

4 key trends for 2023

74 As of August 1st, 2023, 74 carbon pricing mechanisms have been identified worldwide, in either the form of carbon taxes or emissions trading schemes (ETS). These mechanisms can operate at different levels: 31 of them operate at the provincial level, 42 at the national level, and 1 at the interstate level (EU ETS). The jurisdictions covered by carbon pricing mechanisms accounted for 54% of global GDP in 2023 and 50% of global greenhouse gas (GHG) emissions.

USD 0,01-154

The range of explicit carbon prices is very wide: as of August 1st, 2023, they ranged from 1 cent per ton in Baja California (in Mexico) to USD 154 in Uruguay. Currently, over 70% of the covered GHG emissions are still priced at less than USD 20 per tCO₂e. However, in 2017, the Stern-Stiglitz report estimated that the incitative effect of these mechanisms could only be fully achieved with prices ranging from USD 40 to 80 per tCO₂e in 2020 and from USD 50 to 100 per tCO₂e in 2030.

USD 93 bn

After reaching USD 97 billion USD in 2021, carbon pricing revenues have since stabilized at USD 93 bn in 2022. This relative decrease between 2021 and 2022 is mainly due to exchange rate movements over the same period and the reduction in auctioned allowances. More than 50% of carbon revenues are earmarked to green or development projects, 10% are redistributed to households or companies affected by carbon pricing, while the remaining (32%) goes into the general budget of each jurisdictions without any specific allocation (see p.10).

Although there has been an increase in the number of carbon pricing mechanisms within recent years, the majority of carbon revenues comes from 5 mechanisms which account for three-quarters of the revenues: the European, British and German ETS (44%, 8% and 7% respectively), and the carbon taxes in France and Canada (9% and 7% respectively).

24% This figure represents the share of emissions covered by a carbon pricing mechanism and includes emissions taxed at a either reduced price or covered by free allowances. If we only consider emissions taxed at the explicit price, this figure drops to 6%.

ZOOM ON THE LATEST DEVELOPMENTS

Between 2022 and 2023, several new carbon pricing mechanism have been introduced worldwide. On a national scale, **Indonesia** launched the first phase of its ETS, covering 99 electric plants, or 80% of the country's generating capacity. In **Japan**, 400 companies volunteered in the new ETS covering 28% of the country's emissions. **Australia** has reformed the rules of its Safeguard Mechanism, transforming it into to a *Baseline and Credits* type ETS to cover 28% of national emissions. Finally, in **Hungary**, the government has announced the retroactive introduction of a tax, effective from January 1st, 2023, targeting companies that benefit from a significant allocation of free allowances under the EU-ETS. This tax consists of 2 components: a carbon price of EUR 40 per tCO₂e, and a 10% transaction fee on the value of the free allowances obtained.

At the provincial level, in Mexico, the states of **Guanajuato** and **Durango** have implemented their own environmental taxes in 2023 including a component on GHG emissions. In **Tamaulipas**, the collection of allowances believed to be due to challenges faced by the state in measuring the emissions of companies are believed to be the reason for this failure. In **Baja-California**, many appeals have been granted by the Mexican judiciary, exempting the plaintiffs from paying the tax without abolishing it altogether, and stipulating that only the Federation had the power to tax petroleum products such as gasoline or diesel.

In the United-States, **Washington State** has launched its *Cap-and-Trade* ETS. The Regional Greenhouse Gas Initiative (RGGI), a multi-state ETS in the eastern United-States, is making news. Indeed, political battles continue in **Pennsylvania** to determine whether or not the state should join the RGGI, while **Virginia** is making progress in its efforts to withdraw from the same market. In **North Carolina**, the recent Senate votes make it highly unlikely that the state will join the RGGI. In **Canada**, **Nova-Scotia**, **New-Brunswick**, **Prince Edward Island** and **Newfoundland and Labrador** have abandoned their provincial carbon tax in favour of the federal levy. **Nova-Scotia** and **Saskatchewan** have modified their own ETS to meet the federal requirements (see p.3).

IMPACT OF THE ENERGY CRISIS AND THE WAR IN UKRAINE IN EUROPE

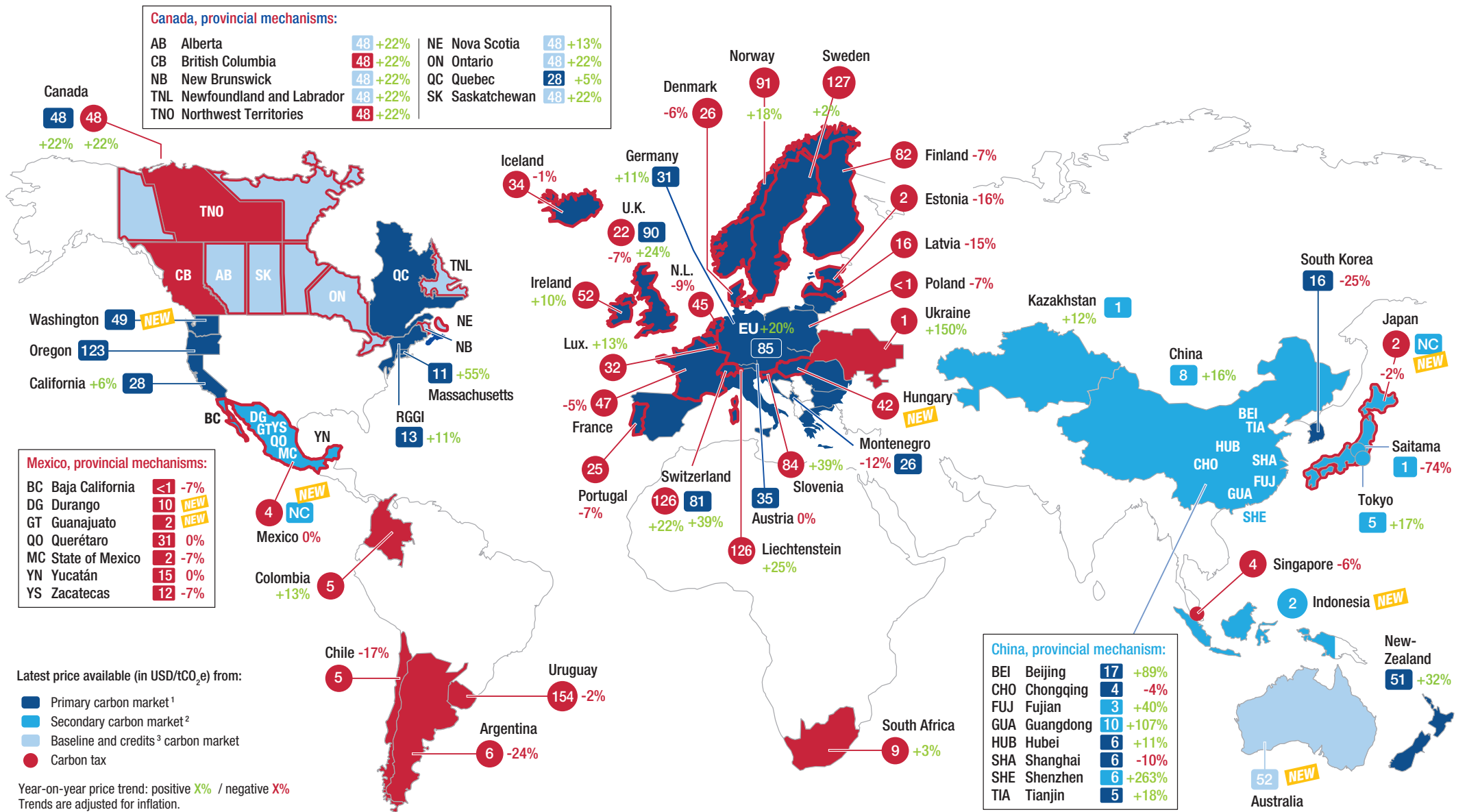
To contain the rise in energy prices, some European countries have taken measures targeting their carbon pricing instruments. In **Portugal**, where the carbon tax rate is linked to the previous year's EU-ETS allowance price, it has been decided to freeze its tax rate at the 2021 level as of January 2022. **Slovenia**, using a similar fiscal instrument, tripled its carbon tax rate between 2020 and 2022, but then suspended its collection from June 21, 2022 until May 9, 2023. **Austria** delayed the implementation of its ETS by 3 months during the summer of 2022. **Germany** has frozen the increase in its mechanisms scheduled for 2023 and is using its ETS revenues to contain the rise in energy prices (see p.11). In **Ukraine**, carbon tax collection still continues in the *oblasts* unaffected by the conflict with revenues earmarked for a new 'Decarbonization and energy efficiency Fund' in 2024.

