EFFECTIVE CARBON TAX DESIGN **KEY CONSIDERATIONS FROM LATIN AMERICA**

MEF Climate Change PLATFORM

Ministries of Economy and Finance

IDB

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JEL Codes: H23, Q54, Q58

Keywords: carbon tax, fiscal policy, fiscal management, carbon pricing, tax policy, climate policy, emission reduction

Inter-American Development Bank
1300 New York Avenue, N.W.
Washington, D.C. 20577
www.iadb.org

The Institutions for Development and the Climate Change and Sustainable Development Sectors were responsible for the production of this publication.

External vendors:

Coordination of the editorial production: Sarah Schineller and Nicolás Cañete
Editor: Rachel Thalmann
Design: Carlos Mario Lis

Acknowledgments

Members of the Regional Climate Change Platform of Ministries of Economy and Finance (MEF Climate Change Platform) prepared this study as part of the activities of Working Group 2 on tax revenues and incentives. It was carried out under the leadership of the Ministry of Finance of Chile and with the support of the Inter-American Development Bank (IDB), in its capacity as technical secretariat of the platform.

The production of the study was coordinated by José Miguel Alvarado and Daniela Buchuk, from the Ministry of Finance of Chile; Alfredo Ramírez and Nicolás García, from the Ministry of Finance and Public Credit of Colombia; Adán García, Gilberto Sosa, Estefanie Serrano, César Alejandro Paz, and Haydee Munguía, from the Ministry of Finance and Public Credit of Mexico. Marcelo Caffera, Hipólito Talbot-Wright, Eugenia Arioua, and Raúl Delgado drafted the document.

The members of the platform are grateful for the invaluable comments provided by Huáscar Eguino.

About the Platform

The MEF Climate Change Platform is a unique regional collaboration network between governments that is transforming the way Latin America and the Caribbean address climate challenges through fiscal policy, turning them into opportunities for economic development. Established in 2022 by mandate of the IDB Governors and led by the ministries of economy and finance, it brings together 26 borrowing countries around a shared vision of sustainable financing. Through collective intelligence, it generates specialized knowledge and promotes the implementation of practical climate fiscal policy solutions, strengthening the competitiveness and resilience of the region's economies. The Platform is funded by the German Government's International Climate Initiative.

Glossary

Anthropogenic	Resulting from or produced by human activities.
CO_2 equivalent (CO_2 eq)	The amount of carbon dioxide (CO_2) that would cause the same integrated radiative forcing or temperature change, over a given time horizon, as an emitted amount of a greenhouse gas (GHG) or a mixture of GHGs.
Decarbonization	The process by which countries, individuals, or other entities seek to achieve a fossil carbon-free existence. Generally, it refers to a reduction in carbon emissions associated with electricity, industry, and transportation.
Net CO_2emissions zero	Net zero carbon dioxide (CO_2) emissions are achieved when anthropogenic CO_2 emissions are globally balanced with anthropogenic CO_2 removals over a specified period. Net-zero CO_2 emissions are also known as carbon neutrality.
Emissions avoidance	Reducing GHG emissions by completely avoiding the use of a service that produces emissions using a service with lower emissions and/or the development of technologies and systems that enable the service to be provided in ways that reduce emissions.
Greenhouse gases	GHG are gaseous constituents of the atmosphere, both natural and anthropogenic (resulting from or produced by human activities), that absorb and emit radiation at specific wavelengths within the spectrum of Earth's radiation emitted by the Earth's surface, the atmosphere itself, and clouds. This property causes the greenhouse effect. Water vapor (H_2O), carbon dioxide (CO_2, nitrous oxide (N_2O), methane (CH_4), and ozone (O_3) are the main GHGs in the Earth's atmosphere.
Mitigation (of climate change)	Human intervention to reduce emissions or increase sinks of GHGs.
Carbon dioxide removal	Anthropogenic activities that remove CO_2 from the atmosphere and store it in a durable manner in geological, terrestrial, or oceanic reservoirs or in products. It includes existing and potential anthropogenic enhancement of biological or geochemical sinks and direct capture and storage from air but excludes natural uptake of CO_2 not directly caused by human activities.
Carbon sequestration	The process of storing carbon in a carbon reservoir (any part of the climate system with the capacity to store or accumulate carbon).
Sink	A reservoir (natural or human, in soil, ocean, and plants) where a GHG, aerosol, or precursor of a GHG is stored.

Source: IPCC (Intergovernmental Panel on Climate Change). n.d. IPCC Glossary Search. Geneva: IPCC. Available at: **https://apps.ipcc.ch/glossary/.**

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Abbreviations

CDM	Clean development mechanism
CEL	Clean energy certificates
CO_2	Carbon dioxide
CRE	Certified emission reduction
DEM	Emission rights
DIAN	National Tax and Customs Directorate
EA	Emission allowance
ETS	Emissions trading system
Fonsurec	Fund for Sustainability and Climate Resilience
Fotease	Fund for Energy Transition and Sustainable Energy Use
GHG	Greenhouse gases
LPG	Liquefied petroleum gas
IEPS	Special Tax on Production and Services
CPI	Consumer Price Index
IPCC	Intergovernmental Panel on Climate Change
VAT	Value-added tax
LTCS	Long-term climate strategy
MMA	Ministry of the Environment, Chile
MRV	Monitoring, reporting, and verification of emissions
NDC	Nationally determined contribution
NO_x	Nitrogen oxide
NGO	Nongovernmental organization
GDP	Gross domestic product
PM	Particulate matter
PNIS	National Comprehensive Program for the Substitution of Illicit Crops
RETC	Register of Pollutant Emissions and Transfers
SHCP	Ministry of Finance and Public Credit
SII	Internal Revenue Service
SO_2	Sulfur dioxide
UMA	Unit of measurement and update

Introduction

Rationale

Latin American and Caribbean (LAC) countries have signed the Paris Agreement, which seeks to increase adaptation to climate change and stabilize global warming below 2°C and as close as possible to 1.5°C above pre-industrial levels. This requires achieving net zero greenhouse gas (GHG) emissions by 2050 (IDB and DDPLAC, 2019). Achieving decarbonization requires far-reaching and unprecedented global action in all sectors, such as electricity generation, transportation, construction, and agriculture, among others. This poses both challenges and opportunities for fiscal sustainability. In this regard, the work of ministries of economy and finance is essential.

The Regional Climate Change Platform of Ministries of Economy and Finance (MEF Climate Change Platform) is a space for sharing knowledge on fiscal policymaking to address the consequences of climate change. Its goal is to identify progress and needs for incorporating climate change action into the fiscal policies of LAC governments. Within the platform, the ministries have established different working groups, one of which addresses issues related to revenue and tax incentives that contribute to climate change mitigation. This working group seeks to improve understanding of the limitations and barriers of various carbon pricing instruments to promote carbon neutrality and strengthen resilience in the LAC region.

Among the issues prioritized by the members of this working group is the study of carbon taxes. These are a carbon pricing instrument that imposes a tax on the units (kilograms or tons) of carbon (CO_2e) emitted by a GHG source. A GHG source that is subject to a carbon tax as its only regulation can emit as much CO_2 as it wants, but it must pay a certain amount of money for each ton emitted. For example, if the CO_2 tax is US$5/ton and this year the source emits 100 tons of CO_2 , it will have to pay US$500.

Carbon pricing instruments, and carbon taxes in particular, are among the most frequently mentioned public policy instruments for tackling climate change. These instruments are growing in popularity. To date, five LAC countries—Argentina, Chile, Colombia, Mexico, and Uruguay—have implemented carbon taxes as part of their climate change policy. Other countries in the region have expressed interest in following suit (Talbot Wright et al., 2024).

However, making these instruments effective presents numerous challenges. First, they must be adapted to the country's socioeconomic context. Second, their proponents must manage potential opposition, as their implementation carries the risk of increasing the cost of living for individuals and undermining the competitiveness of businesses. Finally, an effective carbon tax must establish an institutional structure with well-defined roles and clear responsibilities.

In view of these challenges, it is important to analyze regional experiences with carbon pricing by consulting with the relevant finance ministries and studying the design and implementation processes. This exercise can help identify best practices and lessons learned that can improve the design and implementation of these instruments and support other countries wishing to adopt them.

Objective

The document describes describe the experiences of Chile, Colombia, and Mexico as examples of designing and implementing carbon pricing that is tailored to the reality and needs of the region. Studying these cases together provides an opportunity to support the design of new instruments of this type that are tailored to the needs of countries to meet their climate goals.

Based on economic theory, evidence, and the experiences of these three countries, the document identifies and develops five key considerations to take into account when designing and implementing a carbon tax: *(i)* define tax objectives and analyze policy options; *(ii)* finalize the design: coverage, rate, and institutional framework of the tax; *(iii)* manage public acceptance; *(iv)* address distributional impacts; and *(v)* evaluate the use of offsetting mechanisms. The following sections develop these considerations and illustrate them using experiences from the three countries in this area.

Theoretical Justification for a Carbon Tax

Due to their physical characteristics, most goods and services provided by ecosystems are public goods.[2] Therefore, in the absence of some form of regulation or social norm, the uncoordinated consumption of ecosystem goods and services[3] by companies and consumers results in the overexploitation of the ecosystems that provide them.[4] This is because the costs imposed on others by their individual use are not taken into account. This imposition of costs on third parties is called a negative externality.

Economic theory suggests that one way for those responsible for negative externalities to internalize them is to face a price or cost for extracting natural resources or using ecosystem services. A carbon tax is an example of such a cost. This is a mechanism for emission sources to internalize (consider) the current and future damage that GHG emissions cause to the planet through global warming. In this way, carbon taxes act as an incentive for GHG emitters to reduce their emissions.

[1] Chile, Colombia, and Mexico are not the only countries in the region that apply carbon prices. Argentina and Uruguay also have explicit carbon prices. To introduce the carbon tax on gasoline in Uruguay, a new "CO_2 tax," with CO_2 emissions replaced a specific gasoline tax as the tax base (unlike the specific tax it replaced, which was based on liters of gasoline). As Uruguay's objective with this tax is to make explicit an important tax burden on CO_2 emissions implicit in fuel taxes (Uruguay's CO_2 tax is the highest in the world) and not to change the final price of gasoline, the analysis of this case is not relevant to the purpose of this report. Similarly, the CO_2 tax applied in Argentina, except for fuel oil, replaced part of the pre-existing fuel taxes with the aim of preventing the final price of fuels from increasing (Gutman, 2019). In the Argentine case, between 2021 and 2024, the corresponding adjustments to the tax, which has been in force since 2018, were repeatedly suspended. As a result of this and the high devaluation, in 2023 the value of the tax was US$0.81/$tCO_2$, when it was originally US$10/$tCO_2$ (World Bank, 2023). For these reasons, the Argentine tax is not considered in this report.

[2] Public goods or services are those that can be consumed by more than one person at the same time and are available to everyone, since no one can be excluded from their consumption (Musgrave, 1959; Samuelson, 1954, 1955).

[3] Ecosystem goods and services are goods and services provided by ecosystems (natural capital, in general) that satisfy human needs, either directly or indirectly (Dasgupta, 2021).

[4] For the purposes of this study, the ecosystem service provided by the atmosphere is its capacity to assimilate carbon, while overexploitation takes the form, in the long term, of a sustained increase in the average temperature of the planet due to the emission and accumulation of GHGs.

This internalization can also be achieved with instruments that are not based on economic incentives but rather on prescriptions, such as emission standards (legal limits on emissions), technological standards (the requirement to install certain technology), and mandatory environmental management plans, among others. According to economists who promote a carbon tax over prescriptive instruments, under certain circumstances the tax has some advantages:

- It is a **cost-effective** instrument; that is, it achieves emission reductions at the lowest possible cost. Specifically, it minimizes the sum of the costs that sources must incur to reduce emissions (Baumol and Oates, 1988).[5]
- In the short term, depending on the amount of the tax, it can be a powerful incentive for firms to reduce emissions by changing their production processes and for individuals to limit their carbon footprint by changing their consumption patterns. It is also an incentive for both firms and consumers to invest in (available) less carbon-intensive or, ideally, carbon-neutral technologies.
- In the long term, the tax can incentivize the creation of new technologies through research and development (innovation).

Finally, a carbon tax is not the only economic incentive-based instrument that can be applied: GHG emission permit markets and various subsidies for the adoption of lower-carbon technologies are economic incentive options that set an explicit price on carbon emissions and have similar advantages. There are also tax instruments with an effect equivalent to a carbon tax, such as fuel taxes and car engine size taxes, among others (Ahumada et al., 2023).

[5] For this result to be valid in the case of decarbonization, it must be assumed that the evolution of the costs of different abatement technologies over time is known. Furthermore, as investments in technologies often have substantial irreversible components, a company, sector, or country may become "locked in" to a technology for longer than desired. Consequently, the long-term path that minimizes the costs of decarbonizing the economy may differ from what is indicated by cost minimization at a given point in time (Gillingham and Stock, 2018). In other words, it may make sense to invest in a technology that is more expensive today if the costs imposed by the irreversibility of technologies that are cheaper today are sufficiently significant (Vogt-Schilb, Meunier, and Hallegatte, 2018). It is unclear whether other climate policy instruments (markets, subsidies, standards, bans, electricity supply network reforms, regulations, etc.) have advantages over an emissions tax in addressing these issues. Given these difficulties, and others discussed below, the transition to a decarbonized economy should not rely on a tax as the sole instrument.

The Contribution of Carbon Taxes

A clear and fundamental premise of the Paris Agreement, which has broad international and scientific consensus, is that to avoid the worst consequences of climate change, the world must achieve net-zero emissions by mid-century and substantial reductions by 2030. Emission reductions and low-carbon economies can be considered like decarbonization and net-zero carbon economies, but they have different meanings and profound differences in their implications.

Emission reduction. Generally, reducing the amount of GHGs released into the atmosphere involves making changes to production processes and developing technologies that decrease the emission intensity of economic activities without necessarily eliminating emissions entirely.

Low-carbon economies. These are economies that have relatively low GHG emissions compared to a conventional economy. They involve a transition to cleaner energy sources, energy efficiency measures, and sustainable practices in various sectors. However, a low-carbon economy does not always entail the total elimination of emissions.

