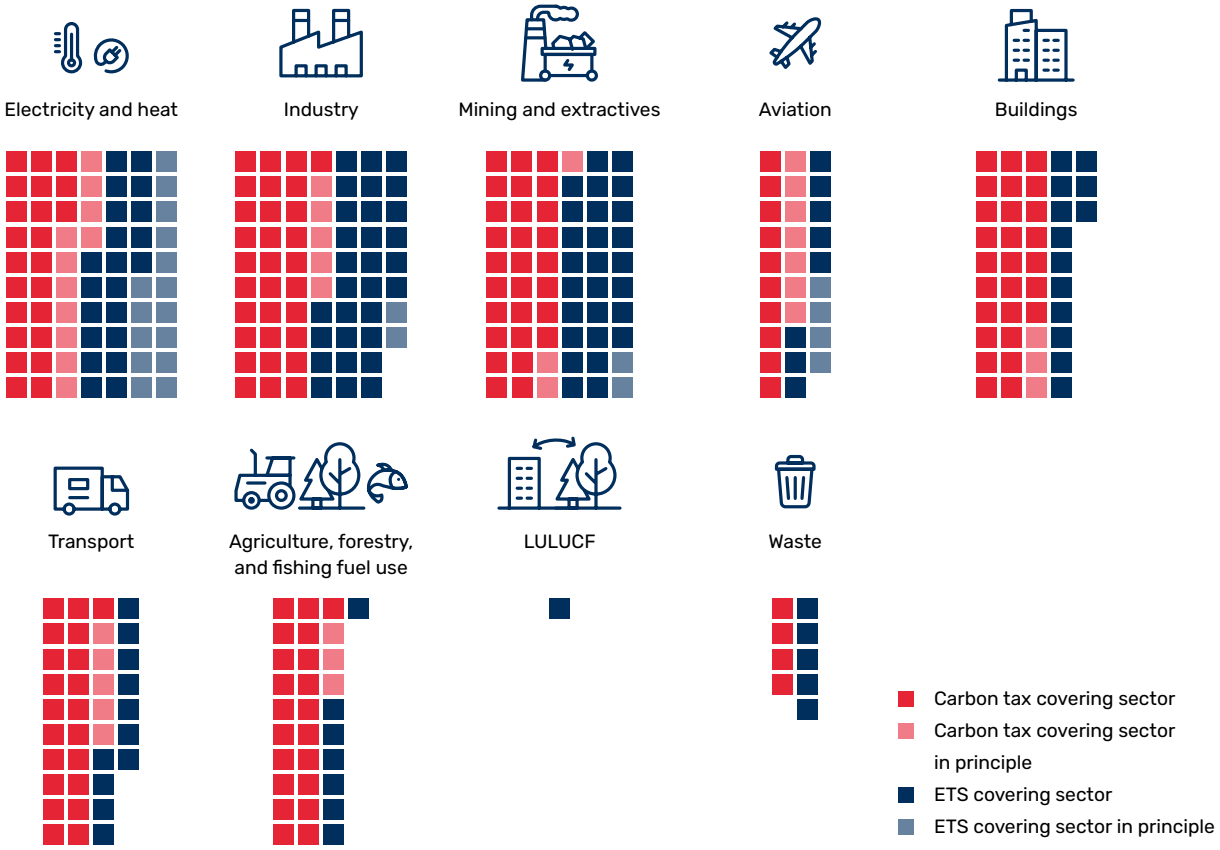
[ii] Excluding instruments that cover the sector in principle, with negligible or no de facto coverage.

Around 70% of jurisdictions with carbon pricing have more than one carbon pricing instrument in place.

place a carbon price on less traditional sectors, including shipping and waste. Carbon pricing in Germany, the Republic of Korea, and Singapore covers solid waste or waste incineration, and the UK will start including energy-from-waste and waste incineration emissions in 2028. This is a sector that can be complicated to regulate because of the long time frame over which emissions occur and because the waste generator generally does not operate waste management (e.g., landfills). Maritime transport is also an area of growing coverage. The ETS in the Republic of Korea and the Shanghai Pilot Emissions Trading System have been covering emissions from maritime transport since 2021 and 2016, respectively. The EU ETS has started phasing in surrender obligations for CO_2 emissions from all large ships (≥ 5,000 gross tonnage) entering EU ports. Starting in 2026, it will also consider CH_4 and N_2O emissions. The UK ETS will cover emissions from domestic maritime transport in 2026.

FIGURE 11

Covered sectors in implemented ETSs and carbon taxes

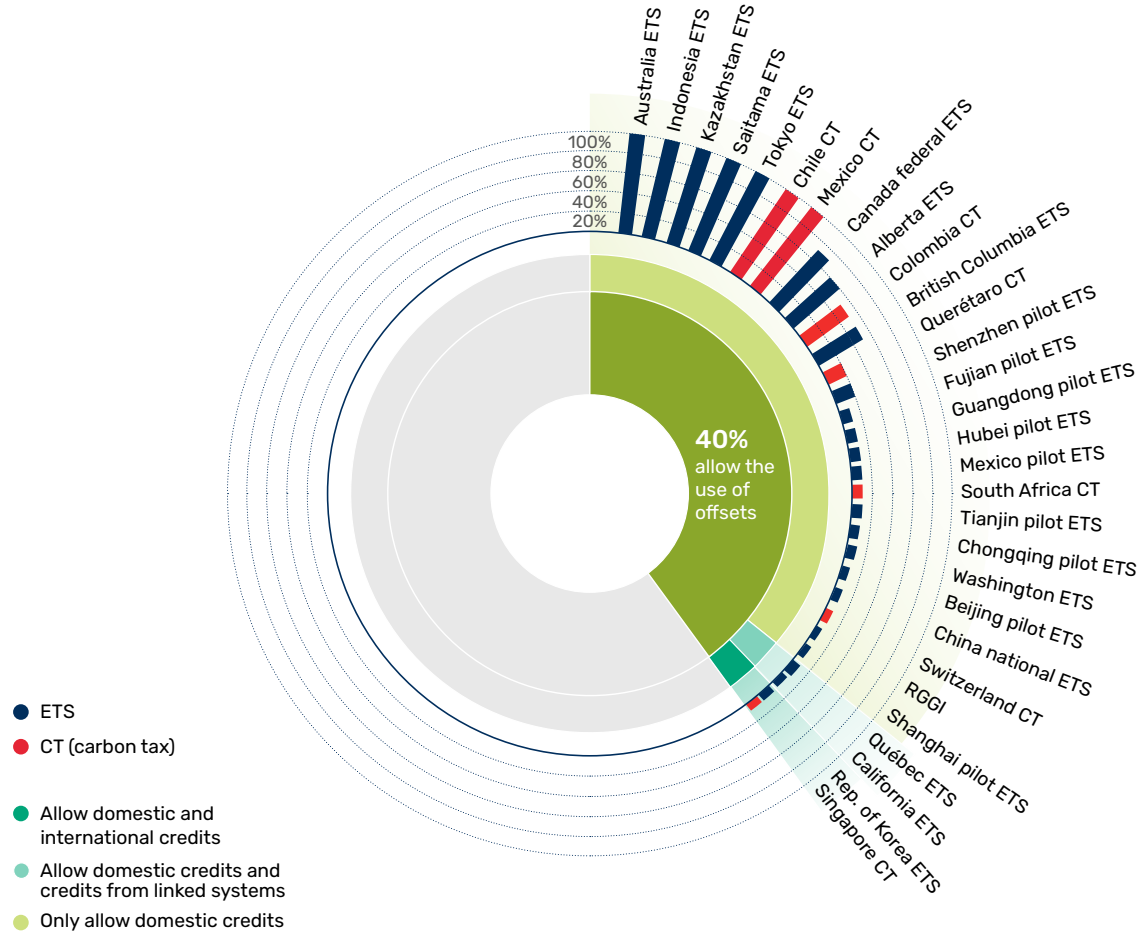


Each square represents a single instrument. This figure is not intended to display overlap between covered emissions (e.g., Massachusetts ETS and RGGI) or multiple instruments (e.g., UK ETS and UK carbon price support mechanism).

Governments allow regulated entities to use carbon credits toward their GHG obligations to increase flexibility, lower compliance costs, and extend the carbon price signal to uncovered sectors. Currently, around 40% of carbon pricing instruments in operation (7 carbon taxes and 23 ETSs), allow for the use of carbon credits to offset liabilities (see Figure 12). Most do so with restrictions. For example, almost all jurisdictions only permit the use of domestically generated carbon credits. Singapore began allowing businesses liable to pay the carbon tax to use international carbon credits that meet defined environmental integrity criteria to offset up to 5% of their taxable emissions in January 2024. Carbon taxes permitting the use of domestically generated carbon credits to offset tax liabilities include Chile, Colombia, and South Africa. Among ETSs, California, Mexico, and the Republic of Korea, as well as others, allow for the limited use of carbon credits from specified crediting mechanisms.

FIGURE 12

Carbon credit use in ETSs and carbon taxes



CHAPTER 03

Carbon crediting– markets and mechanisms

CHAPTER 3

Carbon crediting—markets and mechanisms

Carbon credit markets navigated relatively turbulent conditions during 2023. While concerns about credit quality and integrity of claims persisted, there was widespread progress on initiatives to promote confidence and build trust. However, the impact of these initiatives will take time to be realized. The downward trend of credit issuances, which started in 2022, continued. However, new and planned crediting mechanisms and approaches improved the supply outlook, targeting different demand segments across the domestic-international and voluntary-compliance spectrums. Demand for carbon credits continues to be mostly driven by voluntary purchases, although compliance demand is emerging. Carbon credit prices mostly declined, though credit types with specific features, such as high co-benefits or recent vintages, traded at a premium, which is particularly noticeable in over-the-counter (OTC) trades.

Demand for carbon credits continues to be mostly driven by voluntary purchases, although compliance demand is emerging.

3.1 New crediting mechanisms coming online will boost supply outlook, which may begin to counterbalance recent falls in issuances

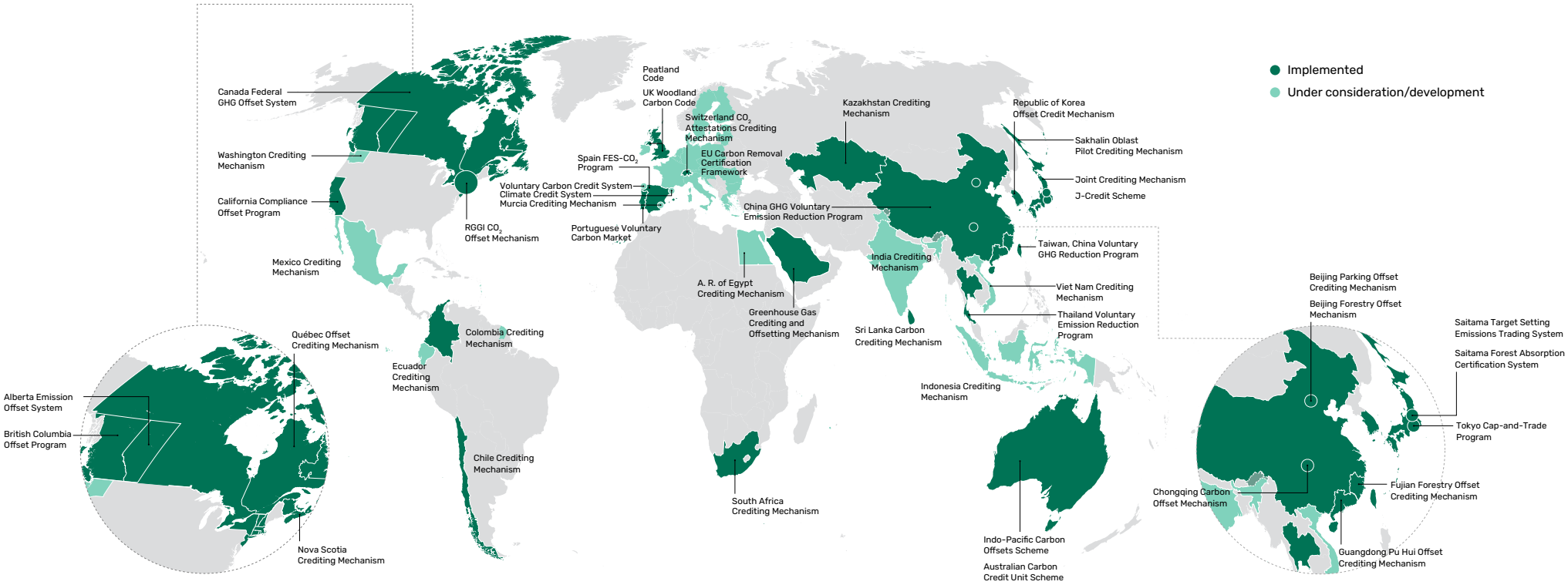
Governments, particularly in middle-income countries, are increasingly including crediting frameworks in their policy mix, with a view to supporting both compliance and voluntary markets. Some middle-income countries see the development and expansion of domestic carbon credits as a springboard for participation in international carbon markets, which can serve as a vehicle to fund the low-carbon transition.[57] Others focus on domestic use instead of selling carbon credits on international markets. These two motivating factors have generated significant progress on crediting mechanisms across several jurisdictions in the last year. Looking forward, several initiatives are in place to support countries in gaining access to international credit demand, providing up-front and large-scale carbon finance, outlining standard operating procedures, delivering technical assistance, and offering capacity building, among many other support measures.[58]