Additional sources and charts:

[Global carbon accounts in 2023](#), I4CE

To obtain more information or provide feedback regarding the sources used for this 2023 edition of the global carbon accounts, and in particular the national sources: contact@i4ce.org

Map of explicit carbon prices around the world in 2023

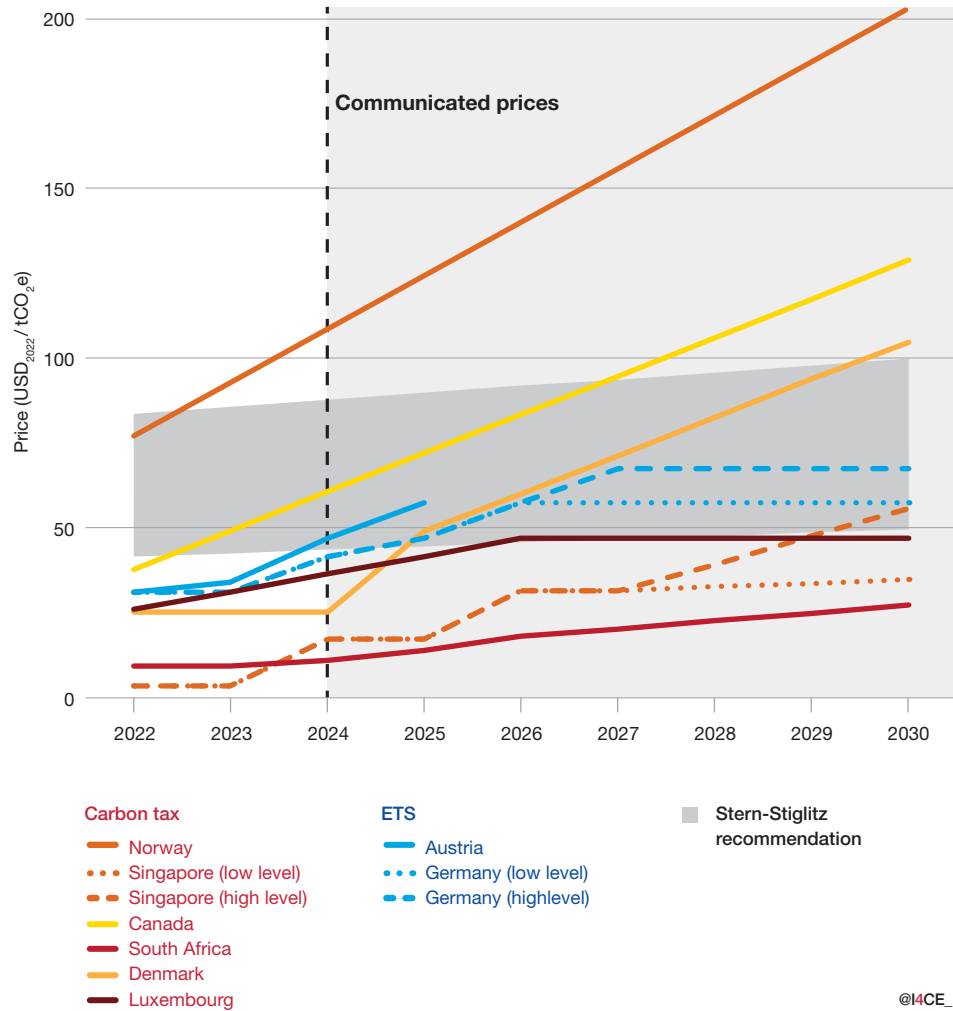


¹ Allowances are auctioned by a public authority

² Trading of allowances between players, with no revenue for the public authority

³ Emissions standard to be met by each player. If the standard is exceeded, the player must buy allowances (possibly from the public authority).