Decarbonization. This involves the systematic reduction or elimination of the carbon footprint within an economy or specific sectors. It transcends austere efforts to reduce emissions and encompasses a comprehensive and transformative approach. Decarbonization comprises five pillars (Jaramillo and Saavedra, 2021):

- Transitioning to zero-carbon electricity production, which is typically achieved by adopting renewable energy on a large scale.
- Transitioning to mass electrification: widespread use of electricity in vehicles, heating systems, and cooking.
- Expanding non-motorized and public transportation.
- Reversing deforestation, substantially improving and extending low-carbon agricultural practices, and conserving and restoring carbon-rich natural ecosystems.
- Improving efficiency and minimizing waste in all sectors, with a focus on energy and food consumption, while transitioning to less carbon-intensive industrial processes, building materials, and diets.

Net-zero or carbon-neutral economies. A carbon-neutral or net-zero economy is one in which all decarbonization actions are implemented and total GHG emissions produced are balanced by emissions removed from the atmosphere through natural or artificial means. This means that any remaining emissions are offset, resulting in a net-zero impact on GHG concentrations in the atmosphere. Like decarbonization, a net-zero economy requires much more ambitious and far-reaching changes than a low-carbon economy. In terms of mobility, for example, the goal is not for people to reduce their use of internal combustion engine cars, but to use modes of transportation that generate no emissions.

Due to the potential consequences of global warming, the medium-term goal of climate policy should not be to reduce GHG emissions to a certain level, but rather to decarbonize the economy. Carbon taxes should contribute to this goal. The following section discusses the challenges facing taxes in this role.

Challenges in Implementing a Carbon Tax

Implementing a carbon tax entails various challenges. First, there are **socioeconomic challenges**, or distributional impact challenges, which can compromise the political viability of a carbon tax. Imposing a carbon price in the absence of other policies and without adequate phase-in could increase costs for consumers and firms directly affected by the tax. In addition, the increase in costs could be passed on to the prices of goods and services that are not directly taxed. These effects generate opposition to the tax. The higher the price, the greater the opposition. Special consideration should also be given to ensuring that introducing such policies does not adversely affect vulnerable sectors. For these reasons, it may be desirable for the implementation of carbon pricing to be accompanied by complementary policies that mitigate the potential negative impacts on the sectors of the population most affected, particularly vulnerable sectors.

Second, there are **institutional challenges**. Creating a carbon tax requires specific skills and knowledge to design and implement it, as well as to assess its economic impact and effectiveness, define the methodology for accounting for emissions and collecting the tax, and establish mechanisms to monitor and enforce it. It also requires complementary regulations; environmental agencies at different levels of government; monitoring, reporting, and verification systems; and human resources with the appropriate skills in government offices (Russell and Powell, 1997). In the specific case of a carbon tax, Fazekas, Bataille, and Vogt-Schilb (2022), Heal and Schlenker (2019), and Rosenbloom et al. (2020) note the following institutional challenges: regulatory constraints that can slow the adoption of technology and lack of information and capacity.

Finally, carbon taxation presents **specific challenges**. The political and institutional challenges mentioned above are not new. In fact, they were active constraints in the case of the first pollution taxes and markets tested in LAC countries (see Caffera, 2010 and 2017). Carbon prices are no exception. However, there are important differences

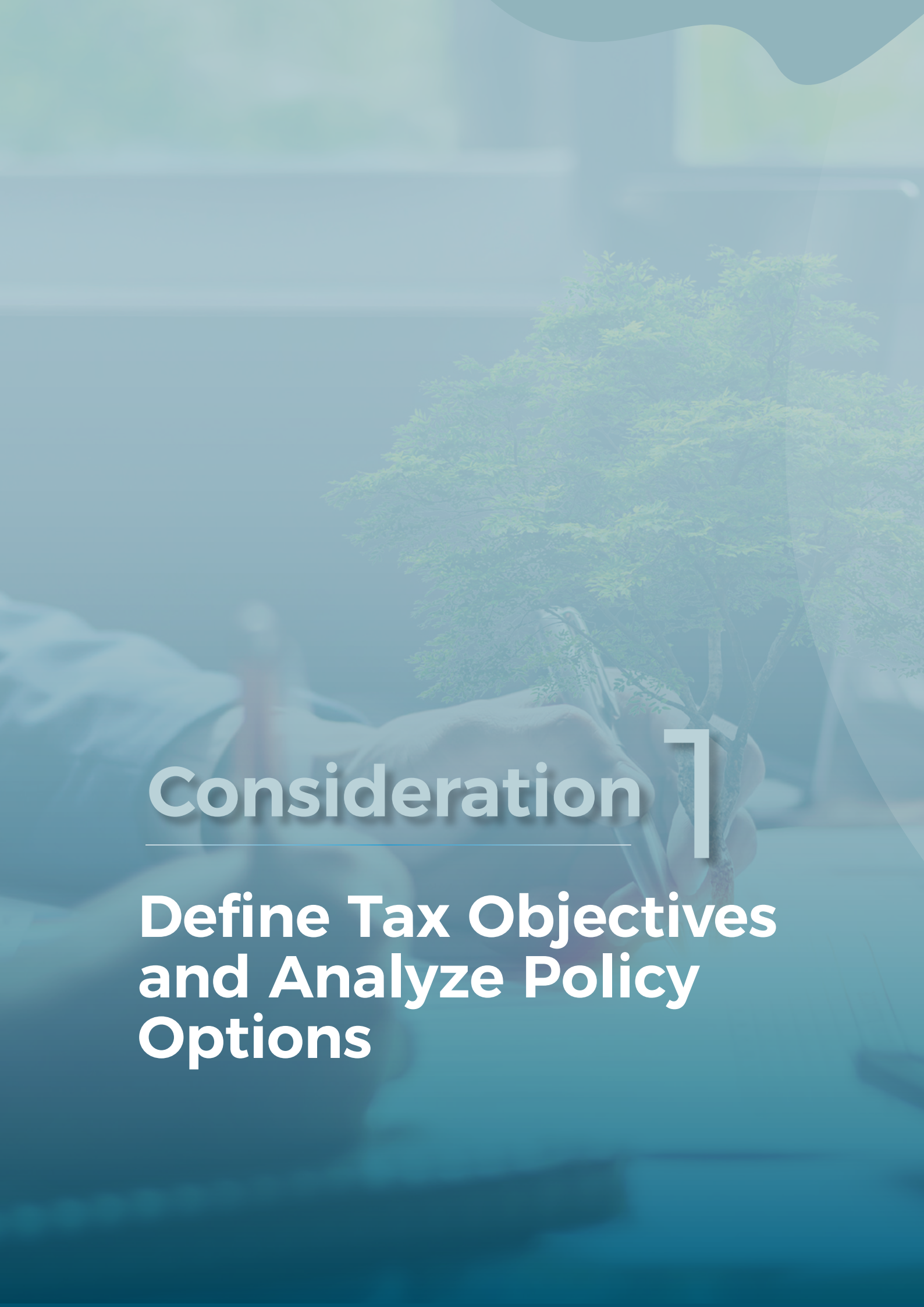
compared with the pricing of other conventional pollutants, which increase the political and institutional challenges. These differences are threefold:

- The purpose of carbon pricing is to reduce GHG emissions, which is a **global public good**. In other words, the benefits of the measure are global, while the costs fall on individual countries. In the case of the LAC region, the action of any country does not change the global emissions trajectory or its consequences.

- The **goal of climate policy objectives**, which should be the complete decarbonization of the economy. This is an ambitious goal, which transcends the goal of reducing emissions by a certain percentage. As such, it poses challenges for carbon taxes. On the one hand, to achieve a GHG-free economy through carbon pricing alone, sufficiently high prices must be set. This can generate strong public opposition due to the high economic and social costs that would be incurred during the transition. In addition, in some sectors, a carbon tax has limited capacity to induce GHG emission reductions. In steel and cement manufacturing, for example, there is no technology available to reduce the emissions associated with the chemical reactions intrinsic to the production process in these industries. In these cases, for tax design purposes, it is important to distinguish between emissions generated by the production process and those generated using fossil fuels. Perhaps because of these challenges, evidence suggests that the carbon prices implemented to date in the region have not put economies on the path to decarbonization (Talbot-Wright et al., 2024). There is little evidence that they have encouraged investments consistent with a transition to net-zero emissions (Lilliestam, Patt, and Bersalli, 2021).

- Additional **infrastructure and financing barriers** include existing regulations, economies of scale, technical capabilities, and high initial investment costs, which prevent the adoption of clean technologies. These barriers limit the effects of relative price changes caused by emissions taxes (Fazekas, Bataille, and Vogt-Schilb, 2022; Talbot-Wright et al., 2024). For example, the lack of electricity transmission and distribution infrastructure can act as a barrier to the installation of renewable energy if areas with abundant solar and wind energy are not properly connected to the electricity grid (Heal and Schlenker, 2019; Rosenbloom et al., 2020). The difficulty of accessing credit to finance clean energy projects is another potential challenge to be addressed. While this is a threat to any regulation seeking investment in technology, especially for smaller companies and vulnerable households, in the case of the transition to a net-zero economy, access to credit is essential and may be even more difficult due to the size of the initial capital investment required, such as for the installation of large-scale renewable infrastructure (Fazekas, Bataille, and Vogt-Schilb, 2022).

Decarbonization entails structural transformations in multiple sectors (Green, 2021). To achieve these transformations, it is necessary to identify the most important sectoral barriers and develop public policies to overcome them.



Consideration 1

Define Tax Objectives and Analyze Policy Options

Theory

Define Objectives

The first step in creating a carbon tax is to define its objectives. Below are some of the possible objectives of a regulator when establishing a carbon tax:

- **Reduce emissions.** The main objective of a carbon tax is to reduce emissions from sources subject to the tax by a predefined amount. Depending on its amount, a tax on carbon emissions encourages the adoption of production processes and technology with a lower carbon footprint. Likewise, on the demand side, it increases the relative prices of final products with a higher carbon footprint and thus discourages their consumption.

  The emission reductions sought through the carbon tax should be consistent with or support the mitigation targets included in the nationally determined contribution (NDC) and the long-term climate strategy (LTCS). This involves determining the percentage of the nationally committed mitigation that the tax will drive and the sectoral transformations necessary to achieve the proposed objectives, as well as how carbon taxes can be relevant, among multiple policies, to achieve this goal.

- **Create a source of fiscal** resources. Carbon taxes can provide an alternative and predictable source of tax revenue while internalizing negative environmental externalities. Revenue can be used strategically to optimize the tax structure by reducing distortionary taxes, financing climate adaptation and/or mitigation measures, implementing targeted cash transfers to vulnerable populations, or investing in critical infrastructure, among other key fiscal uses. In addition, because carbon taxes can be integrated into the existing tax collection architecture, they may offer significant administrative advantages over other environmental regulatory instruments. From a medium- and long-term fiscal sustainability perspective, by incentivizing emission reductions in the present, these taxes can contribute to lowering future public spending associated with climate impacts, including minimizing disaster response expenditures by strengthening infrastructure vulnerable to extreme weather events, such as heavy rainfall.

- **Mobilizing private and public resources for climate action.** When a carbon tax is linked to a system of offsetting such taxes through the purchase of carbon credits, the instrument can also serve to mobilize private financing for climate action by enabling a market for the purchase and sale of carbon credits where firms can acquire carbon credits associated with projects that remove, avoid, or reduce emissions and thereby lower their tax burden. On the other hand, the temporary revenue[6] generated by the carbon tax can be used to finance climate action or policies that compensate sectors affected by the process of reducing emissions.

[6] Since the objective of the tax is to reduce emissions, revenue will gradually decline as behavioral changes take effect. Consequently, emissions taxes do not constitute permanent revenue for the treasury.

Analyze Policy Options

As mentioned above, other climate policy instruments besides a carbon tax include those that are not based on prices or economic incentives, such as prescriptive instruments; and those that are, such as reducing or reforming fossil fuel subsidies, taxes on goods whose use generates emissions, and financial promotion policies for carbon-neutral technologies. Like the tax, these instruments can take various forms and be combined with each other.

The selection of instruments should be based on the defined objectives, available capacities, and the advantages and disadvantages of each instrument. Regarding economic costs, prescriptive instruments such as emission standards or technology standards can achieve the same emission reduction objectives as taxes, but a carbon tax should achieve this at a lower economic cost.

Another relative advantage of economic incentives is that they can act as a stimulus for the sustained adoption of green technology over time. In contrast, prescriptive instruments, such as technology standards, only drive the adoption of the technology mandated by the regulation. For regulated sources to incorporate new technology over time, as it develops and its price falls sufficiently, it is important to updated technology standards.[7]

In contrast, policy instruments based on emissions pricing face other types of challenges. The general recommendation on policy option analysis is to design and adopt the mix of instruments that best suits national or local conditions.

Practice

The Case of Chile

Chile has a tax on carbon dioxide (CO_2) emissions from fixed sources, established by Article 8 of Law 20,780 of 2014, along with other taxes on nitrogen oxide (NOx), sulfur dioxide (SO_2), and particulate matter (PM) emissions.[8] The tax was part of a broad set of tax reforms aimed at increasing tax revenues to finance public spending, with the primary purpose of addressing inequality gaps (BCN, 2014).

However, subsequent laws emphasized its role as an instrument that contributes to the fulfillment of national environmental policy goals. In fact, the Framework Law on Climate Change (Law 21,455 of 2022), in which Chile legally commits to achieving carbon neutrality by 2050, states that economic instruments "shall directly or indirectly

[7] On this point, Vogt-Schilb, et al. (2018) argue that, due to their degree of irreversibility, the adoption of technologies driven by a tax might lead to a path inconsistent with carbon neutrality that is costly to exit. This is because technologies that are more cost-effective today may not necessarily be consistent with carbon neutrality. Currently, uncertainty about the future evolution of the cost of different technologies affects both taxes and other policy instruments. The regulator does not have sufficient information to determine with certainty which technology to subsidize and which to tax by decree. Therefore, it is not possible to argue with certainty in favor of one instrument over another based on this possibility.