The roles of emerging governmental crediting mechanisms and approaches to implementation are diverse. New crediting mechanisms have been launched in five jurisdictions since 2023, including three at the national level (Chile, Portugal, and Saudi Arabia) and two in North American subnational jurisdictions (Nova Scotia and Washington). With these most recent additions, governmental crediting mechanisms now amount to 35 globally (see Figure 13). Moreover, another 11 jurisdictions are currently considering carbon crediting mechanisms as part of their policy mix. This includes India, which has revised its carbon pricing plans, simultaneously advancing a baseline-and-credit ETS and a national crediting mechanism. Thailand's domestic crediting mechanism, the Thailand Voluntary Emission Reduction Scheme (T-VER) has upgraded its standard to Premium T-VER to promote alignment with international standards, attracting interest from international buyers.[59] Thailand is also considering the development of a carbon tax or ETS, which could allow the use of T-VER credits to offset compliance requirements.[60] In Viet Nam, the government aims to establish a crediting mechanism focused on the solid waste and transport sectors to support its ETS commencing in 2028 with provisions allowing for participation under Article 6 of the Paris Agreement.[61] After a six-year suspension, China has relaunched project registrations under its China Certified Emissions Reduction Scheme, providing a supply of credits that companies can potentially use to offset a share of their compliance obligations under the China's national ETS and the pilot ETSs of Beijing, Chongqing, Fujian, Guangdong, Hubei, Shanghai, Shenzhen, and Tianjin.[62] In September 2023, Chile launched a crediting mechanism to allow companies to reduce carbon tax liabilities using credits from specified methodologies under the Clean Development Mechanism (CDM), Verified Carbon Standard (VCS), and Gold Standard.[63] In March 2024, Chile officially approved the first eight renewable energy projects under these standards.[64] In Brazil, the February 2024 draft ETS bill set out a framework for the acceptance of carbon credits to meet compliance obligations through a "gatekeeping" model that, if approved, will rely on existing crediting mechanisms. The EU Carbon Removals Certification Framework, which is focused on stimulating carbon removals through robust and standardized certification of removal credits, was adopted by the European Parliament in April 2024, and awaits adoption by the European Council.[65] The legislation only allows removal credits to contribute toward European climate objectives, excluding them from use towards third countries' NDCs and international compliance schemes such as CORSIA.[66]

Governmental crediting mechanisms now amount to 35 globally.

FIGURE 13

Map of governmental crediting mechanisms



An instrument "under development" means that a government is actively working towards the implementation of a crediting mechanism, and this has been formally confirmed by official government sources. This includes, for example, where a mandate has been established but no credits have been issued. If a government has announced its intention to work toward the implementation of a crediting mechanism and official government sources formally confirm that intention, the instrument is "under consideration." For those countries with multiple crediting mechanisms that have both "under development" or "under consideration" and "implemented" crediting mechanisms, the map will show the status of the latter. The status of crediting mechanisms in subnational jurisdictions is also reflected in the map.

BOX 2

Understanding carbon credit markets

Carbon credit markets trade "carbon credits," which are units that are generated through voluntarily implemented mitigation activities. Carbon credits can represent emission reductions or emission avoidance, for instance by destroying methane generated at landfills or meeting energy demand with solar or wind instead of fossil fuels. Avoided deforestation projects are another example of an emission avoidance project. Carbon credits can also represent emission removals from the atmosphere, such as sequestering carbon through afforestation or directly capturing carbon from the air and storing it. Each carbon credit represents 1 tCO_2e reduced or removed.

Supply of carbon credits is delivered by three main categories of crediting mechanisms:

- **International crediting mechanisms** are those administered or managed by an international organization that is established with authority of national governments, such as UN agencies. This category includes mechanisms established under the Kyoto Protocol (including CDM) and Article 6 of the Paris Agreement.[i]
- **Governmental crediting mechanisms** are those administered by one or more governments, such as the Californian Compliance Offset Program and the Australian Carbon Credit Unit (ACCU) Scheme.
- **Independent crediting mechanisms** include those administered by a non-governmental organization, such as Verra and Gold Standard.

Additional detail, including definitions and descriptions of project categories, is provided in Annex A.

Carbon credits are retired once the benefit has been claimed for voluntary or compliance purposes. Retired credits are a useful proxy for demand for credits, which can stem from a range of drivers, meaning that few sources of supply can be matched with only one source of demand. However, it is possible to identify four market segments, largely based on demand drivers:

1. **International compliance.** This primarily consists of (i) countries voluntarily purchasing/utilizing credits or "mitigation outcomes" recognized under international treaties to help meet their GHG mitigation commitments; and (ii) airlines purchasing credits eligible for meeting their obligations under CORSIA.
2. **Domestic compliance.** This includes companies purchasing credits that are eligible for meeting their obligations under domestic law, usually an ETS or a carbon tax. These may include credits issued under international, governmental, or independent crediting mechanisms, depending on the rules established by respective governments.
3. **Voluntary,** which consists of (mostly private) entities purchasing carbon credits for the purpose of complying with voluntary mitigation commitments. This buyer group primarily sources credits issued under independent crediting standards, though some entities also purchase those issued under international or governmental crediting mechanisms.

[i] Article 6 of the Paris Agreement provides the framework for international compliance carbon markets; Article 6.4 establishes a centralized mechanism supervised and governed by the United Nations Framework Convention on Climate Change, which is expected to be administratively similar to the CDM of the Kyoto Protocol; Article 6.2, on the other hand, provides a basis for bilateral or plurilateral voluntary cooperation among countries, which potentially offers flexibility to reduce greenhouse gas emissions through a variety of processes, mechanisms, and standards.

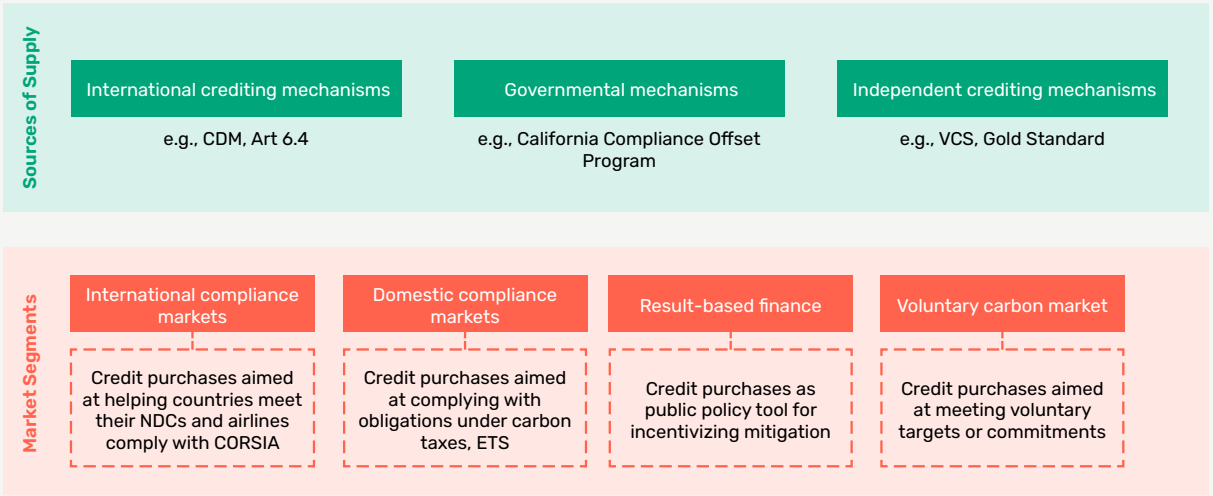
4. **Results-based finance** refers, in the context of the carbon market, to purchases of carbon credits by governments or international organizations for the purpose of incentivizing climate change mitigation or helping host countries meet national targets. Results-based finance can also refer to broader payments in return for the achievement of emission reductions or removals, without any transfer of credits or other ownership.

The linkages and overlaps across compliance and voluntary markets, as well as international and domestic markets, continue to evolve.[67]

One of the key features of international compliance markets is the requirement for the credit to be subject to a "corresponding adjustment"—an accounting measure performed by national governments under Article 6 of the Paris Agreement to prevent double counting of emissions reductions and removals. This report refers to these as "correspondingly adjusted credits." International compliance markets must exclusively trade correspondingly adjusted credits, and such credits will potentially be used also within voluntary carbon markets.

FIGURE 14

Types of carbon crediting mechanisms and market segments



Source: Adapted from State and Trends of Carbon Pricing 2022

Issuances of carbon credits fell for the second consecutive year. Independent crediting mechanism issuances fell by 9% from the previous year. This decline was mainly driven by reduced issuances from the VCS and the American Carbon Registry. Issuances from the main project categories fell in 2023. This trend reflects a range of factors, including project developers delaying credit issuance applications due to associated costs, pending the improvement of market demand and prices, as well as a potential shift in investment and demand away from traditional projects.[68] The two largest project categories—renewable energy and emission avoidance projects in forestry and land use—both faced a near 50% decrease in issuances compared to 2022. For renewable energy projects, the number of projects able to deliver credits is declining. New renewable energy projects face challenges to demonstrate financial additionality requirements and many large-scale renewable projects are reaching the end of their crediting periods. In the case of avoided deforestation projects, reduced issuances could be attributed to weakened market confidence due to continuing concerns of over crediting following prominent criticisms of the integrity of project-level REDD+[ii] activities during 2023.[69] One project category that saw growth was household devices, including clean cookstoves, biodigester systems, and efficient lighting, which increased by 23% (see Figure 15). Household devices now account for 15% of total issuances, up from 5% in 2022. This increase has coincided with an increased focus from project developers on cookstove projects because of the strong health and social co-benefits, and their resilience to poor economic conditions. Nonetheless, recent scrutiny over the potential overestimation of the impacts of cookstove projects highlights the need for more accurate assessment methodologies.[70] In terms of regional supply of credits, China and India remain the largest host countries in terms of issuances, with a roughly 15% share each, but with a 40% year-on-year decrease in issuance volumes respectively.

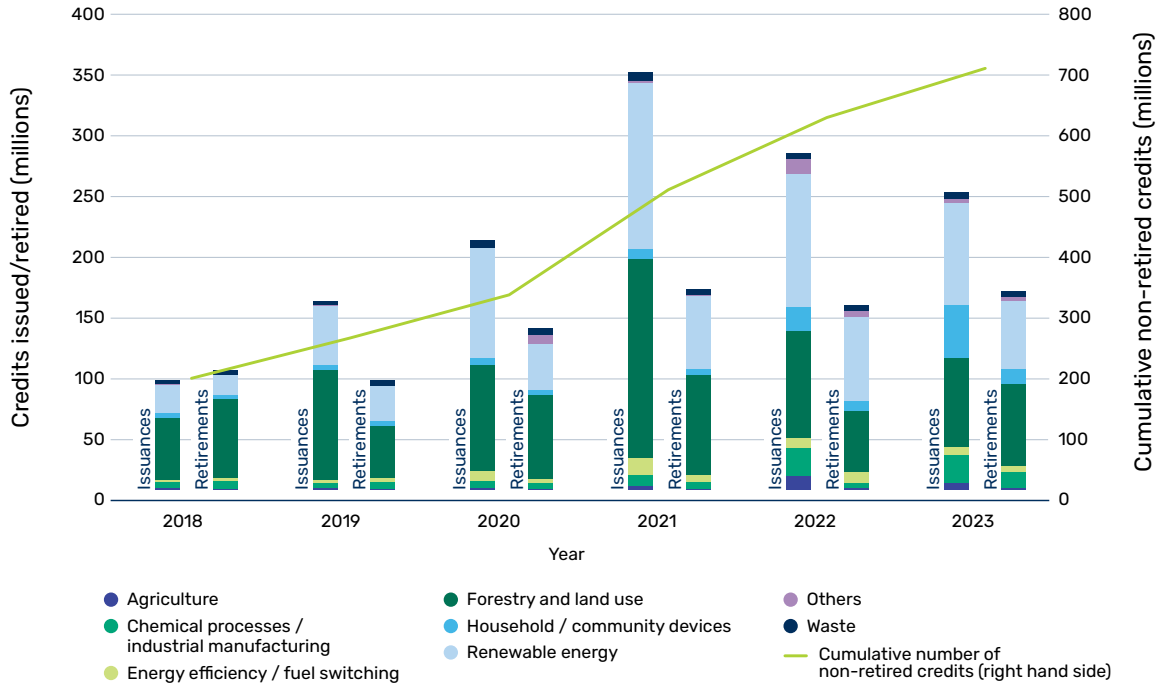
Issuances of carbon credits fell for the second consecutive year.

[ii] Reducing Emissions from Deforestation and Forest Degradation projects, REDD+ encompasses reducing emissions from deforestation and forest degradation in developing countries and includes forest conservation, sustainable management of forests, and enhancement of forest carbon stocks.