8 mechanisms have announced changes in carbon prices

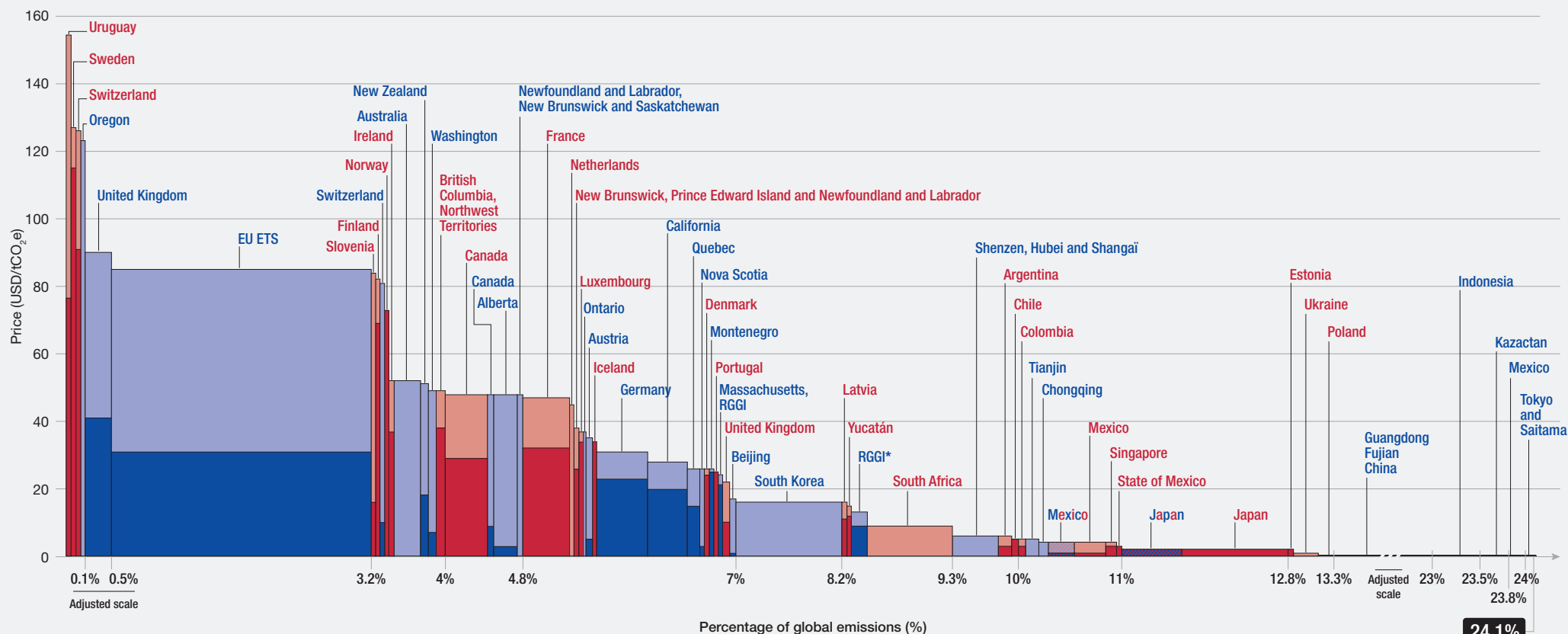


To encourage households and businesses subject to carbon pricing mechanisms to invest in decarbonization solutions, some governments have chosen to announce the future price per ton of CO₂e, thus strengthening the “price signal” (see graph showing mechanisms for which a price change over time has been announced). In 2021, **Norway** presented an ambitious carbon pricing strategy aiming to triple the price of emissions not covered by the EU-ETS by 2030. In 2022, **Denmark** announced a reform on its carbon pricing system from 2025 to include a significant increase in rates between 2025 and 2030, as well as the introduction of two new taxes with lower rates applying to companies already subject to the EU ETS. **South Africa, Luxembourg** and **Singapore** are also planning to increase their carbon taxes in the coming years.

Regarding the ETS, the price per ton of CO₂e can vary depending on several factors, such as the number of emission allowances in circulation, the emissions per entity subject to the market, and speculation. To reduce uncertainty regarding the evolution of prices over time, there are measures that can be applied to ETSS. For instance, the linked market between **Quebec** and **California** sets a price floor on the primary carbon market, which varies each year, above which trading can take place. Other mechanisms have chosen to use the number of allowances auctioned as an adjustment variable. In 2022, **Switzerland** introduced a measure to reduce the quantity of allowances auctioned annually if the number of allowances already in circulation exceeds the previous year’s emissions cap by more than 50%. On the **Beijing** pilot market, authorities auction additional allowances if the price on the secondary market exceeds a ceiling price, and conversely, they buy back allowances from the market if the price falls below a floor price.

Updating of the pan-Canadian approach 2023-2030: making the new federal requirements consistent across the provinces

In 2021, **Canada** presented its new strategy to strengthen carbon pricing over the 2023/30 period. The Canadian federal government set minimum standards in the form of two systems: a federal Output-Based Pricing System (OBPS), a baseline and credits ETS, and a federal fuel charge, a carbon tax. Provinces have the choice to either adhere to the two mechanisms or establish their own system, provided they comply with the minimum requirements. Canada will gradually increase its carbon pricing from 65 Canadian dollars (CAD) in 2023 to CAD 170 in 2030 (equivalent to USD 49 to USD 129) and is implementing new rules to maintain the “price signal”. For example, provinces will no longer have the option to counterbalance the cost of the carbon tax by decreasing their individual fuel taxes, as this would lead to the emissions being considered as uncovered. Nova Scotia, New Brunswick, Prince Edward Island and Newfoundland and Labrador have abandoned their provincial carbon tax in 2023 because they did not comply with the updated pan-Canadian approach. The five provinces are now under the federal system.



Emissions covered at explicit price: ■ ETS ■ Carbon tax ■ ETS and Carbon tax
 Emissions covered at effective price: ■

* RGGI - Regional Greenhouse Gas Initiative : Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, Vermont, Virginia.

Explicit and effective prices

Two instruments put an explicit carbon price: a carbon tax sets a price per ton of CO₂e, and an ETS sets a cap on emissions for a given territory and period, with prices on the primary and secondary markets being automatically influenced by this cap.

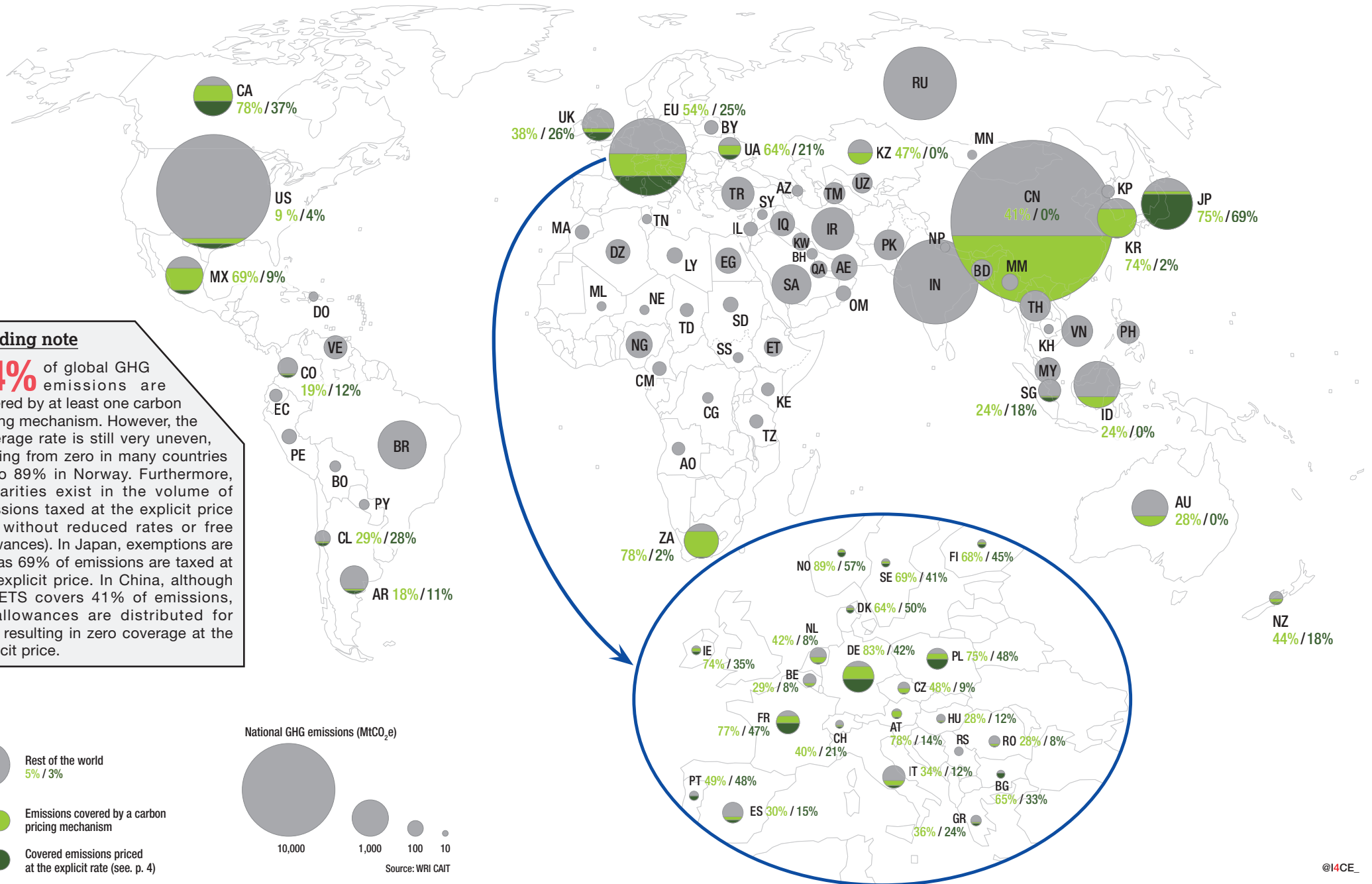
This study calculates “effective prices” (revenues are divided by coverage) that take into account exemptions/reduced rates and free allowances received by some economic actors.