[8] The same law creates a tax on the first sale of vehicles, based on how polluting the vehicle is (CO_2) and local pollutants). However, Article 16 of Law 21,210 of February 24, 2020, introduced significant changes to the tax. This issue will be discussed below.

promote the implementation of actions aimed at complying with the objectives set out in the Long-Term Climate Strategy, the Nationally Determined Contribution, and the Climate Change Financial Strategy...".[9]

In accordance with Article 14 of Law 20,780, the tax began to be applied in 2017. As it is an annual tax, payment was made in 2018. At a rate of US$5 per ton of CO_2 emissions, the tax raised US$168 million in its first year (BCN, 2019). By 2022, the instrument had raised US$171 million, covering 29 percent of national emissions. This revenue does not have a specific allocation because this is not permitted in Chile.

Furthermore, since 2024, Chile has had a green tax offset system (see Consideration V: Integrating carbon taxes and credits). This instrument enables the total or partial offsetting of the CO_2 tax through the purchase of emission reduction or absorption certificates from projects developed in the country (carbon markets). Thus, the regulation seeks to mobilize private sector resources toward specific carbon removal projects.

There is little evidence regarding the analysis of alternative policy instruments carried out by the Chilean authorities during those years. This may be because the tax originated in the context of a tax reform and not because of an independent environmental policy measure. It is also consistent with the goal of increasing tax revenue, which the CO_2 tax pursued as a component of the tax reform.

The Case of Colombia

A carbon tax has been in place in Colombia since December 29, 2016, when Articles 221, 222, and 223 of Law 1,819 of 2016 entered into force. Its primary objective is to reduce CO_2 emissions by discouraging the use of fossil fuels, promoting efficient energy use, and utilizing unconventional sources of renewable energy.[10] The tax will contribute to Colombia's compliance with its commitments under the Paris Agreement, which include achieving a 20 percent reduction in emissions by 2030 compared to 2010.

The revenue from this tax, which in 2023 reached COL$575,274 million (almost US$150 million) (DIAN, 2024a),[11] is earmarked for environmental protection. Initially, in accordance with Article 223 of Law 1,819 of 2016, the revenue was allocated to the Fund for Environmental Sustainability and Sustainable Rural Development (Fondo Colombia Sostenible). The resources were used to manage coastal erosion, conserve water sources, protect ecosystems, and others. Currently, 80 percent of the revenue is allocated to the Fund for Sustainability and Climate Resilience (Fonsurec)[12] and the remaining 20 percent is used to finance the National Comprehensive Program for the Substitution of Illicit Crops (PNIS), managed by the Colombia in Peace Fund. Through this allocation, the Colombian tax is achieving the secondary objective of climate finance.

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[9] Chile's NDC sets intermediate targets that include achieving peak emissions by 2025 and emitting less than 95 $MtCO_2eq$ by 2030 (MMA, 2020a).

[10] In Colombia, fossil fuels are subject to other taxes, such as value added tax (VAT), which is levied at the national and regional levels.

[11] Representative market rate: peso per dollar as of December 31, 2023, according to the Central Bank of Colombia: COL$3.822.05= r US$1 (BanRep, 2023).

[12] Article 196 of Law 2,294 of 2023 changed the name of Fonsurec to the Fund for Life and Biodiversity. It also regulated the composition, tasks, and other aspects of the fund.

Colombia's carbon tax also helps mobilize private resources through the mechanism set out in the current opening paragraph of Article 221 of the law. It enables companies subject to the tax to offset the emissions that give rise to the tax by implementing GHG mitigation initiatives (which must be certified by verification bodies) or purchasing carbon credits from third parties. The original law (Law 1,819) allowed taxpayers to avoid up to 100 percent of their tax obligations generated by this tax. Following the amendments introduced by Article 47 of Law 2,277 of 2022, companies can only avoid up to a maximum of 50 percent of their tax obligations. There is evidence that this offset mechanism promoted emissions mitigation transactions at the national level, particularly in the forestry sector (see Consideration V: Integrating carbon taxes and credits).

When Colombia decided to implement a carbon tax, there were other legal instruments that pursued the goal of reducing GHG emissions. For example, Article 95 of Law 788 of 2002 established exemptions on the value-added tax (VAT) for imported machinery intended for CO_2 reduction projects (Government of Colombia, 2002). Meanwhile, Law 1,715 of 2014 promotes the development and use of unconventional energy sources, especially renewables (Government of Colombia, 2014). Article 11 of that law (amended by Article 8 of Law 2,099 of 2021) provides that those who invest directly in unconventional sources of electricity may deduct up to 50 percent of the total investment made from their income. Article 12 (amended by Article 9 of Law 2,099 of 2021) exempts from VAT domestic or imported equipment, components, machinery, and services that constitute investments in the production or use of energy from unconventional sources (Government of Colombia, 2021). Likewise, Article 13 provides for tariff incentives, and Article 14 allows for accelerated depreciation of assets used in energy production. As was the case with Chile, there is no evidence that Colombian authorities and legislators considered instruments other than taxation during the development of this policy.

The Case of Mexico

Mexico formally introduced tax and market incentives as policy instruments to promote sustainable development in 1996 through the General Law on Ecological Balance and Environmental Protection. The carbon tax emerged with the 2013 tax reform and came into effect in 2014. It was incorporated as a Special Tax on Production and Services (IEPS), an indirect tax applied to the sale, production, or import of certain goods and services. The IEPS CO_2, which was designed by a team of technicians from the Ministry of the Environment and Natural Resources and nongovernmental organizations (NGOs), was created to reduce fossil fuel consumption, encourage greater energy efficiency, and promote the adoption of cleaner technologies.

The tax reform implemented by the Ministry of Finance and Public Credit (SHCP) in 2013 sought to increase tax revenues, which had been hit hard by fluctuations in oil prices, an important source of revenue for the Mexican treasury at the time (Belausteguigoitia, Romero, and Simpser, 2022). However, the General Law on Ecological Balance and Environmental Protection states in Article 22, paragraph 2, that economic instruments of a fiscal nature for the protection of the environment "shall in no case be established for the sole purpose of raising revenue" (Government of Mexico, 1988). As with other taxes introduced in the same reform to correct externalities, such as the tax on beverages with added sugars and pesticides, the resulting increase in revenue was only a secondary consequence.[13]

[13] In 2023, the carbon tax raised approximately US$440 million (World Bank, 2023).

In December 2017, when the carbon tax had been in force for three years, the government published the General Rules for the Optional Payment of the Special Tax on Production and Services on Fossil Fuels through the Delivery of Carbon Credits. These rules allow for the optional payment of the tax through certified emission reduction (CRE) from the United Nations clean development mechanism (CDM), corresponding to projects developed in Mexico, issued as of January 1, 2014. The purpose of this policy decision is to encourage the generation of mitigation projects and align fiscal and climate policies.

Table 1. Summary of Consideration I: Define the Objectives of the Tax and Analyze Policy Options

Consideration	Topics	Possibilities
1. Define objectives and analyze policy options.	Define objectives.	• Reduce emissions. • Mobilize public and private resources.
	Analyze policy options.	• Combine instruments according to objectives, capacities, advantages, and disadvantages of each instrument.

Source: Authors' elaboration.

As in the cases of the Chilean and Colombian taxes, there is no evidence that the Mexican authorities considered other instruments when introducing this tax. This may be because the tax was created as part of a tax reform and not because of an independent environmental policy measure. (Table 2).

Table 2. Objectives and Scope of the Tax in Chile, Colombia, and Mexico

Objetivos y alcances	Chile	Colombia	México
Regulatory framework	The green tax established in Chile by Law 20.780 taxes emissions of carbon dioxide (CO_2), nitrogen oxide (NOx), sulfur dioxide (SO_2) and PM from fixed sources with annual emissions greater than 25,000 tons of CO_2 or 100 tons of PM. The purpose of the tax is environmental. The same law also creates a tax on the first sale of vehicles, based on how polluting the vehicle is (CO_2 and local pollutants). In 2020, Article 16 of Law 21,210 introduced amendments to the tax.	Colombia has a carbon tax regulated by Law 1,819 of 2016. The primary objective of the tax is to reduce CO_2 emissions by discouraging the use of fossil fuels, promoting efficient energy use, and utilizing unconventional sources of renewable energy.	The carbon tax was introduced as part of the 2013 tax reform and came into force in 2014 with an environmental objective. It was incorporated as an IEPS, an indirect tax applied to the sale, production, or import of certain goods and services.

Source: Authors' elaboration.

Conclusions

This section analyzes the possible objectives and policy options that countries should consider when establishing a carbon tax, as well as how Chile, Colombia, and Mexico have applied these principles in practice. In terms of objectives, theory clearly identifies three fundamental purposes: reducing emissions, generating fiscal resources, and mobilizing financing for climate action. By studying the experiences of the three countries and comparing them with the theoretical foundations, it is evident that in all cases a pragmatic approach was followed which, although not strictly applying the theoretical recommendations on systematic analysis of policy options and initial strategic definition of objectives, has evolved positively towards greater alignment with the conceptual foundations of carbon taxes. In this regard, the areas of convergence and divergence are outlined below.

Areas of Greatest Convergence with Theory

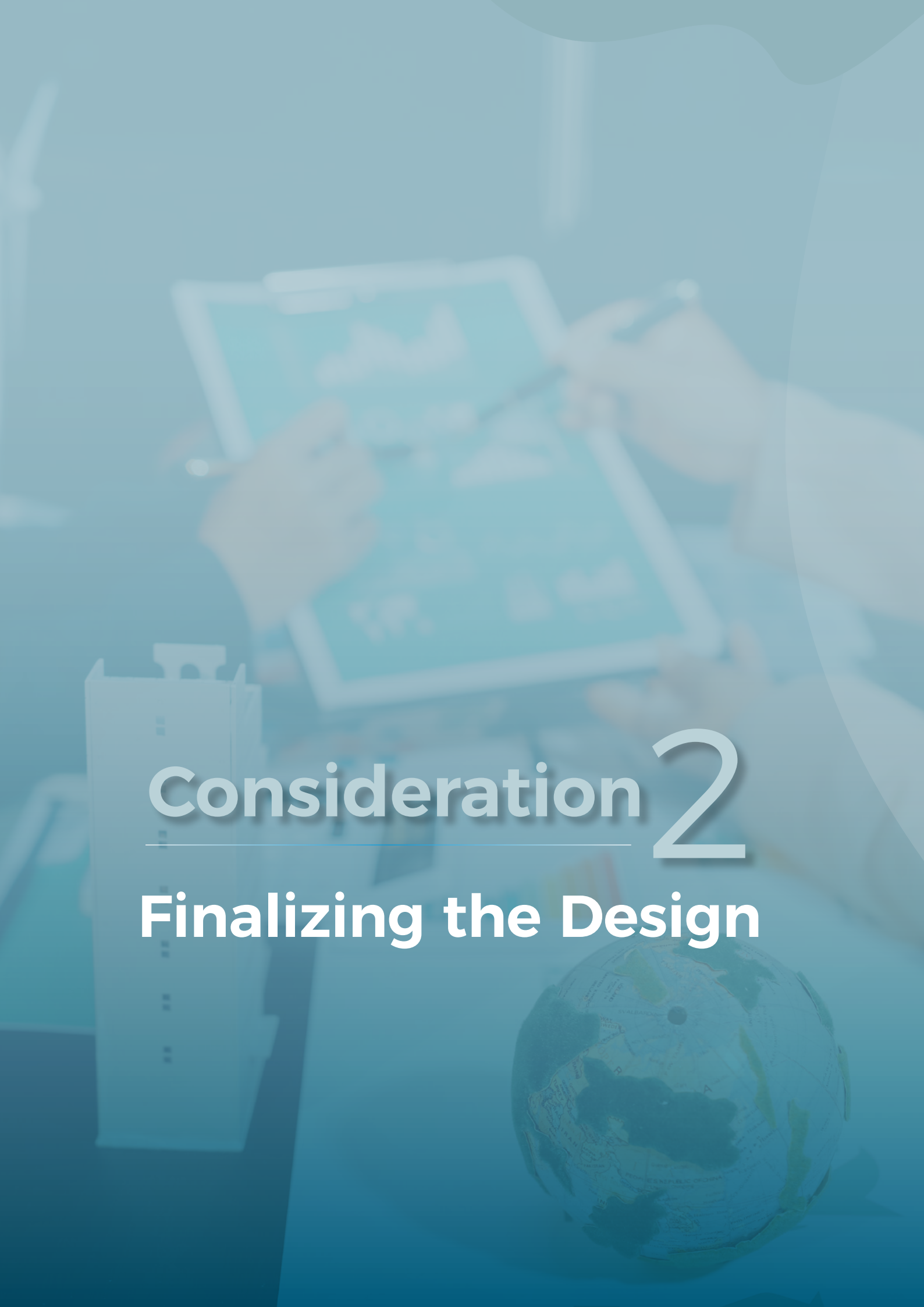
Evolution toward defined climate objectives. Although taxes emerged as fiscal measures, the three countries established carbon taxes with a primarily environmental objective. Chile established an explicit link between the tax and its NDC and LTCS. Similarly, Colombia linked the carbon tax to the fulfillment of national objectives under the Paris Agreement and directs a portion of the revenue to finance specific environmental actions. For its part, Mexico linked the tax to reducing fossil fuel consumption, sustainable development, energy efficiency, and clean technologies.

Development of complementary offset systems with carbon markets. All three cases show a trend toward integrating the tax with offset mechanisms through carbon credits. To a certain extent, this is in line with the idea of mobilizing private financing for mitigation projects. Colombia defined this possibility when it created the tax, while Chile and Mexico incorporated it a few years later.

Areas of Less Convergence with Theory

Limited analysis of policy options. Although theory recommends designing and adopting the combination of instruments best suited to national or local conditions, there is no evidence that any of the three countries has conducted a systematic comparative analysis of carbon taxes and alternative instruments. The choice of taxation seems to have responded to opportunities within broader tax reforms rather than to a comprehensive assessment of alternatives.

Limited integration with existing complementary policies. Although Colombia and Mexico already had instruments in place to promote clean technologies and renewable energy, the integration of the carbon tax with these mechanisms does not appear to have been strategically planned. Theory suggests more deliberate coordination between market and regulatory instruments.



Consideration 2

Finalizing the Design

As noted above, implementing a carbon tax presents challenges associated with the economic, political, and social context in which it will be applied. To maximize its political viability and effectiveness, these constraints must be considered. This section brings together key considerations to keep in mind when designing this type of tax.