While it takes time for new supply to be realized, alternative approaches to crediting are starting to materialize. The long lead times to generate abatement and issue credits, combined with uncertain and changing demand signals, mean unlocking new sources of supply takes time. In addition, there is a need to ensure that governments and businesses are ready to participate, while also exploring options for innovative approaches and opportunities to reduce transaction costs. However, these priority areas must be balanced against maintaining environmental integrity. This highlights the challenge with short-term supply expansions. However, additional sources of carbon credit supply will start to become available in coming years. For example, the World Bank's Forest Carbon Partnership Facility (FCPF) has been supporting countries to generate high-integrity carbon credits generated from the preservation and sustainable management of forests in their jurisdictional-scale programs. The 15 participating countries are expected to generate up to 270 million credits by 2028, 126 million of which may be available to carbon markets as decided by each country. Also, integrating credit markets into sector-level transition plans can mobilize finance at a greater scale. Initiatives like the Energy Transition Accelerator and the Innovative Carbon Resource Application for Energy Transition Project for Uzbekistan (iCRAFT) that support policy-based crediting are aiming to generate carbon credits from reductions across the energy sector. The State and Trends of Carbon Pricing: International Carbon Markets 2023 report provides further information on these initiatives.

FIGURE 15

Issuances and retirements by project category in independent crediting mechanisms, 2018-2023

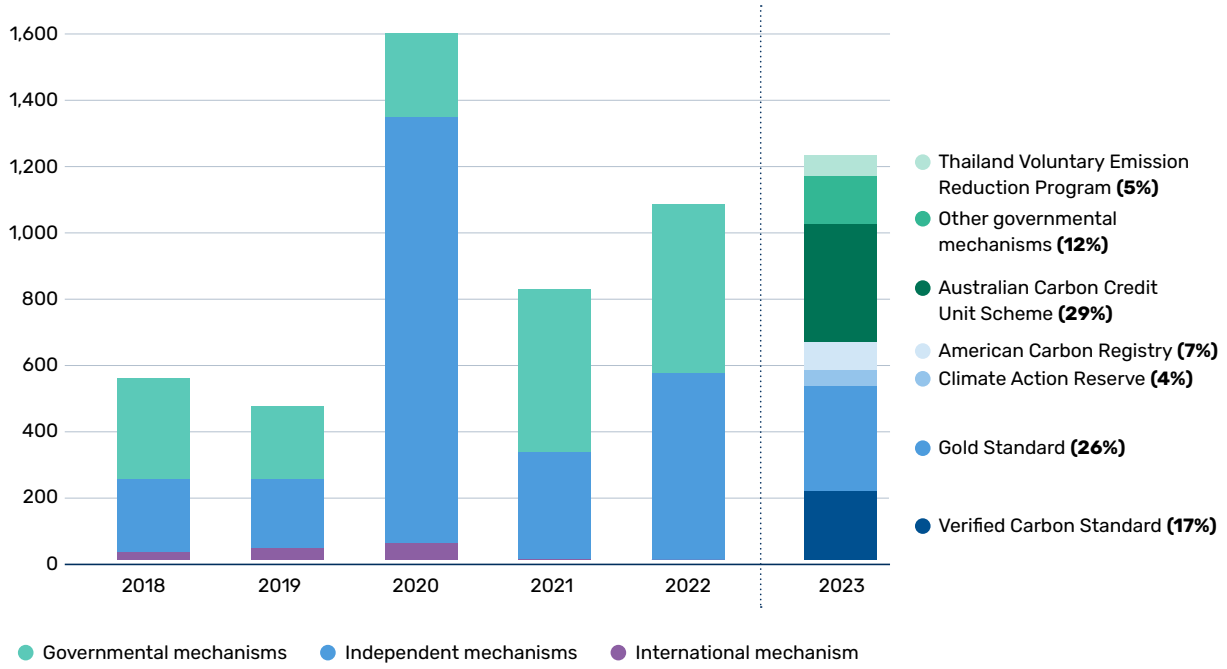


Volume of issuances and retirements by project category covers the following crediting mechanisms: American Carbon Registry, Climate Action Reserve, Gold Standard, and Verified Carbon Standard. Project categorization has been provided by Ecosystem Marketplace. All issuance and retirements data here refers to original issuances, which only include the first time a credit has been issued for a specific emission reduction/removal activity to avoid double counting. Original issuances do not rely on any previous issuances from other crediting mechanisms.

The project pipeline is growing for projects with co-benefits, which is an important attribute for voluntary demand. While project registrations do not necessarily predict future supply (because the scale of issuances from registered projects differs by sector, category, and region), it is a good indicator of activity and interest and can help provide an indication of the changing appetite for certain project types. In 2023, while total project registrations remained stable, registrations of projects for household devices grew, reflecting increased interest in this project category with highly visible co-benefits. As a result, household devices accounted for almost half of all new project registrations in 2023, making it the largest contributor of new registrations for the first time. Registrations are split mostly equally across independent and governmental mechanisms, with the share of the latter decreasing in recent years. Of the governmental mechanisms, Australia's Carbon Credit Unit Scheme dominates, accounting for nearly 30% of project registrations in 2023 with the majority of new registrations coming from Australian forest-based removal projects (see Figure 16).[iii] Some of these projects had already been actively issuing credits. The relative contribution of different categories is likely to continue evolving over time as demand and ultimately supply respond to shifts in market preferences.

FIGURE 16

Annual registrations by crediting mechanism type from 2018 to 2023

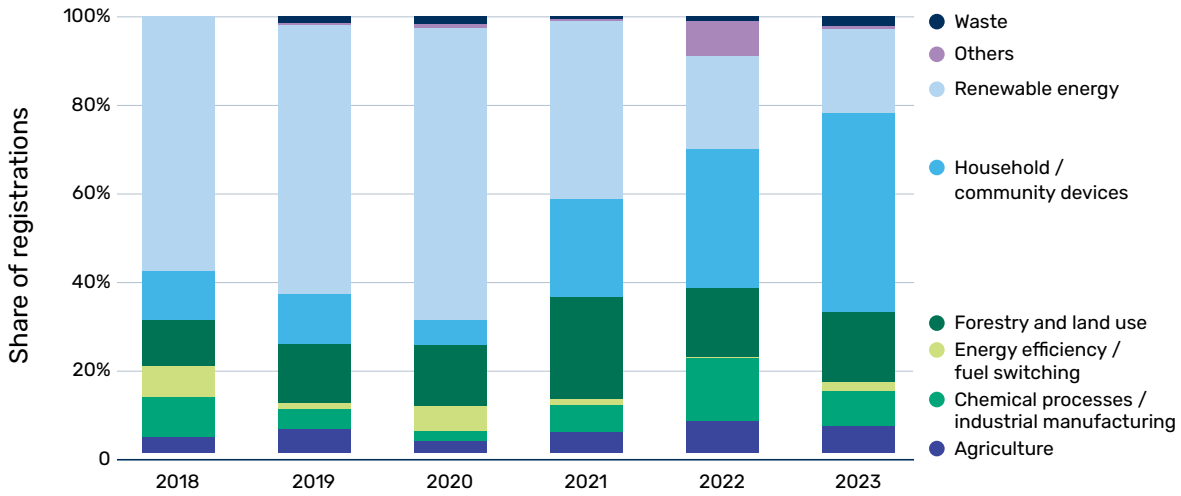


[iii] A dramatic spike in registrations under the VCS (over 1,000 projects), largely relating to registrations of renewable energy projects in India and China, occurred in 2020. However, a portion of the projects contributing to the increase in observed registrations in 2020 were not entirely new projects but rather a result of transitioning existing projects to Verra's central registry from third-party service providers' registries.

Annual registrations in independent and international crediting mechanisms have been retrieved by the World Bank and cover the following mechanisms: American Carbon Registry, Clean Development Mechanism, Climate Action Reserve, Gold Standard, and Verified Carbon Standard. Annual registrations in governmental mechanisms were provided by the jurisdictions and include registrations from the Alberta Emission Offset System, Australian Carbon Credit Unit Scheme (ACCU), British Columbia Offset Program, Canada Federal GHG Offset System, Joint Crediting Mechanism, Nova Scotia Crediting Mechanism, Quebec Offset Crediting Mechanism, Saitama Forest Absorption Certification System, Spain Carbon Fund for a Sustainable Economy (FES-CO2) Program, Switzerland CO_2 Attestations Crediting Mechanism, Thailand Voluntary Emission Reduction Program, and Washington Crediting Mechanism,

FIGURE 17

Share of annual registrations by project category in independent mechanisms from 2018 to 2023



Data on annual registrations by project category in independent mechanisms has been retrieved by the World Bank and covers the following mechanisms: American Carbon Registry, Climate Action Reserve, Gold Standard, and Verified Carbon Standard. Project categories provided by Ecosystem Marketplace.

CDM activities transitioning to the Paris Agreement could add significant supply, which could be used for international compliance—although the volume of credits is highly uncertain. Nearly 1,400 CDM activities requested to transition into Article 6, with a large potential for future issuances. Rules are in place for CDM activities to adapt to the new Article 6.4 mechanism, and project participants had until the end of 2023 to apply. Approximately 38% of eligible project activities and 67% of eligible Programmes of Activities (PoAs) requested to transition. If approved, these projects could issue over 900 million units [iv] under Article 6.4 for the 2021-2025 period.[71] Moreover, an additional 87 million CDM Certified Emission Reductions (CERs) could be issued for pre-2020 emission reductions, which could be used by countries to achieve their first NDCs.[v] While this suggests a theoretical upper limit of close to 1 billion CERs and Article 6.4 credits, actual issuances will likely be much lower (perhaps an order of magnitude) after accounting for issuance success, the extent that authorization is obtained, and the successful approval by the host country, among others. The number of reductions and removals under the Article 6 framework will also depend on

[iv] This number consists of 874 million credits from projects using a CDM methodology and 30 million from projects adopting an Article 6.4 methodology for the 2021-2025 period during which issuance is possible (thereafter, eligible projects would have to request a renewal of crediting period under Article 6.4 to continue issuing credits).

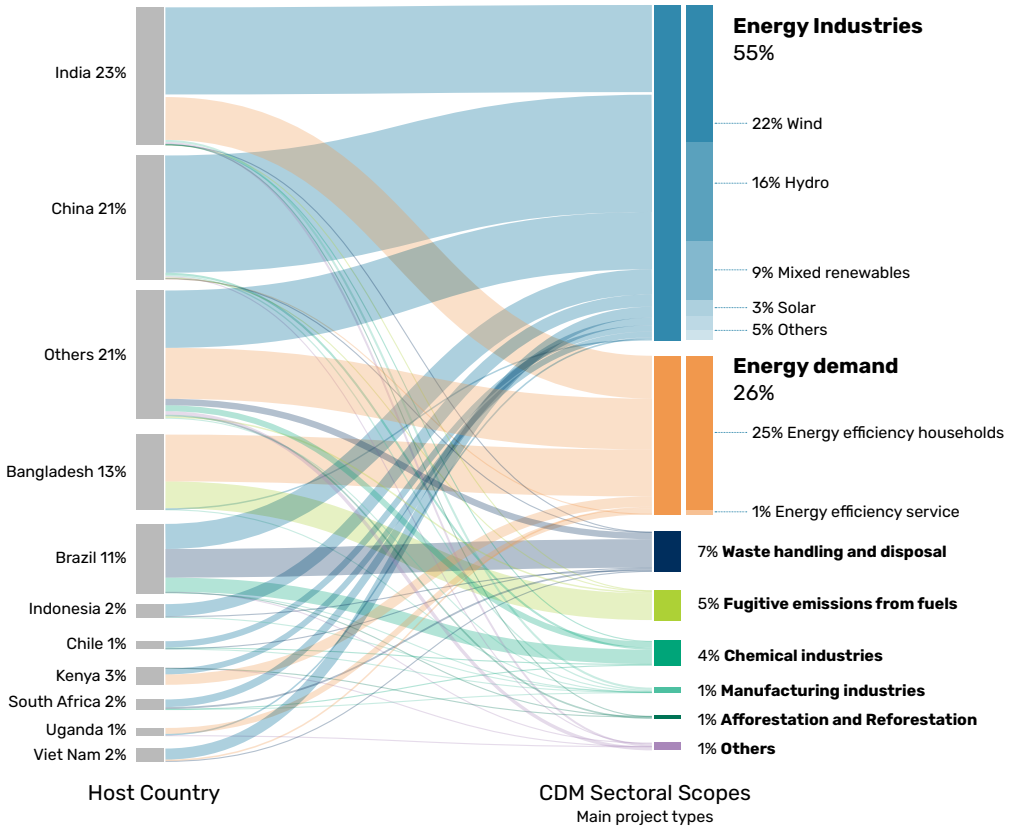
[v] As per the provisions for the transition of CDM activities into the Paris Agreement, countries may use CDM CERs toward the achievement of their first NDC only. Eligible CERs are those stemming from projects registered after 2013, and only for emission reductions before 2021. The host country must approve the transition, but the use of the CERs is not subject to corresponding adjustments.

the decisions made by project operators on whether to transition or follow alternative credit issuance paths. Almost 75% of the potential credit volume is based in Asia (mainly Bangladesh, China, and India), Brazil hosts around 11%, and notable potential volumes are located in Africa (e.g., Kenya, South Africa, and Uganda) (see Figure 18).[72]

More than 50% of the credit potential stems from renewable energy projects, and over 20% from efficient cookstove projects. Host countries now have until December 31, 2025, to fulfill Article 6 participation requirements[vi] and to communicate to the United Nations Framework Convention on Climate Change (UNFCCC) Secretariat which activities are approved for transition. Thereafter, the UNFCCC Secretariat and the Article 6.4 Supervisory Body will assess applications.[73]

FIGURE 18

Potential issuances from 2021-2025 activities that requested transition by host country and project type



This figure shows potential issuances from CDM activities that submitted requests to transition to the Article 6.4 mechanism. Data from the UN Environment Programme's CDM Pipeline, available at https://unepccc.org/cdm-ji-pipeline. Background information from the CDM Registry, available at https://unfccc.int/process-and-meetings/the-paris-agreement/paris-agreement-crediting-mechanism/transition-of-cdm-activities-to-article-64-mechanism

[vi] These are being a party to the Paris Agreement, maintaining an NDC, having a designated national authority, providing information on how Article 6 participation contributes to sustainable development, and clarifying which activity types are eligible for Article 6, including how they contribute to NDCs, long-term strategies, and other goals.