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Reading note

This graph represents explicit prices (primary market for ETSs) and effective prices based on the covered emissions from ETS and carbon taxes. For instance, the Korean ETS (K-ETS) alone covers 1.2% of global emissions at a price of USD 16 on the primary market. However, given the large number of free allowances, the effective price is close to USD 0.

To make this graph easier to read, some histograms have been enlarged and are not ‘to scale’.



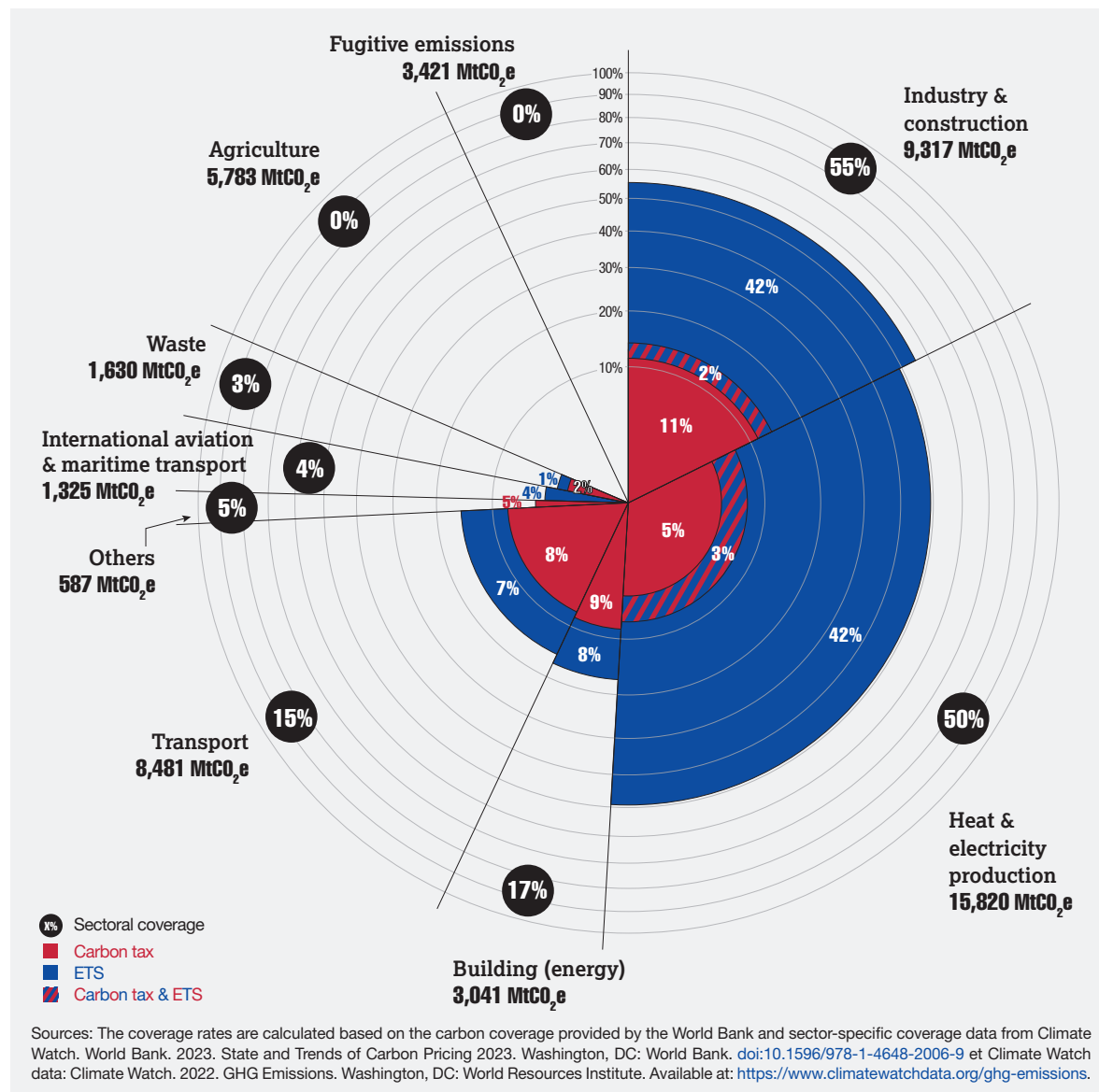
In 2023, the emissions coverage rate is slightly above 24%, taking into account emissions taxed at a reduced rate or covered by free allowances. However, coverage remains highly uneven across sectors and depending on the different mechanisms applied.

The coverage of the **industry and construction sector** is the highest (55%, chart to the right). This high percentage is largely tributed to ETSs (40%) – mainly through the EU ETS, but also via the 8 Chinese pilot markets – targeting the industry sector, which represents a significant volume of emissions. The same applies to **power and heat generation** (49%), where China’s national market alone, covering 2,162 power plants, accounts for 57% of emissions covered in this sector. Carbon taxes also contribute, albeit more modestly, to the pricing of these two sectors (11% and 5%). In some countries/provinces, the two mechanisms overlap (in Mexico and the UK, for example). However, it does not necessarily imply double pricing: it can take the form of partial tax exemptions on one side, or free allowance allocations on the other. The Hungarian carbon tax, aimed at taxing the emissions from companies benefiting from free allowances via the EU-ETS, is a good example of the latter.

In **the building** (17%) and **transport**¹ (15%) sectors, coverage is evenly split between ETSs and carbon taxes. The second mechanism is used in Canada and Latin America for these two sectors. Germany and Austria, meanwhile, have opted to introduce national ETS in 2021 and 2022 to cover emissions not subject to the EU ETS. It should be noted that these two ETSs will act as carbon taxes until 2026: fossil fuels distributors purchase emissions allowances at a fixed price.

Some emissions remain challenging to price, due to difficulties in accurately measuring them. This is particularly the case with **waste**-related emissions, where the coverage rate is very low (3%). Similarly, **fugitive emissions** and the **agricultural sector**¹ are not currently covered (0%). Similar to New Zealand (see [2022 edition](#)), Denmark is also aiming to price emissions from agriculture by 2025. In both countries, farmers could choose between two methods for accounting for their emissions, with a simpler model based on national averages, or a more complex one using their own data from the farm.

Regarding **international aviation and maritime transport** (covered at 4%), only the EU, UK and Swiss ETSs cover international flights, but solely within the European Economic Area. Between 2024 and 2026, the EU will gradually include emissions from maritime traffic in its ETS, according to the following rule: 50% of emissions will be covered if the port of departure or arrival is within the EU, and 100% if both ports are within the EU.