Theory

Once the objectives of the tax have been defined, the next step is to determine the **rate** and **coverage** in line with these objectives. It will then be necessary to establish its **institutional framework**, that is, the roles and responsibilities of each institution (Ministry of Environment, Ministry of Economy, General Tax Directorate, or similar entity). In general, two fundamental aspects must be specified: tax policy, which includes determining the amount generated in each period from the tax, the taxpayers, the rate, among other things; and tax administration, that is, the entity that collect the tax, the institutions that will monitor emissions, and where tax will be collected, among other things. These issues are reviewed below.

Rate

There will often be a trade-off between setting a rate high enough to achieve ambitious policy objectives and low enough to avoid seriously affect the competitiveness of businesses and the vulnerability of lower-income households. Therefore, in addition to estimating the impact of different rates on emissions, the potential effect on gross domestic product (GDP), the competitiveness of affected sectors, household income and its distribution, and, in particular, the income of the most vulnerable households should be calculated.[14] In this context, the ambition of the tax objectives and the rate are likely to be defined simultaneously. An important issue in setting the rate is the frequency of increases. For example, a limited increase each year can help balance environmental objectives with the potential negative effects of a high rate as a final goal.

One of the most significant disadvantages of a tax versus an emissions permit market is that the regulator must estimate the abatement costs of regulated sources and households, since abatement costs are generally private information held by the sources, and the regulator only has partial information. One possible solution is to periodically assess the impact of the tax on emissions and consumption and investment patterns and adjust the rate upward if emission targets are not met or downward if they are exceeded (Baumol and Oates, 1988).

[14] Alternatives for managing these impacts are discussed in Section III: Managing public acceptance.

Box 1. Determining the Tax Rate

There are two basic conceptual criteria for setting the rate of a carbon tax. The first is the Pigouvian approach.[a] That is, a basic justification for a carbon tax is to ensure that sources of GHGs consider the damage they cause, the amount of the tax on the emission of 1 ton of carbon should be related to the present value of the damage caused by that ton. According to this approach, the tax rate should be equal to the social cost of carbon, or the present value of the damage caused by the ton of carbon emitted. This amount is not easy to calculate, partly due to technical complexities. For example, is difficult to calculate how the climate will behave, what the consequences of extreme weather events will be, how technology will evolve, and other factors. But the difficulty is also related to an ethical issue. The value depends, for example, on the degree of estimation of future generations (i.e., the discount rate used to bring the future benefits of today's action to present value). For these reasons, the calculation of the social cost of carbon has increased over time. In the last 10 years, it has risen from US$9/tCO$_2$ to US$40/tCO$_2$ with a high discount rate and from US$122/tCO$_2$ to US$525/tCO$_2$ with a low discount rate (Tol, 2023). Furthermore, this calculation does not incorporate many benefits that markets do not capture. In this case, a recent study puts the social cost of carbon at US$1,056 tCO$_2$ (Bilal and Känzig, 2024). In practice, the regulator can estimate the social cost of carbon and use this value as a weighting factor in determining the amount. Chile chose this option.

The second approach that regulators can take is to set an emission reduction target for generating sources and establish a tax that is consistent with that target. In this approach, the emission reduction target is not necessarily related to the emission reduction that would be achieved with the Pigouvian tax. Examples of such targets include Colombia's commitment under the Paris Agreement to achieve a 20 percent reduction in emissions by 2030 compared to 2010, and Chile's goal of achieving carbon neutrality by 2050. One advantage of this approach is that it avoids the uncertainty of current estimates of the social cost of carbon. Furthermore, the amount of the tax resulting from the local calculation of the social cost of carbon may be politically unfeasible. On the other hand, the regulator may opt for this approach to set an emission reduction target consistent with what science dictates to avoid warming of more than 2°C with a probability of two-thirds (i.e., carbon neutrality by 2050).

According to this approach, in which the regulator sets a reduction in emissions, the amount of the tax should be related to the costs of the regulated sources to reduce their emissions to the specified level. More precisely, it should be equal to the marginal abatement cost of reaching the permitted emissions level (i.e., the cost of reducing GHG emissions in the environment around the target set by the chosen policy option). Economic theory suggests that, faced with a carbon tax, GHG sources will reduce emissions through investments and process changes that cost them less than paying the tax. In other words, according to theory, the amount of the tax determines how much emissions will fall for regulated sources. Thus, within the range allowed by the technology available at a given time and provided that the tax is properly enforced, the higher the tax, the lower the emissions.

Therefore, to set the carbon tax rate based on this second approach, it is essential to estimate how firms in different sectors and households in different income deciles will respond to different rates. The key variable that determines this response is the relationship between the tax rate and the emission reduction costs faced by businesses and households. This information is known as abatement costs. For consumers, it refers to the costs of consumer goods or services with a lower carbon footprint and substitutes for those with a higher footprint, whose costs rise because of the tax.

The relationship between the tax rate and the abatement costs of the affected companies and households will determine the emission reduction and revenue that the tax will achieve, as well as the amount of private resources that a non-recourse mechanism can mobilize through an associated carbon credit market (see Consideration V: Integrating taxes and carbon credits), as it will determine the maximum price to be paid for these credits and who will pay them (no one will want to pay a carbon tax through a carbon credit if the reduction of 1 ton of CO_2 represented by a credit is more expensive than paying the tax for the same ton of CO_2).

[a] So called because the approach represents a series of taxes proposed by the English economist Arthur Pigou to address externalities.

Coverage

Coverage refers to the sectors affected by the emissions tax (transportation, electricity generation, industry, etc.). Although emissions generate the same cost regardless of the sector that emits them, the tax may affect different sectors differently. Consequently, the design of the instrument may initially provide for partial coverage as part of the strategy for managing acceptance *(see Consideration III: Manage public acceptance)* or managing its effectiveness *(see Consideration IV: Enhance carbon price interventions)*, or to avoid taxing sectors where the instrument may have a low impact on emissions but a high economic impact.

In practice, tax coverage may be defined simultaneously with the determination of the ambition of its objectives and rate, since an emission reduction and revenue target can be achieved with different combinations of rate and coverage. In other words, the level of emission reduction can be achieved with a relatively high rate and relatively low coverage, or vice versa.

Typical variables for defining partial tax coverage are the sector, the size and type of sources, and administrative jurisdictions. Carbon taxes generally include the energy and industrial sectors but exclude the agricultural sector. They also tend to cover large sources and exclude small ones. To this end, a threshold for CO_2 emissions per year is established: if sources exceed this threshold, they become subject to the tax. Another way to define carbon tax coverage is by source type. Carbon-emitting sources can be classified as fixed or mobile. **Fixed sources** have a fixed point of emission in space (e.g., a chimney). They correspond to industrial and commercial establishments or buildings with boilers. **Mobile sources**, on the other hand, usually include means of transportation (cars, ships, etc.). Finally, carbon sources may be exempt from the tax depending on their location in certain jurisdictions.

Collection Points

The type of source taxed (mobile, fixed, or both) determines the regulator's options regarding collection points. There are two options. The first is to collect the tax **upstream,** that is, at the points where the good or input that produces carbon emissions enters the economy. In the case of fossil fuels, for example, the upstream tax is levied on oil extraction, refining (production of gasoline, etc.), or importation. The second option is to levy the tax **downstream**, that is, where the emissions occur. In this case, the GHG emitter is responsible for the tax liability. In the case of fossil fuels, the tax is levied on their purchase. The consumer is responsible for the tax liability.

The fundamental criteria for deciding between upstream or downstream as the point of collection are the ease and the cost of collection. Generally, collecting the tax upstream is easier and less costly, as the number of taxpayers is much smaller. This simplifies tax enforcement without significantly compromising its effectiveness, as the tax on a relatively small number of companies upstream will be passed on downstream to distributors and consumers. On the other hand, a downstream tax allows for more targeted collection based on the source of emissions, which increases flexibility in modifying coverage.

Design of a Carbon Offset System

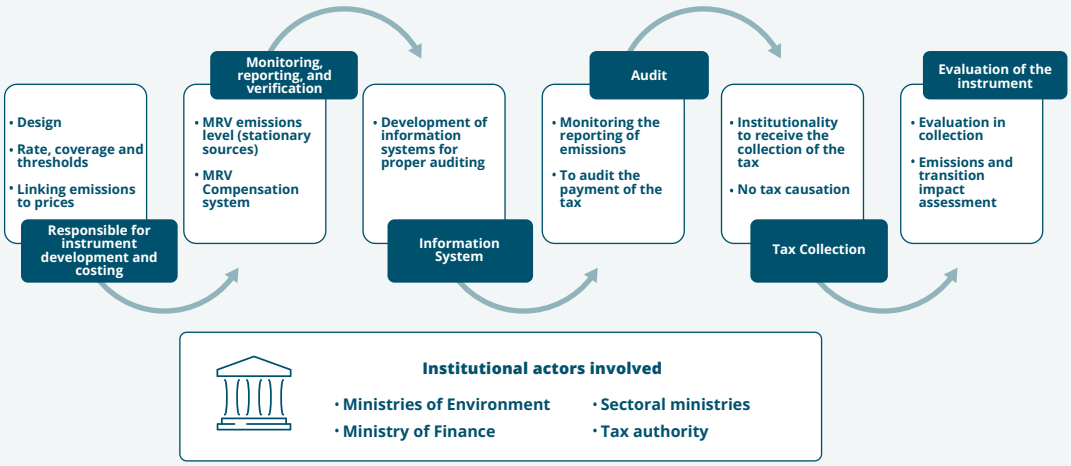
A carbon tax instrument may also consider the use of carbon credits as an alternative mechanism to tax payments (Talbot-Wright et al., 2024). A carbon credit is generated when a third party certifies that it has absorbed, reduced, mitigated, or avoided 1 ton of CO_2 emissions. A company can purchase this credit to offset its CO_2 emissions. Carbon credits can be purchased on a voluntary market or be the result of regulation that requires them and therefore creates such a market. This mechanism allows taxed institutions to lower costs and, at the same time, can incentivize the reduction or absorption of emissions to the extent that credits are purchased at a lower cost than the tax per ton of emissions. Consideration V: Integrating carbon taxes and credits discusses this mechanism in detail.

Institutional Framework

To design and implement a tax, it is necessary to define its institutional framework, with specific roles and responsibilities for each stage. In particular, the roles of the different institutions should be established in the following activities:

- Design of the instrument
- Development and maintenance of information systems on emission levels and associated systems (emission monitoring, reporting, and verification [MRV] systems), which are essential for the proper functioning (enforcement) of the tax and compensation systems
- Governance and adequate capacities for the proper enforcement of the instrument
- Tax collection and administration of revenue
- Periodic evaluation of the impact of the instrument on emissions and relevant socioeconomic variables, to adjust the design of the tax to align it with the objectives and increase its effectiveness

Figure 1. Actors Involved in the Design and Operation of a Carbon Tax



Source: Authors' elaboration.

Defining institutional roles in carbon taxes depends on two key factors. First, the regulatory framework establishes the formal responsibilities of each institution. In the case of a tax, for example, the main responsibility for collection, enforcement, and administration of revenue falls to the finance/treasury ministries and tax authorities (such as the Internal Revenue Service, or SII, in Chile or the National Tax and Customs Directorate, or DIAN, in Colombia).

Second, existing technical capacities influence the allocation of functions, especially where the regulations are not explicit. Thus, finance ministries tend to lead the analysis of the macroeconomic, fiscal, and distributional impacts of the tax (as in Mexico, where the SHCP developed carbon tax impact models). Sectoral ministries contribute their specific expertise: environment ministries are usually responsible for emissions monitoring, reporting, and verification systems (as is the case of the Ministry of the Environment, or MINAM, in Peru); while ministries such as energy, transport, or industry contribute technical parameters to determine the tax base in their respective sectors (as is the case of the Secretariat of Energy in Argentina).

Table 3. Main Institutional Functions in the Implementation of a Carbon Tax

Agency	Functions
Ministry of Finance	• Design of the tax structure • Determination of rates and thresholds • Management of tax revenues • Economic impact assessment
Tax authority	• Tax administration • Auditing and control • Collection system management • Tax dispute resolution
Ministry of the Environment	• Development of emissions monitoring, reporting, and verification. • Environmental impact assessment • Alignment with climate policies • Coordination with the NDC and LTCS
Sectoral ministries	• Provision of sectoral data • Implementation of complementary measures • Coordination with sectoral actors Assessment of sectoral impacts

Fuente: elaboración propia.

Practice

The Case of Chile

Chile's green tax levies carbon dioxide (CO_2), nitrogen oxide (NOx), sulfur dioxide (SO_2), and PM emissions from fixed sources with annual emissions greater than 25,000 tons of CO_2 or 100 tons of PM. In the case of CO_2, the tax rate is US$5/t. This tax covers 29 percent of national emissions. The tax rate and coverage are based on the weighting of various factors, such as the social price of CO_2 and local pollutants, macroeconomic effects, sectoral effects, distributional effects, and a comparison of rates with countries with similar characteristics and developed countries.

Rate

The tax value was determined based on the social cost of CO_2 estimated by the Ministry of Social Development. When the law was drafted in 2014, the estimated social cost of carbon was CLP$2,213, equivalent to US$4.18 per ton. The final value of the tax was set at US$5/t, about US$1 more than the original value (Ministry of Social Development, 2014).[15]

Until 2016, when the methodology for estimating the social price of carbon changed, the Social Investment Evaluation Division of the Ministry of Social Development calculated the social price of carbon based on the average market price of instruments traded under the CDM. The new methodology determines the social price of carbon based on marginal abatement costs, which come from the Mitigation Action Plans and Scenarios project in Chile.

The Ministry of Finance is currently evaluating a modification to the existing green tax. To this end, a macroeconomic analysis was conducted, which studied the aggregate impacts that different CO_2 emission tax rates could generate, according to the Climate Policy Assessment Tool model of the International Monetary Fund. The model indicated, in line with the specialized literature, that the net impact of the tax on the economy depended heavily on the use of the resources collected from the emissions tax. It also determined that the overall effect on economic activity could be positive, provided that the resources collected were temporarily allocated to productive activities.