3.2 While voluntary retirements have remained relatively stable, the emergence of new compliance markets will likely boost demand

Retirements for carbon credits held steady year-on-year, but remain substantially lower than supply, generating a growing pool of non-retired credits in the market. Demand for carbon credits, as reflected through retirements, remained largely stable from 2022 to 2023. The mix of retired units remained steady among most project categories, albeit with minor shifts in their relative share. Renewable energy credits, which accounted for over half of all retirements in 2022, represented 38% of retirements in 2023. At the same time, avoidance projects in forestry and land use increased their relative share from 23% to 33%. Almost 90% of all retirements came from credits issued by independent crediting mechanisms, reflecting their abundance in the market. Carbon credit retirements in 2023 remained substantially lower than issuances. Issuances have consistently exceeded retirements for the past five years (see Figure 15). As a result, there are currently over 700 million non-retired credits from the main independent mechanisms. Around 38% of these credits come from renewable energy projects (mostly large electricity grid-connect projects) and 32% from avoided deforestation/conversion projects. The gap between retirements and issuances is caused at least in part by a misalignment between continuous adjustments to buyers' preferences and the long lead time for credit delivery. As a result, there is a high potential for different market dynamics across various market segments, with some being undersupplied while many others are oversupplied. This can lead to a surplus of legacy carbon credits with attributes (including project type) that were once in high demand. This may be partially addressed by the assessment process being undertaken by the Integrity Council for the Voluntary Carbon Market (ICVCM) (discussed in Section 3.4), which could help boost demand for the portion of legacy carbon credits that receive the ICVCM label.

Compliance demand is building but voluntary demand continues to dominate, with market fragmentation likely to continue in the short term. Notwithstanding the current data limitations (see Box 3), indicative estimates based on credit retirements and compliance requirements suggest that voluntary demand accounts for around 90% of the total demand for carbon credits (see Figure 19). However, compliance demand will likely grow, as more domestic compliance instruments are rolled out and allow the use of domestic and international credits and as CORSIA transitions from its voluntary first phase to its mandatory second phase in 2027. The diversity of demand for carbon credits (summarized in Box 2) has contributed to significant market fragmentation. Some of this fragmentation stems from the different purchasing priorities and heterogeneous values for determining quality across buyers. Efforts by the ICVCM to assess carbon credit quality and the availability of a centralized crediting mechanism under Article 6.4 of the Paris Agreement could promote standardization on defining carbon credit quality. Nevertheless, some fragmentation will likely persist due to the inherent diversity of buyers' preferences. Voluntary buyers, for example, seek out credits with specific attributes (such as project location, project type, and credit vintage) in addition to the credit price. Country-level trades under Article 6.2 (while somewhat limited to date) have targeted specific policy priorities. But

Nevertheless, some fragmentation will likely persist due to the inherent diversity of buyers' preferences.

importantly these trades, along with those to meet compliance requirements under CORSIA, require a corresponding adjustment. Thus, while alignment may improve as standardization increases, market fragmentation is expected to continue in the short term, albeit with overlaps across market segments competing for the same units.

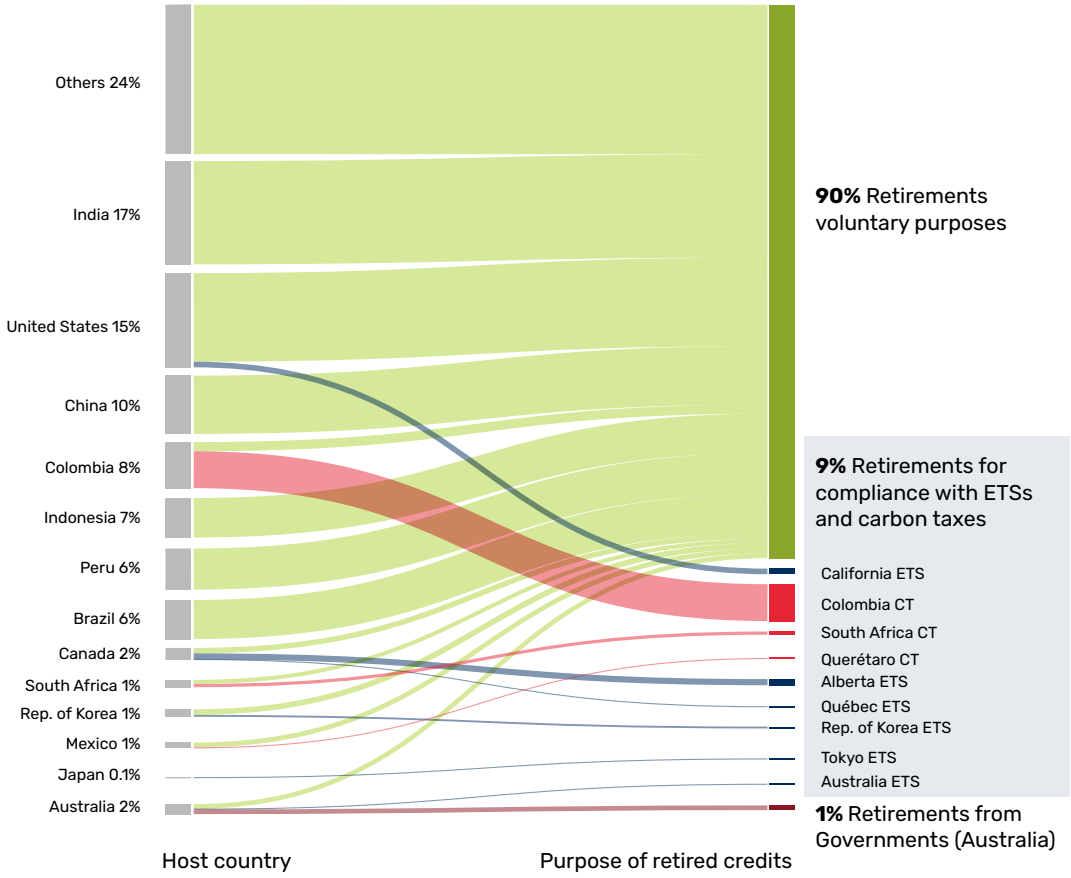
BOX 3

Tracking purpose of retirement

Registries have generally not tracked whether carbon credits have been retired for voluntary or compliance purposes. Gold Standard's new requirements to track the purpose of retirement highlight the potential for this to change.[74] Other registries will likely look to add similar functionality to promote transparency and alignment with the ICVCM Core Carbon Principles. Complementary efforts, including the Climate Action Data Trust, will provide greater transparency and accountability to promote more efficient carbon markets.

FIGURE 19

Indicative allocation of retirements by host country to major markets in 2023



This figure illustrates the volume of retired credits in 2023, showing the country of issuance of retired credits on the left-hand side and the purpose for the retirement—either voluntary or for compliance—on the right. It is important to note that registries typically do not track the purpose of retirement. Government officials provided 2023 compliance retirement data for Alberta, Australia, California, Colombia, Québec, Republic of Korea, South Africa, and Tokyo. Québec CaT, 2023 compliance retirements may not reflect full compliance demand due to triennial compliance cycles. For Colombia, the number of voluntary retirements was established in proportion with the compliance-voluntary ratio from Cercabono. For the Republic of Korea all credits are assumed to originate from domestic projects. For Queretaro, retirements as indicated in government's press release. The overall share of retirements for compliance purposes could be higher, as, for example, the volume of credits retired under China's GHG voluntary emission reduction program for the Chinese Pilots in 2023 is not available.

The commencement of the first phase of the CORSIA program could catalyze a new source of demand from airlines for credits with corresponding adjustments. On January 1, 2024, CORSIA transitioned from its pilot phase into its first phase—a voluntary phase[vii]—which introduced greater restrictions on the types of credits eligible for compliance, including only allowing correspondingly adjusted credits with emission reductions delivered after 2021. The total demand for carbon credits under Phase 1 is expected to range between 64 and 162 million tons, although credits will not have to be surrendered until January 2028.[75] This demand is expected to increase significantly in the second phase (2027-2035), as most International Civil Aviation Organization country members will be required to participate (the few exceptions are least developed countries and small island states). A substantial increase in the supply of correspondingly adjusted credits will be necessary within the next four years to meet this demand. However, the availability of supply remains uncertain. The requirement for corresponding adjustments (and the associated host country authorization) creates significant uncertainty on the future supply of CORSIA-eligible credits.

As highlighted in the State and Trends of Carbon Pricing: International Carbon Markets 2023, very few governments have the systems and processes in place to facilitate authorization.[76]

While only two crediting mechanisms have so far been approved under CORSIA's first phase,[viii] the supply of CORSIA-eligible credits is witnessing some encouraging developments.[77] For example, Guyana, the first country to provide host country authorization, has made around 5 million Architecture for REDD+ Transactions credits available for CORSIA Phase 1 buyers.[78]

A substantial increase in the supply of correspondingly adjusted credits will be necessary within the next four years.

[vii] CORSIA has three implementation phases, with evolving participation requirements and criteria for units eligible for compliance. During the pilot phase (2021-2023), participation by countries was voluntary and covered airlines were allowed to use carbon credits dating back to 2016. Country participation remains voluntary for the first phase (2024-2026).

[viii] As of April 1 2024, only ACR and the Architecture for REDD+ Transactions were approved under CORSIA's first phase.

3.3 Carbon credit prices and trends varied across market segments, with buyers willing to pay a premium for credits with specific attributes

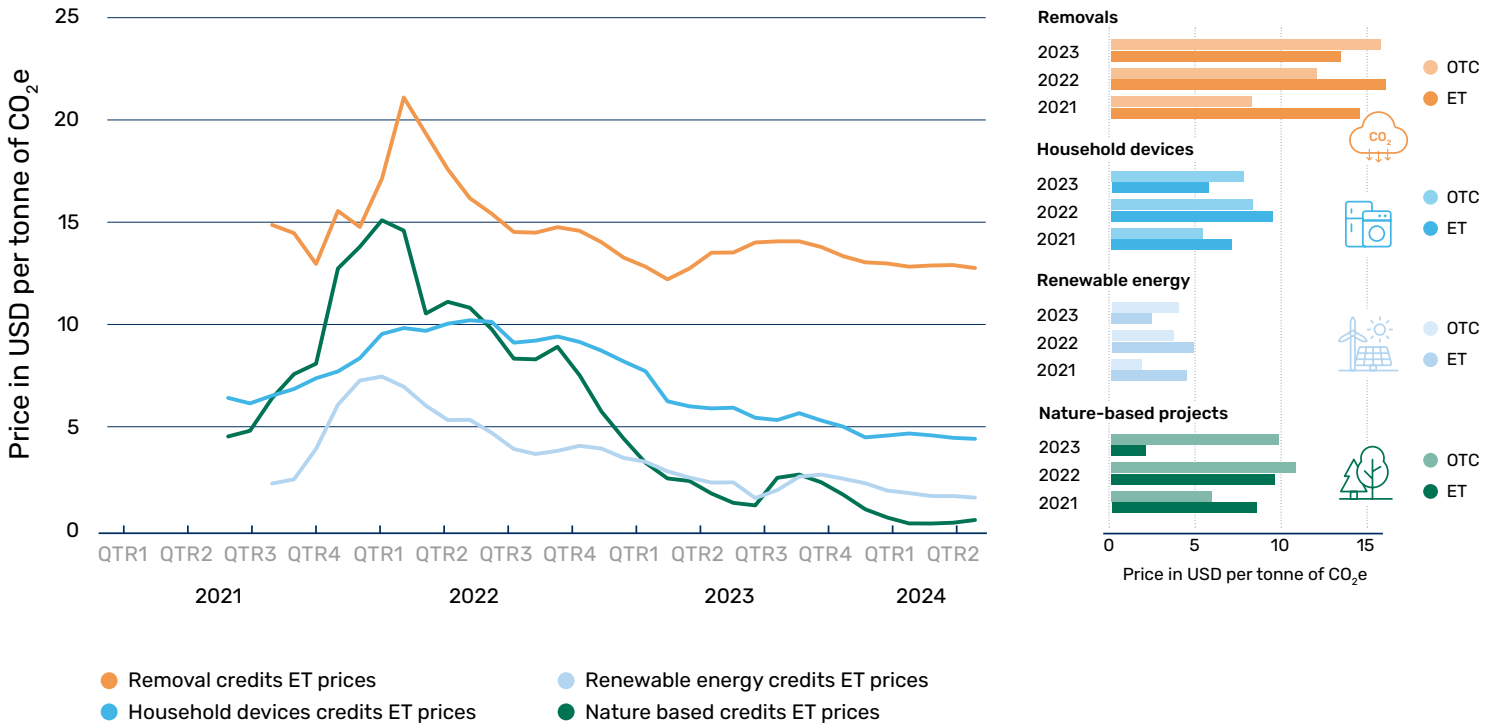
Carbon credit prices have declined across most project categories, but prices for emission removal credits (such as from afforestation projects) have demonstrated significant resilience. Carbon credit prices were, on average, slightly lower compared to a year ago. For example, Ecosystem Marketplace average over-the-counter (OTC) price was $7.12 (down from $7.53 in 2022). Lower prices among most project categories coincided with reduced trade activity for both exchange-traded contracts and OTC transactions: trade volumes under Xpansiv CBL, the largest exchange platform, and the volume of OTC transactions reported to Ecosystem Marketplace both fell by over 50% in 2023 compared to 2022.[79] As highlighted in Figure 20, there is a price gap in 2023 between OTC and exchange-traded contracts and OTC prices displayed greater resilience than exchange-traded contracts over the past three years for the identified project categories. This suggests buyers of credits are willing to pay a premium via OTC transactions to acquire credits with attributes that serve a specific purchasing strategy. For example, exchange-traded prices for renewable energy projects fell by over 50% between 2022 and 2023 but held largely stable in OTC transactions, while prices for household device projects dropped from their 2022 high, across both exchange-traded contracts and OTC transactions. Nature-based credits—covering both emission avoidance and emission removal projects within the agriculture, forestry and other land use categories—traded in exchange-traded contracts saw the most significant decrease, with average prices collapsing by nearly 80% between 2022 and 2023 to below USD 2.