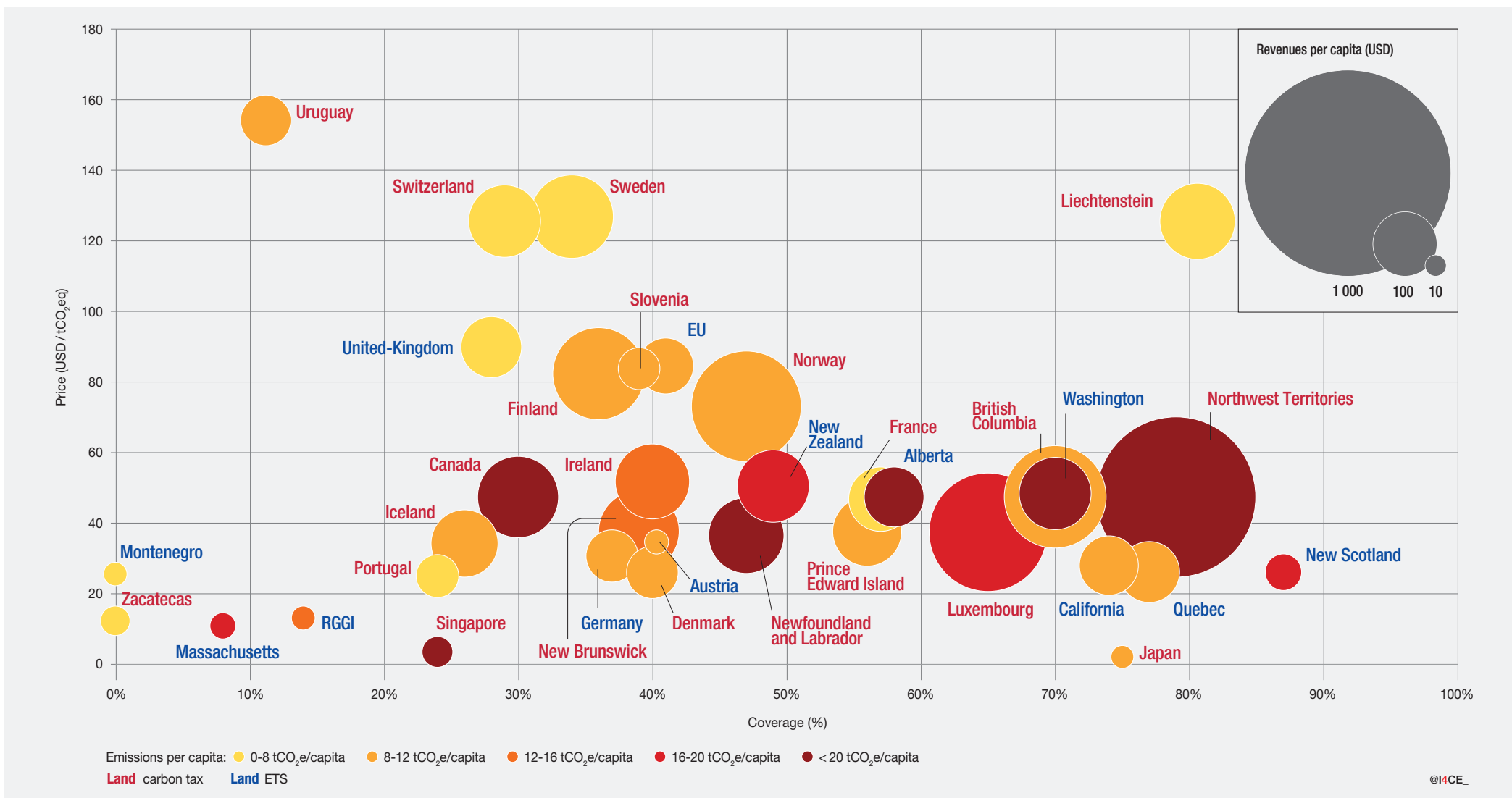
Reading note

55% of emissions from the Industry & Construction sector, totaling 9,317 MtCO₂e, are regulated by a carbon pricing mechanism. Among these emissions, 42% are subject to ETSs, 11% to carbon taxes, and 2% to both mechanisms simultaneously.

¹ In this typology, the «transport» category includes domestic aviation and shipping, while the «international aviation & maritime transport» category refers to international travel.

The carbon revenues formula: price, coverage, and emissions

Details for the 35 mechanisms generating the highest revenues per capita



Reading note

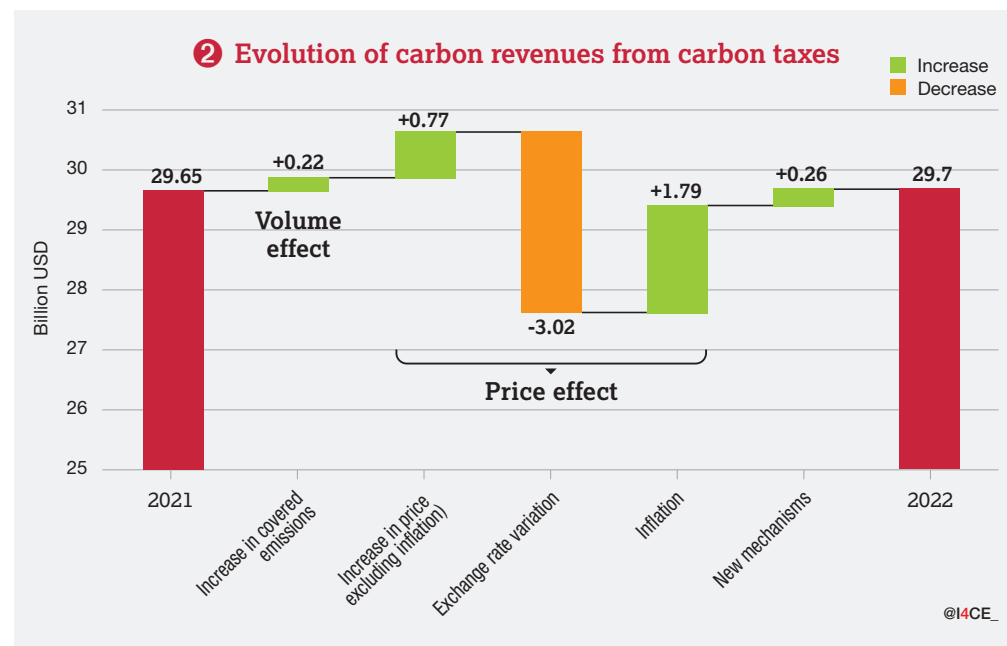
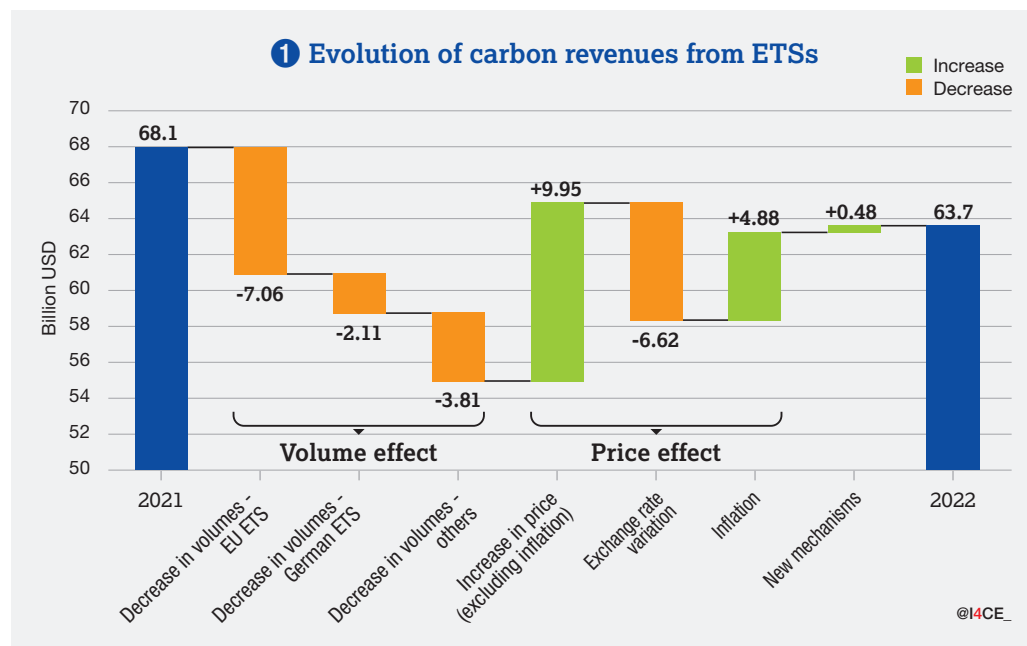
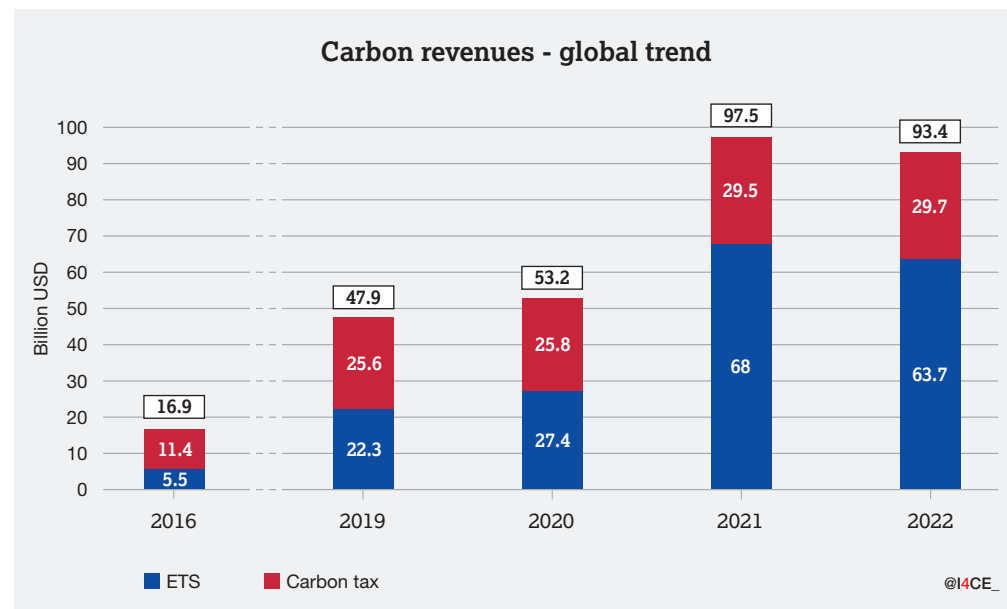
This graph shows the ambition of the carbon pricing instrument based on its price level and coverage as a function of emissions per capita.