Coverage

Originally, the CO_2 tax established a criterion based on installed energy capacity (boilers or turbines) that, individually or collectively, added up to a thermal power equal to or greater than 50 MWt (megawatts thermal), and only included sources from the electricity generation sector. In 2020, Law 21,210 changed the allocation criterion to the number of annual emissions and set thresholds at 25,000 tons for CO_2 and 100 tons for PM. It also expanded the coverage of the tax by modifying the allocation criterion from installed capacity to total annual emissions. As a result, all establishments that emit more than 25,000 tons of CO_2 per year are subject to the tax. These changes came into effect in 2023.

Point of Collection

In Chile, the CO_2 tax is collected downstream. In other words, those subject to the tax are users of fossil fuels and not their producers, distributors, or importers, as is the case in Colombia or Mexico (Mexico, 2021).

The tax base corresponds to the total emissions generated by the taxpayers concerned and not to the amount of fossil fuel they purchase. This involves identifying the emissions from each source. To this end, sources must report their emissions annually, which are verified and sent to the Ministry of Finance for collection.

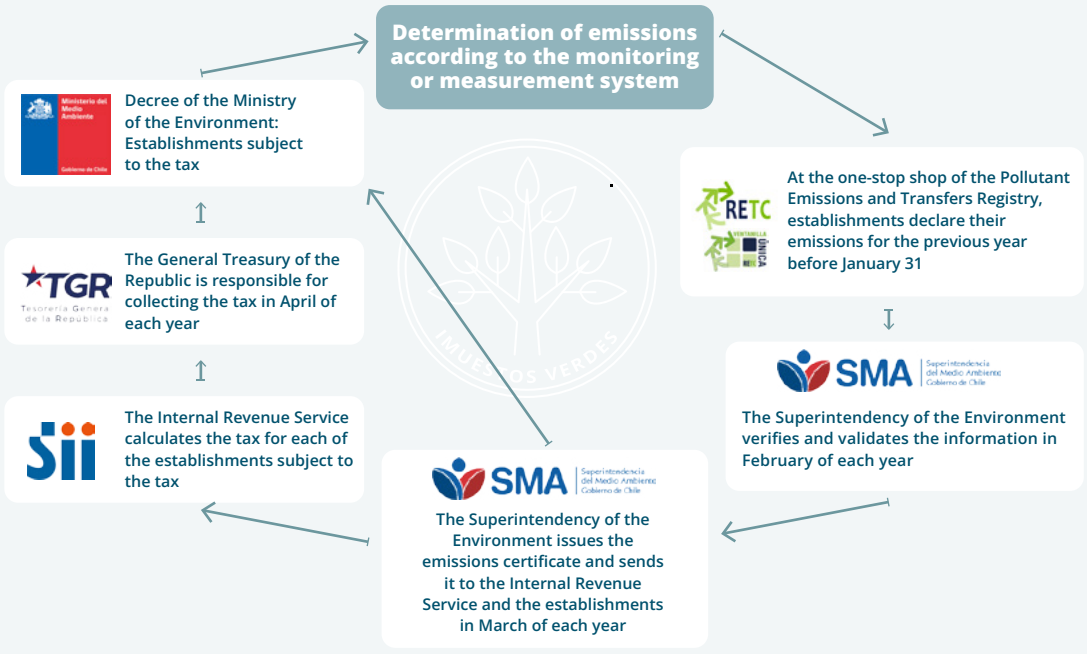
[15] In 2016, POCH Ambiental S.A. and the British Embassy in Chile presented the report, Integrating Climate Change into Chile's National Public Investment System. A summary of this work is available at https://sni.gob.cl/storage/docs/Precio%20Social%20del%20CO2.pdf.

Institutional Framework

In Chile, the division of institutional roles is based on regulatory issues (that is, which institution is mandated to do what) and associated technical capacities (Figure 2). More specifically, the Ministry of the Environment and Sustainable Development keeps a register of companies covered by the tax, which must declare their emissions by January 31 of each year at the single window of the Register of Emissions and Transfers of Contaminants (RETC). The Superintendency of the Environment verifies that these emissions reports comply with the regulations. If they are compliant, it validates the reports in February, issues an emissions certificate in March, and sends it to the Internal Revenue Service (SII) and the establishments. The certificate consolidates the previous year's emissions reported by each taxpayer. Finally, it sends the necessary data to the SII so that it can calculate the tax.

For its part, the SII calculates the amount owed in carbon tax for each establishment and informs the General Treasury of the Republic, which is responsible for collecting the tax in April. Meanwhile, the Ministry of Finance is responsible for assessing the economic and distributive impact of the tax, and the SII is responsible for its design and review, in accordance with tax regulations.

Figure 2. Institutional Framework of the Green Tax in Chile



Source: Chilean Ministry of the Environment.
Note: The process flow should be adjusted during the design phase.

The Case of Colombia

Colombia taxes GHG emissions from the burning of fossil fuels at a rate of COL$25,799.56 per ton of CO_2 equivalent (CO_2eq) (approximately US$6.6)[16] (DIAN, 2024b). The tax affects the first activity in the supply chain for sale, import, or self-consumption, except in the case of coal, where the tax is a single-stage, final-stage tax.[17]

Rate

A relevant aspect in defining the rate was its impact on the price of electricity. The significant share of hydroelectric power generation and the existence of energy subsidies for households contributed to making it viable. To neutralize the impact of the carbon tax on electricity rates, industrial and commercial companies can offset rate increases with reductions in energy surcharge payments.

Another aspect considered when introducing this instrument was its distributional impact. Based on an analysis of the distribution of liquid fuel consumption by income decile, the authorities concluded that most consumption fell on the highest deciles, which contributed to the viability of the tax.

The impact of this tax on the price of each fuel depends on its GHG emission factor. This factor is expressed in kilograms of CO_2 eq per unit of energy (terajoules) and is determined according to the volume or weight of the fuel and its calorific value.

Law 1,819 of 2016 established an initial rate for the carbon tax of COL$15,000 per ton of CO_2eq (equivalent to US$5).[18] It also defined the mechanism for annual adjustment of the rate, according to which the National Tax and Customs Directorate (DIAN) adjusts the tax rate each February by 1 percentage point above the variation in the consumer price index (CPI) for the previous year, calculated by the National Administrative Department of Statistics. If the adjustment results in a value that exceeds or equals the equivalent of 3 tax value units per ton of CO_2eq, the rate is set at 3 tax value units. However, this restriction does not currently apply (the tax value is less than one-fifth of the value of 3 tax value units).

Coverage

The Colombian carbon tax is levied on "the CO_2 equivalent present in fossil fuels, such as petroleum derivatives (gasoline, kerosene, jet fuel, diesel fuel, and fuel oil), and solids used for combustion" (Article 47 of Law 2,277 of 2022). Articles 221 and 222 of Law 1,819 of 2016 establish the following exceptions: for liquefied petroleum gas (LPG), the tax is only levied on sales to industrial users; for natural gas, on sales to the hydrocarbon refining and petrochemical industry. In addition, the tax is not levied when fossil fuels are exported by their producer or by the exporter in the case of coal exports. The law also includes exemptions for fuel alcohol intended for blending with

[16] Representative market rate (peso per dollar) as of January 31, 2024 (date of issuance of Resolution No. 000007) according to the Banco de la República: COL$3825.60 = US$1 (BanRep, 2024).

[17] In accordance with Article 221 of Law 1,819 of 2016, "in the case of coal, the taxpayers and persons liable for the tax are those who acquire or use it for their own consumption within the national territory. Those liable are those who will self-assess the tax."

[18] Representative market rate (peso per dollar) as of December 31, 2016 (date of issuance of the law) according to the Banco de la República: COL$3,000.71 = US$1 (BanRep, 2016). There is no clear evidence regarding the methodology used to arrive at this rate.

gasoline (r mixed with ethanol), biodiesel produced from vegetable products, the sale of marine diesel, and fuels used for refueling ships in international traffic.

Emissions from coal combustion, exempt from carbon tax under Law 1,819 of 2016, were included in the tax base by Law 2,277 of 2022, except those from coke oven coal combustion. The tax on carbon emissions will enter into force in 2025 and will be implemented gradually. These emissions will begin to pay 25 percent of the rate in 2025 and, through increases of 25 percentage points each year, will pay the full rate in 2028.

Finally, at the request of members of Congress, Colombian law provides for geographical differentiation of the tax rate. In some Colombian departments and municipalities, there is no tax on gasoline, motor fuel oils, and jet fuel. In departments and municipalities where hydrocarbon exploitation or fuel refining takes place, the full tax rate applies (Congress Gazette, 2016).

Collection Point

In Colombia, the carbon tax is a single-stage, first-stage tax, meaning that it is applied only at the first point in the production or distribution chain, except for coal, which is taxed at the final stage. In other words, the collection point is the first activity in the supply chain, whether it is a sale within the national territory by domestic companies, withdrawal for their own consumption, or importation for sale within the national territory or for their own consumption.

Institutional Framework

The DIAN administers the tax (Article 222 of Law 1,819 of 2016). Sources declare the amount due and pay it every two months using Form 465. In this declaration, the sources record the carbon tax to be paid, for which they itemize sales, withdrawals for their own consumption, and imports made for each fossil fuel. They also record non-taxable transactions for each fossil fuel. Finally, they must settle the balance to be paid for the tax, as well as any applicable penalties. The DIAN keeps a record of the sources affected, verifies the accuracy of the returns, and requires the person responsible (or third parties, of whom it also has a list) to issue reports or respond to inquiries (Articles 684 and 779-1 of the Tax Statute), among other investigative and enforcement powers at its disposal.

The Case of Mexico

Mexico's federal carbon tax levies fossil fuels according to their potential to generate CO_2 emissions.

Rate

To determine the rate, the team responsible for designing the tax considered estimates of the social cost of carbon (the estimated present value of the damage caused by 1 additional ton of CO_2 released into the atmosphere) and carbon prices in other countries (Belausteguigoitia, Romero, and Simpser, 2022). However, even the lowest estimates of

the social cost of carbon were considered politically nonviable. In this context, the team created an index by weighting the prices of several international markets in Europe, New Zealand, and California. Using data from October 2012 to June 2013, an average price of MXN$70.68 per ton of carbon (about US$5.70 at the time) was obtained. This was the rate initially proposed by the federal government. With this rate, the Mexican government estimated that emissions in 2014 were reduced by 5.83 million tons of CO_2 (1.18 percent of the country's total emissions) and MXN$26.742 billion (around US$2 billion, or 1.8 percent of the federal government's revenue that year) was collected.

Some of the most affected companies, such as those operating with natural gas-based processes, protested the tax, arguing that they had converted their production processes to natural gas to use the fossil fuel with the lowest carbon content per unit of energy. In response, the Chamber of Deputies modified the tax structure. First, it limited the amount of the tax to align it with inflation targets. Thus, the tax could not exceed 3 percent of the sale price of each fuel. Second, it decided to apply it only to the excess carbon emitted compared to natural gas. In other words, the carbon tax was established on the difference between the carbon content of the taxable fuel and the carbon content of natural gas. Congress approved the structure presented by the Chamber of Deputies. In its new version, the proposal set the rate at MXN$39.8 per ton of CO_2 (US$3.21/tCO_2). The rate is adjusted according to the increase in the consumer price index (CPI). Therefore, the rate of the IEPS on Mexican carbon remains constant in real terms over time. In 2024, the carbon tax adjusted for changes in the CPI and the exchange rate reached US$3.7/t$CO_2$.

Due to the practical difficulty of measuring emissions from mobile sources and the costs of doing so for fixed sources, the design team decided that the tax should be levied on fossil fuels according to their potential to generate CO_2 emissions. The emission factors used to calculate the emission potential of each fuel were the values used by the Intergovernmental Panel on Climate Change (IPCC). However, the unit of measurement for the tax is expressed in pesos per liter or ton for most fuels. In other words, the tax is levied on fossil fuels per unit (liter, etc.). To calculate the specific IEPS, a rate per ton of CO_2 is set, and the IPCC emission factors for each fuel are used to calculate the corresponding amount for each fuel.

In terms of revenue, this tax collected MXN$65.34 billion (US$3.843 billion) between 2014

Coverage and Collection Point

In Mexico, the federal CO_2 tax is levied upstream. It is applied to the production, import, and sale of fossil fuels intended for combustion processes. As it taxes fuels according to their emission potential, this applies to both mobile and stationary sources. Emissions are estimated based on the emission factors and fuel sales, so it does not require a specific MRV scheme for emissions (Mexico$_2$, 2022).

As noted, Congress modified the tax structure and introduced an exemption for natural gas, but also for fossil fuels used in production processes that do not require combustion, such as paraffins. In addition, the rate and collection point vary geographically.

Institutional Framework

The institution that determines the rates and quotas for the federal carbon tax and the IEPS on gasoline and diesel is the SHCP. However, the Mexican Constitution and the Fiscal Coordination Law allow taxes to be levied at subnational levels of government. Accordingly, nine states have implemented carbon taxes: Querétaro, San Luis Potosí, Tamaulipas, Nuevo León, Yucatán, Zacatecas, Durango, Guanajuato, and the State of Mexico.

The levying of carbon taxes at the subnational level in addition to the federal tax raises questions about coordination and compatibility. In this regard, the solution seems to lie in the restrictions established by the regulations. First, state taxes cannot be levied on emissions from fixed sources under federal jurisdiction. According to Mexican law, only the federal government has the power to apply a direct carbon price to fossil fuels (Mexico$_2$, 2022). For this reason, subnational governments have opted for a downstream approach and have taxed emissions directly (Mexico$_2$, 2022). The disadvantage is that these taxes require emissions monitoring, which requires additional capacity on the part of the states. As detailed in Box 2, these regulatory constraints have not always translated to the setting of rates like the federal rate.

Box 2. Subnational Carbon Taxes: The Case of Mexico

Mexico has three types of carbon pricing instruments: a federal carbon tax implemented in 2014, a national emissions trading system that began its pilot phase in 2020, and a series of subnational carbon taxes that began to be developed and implemented in the same year. The first precedent for state climate change fiscal policies originated in 2019, when the state of Zacatecas obtained a ruling from the Supreme Court of Justice of the Nation validating a series of environmental taxes, thereby setting a precedent. These environmental taxes cover environmental remediation, atmospheric emissions, soil, subsoil, and water pollution, and the final disposal of solid waste in public and private landfills.