Average OTC prices for forestry and land-use credits covering both avoidance and removals from activities similar to the nature-based credits decreased by 10% in 2023, from a high of USD 10.84 in 2022. While the broader category of nature-based credits saw significant price falls, prices for removal credits (which does not include avoided emissions projects, such as REDD+) were the most resilient—the prices of exchange-traded contracts for removal credits remained largely stable in 2023, while removal credits transacted OTC saw prices increase by 30%. This suggests that the fall in nature-based carbon credit prices is linked to emissions *avoidance* projects, rather than emission *removal* ones. Market hesitations resulting from analysis during 2022 and 2023 raising concerns of overcrediting from project level REDD+ activities and questioning the integrity of carbon credits from these projects might explain such a fall.[80]

Carbon credit prices were, on average, slightly lower compared to a year ago.

FIGURE 20

Exchange-traded (ET) prices from April 2021 to 1 April 2024 and comparisons between yearly average of ET and over-the-counter prices (OTC)



This figure illustrates the exchange-traded and over-the-counter prices of carbon credits. Exchange-traded prices are based on monthly and yearly averages of the price assessments provided by Platts, S&P Global Commodity Insights, 2024. For each of its price assessments Platts has identified a reference base to represent fungible credits across each market segment, considering certification, vintage, volume, and the Sustainable Development Goals. Adjustments are made for credits that vary from this base, normalizing values based on factors like technology, certification standards, geography, and additional benefits to align them with the market value of the reference base. OTC prices were provided by Ecosystem Marketplace and updated as of February 29. OTC prices represent volume-weighted yearly averages of carbon credit trades in the voluntary carbon markets. Discrepancies may exist in project categorizations between the exchange-traded and OTC data due to different source methodologies. See Annex A – definitions for a detailed note on the carbon credit categorizations used in this figure. Details on Platts's assessments can be found in the Platts' Specification Guide

Price differentiation is visible across several dimensions, including vintage and perceived quality. Beyond project categories, price differences are evident also across different vintages. Analysis from Ecosystem Marketplace suggests that buyers in 2023 were willing to pay a 53% premium for "newer" credits (i.e., less than five years old), which is similar to the premium seen in 2022. A significant premium for newer vintages is also seen in exchange-traded contracts, especially for vintages after 2021. Trader analysis from Platts, S&P Global Commodity Insights, for example, shows a slight premium for cookstove credits with newer vintages: 2023 vintage credits are priced up to USD 2 higher than 2020 vintages. In mid-March 2024, Intercontinental Exchange contracts for December 2024 delivery for nature-based credits with 2021-2025 vintage traded at USD 2.17, a near five-fold premium compared to nature-based credits with 2016-2020 vintage.[81] This pattern may reflect market concerns regarding the legitimacy of older projects and methodologies as well as an interest in matching credit vintages to emissions, although demand for older credits remains.[82] Perceived quality also commands a price premium. Recent data indicate a correlation between proprietary quality ratings and carbon credit prices, and a survey found that buyers from various market segments are prepared to pay more for high-quality credits.[83] In spite of a limited market, correspondingly adjusted credits also see higher prices, although volumes are too low to draw strong conclusions. As an example, the average cost of these credits purchased by the Swiss Klik foundation was USD 23 per tCO_2e. Market prices for CORSIA-eligible credits jumped, with Intercontinental Exchange contracts for December 2024 delivery exceeding USD 20 per tCO_2e in mid-April 2024, up from USD 9 per tCO_2e in March 2024.[84]

3.4 Despite the lack of international agreement, Article 6 implementation is progressing while a range of initiatives continue to emerge to improve confidence and manage risks

The integrity of carbon credits remains a critical area of concern. In a survey conducted by the International Emissions Trading Association (IETA), market participants identified negative public perception and the quality of carbon credits as the primary obstacles confronting the voluntary carbon market.[85] In addition to long-standing concerns relating to environmental integrity, questions have emerged around the territorial, financial, and social impacts on affected communities.[86] Responding to these challenges, the ICVCM aims to create a minimum global benchmark for high-quality carbon credits. The ICVCM evaluates crediting programs and crediting methodologies separately, and the ICVCM label can only be applied after both the crediting program and methodology have been approved by the ICVCM. Having finalized its Core Carbon Principles (CCPs) and Assessment Framework, the ICVCM has initiated assessments of crediting programs and methodologies covering around 850 million credits.[87] In April 2024 the first batch of CCP-eligible programs was announced, with ACR, Climate Action Reserve, and Gold Standard approved as meeting the criteria outlined in the CCPs. The ICVCM is also working on assessments for jurisdictional REDD+, renewable energy, and cookstove-related categories, among others.[88] Approvals of such methodologies from CCP-eligible crediting programs are expected to generate the first CCP-labeled credits by Q3 2024. Government authorities and regulatory bodies, including in the UK and Singapore, are beginning to consider the CCP as a potential international benchmark, or minimum quality standard.[89] This could help give

Recent data indicate a correlation between proprietary quality ratings and carbon credit prices.

governments confidence when considering integrating carbon credits into their domestic systems and frameworks, while also helping to standardize supply-side quality. For example, in the United States, the Commodity Futures Trading Commission (CFTC) has issued preliminary guidance for "voluntary carbon credit" derivatives listings on CFTC-regulated exchanges and highlighted CCPs' contributions to help provide assurance of a credit's quality.[90]

Several initiatives are responding to concerns regarding a perceived lack of checks and guidance as to how and when a business can make certain claims. This includes the Science Based Targets initiative (SBTi) and the Voluntary Carbon Markets Integrity Initiative (VCMI). The SBTi provides guidance for companies setting Paris Agreement-aligned decarbonization plans, while the VCMI guides companies in making environmental claims when purchasing carbon credits for residual emissions beyond direct decarbonization measures.[ix] As outlined in the State and Trends of Carbon Pricing: International Carbon Markets 2023 report, the VCMI finalized its Claims Code of Practice in 2023, and the first claim was made under the code in February 2024.[91] Both organizations are working on further guidance for the use of carbon credits. The SBTi released guidance on the development and execution of strategies for beyond value chain mitigation (which can include the purchase of carbon credits) to support other economic and social actors to reduce and remove GHG emissions.[92] It is currently also exploring the role that Environmental Attribute Certificates (including carbon credits) can play toward Scope 3 abatement (i.e., in the value chain but beyond the direct control of the reporting organization).[93] The VCMI released a draft version of a "Scope 3 Flexibility Claim," which would allow the use of carbon credits for up to 50% of Scope 3 emissions until 2030 after all direct decarbonization measures have been implemented.[94] Other actors see a smaller role for carbon credits in this space. In the EU, for example, the new Empowering Consumers in the Green Transition Directive[95] establishes a ban on green claims based on carbon offsetting, although the Green Claims Directive (which will be negotiated by the European Commission, Parliament, and Council after the 2024 elections) is expected to establish further criteria on environmental claims, including on the use of carbon credits.[96] In the US, efforts are ongoing (by the Federal Trade Commission and state legislatures) to provide additional guidance on the types of environmental marketing claims that can be made about the use of carbon credits.[97] These developments highlight the ongoing efforts to refine the role of carbon credits in corporate climate strategies amid broader scrutiny and debate over their effectiveness in climate action.

Perceived quality also commands a price premium.

[ix] The UN High-Level Expert Group on the Net-Zero Emissions Commitments of Non-State Entities recommended a similar approach of reducing emissions in and beyond the value chain before using carbon credits. See High-Level Expert Group on the Net Zero Emissions Commitments of Non-State Entities, "Integrity Matters: Net Zero Commitments by Businesses, Financial Institutions, Cities and Regions," accessed April 29, 2024, https://www.un.org/sites/un2.un.org/files/high-level_expert_group_n7b.pdf

Lack of clarity on financial and market integrity aspects further creates an uncertain investment environment and remains as another key bottleneck to scaling up high-integrity markets. The ambiguity surrounding the legal nature of carbon credits, coupled with the absence of harmonization, interoperability, and oversight in market infrastructure, exacerbates the risks of fraudulent activities, particularly as the market expands. Recent efforts from international bodies to clarify the legal nature of credits and improve regulatory oversight are a step in the right direction for scaling globally interconnected high-integrity markets. For example, the International Institute for the Unification of Private Law (UNIDROIT) is working toward producing guidelines for determining the legal nature of carbon credits[98] and the International Organization for Securities Commissions has published a consultation paper outlining good practices to be adopted by regulators and relevant authorities for boosting market integrity. Guidance from both efforts is not yet finalized and the potential adoption by national regulators remains to be seen. In the meantime, several efforts are also underway to standardize and regulate secondary carbon markets. The draft guidance from CFTC (discussed earlier in this section) is one such effort that is occurring domestically in the US. Additionally, the International Swaps and Derivatives Association and IETA[99] have published standardized templates and definitions for harmonizing physically settled secondary market transactions. Separately, the lack of a common framework and limited interoperability among various national accounting systems, registries, and exchange interfaces could act against efforts to scale these markets.

Carbon credit insurance products continue evolving to help participants manage buyer-side risks. Carbon credit transactions entail challenges, such as the risk of underperformance in generating units (and the inability by the project to deliver credits to a buyer), carbon stock reversals, and potential credit invalidation by the regulator (e.g., due to fraud). Political risks are also relevant. This includes, for example, revocation of carbon ownership rights, a ban on carbon credit exports, and revocation of a corresponding adjustment (despite a government commitment), among others. Buyers are exposed to reputational risks, where, for example, funded projects fail to deliver on environmental promises or where a project causes social or ecological harm. Insurance products are emerging to mitigate some of these risks and offer assurance to buyers, while also shielding them from the costs and complexities of extensive due diligence processes. For example, the Multilateral Investment Guarantee Agency's political risk insurance provides protection against losses arising from a government's breach or reversal of binding commitments regarding rights on carbon credits and corresponding adjustments. Private insurers are also expanding their offerings. For example, Kita's insurance against nondelivery of removal credits now offers clients the option to receive replacement carbon credits drawn from a carbon supplier pool, Oka, The Carbon Insurance Company now offers carbon credits with built-in insurance against reversal and invalidation for carbon credit buyers, and CFC has launched a carbon delivery insurance product that covers both physical and political risks faced by credit purchasers.[100] In addition, governments and international institutions are developing innovative financial instruments to help address financing barriers to developing carbon crediting projects (see Box 4).

Recent efforts from international bodies to clarify the legal nature of credits and improve regulatory oversight are a step in the right direction.

BOX 4

Integrating emission reduction and removals into innovative financial instruments

The lack of upfront financial capital is often one of the biggest obstacles for kick-starting an emission reduction or removal project.[a] Governments and international institutions are actively exploring innovative financial instruments to address this issue. They are seeking to reorient cash flows and leverage carbon credit revenue within traditional financing approaches to attract private investment toward projects in developing countries.

One notable example is the World Bank's Emission Reduction-Linked Bond, a novel approach channeling private funds into emission reduction efforts while offering investors carbon credit-linked returns. This bond diverges from traditional bonds by linking the interest payments on the bond to the delivery of carbon credits. The emission reductions achieved are certified as carbon credits through independent crediting mechanisms, and they are monetized through an emissions reduction purchase agreement. An equivalent amount of financing is made available up front to finance the project.

In 2023, the World Bank secured $50 million through such a bond to finance a water purification project in Viet Nam that was anticipated to reduce or avoid 3 $MtCO_2e$ by reducing the need for biomass in boiling and purifying water.[b] Instead of making regular coupon payments to investors, an equivalent amount of financing is front-loaded and paid via Citi, through a hedge transaction, to finance a specific water purification project. This project's emission reductions were certified under the VCS, and investors receive semi-annual returns based on the sale of the issued carbon credits (see Figure 21).