For example, the Canadian province Northwest Territories has a high coverage (almost 80% of its emissions) at a price of USD 48 USD per tCO₂e. Its per capita emissions are among the highest: over 20tCO₂e/capita.

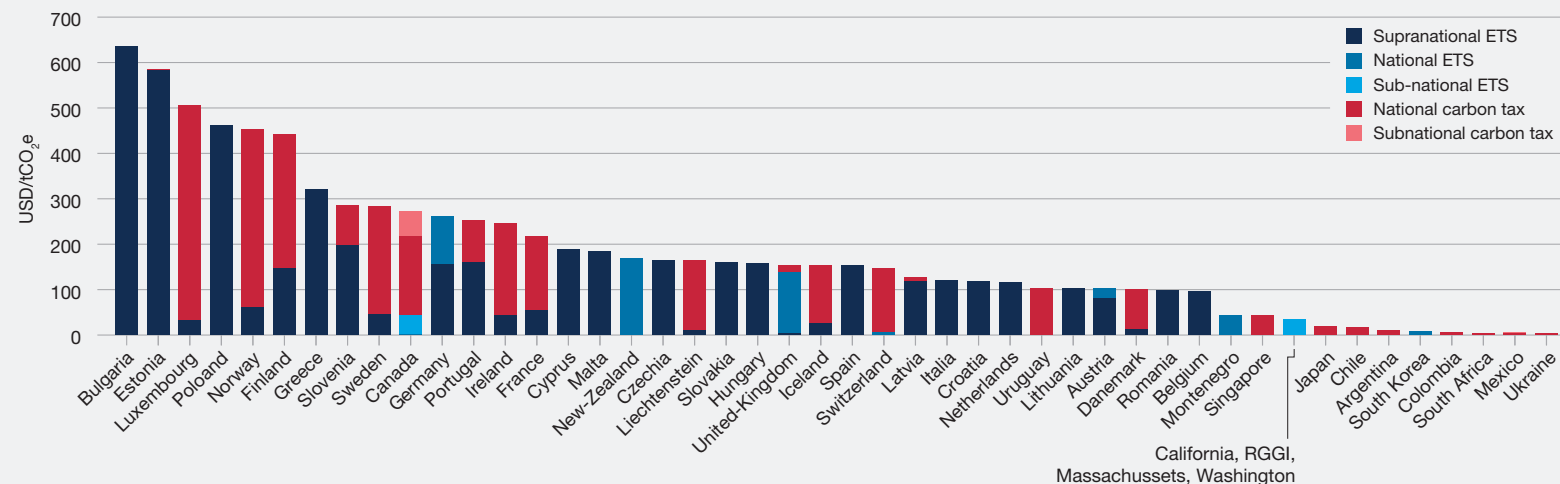
The ambition of a national climate policy is not solely defined by a single mechanism, but must also take into account other complementary pricing mechanisms as well as a broader set of public policies (budgetary spending, other incentives, regulation, etc.), among which a carbon pricing can be, depending on the case, an essential pillar, a welcome addition, or even an optional complement.

In 2022, carbon pricing revenues expressed in USD fell slightly. This decrease can be attributed to intrinsic and extrinsic factors from pricing mechanisms themselves:

- **The reduction in the number of allowances auctioned was not fully offset by the increase in selling prices on the primary markets.** On the European market, this drop is notably due to the Market Stability Reserve, which automatically reduces the number of allowances auctioned in order to stabilize market prices.
- **Fluctuations in exchange rates have a downward impact on reported monetary volumes, and are only partially offset by inflation.** The euro's decline against the dollar between 2021 and 2022 (-15%) leads to a significant devaluation of carbon revenues expressed in USD, primarily due to the share of European mechanisms in carbon revenues, but expressed in EUR, carbon revenues increased from 83 to 89.5 billion in one year. **Inflation helps to increase the volume of revenues for allowance markets, and for taxes whose trajectory is indexed to rising prices.** However, this increase merely reflects the general rise in prices, and does not reflect the specific ambition of pricing mechanisms. On the contrary, where carbon pricing trajectories are not indexed to inflation, the latter contributes to eroding the incentive power of the price signal, as well as the real revenue collected by the tax.



1. Carbon revenues per capita (in PPP)



⚠️ China (national ETS), Australia, Indonesia and Kazakhstan do not generate any revenue.