Zacatecas was the first state to implement two of the four environmental taxes approved by the Supreme Court: taxes on GHG emissions and on soil, subsoil, and water pollution. Since then, other states have joined Zacatecas in developing or designing carbon taxes. Querétaro, San Luis Potosí, Tamaulipas, Nuevo León, Yucatán, Durango, Guanajuato, the State of Mexico, and Zacatecas have taxes in place (although in the State of Mexico it is inactive); while Jalisco has designed a tax that is still under discussion. Thus, 10 of 32 states have implemented carbon taxes. Table R2.1 summarizes the main characteristics of these instruments. The order of the states corresponds to the date of design and/or implementation of the tax.

Table R2.1. Subnational Carbon Taxes in Mexico

State	Regulatory point	Tax base	Tax rate	Flexibility mechanism	Use of revenue
Zacatecas	Downstream	Fixed sources: CO_2, CH_4, N_2O, HFC, PFC, SF_6	MXN$ 250/tCO_2e (US$14,5/$tCO_2e$)	None	Priority given to environmental and economic improvement projects
Tamaulipas	Downstream	Fixed sources emitting at least 25tCO_2e mensuales. CO_2, CH_4, N_2O, HFC, PFC, SF_6. Except for natural gas	Three times the daily value of the unit of measurement and update (UMA) MXN$325,71/$tCO_2e$ (US$19/$tCO_2e$) in 2024 (INEGI, 2024)	Taxpayers may reduce the tax base by up to 25% of the tons of CO_2 equivalent through the acquisition of certified emission reductions (Government of Tamaulipas, 2007)	Compliance with state policy on climate change
Querétaro	Downstream	Fixed sources: CO_2, CH_4, N_2O, HFC, PFC, SF_6	5.9 times the daily value of the unit of measurement and update (UMA) MXN$640,5/$tCO_2e$ en 2024 (INEGI, 2024)	Taxpayers may reduce up to 20% of the taxable base through certified mitigation initiatives in forestry, energy, livestock, and waste (Querétaro Legislature, 2014)	Infrastructure works and environmental projects
Yucatán	Downstream	Fixed sources: CO_2, CH_4, N_2O, HFC, PFC, SF_6	2.7 times the daily value of the UMA MXN$293,1/$tCO_2e$ (US$17,13/$tCO_2e$) en 2024 (INEGI, 2024)	Fiscal incentives to avoid, reduce, or capture emissions	Ensure health protection and access to a healthy environment
State of Mexico	Downstream	Non-federal fixed sources: CO_2, CH_4, N_2O	MXN$58/$tCO_2e$ (US$3,39/$tCO_2e$) en 2024	None	Actions to ensure a healthy environment
Guanajuato	Downstream	Fixed sources: CO_2, CH_4, N_2O, HFC, PFC, SF_6	MXN$45/t CO_2e (US$2,63/tCO_2e) en 2024	20% tax incentive. Tax incentive of up to 25% for reducing or offsetting emissions	Priority given to environmental and economic improvement projects

Cuadro R2.1. Subnational Carbon Taxes in Mexico *(continuation)*

Jalisco	Downstream	Fixed sources exceeding 25.000 tCO_2e, CO_2, CH_4, N_2O, CN	To be determined	Deductions of up to 45%	Technological conversion and environmental conservation
San Luis Potosí	Downstream	Fixed sources: CO_2, CH_4, N_2O, HFC, PFC, SF_6	Three times the daily value of the UMA MXN$325,7/t CO_2e (US$19/tCO_2e) en 2024	Tax incentives	Not established
Durango	Downstream	Fixed sources: CO_2, CH_4, N_2O	MXN$100/t CO_2e (US$5,85/t CO_2e)	None	Not established

Source: Prepared internally with information from Mexico2 and official state government websites.
Note: The tax rate is converted from Mexican pesos to US dollars at an exchange rate of MXN$17.11 = US$1 as of April 30, 2024.

To design and implement the carbon tax, the competent federal authorities based their approach on the guidelines developed by the World Bank's Carbon Market Readiness Partnership (CMRP, 2017). These guidelines are organized around five key elements: *(i)* the tax base, *(ii)* the tax rate (these two elements determine what will be taxed and at the rate that taxpayers will pay), *(iii)* the institutions that will ensure oversight and compliance (i.e., the government's tools for enforcing taxpayer obligations), *(iv)* the use of the resources collected, and *(v)* how to avoid unintended effects.

The specific objectives of subnational carbon taxes vary. However, in general, the states agree on reducing GHG emissions and promoting the transition to a low-carbon economy. They also seek to encourage the adoption of clean technologies, energy efficiency, and innovation in key sectors.

As is the case at the federal level, state carbon taxes in Mexico differ in terms of structure, tax rates, and sectoral scope. In addition, they must be complemented by other environmental policies, such as incentives for clean energy and other actions that promote climate change mitigation.

Subnational carbon taxes also face significant challenges. As with federal taxes, their effective implementation and real impact depend on factors such as the potential resistance of the economic sectors affected, administrative capacity, and the combination with other fiscal policies to mitigate climate change. They must also be coordinated with policies at the federal level.

Sources: Mexico$_2$ (2024) and PMR (2017).

Ex-post Impact Analysis

Mexican authorities estimate that between 2014 and 2023, fossil fuel taxes have mitigated 138.6 $MtCO_2$. This is equivalent to an annual reduction of 9.5 percent of total CO_2 emissions from the transport sector in 2019.

More recently, the SHCP developed a tool that estimates the effects of the tax on emissions and the economy (GDP and employment, total and by sector), using a social accounting matrix methodology and technical coefficients. The estimated effect on GDP for the period 2014–19 was a decrease of 0.02 percent on average compared to the base year (2014), equivalent to MXN$22.054 billion (54.7 percent of carbon tax revenue in the same period).

The SHCP is currently working on the development of a computable general equilibrium model disaggregated by electricity generation subsectors. Its objective is to assess the medium- and long-term impact of environmental and energy policy, measured at the macroeconomic, sectoral, and household levels.

Table 4. Summary of Consideration II: Finalizing the Design

Consideration	Issues	Possibilities
2. Finalize the design	Determine the rate.	Pigouvian approach: set a tax equal to the social cost of carbon.
		Set a tax in line with the emission reduction target.
	Determine the coverage.	Determine the economic sectors included (in general, carbon taxes include the energy sector, but not agriculture).
		Define an emissions threshold: sources that exceed it are taxed.
		Determine the type of sources: fixed or mobile.
	Determine the point of collection.	Upstream, or at the point where the good or input enters the economy (import, production).
		Downstream, or at the point where emissions are produced.
	Design a compensation system.	A compensation system is a mechanism that allows companies affected by a carbon tax to avoid paying all or part of it by purchasing credits or certificates on the market. There are two market options: *(i)* voluntary market (guided by reputational and commercial objectives and customer demand) and *(ii)* regulated market (creation required by regulation or legislation).
	Define the institutional framework.	Define the roles of each institution, based on regulations and the capacities of each entity. Some of the actors involved are the Ministry of the Environment, the Ministry of Economy, sectoral ministries, the Ministry of Finance, and tax authorities.

Source: Authors' elaboration.

Table 5. Tax Design in Chile, Colombia, and Mexico

Design	Chile	Colombia	Mexico
Rate	The tax rate was determined based on the social cost of CO_2. The final tax rate was set at US$5/t, approximately US$1 more than the original rate.	Law 1,819 of 2016 established an initial rate for the carbon tax of $15,000 per ton of CO_2 eq (approximately US$5) and an adjustment mechanism whereby the DIAN adjusts the tax rate by 1 percentage point above the variation in the CPI for the previous year.	The rate was calculated based on estimates of the social cost of carbon, but subsequent legislative discussions brought the initial value of the rate to MXN$39.8/t$CO_2$ (US$3.21/t$CO_2$), with an adjustment based on the increase in the CPI. Therefore, the Mexican IEPS CO_2 rate remains unchanged in real terms over time. In 2024, the carbon tax adjusted for CPI and exchange rate changes reached US$3.7/t$CO_2$
Coverage	Law 21,210 established the criteria for affecting the amount of annual CO_2 or PM emissions and set the thresholds for fixed sources at 25,000 tons for CO_2 and 100 tons for PM per year. All establishments that emit more than 25,000 t/CO_2 per year are subject to the tax.	The Colombian carbon tax levies CO_2 equivalent present in fossil fuels, such as petroleum derivatives (gasoline, kerosene, jet fuel, diesel fuel, and fuel oil), and solids used for combustion. The law also defines exceptions for fuels based on their use or destination.	It taxes fossil fuels according to their potential to generate CO_2 emissions.
Collection point	Downstream. Those liable for the tax are users of fossil fuels that emit GHGs or PM.	Upstream. Applies only at the first point in the production or distribution chain, except for coal, which is taxed at the last stage.	Upstream. Applies to the production, import, and sale of fossil fuels intended for combustion processes. Applies to fixed and mobile sources.
Institutional framework	The Ministry of the Environment keeps a register of companies covered by the tax.	The tax is enforced by the DIAN.	The Ministry of Finance and Public Credit determines the rates and quotas for the federal carbon tax and the IEPS on gasoline and diesel.
	The Superintendency of the Environment verifies that companies' emissions reports comply with regulations.	The DIAN keeps a register of the sources affected.	Ten of 32 subnational states have carbon taxes.
	The Internal Revenue Service calculates the tax, determines its design, and reviews it.		
	The General Treasury of the Republic collects the tax.		
	The Ministry of Finance is responsible for assessing the economic and distributive impact of the tax.		

Fuente: elaboración propia.

Conclusions

Carbon tax design involves a set of theoretical considerations, including determining the rate, coverage, point of collection, and institutional framework. Analysis of experiences in Chile, Colombia, and Mexico suggests that carbon tax design faces an inevitable tension between technical purity and political feasibility, which is why it is possible to identify convergence and divergence with respect to these considerations.

The following is a summary of the areas where greater convergence is observed and those where convergence is less evident:

Establishment of low initial rates. All three countries implemented taxes with initial rates (US$3–US$6/tCO2) that were significantly lower than estimates of the social cost of carbon with the aim of prioritizing political feasibility, but in doing so they affected the immediate environmental effectiveness of the instrument.

Consideration of social costs. All three countries used estimates of the social cost of carbon or international benchmarks as a starting point for determining their initial rates. Subsequently, they adjusted the estimates due to political factors.

Collaborative institutional arrangements. All three countries distributed responsibilities among environmental, tax, and financial institutions according to their existing competencies, which enabled them to avoid creating entirely new structures.

Prior economic assessment. All three countries conducted analyses of potential economic impacts before setting rates and coverage, as recommended by economic theory.

The areas with the greatest differences between theory and practice in the three countries include the following:

Proliferation of exemptions. Contrary to the theoretical principle of broad and uniform coverage, all three countries established various types of exemptions: the initial exclusion of coal and tax-free treatment of fuels in certain regions in Colombia, the exemption of natural gas (due to pressure from industry) in Mexico, and limitations on the sectors where the tax was to be applied in Chile.

Different collection points. Chile opted for a downstream system, while Colombia and Mexico implemented upstream systems, reflecting different priorities between accuracy and administrative ease.

Absence of adaptive mechanisms. Although theory recommends adjusting rates periodically according to their impact on emissions (Baumol and Oates, 1988), only adjustments for inflation were established, without linking them to environmental outcomes.

Consideration 3

Managing Public Acceptance

Theory and Evidence

The Problem

Taxpayers tend not to take kindly to new taxes. While carbon taxes may be better regarded than traditional taxes, they have slowly gained acceptance, due more to the increased costs they generate than to their environmental impact (Carattini, Carvalho, and Fankhauser, 2018). There are currently 37 carbon taxes in place worldwide—27 at the national level and 10 at the subnational level—while another 11 are under consideration (World Bank, 2024). However, the implementation of carbon taxes has proven to be a political and social challenge.

The possibility of setting taxes high enough to achieve GHG emission reductions compatible with the Paris Agreement targets has been difficult. First, there are distributional impacts. A carbon price could increase costs for consumers and firms directly affected by the tax and, in so doing, increase the price of goods and services not directly taxed. A carbon tax on fossil fuel emissions, for example, raises production costs for companies and household spending on fossil fuels. The impacts could also be indirect, via price increases resulting from higher costs for companies. Depending on the size of the impact, this could affect household purchasing power, real wages, the level of business activity, competitiveness, and/or investment.

As a result of these cost increases, carbon taxes often generate opposition among the public and groups with interests, such as business owners and workers in sectors that supply the technologies or inputs that must be replaced to achieve carbon neutrality. The higher the rate, the greater the opposition. This is especially true under unfavorable macroeconomic conditions. Currently, the imposition of a carbon price can generate significant opposition, as occurred in France in 2015. In addition, the development of new technologies to reduce emissions can take time, which could extend the cost of the transition.

Public acceptance or rejection of a carbon tax is based on perceptions of the following: (*i*) the personal costs it imposes, that is, the direct impact on the cost of living (in particular, taxpayers tend to be opposed to sudden changes in rates); (*ii*) its impact on business competitiveness and employment (since the implementation of a carbon tax may reduce a company's competitiveness vis-à-vis competitors in other countries that are not subject to such taxes); (*iii*) its regressivity; (*iv*) its effectiveness in reducing emissions, and, as a corollary to this, and (*v*) the government's objective in promoting the tax (revenue collection vs. emission reduction) (Carattini, Carvalho, and Fankhauser, 2018; Dabla-Norris et al., 2023; Köppl and Schratzenstaller, 2023).

Furthermore, acceptance is not a static phenomenon. It varies over time in either direction. Thus, there is evidence that resistance can give way. Opposition may decline as people experience the tax. Murray and Rivers (2015) review the case of the carbon tax in the Canadian province of British Columbia, which illustrates this increase in acceptance. On the other hand, at least four carbon taxes have been repealed after implementation (Slovenia, 2022; Alberta, Canada, 2019; Baja California, Mexico, 2021; and Tamaulipas, Mexico, 2023), and others were modified or rejected in advanced stages of design (Australia, 2014; France, 2000; Switzerland, 2000 and 2015; Washington, 2016) (Carattini, Carvalho, and Fankhauser, 2018, World Bank, 2024).