The Emission Reduction-Linked Bond is considered a low-risk investment with an AAA credit rating,[c] as the principal is fully guaranteed by the World Bank and only the coupon is exposed to the risks of carbon credit-related activities. In addition to mitigating risk, this structure potentially offers higher returns for investors. Environmental Finance estimates that investors in this bond might expect a return premium of approximately 100 basis points over a comparable World Bank bond, contingent upon the successful execution of the project and the steady issuance of carbon credits throughout the bond's tenure.[d]

[a] Ananthakrishnan Prasad, et al., "Mobilizing Private Climate Financing in Emerging Market and Developing Economies," Staff Climate Notes, International Monetary Fund, July 27, 2022, https://www.imf.org/en/Publications/staff-climate-notes/Issues/2022/07/26/Mobilizing-Private-Climate-Financing-in-Emerging-Market-and-Developing-Economies-520585

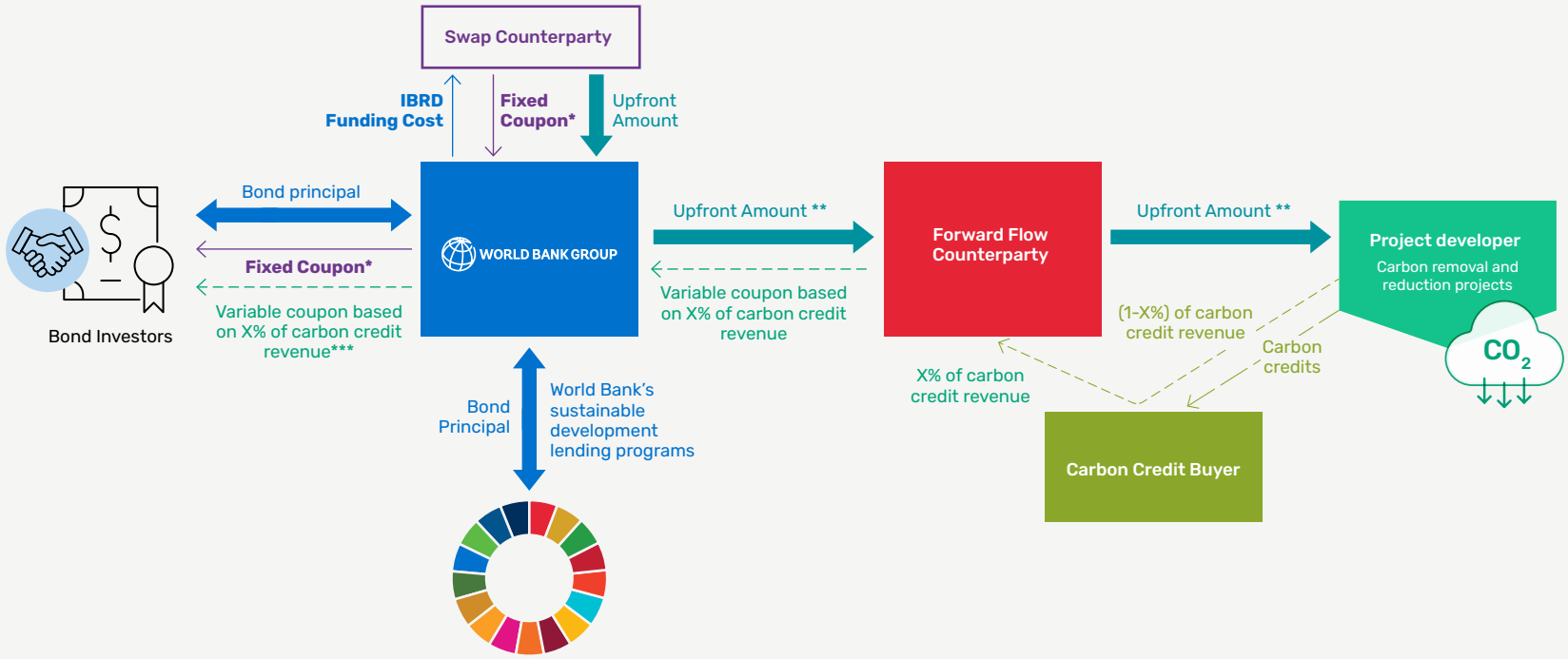
[b] World Bank, "Emission Reduction-Linked Bond Helps Provide Clean Drinking Water to Two Million Children in Vietnam," February 14, 2023, https://www.worldbank.org/en/news/press-release/2023/02/14/emission-reduction-linked-bond-helps-provide-clean-drinking-water-to-two-million-children-in-vietnam

[c] Michael Bennett, Akinchan Jain, "Outcome Bonds: Linking Investor Returns to Sustainable Development Project Outcomes," World Bank Blogs, October 30, 2023, https://blogs.worldbank.org/en/voices/outcome-bonds-linking-investor-returns-sustainable-development-project-outcomes

[d] Ahren Lester, "World Bank Issues 'Unique' Carbon Credit-Linked Bond," Environmental Finance, February 15, 2023, https://www.environmental-finance.com/content/news/world-bank-issues-unique-carbon-credit-linked-bond.html

FIGURE 21

How the Emission Reduction-Linked Bond works



*Lower than ordinary IBRD vanilla bond coupon (IBRD funding cost).
** Upfront amount is disbursed in tranches based on project achieving certain pre-defined milestones
*** Backed by forward carbon credit purchase agreement

World Bank outcome bonds aim to mobilize up-front capital from bond investors to support carbon removal and reduction projects. These outcome bonds can provide investors with a guaranteed return of principal and a guaranteed minimum return, plus a variable return linked to carbon credit revenue from a specific development project(s). Investors give up a portion of the coupons they would ordinarily earn on a conventional IBRD bond, and agree for those foregone coupons to be directed to provide up-front financing to a specific project(s). In return, the project gives up a portion of the potential future carbon credit revenue which is used to provide a variable coupon to the bond investors. Depending on the performance of the project(s) investors overall return will be higher or lower than a conventional IBRD bond.

Implementation of Article 6.2 continues, despite rules not being finalized. The first trade of Internationally Transferred Mitigation Outcomes (ITMO), between Thailand and Switzerland, and the first authorization under Article 6.2 for credits issued by an independent crediting mechanism, by Rwanda under the Gold Standard, took place in 2023, signaling a potential source of supply of credits issued from independent standards that convert to ITMOs after a government's authorization and corresponding adjustment.[101] As highlighted in the State and Trends of Carbon Pricing: International Carbon Markets 2023, the number of bilateral agreements under Article 6 continues to grow.[102] Over a dozen more bilateral agreements have been established since the report was published last year, putting the total agreements in place at over 80.[103] Switzerland and Ghana have also submitted their respective first initial reports to the UNFCCC, kick-starting the transparency provisions under Article 6.2.[104] Countries are also engaging with the private sector through Article 6.2. Ghana, for example, is in conversations with BP (British Petroleum) for the sale of correspondingly adjusted ITMOs.[105] While some countries have fully operational A6 frameworks, most are still at the preparatory stage. Despite having signed agreements with Switzerland and Singapore, countries like Peru and Senegal are still in the process of drafting essential regulations to support ITMO authorizations. Moreover, delegates at COP28 could not agree on fundamental issues, such as the definition of a cooperative approach, nor on rules and processes to revoke ITMO authorizations. While the lack of further guidance on Article 6.2 does not hinder countries from engaging in Article 6.2 approaches such as issuing Letters of Authorization (LoAs) to projects under independent crediting mechanisms, it presents challenges leading to uncertainty, which can complicate and delay efforts to build host country capacities and stimulate investments.

Delays to the new crediting mechanism under Article 6 are a setback but market participants continue using existing crediting mechanisms. While the modalities and procedures for the crediting mechanism under Article 6.4 (now known as the Paris Agreement Crediting Mechanism) agreed in COP26 remain valid, delegates at COP28 could not reach agreement on critical rules including on how to deal with the risk of reversals in carbon dioxide removal activities and on the eligibility of emissions avoidance and conservation enhancement activities under the mechanism. This "no agreement" outcome has generated uncertainty regarding the timeline for the Paris Agreement Crediting Mechanism operationalization. While discussions will continue at the technical level, UNFCCC negotiation timelines mean that the Paris Agreement Crediting Mechanism will unlikely be fully operational before 2025. While this delays broader operationalization of a centralized mechanism, the additional time for technical discussions provides an opportunity to develop a more robust framework to support international cooperation. In the meantime, market participants continue using credits generated through independent and governmental crediting mechanisms.

The number of bilateral agreements under Article 6 continues to grow.

CHAPTER 04

Conclusion

CHAPTER 4

Conclusion

Action is urgently needed to align mitigation efforts with the Paris Agreement's temperature goals. This emphasizes the importance of cost-effective policies like carbon pricing. Implemented carbon taxes and emissions trading systems cover around a quarter of global greenhouse gas emissions—largely the same proportion as a year ago. Revenue from carbon pricing hit record highs in 2023, exceeding USD 100 billion for the first time, despite global carbon prices and coverage remaining relatively unchanged. There is further potential on the horizon in Brazil, India, and Türkiye, where carbon pricing policies are under development. While carbon credit markets hold promise to channel climate finance, concerns over market integrity persist, contributing to declining market activity and a growing pool of non-retired credits. This highlights the importance of ongoing efforts to restore confidence and integrity in carbon markets. The World Bank, working closely with stakeholders across the carbon market ecosystem, continues to support these efforts to promote comprehensive and effective carbon pricing and high-integrity and transparent carbon credit markets.

Carbon pricing continues to gain ground to help close the implementation gap, but progress in the past year was slow. Currently, implemented carbon taxes and emissions trading systems cover around 24% of global emissions—a similar level to a year ago. Importantly, large middle-income countries such as Brazil, India, and Türkiye are making notable strides toward carbon pricing implementation, priming future increases in global coverage. Progress on carbon pricing in these countries reflects their recognition of the need for climate action and the important role carbon pricing can play as part of a climate mitigation strategy. Diversity in policy design across planned and implemented carbon pricing instruments also shows that carbon pricing as a policy response can be tailored to countries' specific circumstances. This year, progress was also observed in sector-specific multilateral initiatives for international aviation and shipping. In addition, the EU CBAM commenced, requiring EU importers of specified products to report embedded emissions. Collectively, these efforts could increase the proportion of global emissions covered by carbon pricing instruments to over 30%. However, achieving this requires enhanced political commitment and collaboration. Countries' submission of their Biennial Transparency Reports in 2024, which track progress toward their NDCs, as well as the ratcheting of new NDCs in 2025, could drive further policy action, including on carbon pricing.

Carbon pricing as a policy response can be tailored to countries' specific circumstances.

Despite slow progress, carbon pricing revenue reached new highs—exceeding USD 100 billion for the first time. While this underscores the potential of carbon pricing as a fiscal policy, it is useful to put this milestone in perspective—it is around 50 times larger than the estimated total annual value of the voluntary carbon market, but it is an order of magnitude lower than global explicit fossil fuel subsidies. The growth in collected carbon revenue, while promising, is somewhat surprising given many carbon prices, including some large, long-standing ETSs, experienced price decreases. Carbon pricing levels continued to fall short of the ambition needed to meet the goals of the Paris Agreement. In fact, less than 1% of global GHG emissions are covered by a direct carbon price at or above the price level recommended by the High-Level Commission on Carbon Prices to limit temperature rise to well below 2°C.

Carbon market activity declined in 2023, but important efforts are underway to address integrity concerns and improve confidence. Credit issuances continued their downward trend for a second consecutive year. In addition, off the back of subdued demand, the pool of non-retired credits continued to grow—exceeding 700 million by the end of 2023. While credit prices generally declined during 2023, credits with specific attributes displayed greater price resilience. For example, prices of credits from carbon removal projects increased, signaling a preference for this credit category. Over-the-counter prices also held firm, reflecting the additional flexibility such transactions offer buyers. Similarly, prices of credits with newer vintages and those with a corresponding adjustment also saw higher prices, indicating buyers are willing to pay a premium for credits that meet their specific requirements. Lingering integrity concerns and confidence issues underscore the pressing need for initiatives such as the Integrity Council for the Voluntary Carbon Market and the Voluntary Carbon Markets Integrity Initiative. The impact of these efforts to rebuild market integrity and credibility are likely to begin to be realized during 2024.

New supply and demand sources for carbon credits are emerging and participation in Article 6 continues despite uncertainty. Governments in middle-income countries are increasingly looking at options to integrate crediting frameworks into their policy mix, with the potential to supply compliance and/or voluntary markets. Notably, China has relaunched its China Certified Emissions Reduction Scheme. The European Union, India, and Viet Nam are also all actively progressing crediting mechanisms—each with different drivers and motivations. Voluntary action continues to account for the majority of demand, but domestic and international compliance demand is slowly building. For example, the commencement of CORSIA's first phase could drive substantial demand for correspondingly adjusted credits. Meeting this demand requires countries to increase their Article 6 readiness. Market fragmentation—in terms of price differentiation and different demand drivers across market segments—will likely continue in the short term. This is largely as a result of the inherent diversity of voluntary buyers' objectives, preferences, and purchasing strategies. Despite Article 6 rules and guidance not being finalized, implementation continued—2023 saw the first trade of Internationally Transferred Mitigation Outcomes, as well as the first authorization under Article 6.2 for credits issued by an independent crediting mechanism. This highlights that countries are willing to actively participate in cooperative approaches even in the face of uncertainty.