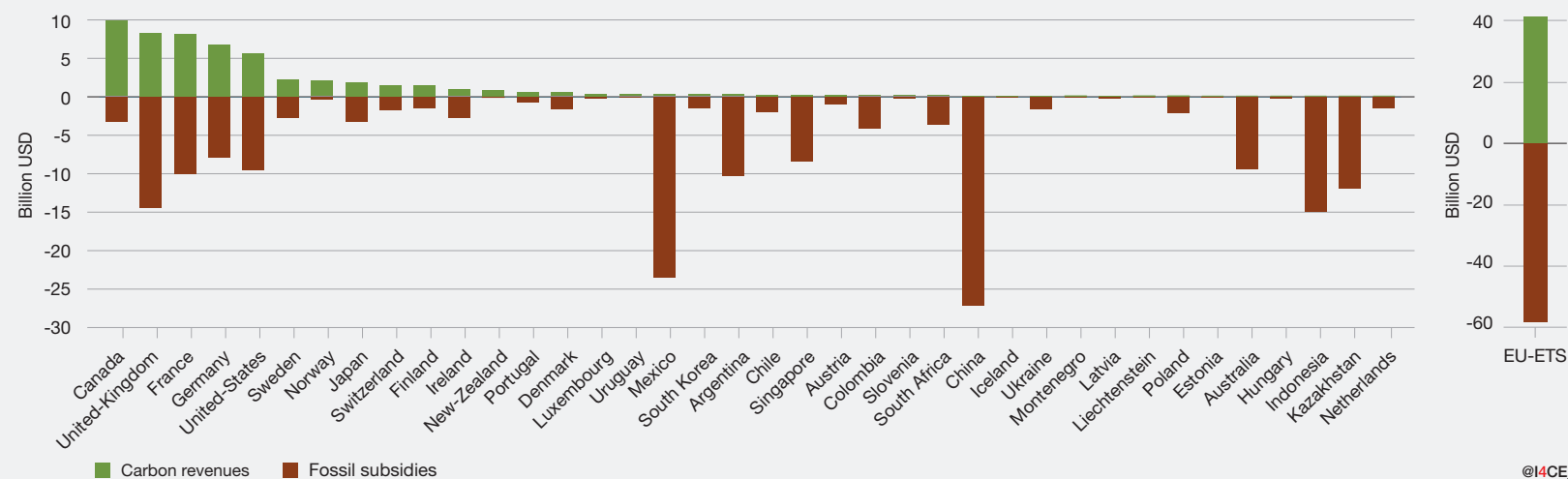
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Reading note 1

Expressing revenues in Purchasing Power Parity (PPP) per capita allows for the comparison of the economic impact of carbon pricing mechanisms on people's real purchasing power. The impact is strongest in Europe, particularly due to the EU ETS. Bulgaria, for example, with a lower GDP per capita and a more carbon-intensive energy mix than the EU average, has a PPP income of USD600 per capita. The 'European Modernization Fund', funded by EU ETS revenues, aims to address for these differences by facilitating a fair energy transition for the most affected Member States.

This chart also takes into account revenues generated at the provincial level. For example, in the United States, only provincial mechanisms generate revenue such as the Californian ETS.

2. Carbon revenues and public support for fossil fuels



Reading note 2

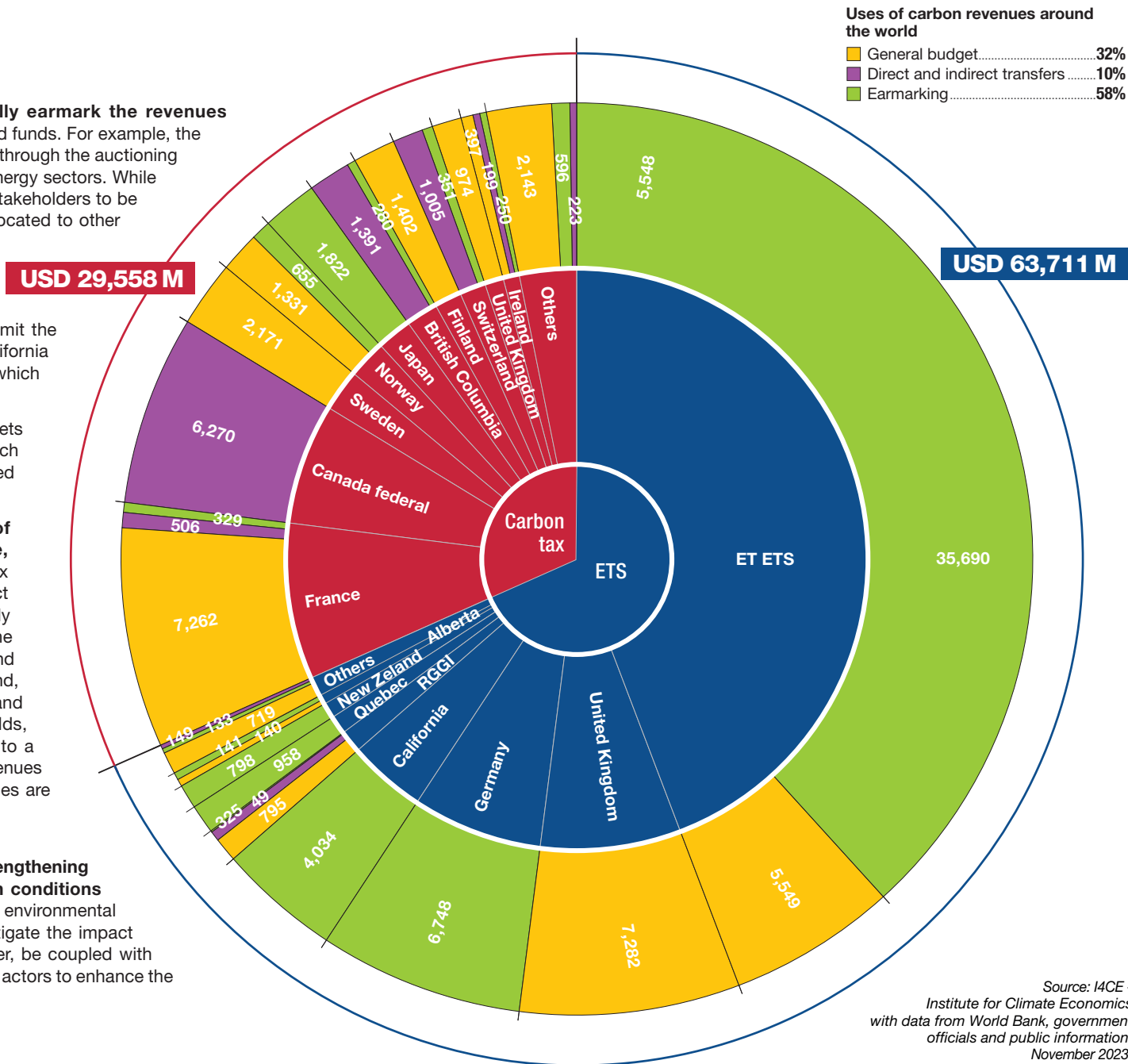
Alongside the revenues from carbon pricing, governments continue to provide massive support for carbon-intensive energy sources. For instance, the French carbon tax and the EU ETS generated USD8.1 billion in France in 2022, compared with nearly USD 10 billion in support for fossil fuels in 2022, according to the *Fossil Fuel Subsidy Tracker* (OECD/IIISD). Please note: subsidies for fossil fuels do not take into account price shields in place in 2022. In France, for example, price shield for natural gas and various fossil fuel subsidies accounted for EUR 16.2 billion in 2022.

ETSs generate the majority of revenues (68%), and generally earmark the revenues to “green” projects (78% of ETS revenues), often through dedicated funds. For example, the ‘European Innovation Fund’, which collected EUR 5.5 billion in 2022 through the auctioning of allowances, funds decarbonization projects in the industry and energy sectors. While these allocations mainly benefit companies, which are the primary stakeholders to be impacted by ETSs, some revenues are also directly or indirectly allocated to other economic players, such as individuals. For instance, Quebec uses its ETS revenues to fund rebates for individuals when purchasing an electric vehicle. In Germany, the revenues generated by the national ETS will offset the discontinuation of a tax on renewable energy (“EEG Umlage”) that was suspended on July 1st, 2023 to limit the increase in energy prices and support renewable energy projects. California has allocated USD 125 million to its “Sustainable forests” program, which aims to reduce forest fires.