One possible demonstration of opposition to carbon taxes is that the value of the levies imposed is low compared to estimates of the social cost of carbon (the estimated present value of the damage caused by one additional ton of CO_2 emitted into the atmosphere). Indeed, while the value of the 30 carbon taxes applied varies between less than US$1 and US$156 (World Bank, 2024), in the last 10 years estimates of the social cost of carbon have increased from US$9/t$CO_2$ to US$40/t$CO_2$ for a high discount rate and from US$122/t$CO_2$ to US$525/t$CO_2$ for a low discount rate (Tol, 2023).

Possible Solutions: Theory

Making carbon pricing socially acceptable is possible. Since support for carbon taxes depends on people's preconceptions, perceptions, and attitudes about their effectiveness, regressivity, costs and benefits (Dabla-Norris et al., 2023), it is advisable to consider these perceptions and attitudes when designing them. Based on practical results, citizens' responses to surveys, and their choices in experiments, here are some measures that can be implemented to make carbon taxes more attractive.

Refunds and Offsets

To the extent that the main reason for opposing a carbon tax is the cost it imposes (Kallbekken, Kroll, and Cherry, 2011), whether to refund taxpayers is an important decision. Since regressivity (in terms of percentage of income) is one of the characteristics of carbon taxes, rebates should compensate lower-income households and/or those in remote locations, smaller businesses, and those whose competitiveness is most affected. There is experimental evidence that these refunds increase support for high and low carbon taxes (especially when accompanied by calculations of what households will pay). An important aspect to consider in the design of the refund is that the mechanism cannot be tied to emissions (e.g., a lump-sum transfer). Another viable measure to manage public acceptance is to reduce the cost of the transition for the workers and communities most affected.

The need to develop reimbursement or compensation mechanisms poses challenges for governments in the region, as many vulnerable households, which are often the most affected, do not have access to cash transfer systems or other programs that would compensate them for the tax due to their informal nature (Missbach, Steckel, and Vogt-Schilb, 2023). In addition, existing transfer programs are imperfect. In response to this situation, governments can expand the coverage of existing cash transfer programs to reach the most vulnerable and affected households. Alternatively, they can consider eliminating distortionary taxes and in-kind transfers. For example, households that own a car can be compensated with investments in public transportation or subsidies for electric cars; households that consume LPG can be compensated with subsidies for electric stoves. Meanwhile, household electricity consumption can be offset with tiered rates or incentives to improve energy efficiency.

Use of Revenue to Finance the Transition

According to the literature, earmarking carbon tax revenues to finance climate solutions increases the acceptability of the instrument (Carattini, Carvalho, and Fankhauser, 2018). Public support increases if the funds raised from this tax are used to address concerns about tax regressivity, subsidies to finance the adoption of low-carbon technologies, and infrastructure for adaptation (Dabla-Norris et al., 2023). Evidence indicates that a small fraction of tax revenues from energy taxes or subsidy removal is sufficient to compensate vulnerable consumers (Missbach, Steckel, and Vogt-Schilb, 2023).

Allocating tax revenue to climate projects not only increases acceptability compared to other measures or combinations but also increases perceptions of fairness and effectiveness. The first consequence appears to be more significant. Acceptability is more closely related to perceptions of fairness than to perceptions of effectiveness (Maestre-Andrés et al., 2021). Likewise, earmarking the use of tax revenues alleviates concerns about the government's motives for introducing the tax.

Non-causation, Exemptions, Variety of Rates, and Gradualism

Just as some measures can impact the effectiveness of carbon taxes, others can increase their acceptance. Here are some examples:

- **Coverage.** As the analysis of experiences shows, a commonly used solution to manage tax acceptance is to exempt certain sectors, fuels, or uses from payment. An intermediate alternative is to define emission thresholds and base exemptions on them: sources with emissions below that threshold are exempt from the tax. The threshold can also be used to determine the level of emissions above which sources are subject to the tax. In this way, taxed sources do not pay for all tons emitted, but only above a certain level. An additional option for varying coverage is to establish different rates.

- **Offsets.** Another measure widely used in Latin America is the non-causation mechanism. In the region, the mechanism chosen has been the purchase of carbon credits. Since the GHG source affected by the tax only purchases credits if their price is lower than the tax, the mechanism is an alternative for sources to lower their tax obligations.

- **Neutrality.** Another feasible solution is to make the carbon tax neutral by reducing another instrument. This potential neutrality has given rise to the argument that taxes have a double dividend: they impose a price on a bad (i.e., emissions) while reducing the price of goods.

- **Graduality.** Imposing the carbon tax gradually allows for managing the impact of its implementation and, therefore, its public acceptance. Graduality involves introducing a low rate, with a predictable schedule of increases, to give households and businesses time to adapt.

Other Viable Solutions

The specialized literature suggests, as an additional policy recommendation, that communication can contribute to managing tax acceptance. In this regard, it recommends providing the public with detailed information on the motivation, objectives, characteristics, and expected results from the earliest stages of tax design. Carattini, Carvalho, and Fankhauser (2018) list five expected results that the government could report on: (*i*) reduction in emissions, (*ii*) other climate co-benefits (e.g., reductions in other pollutants, savings in health costs, etc.), (*iii*) increases in the cost of goods that will be most affected by the tax,(*iv*) the impact on the income of households in different deciles, and (*v*) the impact on economic activity and employment.

Communication can increase social support for carbon taxes. However, this support may not be robust: for example, it may disappear when people receive a message with arguments for and against the tax (Fremstad et al., 2022).

Similarly, there are risks that political support for the carbon tax will be lost with changes in government. In this regard, the very dynamics of social support for a carbon tax make it necessary to evaluate the results in terms of emission reductions and their impact on business and household costs to adjust the design if the targets or expected socioeconomic effects are not met.

Finally, the implementation of a carbon tax allows for the incorporation of a carbon border adjustment mechanism. This is a tariff imposed on imported products whose forms on the local market are subject to a carbon price. It is the balance between the payment made at source for a carbon tax and what would have been paid if the production had taken place in the receiving country. This measure reduces the risk of carbon leakage (carbon-intensive domestic production being replaced by equally polluting imports from countries that do not have a tax) and is therefore a viable option for managing the acceptance of a given tax.

Practice

The Case of Chile

As mentioned, the rate and coverage of Chile's CO_2 tax arose from the weighing of macroeconomic effects, sectoral effects, and estimated distributional effects, among other factors. At the same time, the authorities established an emissions threshold to determine the set of sources affected. Thus, the tax is levied on fixed sources that emit more than 25,000 tons of CO_2 or 100 tons of PM per year. By targeting fixed sources, they avoided imposing a direct tax on the public, thus minimizing the possibility of a negative public reaction (Talbot-Wright et al., 2024).

Another measure to manage acceptance of the tax was to exclude it from the determination of the instantaneous marginal cost of electricity supply. In this way, sources with higher marginal costs would not lose supply opportunities because of the tax (Talbot-Wright et al., 2024).

The Chilean authorities also made use of gradual coverage. Thus, at the outset, the tax affected only sources in the electricity generation sector, and the 2020 reforms extended coverage to other sources in the industrial sector.

In addition to these original acceptance management measures, in 2022 Chile created a technical committee composed of the Ministries of Finance, Economy, Energy, Transportation, and Environment. This committee holds hearings and working meetings with stakeholders (academics, civil society organizations, and business associations, among others) to assess tax value scenarios and coverage at the sectoral level.

Regarding the industrial sector, one of the conclusions of the technical roundtable was that the Canadian Output-Based Pricing System, or cap &amp tax, helped to take the heterogeneity of the industrial sector into account. This system is based on an estimate of the emission generation capacity in each branch, according to installed capacity and available technology, and the determination of a maximum emission level (cap), or efficiency threshold, above which the tax begins to be levied. The rationale for this system is to lower the tax burden without losing its incentive to reduce emissions. In other words, a carbon tax levied when a certain level of emissions is exceeded (calculated using the best available and reasonably affordable technology, for example) remains an incentive to adopt low-carbon technologies while significantly reducing the tax burden, particularly for industrial sectors that are less able to reduce emissions significantly in the short to medium term and those facing greater international competition.

The Case of Colombia

The analysis of Colombia's carbon tax, illustrated in the preceding sections, shows that the issue of acceptance was present from the outset in its design. Issues of distributional impact (e.g., through a specific levy on jet fuel) and competitiveness (e.g., by exempting the sale of marine diesel and fuels used for the refueling of ships in international traffic) were considered.

Likewise, as a strategy to manage acceptance, the bill presented to Congress included a low tariff, with a gradual rate increase scheme based on an annual tax adjustment of 1 percentage point above inflation, allowing for real growth in the tariff each year (Law 1,819 of 2016, Article 222, paragraph 1). The objective of this scheme was to ensure a transition process that would allow industries to adapt and avoid significant macroeconomic and distributional impacts. Similarly, a gradual system was used to include coal in the tax base (Law 2,277 of 2022).

In turn, the management of acceptance provided for the exemption of certain fuels and uses and incorporated the possibility that taxed fuels and uses could be exempted from the tax through the purchase of carbon certificates. Originally, this option applied to all emissions (Law 1,819), but Law 2,277 established a maximum of 50 percent.

Another measure implemented to encourage acceptance of the tax was to specify that the revenue would be used for specific environmental purposes (see the section on Colombia in Consideration I: Defining tax objectives and analyzing policy options). Initially, the revenue was allocated to the Fund for Environmental Sustainability and Sustainable Rural Development (Fund for a Sustainable Colombia). Since 2023, 80 percent of the revenue has been allocated to Fonsurec, and the remaining 20 percent to financing the PNIS.

In the case of Fonsurec, the goal of these resources is to support climate action in line with the NDCs, as well as the reduction and monitoring of deforestation, the conservation of water sources, and the protection, preservation, restoration, and sustainable use of strategic areas and ecosystems.

The Case of Mexico

The team responsible for designing the Mexican carbon tax conducted an ex-ante study of aspects related to its political economy. It analyzed its impact on the lower deciles of the income scale, considered its effect on firms' costs, and assessed the support of the general population and environmental NGOs (Belausteguigoitia, Romero, and Simpser, 2022).

To determine the distributive effect, the SHCP used the National Household Income and Expenditure Survey. The data gathered from the survey established that 52 percent of gasoline consumption occurred in the top two deciles, while the bottom four deciles consumed 11 percent. Meanwhile, the increase in spending for households using LPG in the bottom two deciles was estimated to be MXN$27 per month per household, on average—an increase considered low.

Regarding businesses, the increase in costs in the steel and cement sectors was analyzed. Estimates showed increases of less than 1 percentage point, which were considered insignificant. Therefore, no compensation measure was considered for these sectors.

Regarding the public, the analysis determined that the tax would not receive strong support from the population. Both public opinion and NGOs conditioned their acceptance on the revenue being earmarked for specific climate policy purposes.

The proposal sent by the government to Congress suggested a tax of MXN$70.68 on all fuels. As a result of pressure from the steel, cement, coal, and natural gas sectors, as well as companies that use natural gas, and concerns about possible increases in fuel prices and their impact on inflation, Congress lowered the tax rate so that fuel price increases would not exceed 3 percent. In addition, the proposal incorporated differences for different fuels, exempted emissions from natural gas, and for other fuels, taxed only emissions above the potential emission level of natural gas. As the coal sector also opposed the instrument, the proposal reduced the coal tax to below that of other fuels, differentiated by use. Similarly, the private sector spoke out in favor of applying the tax offset mechanism with carbon credits, arguing that the United States did not have a carbon tax. In response, the possibility of offsetting the tax payment with carbon credits generated through the United CDM through projects carried out in Mexico was incorporated.

Table 6. Summary of Consideration 3: Managing Public Acceptance

Consideration	Issues	Possibilities
3. Managing public acceptance	The problem	• A carbon tax has distributional impacts, as it increases the costs of consumers and firms that are taxed and is passed on to goods and services not directly affected. This can harm business activity, household purchasing power, or real wages and generate opposition. The higher the rate, the greater the opposition.
	Possible solutions	• Refunds and offsets. • Finance the transition to carbon neutrality with the funds raised. • Non-imposition, exemptions, variety of rates, gradualism, and carbon credit markets. • Other viable solutions: Communicate accurate information on the implementation of the tax (expected emission reductions, co-benefits for the climate, impact on household income across different income deciles, etc.), apply a carbon border adjustment mechanism, among others.

Source: Authors' elaboration.

Table 7. Acceptance Management in Chile, Colombia, and Mexico

Acceptance management	Chile	Colombia	Mexico
Rate	The rate and coverage of the CO_2 tax were determined by weighing its macroeconomic, sectoral, and distributional effects, among other factors. In addition, an emissions threshold was established to determine the set of sources affected: The tax is levied on fixed sources with annual emissions exceeding 25,000 tons of CO_2 or 100 tons of PM.	The creation of the tax included a low rate with a gradual annual increase of 1 percentage point above inflation, allowing for real growth in the rate each year. This scheme was intended to ensure a transition process that would facilitate the adaptation of industries and avoid significant macroeconomic and distributional impacts.	The proposal sent to Congress suggested a fixed rate for all fuels. Due to pressure from various industrial sectors, Congress modified this value and established lower rates differentiated by fuel type.

Table 7. Acceptance Management in Chile, Colombia, and Mexico *(continuation)*

Measures for public acceptance	Taxation of fixed sources to avoid a direct tax on the general population and moderate negative public reception.	Exemption for certain fuels and uses. Possibility for taxed fuels and uses to offset the tax through the purchase of carbon certificates. Originally, this possibility applied to all emissions, but as of 2022, there is a maximum of 50%.	Implementation of a tax compensation mechanism with carbon credits.
	Exclusion of the tax from the determination of the instantaneous marginal cost of electricity supply, to prevent sources with higher marginal costs from losing supply opportunities due to the tax.	Specific allocation of revenue for environmental protection. Initially, the revenue was allocated to the Fund for Environmental Sustainability and Sustainable Rural Development (Fund for a Sustainable Colombia). Starting in 2023, 80% of the revenue will go to the Fund for Sustainability and Climate Resilience (Fonsurec), and the remaining 20% will be used to finance the PNIS.	
	Gradual coverage. Initially, only sources in the electricity generation sector were affected. The 2020 reforms extended coverage to other sources in the industrial sector.		
	Dialogue with civil society: Through an interdisciplinary technical committee, hearings and working meetings are held with stakeholders to assess tax value scenarios and coverage at the sectoral level.		
	Cap &amp tax proposal: This system is based on an estimate of the emission generation capacity in each sector, according to installed capacity and available technology, and the determination of a maximum emission level (cap) or efficiency threshold. Above this threshold, the tax begins to be levied. The aim is to reduce the tax burden without losing its incentive to reduce emissions.		