The World Bank is committed to supporting governments and the private sector in their efforts to reduce emissions using carbon pricing and carbon markets. As the role of carbon pricing in addressing climate change evolves, so does the potential complexity of policy design from both a domestic and global context. This elevates the need for cooperation, transparency, and the provision of accurate and timely information and analysis. The World Bank is contributing to these efforts through the provision of information and analysis presented in the State and Trends of Carbon Pricing Products, including promoting access to carbon pricing and carbon credit market data through a modernized State and Trends of Carbon Pricing Dashboard. In addition, the World Bank is also helping to scale up high-integrity carbon credits in forests and other sectors, as highlighted in the World Bank Engagement Roadmap for Carbon Markets, supporting over 30 countries as they seek to understand, prepare for, and implement carbon pricing under the Partnership for Market Implementation program. The World Bank continues to engage with other international organizations, governments, the private sector, and civil society to share knowledge, build capacity, and promote transparency to help support an effective global response to climate change.

2023 saw the first trade of Internationally Transferred Mitigation Outcomes.

Annexes

Annex A Definitions

Carbon pricing

Carbon pricing seeks to align the costs of consuming carbon-intensive fuels or using carbon-intensive processes with the social costs of those activities. If well designed, and sufficiently ambitious, carbon pricing can create strong economic incentives for the changes needed in investment, production, and consumption patterns, and to induce technological advancements, reducing the extent of additional public investment needed. Well-designed carbon pricing policies can help raise revenues in a more efficient and less distortive way than alternative options, like labor taxes, and can yield numerous benefits to society beyond climate mitigation. Carbon pricing is an important policy tool that can be used as part of a comprehensive policy package to decarbonize economies.

Direct carbon pricing

Direct carbon pricing is implemented to reduce GHG emissions by providing a price signal closely linked to actual emissions. Direct carbon pricing instruments are categorized as "compliance" instruments or "carbon crediting" mechanisms. Under compliance instruments (such as emissions trading systems or carbon taxes), covered entities are obligated to pay for the emissions from covered activities. Participation in carbon crediting on the other hand is optional, with participants earning "credits" in recognition of quantified and verified emissions reductions or removals.

Indirect carbon pricing

Indirect carbon pricing refers to instruments that change the price of products associated with carbon emissions in ways that are not directly proportional to the relative emissions associated with those products. These instruments provide a carbon price signal, even though they are often (primarily) adopted for other socioeconomic objectives, such as raising revenues or addressing air pollution. Examples of indirect carbon pricing include fuel and commodity taxes, as well as fossil fuel subsidies affecting energy consumers. For example, fuel excise taxes apply a tax to the volume of fuels, such as gasoline and diesel (e.g., dollars per liter), which places a price on the carbon emissions from the combustion of those fuels. However, the price is not determined in proportion to the relative emissions resulting from the combustion of those fuels. Conversely, fuel subsidies that reduce the price of fossil fuels create a "negative" indirect carbon price signal, which incentivizes higher consumption and therefore increases carbon emissions.

While carbon pricing policies can be categorized as direct or indirect, in practice the distinction is not always obvious. The most direct carbon pricing policy would apply an equivalent and proportional incentive to reduce GHG emissions across all sectors and fuels. Indirect carbon pricing policies still create a price signal that applies to fossil fuels or products, but they are not designed to apply a consistent price across emissions from different sources (e.g., the price is not linked to actual GHG emissions or the carbon content of fuels). ETSs, carbon taxes, and carbon crediting are direct carbon pricing policies, but in reality, all examples of these policies currently in operation differ across sectors, fuels, activities, and/or gases. As a result, the distinction between direct and indirect carbon prices is less stark in practice, and carbon pricing policies sit on a spectrum from direct to indirect.

Term category	Term	Definitions
Carbon pricing instruments	Emissions trading system	In an **emissions trading system (ETS)**, the government places a limit on the amount of greenhouse gas (GHG) emissions from covered entities. Entities must surrender emission units (or "allowances") to cover their emissions within a compliance period. Each emission unit represents the right to emit a certain volume of emissions (typically 1 ton of carbon dioxide equivalent [tCO_2e]) and can be traded between covered entities or sometimes with other traders. There are several different types of ETSs, including "cap-and-trade" and "rate-based" approaches, and different terms are used for the emission units within different systems. The carbon price in these systems is usually a function of supply and demand for emission units.
	Carbon tax	Through a **carbon tax** a government levies a fee on covered entities for their GHG emissions, providing a financial incentive to reduce emissions. Under a carbon tax, the government sets the price of emissions (the tax rate). The resulting volume of emissions reductions achieved by the policy is determined by the response of the emitting entities to the set price.
	Carbon Crediting Mechanism	Under a **Carbon Crediting Mechanism**, tradable credits (representing 1 tCO_2e) are generated through voluntary emissions reduction activities. Carbon credits are issued to activities that reduce emissions, according to protocols that aim to ensure each credit represents a genuine emission reduction. Credits can then be sold to buyers, generating revenue. Carbon credits can represent emissions reductions achieved through either avoidance (preventing GHG emissions from entering the atmosphere—like capturing methane from landfills before it is released), or removal (taking GHGs from the atmosphere, for example through sequestering carbon through afforestation). While carbon crediting mechanisms create a source of supply, they rely on a separate source of demand for credits in order to deliver a financial incentive to reduce emissions. Demand for credits can come from compliance instruments (ETSs or carbon taxes that allow the use of offsets), countries meeting Nationally Determined Contribution targets under the UNFCCC, voluntary offsetting (sometimes linked to internal carbon pricing), or results-based climate finance.
Types carbon crediting mechanisms	International crediting mechanism	Mechanisms managed or administered by an international organization, including those established with authority of national governments, such as UN agencies. This category includes the Kyoto Protocol (including the Clean Development Mechanism) and the Paris Agreement.
	Independent crediting mechanism	Includes those administered by a non governmental organization, such as Verra and Gold Standard.
	Governmental crediting mechanism	Mechanisms administered by one or more governments, such as the California Compliance Offset Program and the Australian Carbon Credit Unit (ACCU) Scheme.
Status	Under consideration	A government has announced its intention to work toward the implementation of a carbon pricing instrument and this has been formally confirmed by official sources.
	Under development	A government is actively working toward the implementation of a specific carbon pricing instrument (for example, a mandate may have been established, but regulated entities do not yet face compliance obligations, or no credits have been issued) and this has been formally confirmed by official government sources.
	Implemented	The instrument is in full operation. For a compliance instrument, the carbon pricing instrument has been formally adopted through legislation and compliance obligations are in force and enforced. For crediting, credits have been issued (or have frameworks in place to allow credits to be used domestically) and activities are ongoing.

Term category	Term	Definitions
Greenhouse gases	CO_2	Carbon dioxide
	CH_4	Methane
	N_2O	Nitrous oxide
	PFCs	Perfluorocarbons
	HFCs	Hydrofluorocarbons
	SF6	Sulfur hexafluoride
	Other	Other greenhouse gases or substances that are not regulated under the UNFCCC, for example black carbon or NOx.
Coverage status	Covered	Point-source emissions from this sector are generally subject to compliance obligations (even if the regulation may apply to entities upstream or downstream from the emissions point source) or eligible for crediting. Some emissions from the sector may not be eligible or covered, for example if there are exemptions or exclusions for a particular greenhouse gas.
	Covered in principle	Some point-source emissions from this sector are covered, but in practice the share of emissions covered is very low. The low coverage rate is usually due to non-sector specific exclusions such as certain fuels or gases being exempt, most entities in the sector falling below relevant thresholds for participation, or most entities already being covered by another initiative.
	Not covered	No point-source emissions from the sector are covered.
Sectors covered by a compliance carbon pricing instrument	Electricity and heat	Emissions resulting from fuels burned in facilities primarily producing electricity or heat for shared use.
	Industry	Emissions produced by industrial facilities including manufacturing, metal production, fertilizer production. Includes emissions from fuel used for energy in these facilities as well as emissions from industrial processes.
	Mining and extractives	Emissions from mines, rigs, and fuel processing. Includes emissions from fuel used for energy in these facilities as well as fugitive emissions.
	Transport	Emissions resulting from fuels burned for energy in the service of moving people or goods (e.g., road, rail) except for aviation.
	Aviation	Emissions resulting from fuels burned in the aviation sector.
	Buildings	Emissions resulting from fuels burned for energy in residential, commercial, and public sector buildings.

Term category	Term	Definitions
Sectors covered by a compliance carbon pricing instrument	Agriculture, forestry, and fishing fuel use	Emissions resulting from fuels burned for energy in the agriculture, forestry and fishing sectors.
	Agricultural emissions	Emissions resulting from agricultural processes like livestock and fertilizer use. Excludes fuel use and land-use, land-use change and forestry.
	Waste	Emissions resulting from waste management facilities including incineration of waste, methane or CO_2 produced from landfills etc. Excludes fuel use.
	Land-use, land-use change, and forestry	Emissions (or removals) resulting from changes to carbon sinks in plants and soils.
Coverage threshold		Some initiatives set a threshold above which entities must, or can, join a compliance carbon pricing instrument. There are many different ways of expressing these thresholds – many use an emissions threshold (e.g., installations with emissions above 25,000 tons CO_2e)
Point of regulation	Point source	The 'Point source' is where the GHGs are physically released into the atmosphere (e.g., at the installation combusting fuel). Regulation at the ' Point source' is where the compliance obligation is imposed on the entities that release the covered emissions into the atmosphere.
	Upstream	The compliance obligation is imposed at a point in the supply chain before the point source of emissions entering the atmosphere. For example, in relation to emissions from fuel combustion, upstream coverage could be at the point at which the fuel is first commercialized by extractors, refiners, or importers, or at point of sale to the final consumer.
	Downstream	Obligations apply at a point in the supply chain after the point source of emissions. This could include entities being liable for the emissions associated with electricity they use. These entities are downstream from the point source of emissions (which would occur at a power station).
Credit project categories under crediting mechanisms	Agriculture	Reducing emissions from any activities in the agricultural sector.
	CCS/CCU	Removals achieved through carbon capture and storage or carbon capture and utilization.
	Energy efficiency/ fuel switching	Avoiding emissions from the participant's energy use either through reducing the amount of energy the participant consumes or switching to a less emissions-intensive energy source.
	Forestry and land use	Increasing the volume of emissions removed from the atmosphere or avoiding emissions being released through changes to terrestrial sinks.
	Fugitive emissions	Avoiding the release (intentional or unintentional) of greenhouse gases during the extraction, processing, transformation and delivery of fossil fuels to the point of final use.

Term category	Term	Definitions
Credit project categories under crediting mechanisms	Chemical process / industrial manufacturing	Avoiding emissions produced by industrial facilities including manufacturing, metal production, fertilizer production. Includes emissions from fuel used for energy in these facilities as well as emissions from industrial processes.
	Renewable energy	Emissions avoided by integrating renewable energy into the energy supply in the place of fossil fuel power.
	Transport	Reduction of emissions resulting from fuels burned for energy in the service of moving people or goods (e.g., road, rail), including for aviation.
Credit project categories for over-the-counter and exchange-traded prices	Household devices	Reflects carbon credits from projects that improve the environmental footprint of the household, including but not limited to clean cookstoves projects and clean water access. The basket of credits for OTC prices includes community devices projects, which may not be included in the projects incorporated within Platts's definition for the assessment of household devices.
	Removals	Reflects carbon credits from nature-based or technological projects that remove GHG emissions from the atmosphere.
	Nature-based	Reflects avoidance or removal credits that fall within Agriculture, Forestry, & Other Land Use categories. This includes, but is not limited to, credits that avoid deforestation (including REDD/REDD+), no till farming, wetland management, soil sequestration (including biochar), reforestation and afforestation projects. The basket of credits for exchange-traded prices includes agriculture projects which are not included in the projects incorporated within Ecosystem Marketplace's OTC definition for forestry and land use.
	Renewable energy	Reflects carbon credits from renewable energy projects that avoid GHG emissions.
Issuance type	Original issuance	Original issuances refer to issuances of credits that reflect the first time a credit has been issued for a specific emission reduction/removal activity. Original issuances do not rely on any previous issuances from other crediting mechanisms.
	Non-original issuance	Non-original issuances refer to issuances of credits that are connected to previous issuances from another crediting mechanism. Non-original issuances can either be issued via direct or adjusted conversions. ***Direct conversions*** are issuances that are converted 1-1 from another crediting mechanism. ***Adjusted conversions*** are issuances that are converted from another crediting mechanism but in accordance with own standards (issuances volumes might be changed).
	Overlap	Overlap can occur as a record of eligible credits as a result of the conversion of a credit from one program to another—meaning the original credit representing the specific emission reduction has been canceled or retired in the original mechanism's registry in order for the subsequent credit to be issued.
Country income group		The World Bank classifies economies for analytical purposes into four income groups: low, lower-middle, upper-middle, and high income. For this purpose it uses gross national income per capita data in US dollars, converted from local currency using the World Bank Atlas method, which is applied to smooth exchange rate fluctuations. More information on country classification can be found on the Knowledge Base, available on the World Bank website: https://datahelpdesk.worldbank.org/knowledgebase/articles/906519

Annex B

Methodologies and Sources

1. Sources and timelines: The State and Trends of Carbon Pricing 2024 report draws on a range of sources, including official reporting (i.e., government budget documents), related legislation that underpins the carbon pricing initiative, statements from governments and public authorities, and information provided by jurisdictions. Data and updates in the report represent the situation as of April 1, 2024, unless stated otherwise.