Revenues generated by ETSs sometimes feed into the general budgets of States or provinces. This is the case in the United Kingdom, which does not formally earmark its ETS revenues. However, it has committed to increase its environmental spending accordingly.

Carbon taxes account for 32% of revenues, and the uses of associated revenues are more diverse. As a fiscal measure, taxes are often used to fund general budgets (53% of carbon tax revenues). However, some governments have opted for more direct redistribution strategies. For example, Canada returns approximately 90% of the revenue generated by its carbon tax to households in the form of quarterly payments, with the remaining 10% going to small and medium-sized companies impacted by carbon pricing. In Switzerland, two-thirds of the carbon revenues are redistributed to businesses and households, in proportion to the amounts collected. For households, redistribution occurs uniformly through health insurance. Finally, to a lesser extent compared to ETSs, around a quarter of carbon tax revenues also fund green projects. In Colombia, for example, 80% of revenues are earmarked for the ‘Climate Sustainability and Resilience Fund’.

The use of revenues from carbon pricing can be a lever for strengthening the social acceptability of such mechanisms, provided certain conditions are met. Earmarking revenues for “green” projects can increase the environmental impact of carbon pricing, while redistributive measures tend to mitigate the impact on stakeholders. These revenue allocation strategies must, however, be coupled with transparency and educational efforts aimed at the relevant economic actors to enhance the acceptability of carbon pricing.



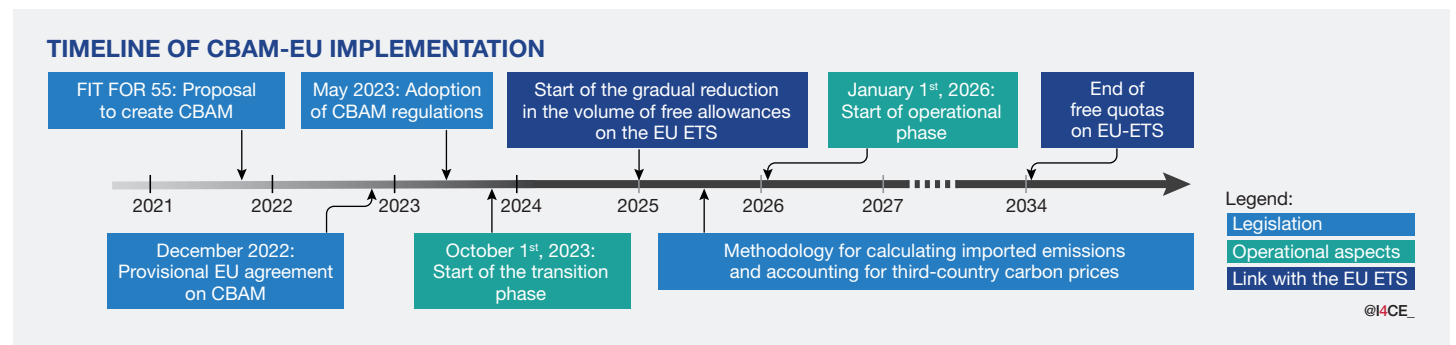
Source: I4CE - Institute for Climate Economics with data from World Bank, government officials and public information, November 2023.

NEW PERSPECTIVES ON IMPORTED EMISSIONS PRICING

THE EUROPEAN CARBON BORDER ADJUSTMENT MECHANISM (CBAM-EU)

To reduce carbon leakage, while at the same time strengthening the ambition of the EU ETS, the **EU launched the transition phase of its European Carbon Border Adjustment Mechanism (CBAM-EU) in October 2023**, with effective implementation in 2026. This mechanism aims to price imported emissions from the production of **six goods: steel, aluminum, cement, nitrogen fertilizers, hydrogen and electricity**. The cost of the CBAM will be borne by the companies responsible for importing one of the above products. They will have to report their imported emissions and buy CBAM certificates at the price of EU ETS allowances, deducting the carbon price already paid by the producer in their own country. Unlike EU ETS allowances, these certificates cannot be traded between entities, and their validity period will be limited. This new measure will allow the EU to reduce and ultimately eliminate the free allocations historically granted to European producers to mitigate “carbon leakage”.

However, the implementation of the CBAM-EU is not straightforward. Firstly, methodologies for accounting imported emissions will need to be refined during the transition period (2023-2026), to take into account the complexity and heterogeneity of production processes, as well as differences in the quality of “Measurement, Reporting and Verification” (MRV) of emissions around the world. Secondly, it will be necessary to cope with the diversity of carbon pricing mechanisms in place outside of Europe, including variations in their application methods (taxes, markets, free allocations, etc.), their coverage or their price. Last but not least, this mechanism must remain within the rules of fair competition imposed by the World Trade Organization. In fact, the EU has ruled out the possibility of subsidizing the exports of goods whose prices will rise with the end of free allowances.



INTERNATIONAL REACTIONS TO THE EUROPEAN CBAM

The introduction of the CBAM has triggered numerous reactions from developing countries. In a joint statement, China, India, Brazil and South Africa highlighted the potentially harmful impact of such a mechanism on emerging markets, whose energy and production technologies are often more carbon-intensive than those of wealthier nations. The CBAM was also a focal point of discussions at the 15th review of EU trade policies organized by the WTO in June 2023, and India has threatened to file a complaint with the WTO against the mechanism. However, despite these reservations, **several countries are looking for ways** to reduce the impact of this mechanism on their exports, either by negotiating bilateral agreements with the EU, or by initiating or accelerating the implementation of domestic carbon pricing mechanisms. Taiwan, for example, is considering the implementation of a carbon tax to mitigate the impact of the CBAM. China is expected to review the expansion timeline of its ETS.

The European CBAM is prompting other countries to consider similar mechanisms. This includes Canada, Australia, and the United Kingdom, which have launched consultations on national CBAMs. In the United States, the Clean Competition Act introduced by the Senate in June 2022 has sparked debates over the introduction of a federal carbon tax coupled with a CBAM, where only emissions exceeding a certain threshold in carbon intensity would be priced by the mechanism.

TWO EXAMPLES OF INDUSTRIAL POLICIES INCLUDING CARBON PRICING: GERMANY AND JAPAN

In June 2023, **Germany** launched a new 15-year, 50 billion EUR compensation plan based on the **Carbon Contract for Difference (CCfD)** model. Applied for the first time in the Netherlands in 2021, this mechanism aims to bridge the gap between the cost of reducing one ton of CO₂e and the price of EU ETS allowance, enabling industries whose abatement costs are higher than the current EU ETS prices to decarbonize at a lower cost. The German model subsidizes both capital expenditure (CAPEX) and operating expenditure (OPEX).

To boost the country’s economic growth while quickly decarbonizing its production system, Japan has unveiled its green transformation plan, including an investment of more than 150 trillion yen (USD 1,000 billion). This plan will be funded by both the public and private sector, and will establish a carbon pricing policy focused on growth through two pillars:

- **Issuing government bonds to subsidize businesses’ investments in decarbonization (GX Transition bonds).** The Issuance of these bonds began in 2023, and the Japanese government aims to raise up to 20 trillion yen (around USD 130 billion).
- **Establishing two carbon pricing mechanisms, where the revenues from which will repay the bonds mentioned above.** Participation in the GX-League, launched in April 2023, will become mandatory in 2026, primarily for industrial and electricity producers. Auctioning of allowances is scheduled to begin in 2033. In addition, a carbon tax on imported fossil fuels is expected to start in 2028.

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