2. Emissions

Greenhouse gas (GHG) emissions data for the most recent year (2022), as well as GHG emissions data from previous years, is sourced from the EDGAR (Emissions Database for Global Atmospheric Research) Community GHG Database, version 8 (2023),[106] where available, or the most recent emissions data from official sources to be consistent across jurisdictions.

- GHG emissions values for Canadian provinces and territories are taken from Canada's latest national inventory.
- GHG emissions values for US states are based on official subnational GHG inventory reports of each of the respective states, available from the US Environmental Protection Agency Greenhouse Gas Inventory Data Explorer.
- To estimate GHG emissions values for Mexican states, emissions reported for Mexico in the EDGAR version 8 database are attributed proportionally according to population data as per the most recent census for the estimated year. Population census data is obtained from the Mexican National Institute of Statistics and Geography.[107] GHG emission estimates for China's subnational jurisdictions are based on estimates included in the International Carbon Action Partnership's (ICAP) Status Report 2024.

The EDGAR dataset provides aggregate data for certain countries, including France and Monaco, Serbia and Montenegro, Spain and Andorra, and Switzerland and Liechtenstein. In these cases, the GHG emissions estimate for each country was determined based on the relative emissions of each country in the most recent GHG emissions inventory reported to the United Nations Framework Convention on Climate Change.

Values are presented in gigatons of carbon dioxide equivalent emissions aggregated using Global Warming Potential values from IPCC AR5 (GWP-100 AR5). Consistent with decision 6/CP.27, parties are transitioning to the AR5 GWP values in their national inventory reports by December 31, 2024.

3. Coverage

The proportion of global GHG emissions covered by a direct carbon price is calculated based on direct carbon pricing instruments that are "implemented." The estimate of emissions coverage for each carbon pricing instrument is based wherever possible on official government sources and considers the scope (sectors, fuels, and/or gases) of policies but does not necessarily factor in all exemptions and/or emissions thresholds or free allocations.

4. Price

Carbon prices are nominal prices and are generally based on the exchange-traded or auction prices on April 1, 2024, or the most recent available. Additional price information is further clarified here:

- As of the time of writing, no information on the value of allowances in the Mexico ETS is available.
- Massachusetts ETS price data is equal to the auction clearing price for 2023 units from the auction held on March 15, 2024.
- California and Québec cap-and-trade price data is the California Carbon Allowance Vintage 2023 Futures for April on April 1, 2024.
- Regional Greenhouse Gas Initiative (RGGI) price data is the weighted average of the allowance transfer transaction prices on April 1, 2024. Prices are converted from USD/short ton carbon dioxide equivalent (CO_2e) to USD/metric ton CO_2e.

- UK ETS price data is the UK Allowance Daily Futures Price on April 1, 2024.
- New Zealand ETS price is the spot price on April 2, 2024.

5. Revenue
Revenue is for the period January 1, 2023, to December 31, 2023. Adjustments are made for jurisdictions with fiscal years that do not align with a calendar year. Where 2023 revenue was not available before the report was finalized, official revenue forecasts for 2023 are used, or revenue is estimated based on revenue collected in 2022. Revenue values are converted from nominal to real (2023 USD) by adjusting the observed value to the target year (2023), using the country deflator (based on the average consumer price inflation index in the International Monetary Fund (IMF) World Economic Outlook Database),[108] then converted into USD using the market exchange in the target year (IMF exchange rates on April 1, 2023).

6. Exchange rate conversions
Price data are converted from national currency to US dollars using the IMF exchange rates on April 1, 2024.

7. 2023 ETS price developments
Price development data is taken from ICAP's Allowance Price Explorer, which has up-to-date information on allowance prices in ETSs. The following sources were also used: the California Air Resources Board website, spot price data provided by the European Energy Exchange group for the EU ETS, the website of the Ministry for the Fight Against Climate Change of Québec, the RGGI website, and the Intercontinental Exchange and the Swiss Emissions Registry.

8. Indicative estimates of the potential GHG emissions covered by different carbon pricing instruments and international initiatives (Figure 6)
All emissions data are based on GHG emissions from the Emissions Database for Global Atmospheric Research (EDGAR version 8.0, https://edgar.jrc.ec.europa.eu/), or are from domestic inventories in the case of subnational jurisdictions. Assumptions are as follows:

- For carbon pricing instruments under development and under consideration where the expected sectoral coverage is known (such as the EU ETS 2 covering buildings and transport, or the Canada Oil and Gas cap-and-trade covering the oil and gas sector), the estimate of potential covered emissions is quantified using the emissions profile of those sectors.
- When no expected sectoral coverage is known, it is assumed that the carbon pricing instrument under consideration or under development will cover emissions from industrial combustion, power industry and processes sectors.
- The lower-bound estimate corresponds to 60% of the emissions in the covered sectors in the jurisdiction, whereas the upper-bound corresponds to 80% of those emissions.
- The analysis excludes emissions from any proposed instruments that would cover a sector that is already covered by an existing carbon pricing instrument.
- Carbon Border Adjustment Mechanism (CBAM) coverage estimates are based on Beaufils, T., Ward, H., Jakob, M. et al. (2023): Assessing different European Carbon Border Adjustment Mechanism implementations and their impact on trade partners. Communications Earth & Environment, 4, 131 (2023), https://doi.org/10.1038/s43247-023-00788-4. The upper-bound of emissions covered by CBAM corresponds to the "Scope 1 and 2 and downstream products, Direct imports only" portion of the "Conservative coverage" estimate and the lower-bound corresponds to the "Scope 1 emissions, Direct imports only" estimate of the same source. There is potentially double counting as some of the CBAM emissions are covered under carbon taxes or ETSs in third countries.
- The upper-bound of emissions covered by CORSIA corresponds to the 2022 emissions from international aviation as per EDGAR version 8, whereas the lower-bound corresponds to 60% of those emissions.
- The upper-bound of emissions covered by a carbon pricing instrument developed under the International Maritime Organization corresponds to the 2022 emissions from international shipping as per EDGAR version 8, whereas

the lower bound corresponds to 60% of those emissions. Coverage estimates are based on a voyage-based approach, using EDGAR data. A vessel-based approach to quantify emissions includes domestic voyages and is likely to be used under a global emissions pricing scheme. This would increase the estimate of greenhouse gas emissions covered by the international shipping global emissions pricing instrument.

9. Prices and coverage across ETSs and carbon taxes (Figure 7)

Nominal prices on April 1, 2024, or most recent exchange traded or auction prices before April 1, 2024, are shown for illustrative purposes only. Only the main rate is shown for each instrument. Some instruments are not shown in figure 7 where current price information is not available. Prices are not necessarily comparable between instruments because of (for example) differences in the sectors covered and allocation methods applied, specific exemptions, and compensation methods.

Several jurisdictions apply different carbon tax rates to different sectors or fuels. In these cases, the included price reflects the highest general tax rate or primary fuel covered by the carbon tax. The instruments included on the x-axis reflect prices provided by each instrument. Jurisdictions with multiple instruments (such as EU member states) may have a jurisdictional price rate and total emissions coverage that may be higher than indicated by an individual instrument. The EU ETS includes 27 EU member states plus Norway, Iceland, and Liechtenstein.

The majority of federal and subnational policies in Canada are priced at the same rate, reflecting the PanCanadian Approach that requires all Canadian provinces and territories to have a carbon pricing system in place that aligns with the minimum national stringency federal standards. These are presented in two instruments (a carbon tax and an ETS). The carbon tax entry (Canada provinces and federal) includes the federal fuel charge, British Columbia carbon tax, and the Northwest territories carbon tax. The ETS entry (Canada federal and provinces) includes the federal Output-Based Pricing System (OBPS) and provincial systems in Alberta, British Columbia, New Brunswick, Newfoundland and Labrador, Nova Scotia, Ontario, and Saskatchewan. The coverage under Canada reflects the combined coverage of Canada's total emissions by the included policies. For subnational Mexico carbon taxes, coverage estimates are based on the fuels covered by each instrument.

The 2030 carbon price corridor is based on the recommendations in the report of the High-Level Commission on Carbon Prices, adjusted for inflation. The 1.5°C 2030 carbon price corridor is based in marginal abatement costs for mitigation pathways from the 2022 contribution of Working Group III to the Sixth Assessment Report of the IPCC, adjusted for inflation.

10.Crediting data

Carbon credit issuance and retirement data are for the period January 1, 2023, to December 31, 2023. Data on issuances, retirements, and project registrations for independent and international crediting mechanisms is either sourced from publicly available carbon crediting mechanism registries or obtained from the organizations that operate independent crediting mechanisms. Project categories provided by Ecosystem Marketplace Data for governmental crediting mechanisms (including issuance and price data) were provided by jurisdiction governments for the following crediting mechanisms: Alberta Emission Offset Program, Australia Emissions Reduction Fund, British Columbia Offset Program, California Compliance Offset Program, Colombia Crediting Mechanism, J-Credit Scheme, Republic of Korea Offset Crediting Mechanism, South Africa Crediting Mechanism, Switzerland CO_2 Attestations Crediting Mechanism, and Tokyo Cap-and-Trade Program. Price data for exchange-traded transactions is provided by Platts, S&P Global Commodity Insights and reflects the most competitively priced underlying contract meeting the carbon credit price assessments' specifications. Price data on over-the-counter (OTC) transactions is provided by Ecosystem Marketplace and reflects price and transaction volume data confidentially disclosed to Ecosystem Marketplace and represents OTC volume-weighted carbon credit prices in voluntary carbon markets, up-to-date as of February 29, 2024.

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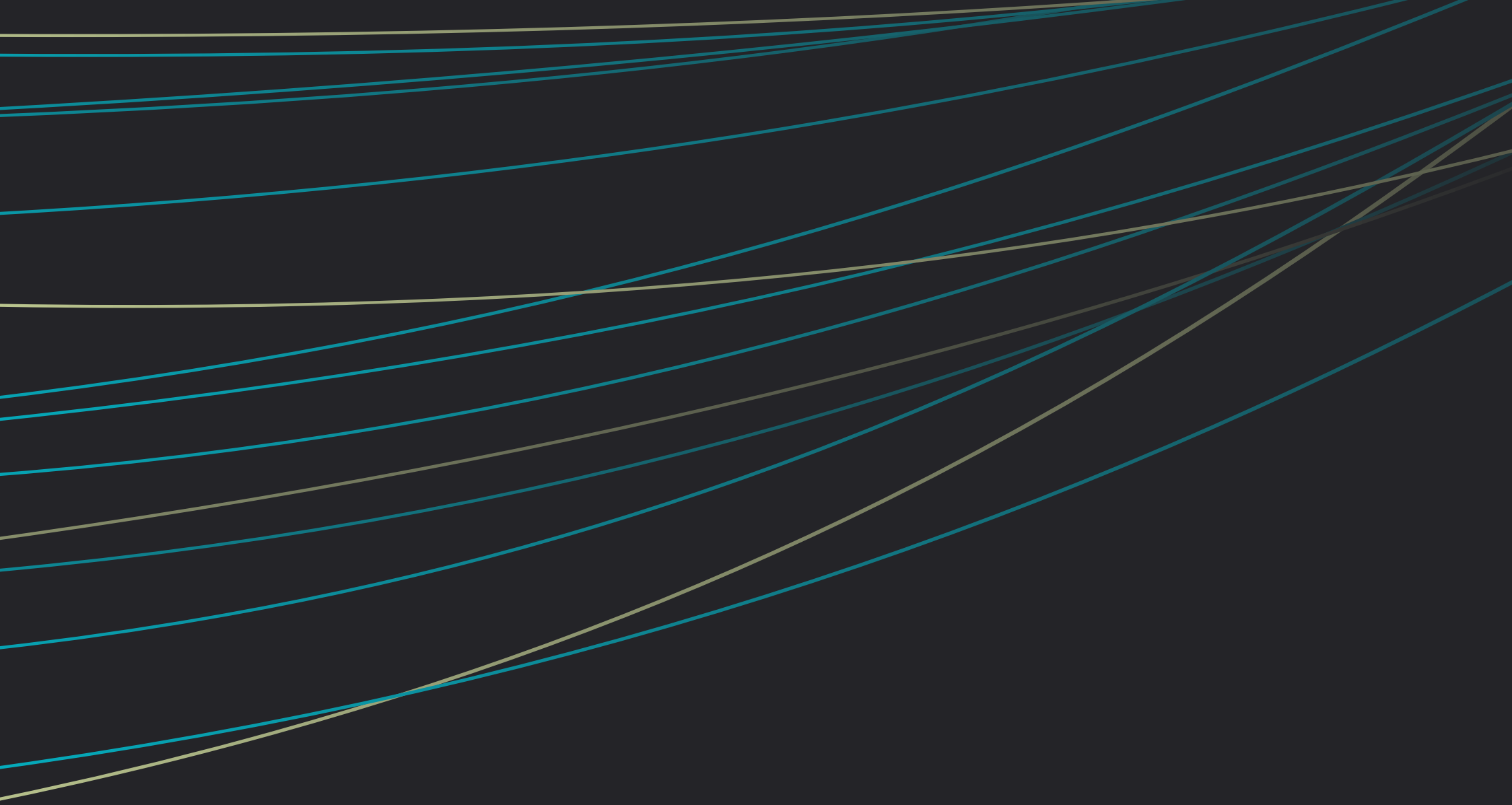

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