Source: Authors' elaboration.

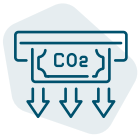
Conclusions

There is a range of possibilities for managing the social and economic impact of introducing a carbon tax. Countries can choose to use some or all these alternatives, depending on the specific local context. In general, in the cases of Chile, Colombia, and Mexico, there was a certain preference for specific types of actions:

Gradual design and moderate rates. All three countries implemented low initial rates. In the case of Colombia, a gradual increase scheme was applied, in line with the theoretical recommendation to introduce the tax progressively to allow time for adaptation.

Selective coverage and thresholds. Chile established emission thresholds to determine which sources were subject to the tax and focused on large, fixed sources. Mexico exempted emissions equivalent to the emission factor of natural gas and applied differentiated rates by fuel. Initially, Colombia excluded certain fuels and uses. These decisions reflect the implementation of the theoretical principle that suggests using exemptions and selective coverage to manage acceptance.

Offsets and non-recourse mechanisms. Colombia and Mexico implemented systems that allow for partial or total exemption through the purchase of carbon credits. These practices follow the theoretical recommendation to offer alternatives to lower the tax burden without neglecting the incentive to reduce emissions.



Specific allocation of revenue. Colombia allocates a portion of the revenue raised to specific environmental purposes (first through the Fund for a Sustainable Colombia and then through Fonsurec and PNIS). Such practices can increase the acceptability of the tax.

Analysis of distributional impacts. The three countries conducted preliminary studies on distributional impacts and effects on business competitiveness, in line with the theoretical recommendation that these effects be assessed to design mitigation measures.

Stakeholder participation. Chile created a technical working group involving a significant number of ministries and held hearings with interest groups. This practice follows the recommendation to involve those affected in the design process.

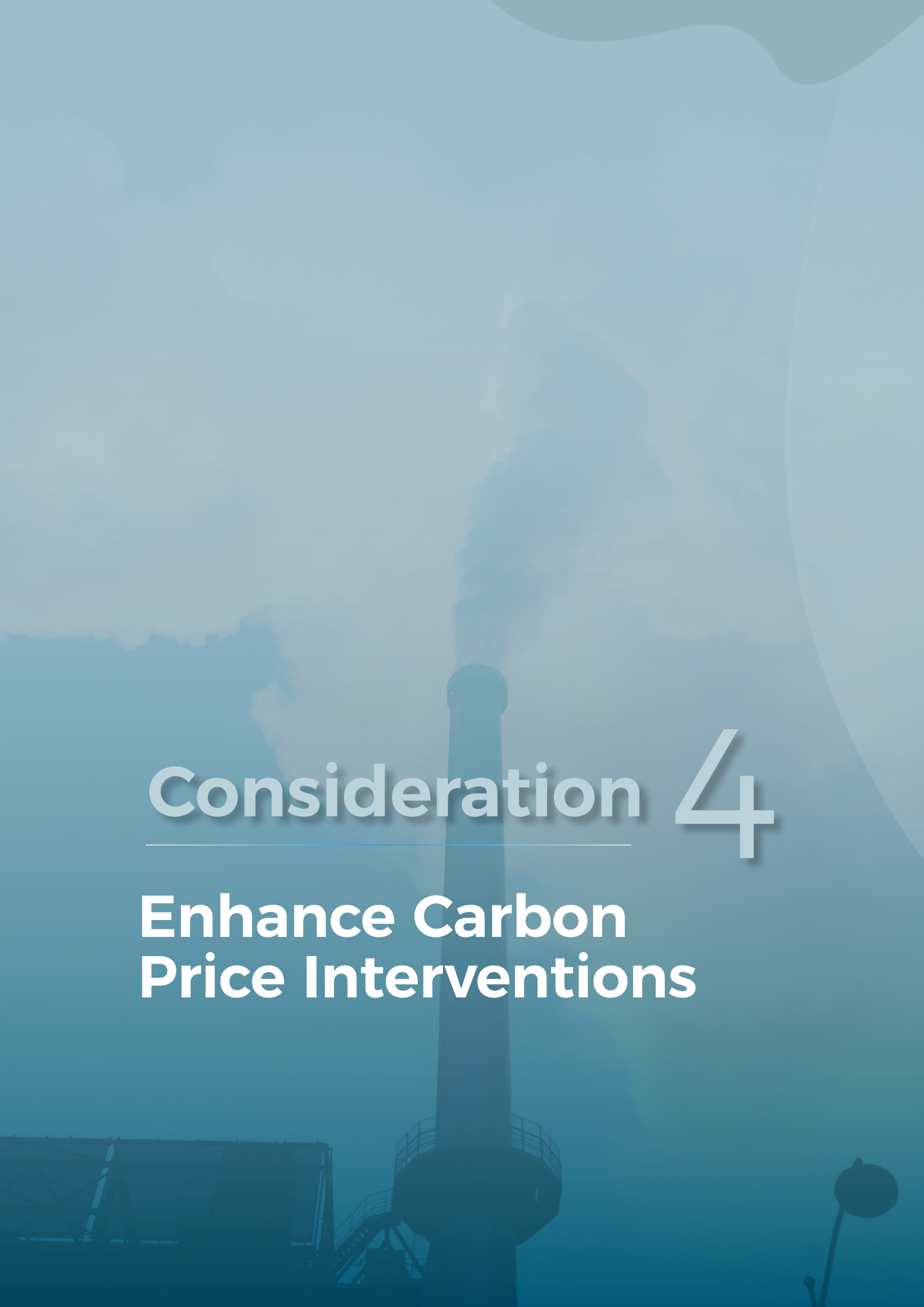
Policy options for managing public acceptance of the tax that were not used in the cases described but may be relevant to other national contexts include:

Direct compensation. Establishing direct reimbursement systems for vulnerable households or sectors may be one of the most effective measures to increase acceptability.

Strategic communication. Developing communication strategies on the expected benefits of the tax, the environmental benefits, or the projected economic impacts, which, according to theory, can be critical for public acceptance.

Fiscal neutrality. Countries may consider reducing other taxes to offset the introduction of the carbon tax (concept of neutrality and/or double dividend).

Evaluation and continuous adjustment. Establish a formal system for monitoring public acceptance and continuous adjustment based on results.



Consideration 4

Enhance Carbon Price Interventions

Theory

Evidence on the effects of carbon pricing measures implemented to date indicates that they have been moderate (Talbot-Wright et al., 2024). Under the right conditions, increasing the cost of an activity that generates emissions could lead to its substitution by a cleaner alternative to lower costs. However, there are other factors besides production or use costs. As seen in previous chapters, there are regulatory, technological, financial, and social barriers. These barriers weaken the emission reductions that carbon taxes could produce (for example, if there is no public transportation, it is more difficult to replace cars, and the cost of an electric vehicle may make it more difficult to access, even though it is cheaper to operate). They also prevent the application of sufficiently high taxes on CO_2 emissions.

Because taxes alone cannot surmount these barriers, carbon pricing should be designed as part of a package of measures and public policies designed to overcome the barriers and make progress toward a carbon-neutral economy, rather than as an isolated action or solution to meet environmental goals. This chapter discusses some of these measures and public policies.

Transformations Needed to Achieve Carbon Neutrality

Although the transformations needed to achieve decarbonization are specific to each sector, there are several barriers that tend to reappear in several sectors. According to Fazekas, Bataille, and Vogt-Schilb (2022), one of the most common and relevant barriers is financial. The adoption and implementation of low-carbon technologies and production processes often require a high initial investment. It can be difficult to access the capital needed to make this investment, especially for smaller companies and vulnerable households. The government can help overcome this barrier by providing support through financial incentives that unlock investments such as direct subsidies, tax credits, or preferential credit lines.

A second common and significant barrier is the lack of infrastructure. A typical example is found in the transportation sector. People who invest in electric vehicles may lack sufficient charging points. Public investment or financial support instruments for private investment can help overcome this barrier.

Another major barrier that lessens the impact of price interventions is the lack of regulations that favor the adoption of green technologies. For example, the design of current incentive schemes tends to encourage the use of fossil fuels through subsidies.

It is therefore important that new laws and regulations that modify the current incentive scheme in favor of green technologies accompany the introduction of a carbon price. This involves gradually reducing subsidies for fossil fuels, synthetic fertilizers, and non-recyclable products and increasing subsidies for low- or zero-carbon alternatives. On the other hand, reforming fossil fuel subsidies can be complemented with more prescriptive measures, such as limitations, bans, or requirements (establishing a maximum number of combustion vehicles in the fleet, setting aside several hectares of

forest that must be preserved or reforested, banning single-use products, etc.). Among these, eliminating or reducing the number of environmental permits required to install and build this infrastructure can have a high impact on the speed of deployment of the infrastructure necessary for decarbonization.

Finally, another common and significant barrier is the lack of information and capacity in the private sector. Producers often lack the technical knowledge to identify low-emission technologies that could be implemented and are unaware of their economic and environmental impacts. Similarly, consumers lack information about the environmental impact of some of the foods and products they choose to consume. The government can help the private sector overcome this barrier through information and training campaigns.

Mechanisms to Enhance the Effectiveness of Carbon Pricing

A national climate policy aimed at carbon neutrality must identify the barriers that prevent the adoption of clean technologies by sector to generate appropriate policies that enable their incorporation (Fazekas, Bataille, and Vogt-Schilb, 2022). The high relative prices of clean technologies are likely to be one of these barriers. In such cases, carbon pricing can contribute to achieving the objective. However, even a high carbon price will not be sufficient if there are additional barriers, such as environmental impact or land-use regulations that make the installation of wind turbines very costly in practice. Talbot-Wright et al. (2024) identify three ways to enhance the effectiveness of carbon pricing:

1. Policy mix

Including carbon pricing within a set of public policies has a greater impact than carbon pricing alone, as it addresses multiple barriers to decarbonization (Haites et al., 2023; IPCC, 2022). Combining policies that encourage the phasing out of carbon-intensive technologies with policies that support the adoption of clean technologies is an effective strategy for the transition to net-zero emissions (IPCC, 2022).

2. Sectoral focus

Evidence suggests that the emission reduction impacts of carbon pricing measures implemented to date are more significant in specific sectors (Green, 2021), where, for example, relative prices play a major role. In some cases, carbon pricing can promote decarbonization from a sectoral perspective (Cullenward and Victor, 2020).

3. Expansion of climate action spending subject to the availability of fiscal space

The implementation of carbon pricing instruments can strengthen climate policies by generating additional fiscal resources. In 2022, global revenue from carbon taxes and emissions trading systems reached US$95 billion (World Bank, 2023). In line with the budgetary principle of no specific revenue earmarking, jurisdictions can assess the feasibility of increasing public investment in strategic areas, such as low-carbon infrastructure, depending on the resulting expansion of fiscal space.

Subsidy Reform as an Alternative

An alternative to carbon taxes is reforming fossil fuel subsidies, since, unlike carbon prices, they encourage the use of polluting technologies and represent a tax burden. In Latin America and the Caribbean, for example, countries provided fossil fuel subsidies totaling US$56.7 billion in 2022 (Black et al., 2023). Reforming these subsidies is important for aligning public spending with climate policies and discouraging the use of polluting technologies.

Policies to reform or eliminate subsidies generate distributional impacts that can incur strong public opposition (Funke and Merril, 2019). However, international evidence shows that it is possible to increase prices in a socially acceptable manner, either by managing distributional impacts with compensation or by implementing them gradually. For example, in 2010, Mexico provided subsidies of US$13/t$CO_2$on average to gasoline and diesel consumers. By 2019, the carbon tax and other excise taxes had changed the situation to net taxes of US$91–US$98/tCO_2. According to Muñoz-Piña, Montes de Oca, and Rivera-Planter (2022), the emissions avoided during that period by the removal of subsidies and the implementation of taxes (transition from negative to positive prices) reached 40 MtCO_2/year, between 17 and 20 percent of fuel emissions in the transport sector in the baseline scenario included in Mexico's NDC.

From a distributional perspective, the greatest impact falls on the most vulnerable households, since changes in fuel prices represent a significant percentage of their income. In contrast, the percentage spent by high-income sectors on direct or indirect purchases of fossil fuels is lower, although they represent a larger share of purchases in absolute terms. Thus, spending on a subsidy and revenue from a fossil fuel tax have a greater impact on lower-income households, but high-income households are the largest beneficiaries or contributors in total dollars. Therefore, a universal cash transfer would make the reform of fossil fuel subsidies progressive (Arze del Granado, Coady, and Gillingham, 2012), and a small fraction of the tax revenue from a carbon tax or the elimination of subsidies is sufficient to compensate consumers in vulnerable sectors (Feng et al., 2018).

Likewise, households affected by fuel subsidy reforms can be compensated with in-kind measures, such as those mentioned above in the case of a carbon tax. For sensitive industries, specific compensation per company may be important. For example, in the period 2014–16, Egypt maintained reduced prices for diesel fuel for buses and taxis; Indonesia (1997) and the Philippines (1998) established support measures to help small and medium-sized enterprises switch from diesel to LPG.

Finally, it is also worth considering other types of tax instruments with roles equivalent to carbon taxes or subsidies, such as fossil fuel taxes defined in liters, engine size taxes, road taxes, and industry-specific taxes, among others. Based on these indirect prices, Latin America and the Caribbean have an effective carbon price of US$18/tCO$_2$, which is much lower than the average for the Organisation for Economic Co-operation and Development countries, which is approximately US$43/tCO$_2$ (Ahumada et al., 2023).

Practice

The Case of Chile

To contribute to the implementation of the objectives of its first NDC, in 2019 Chile developed its first Climate Change Finance Strategy (Ministry of Finance, 2019). This strategy identifies and defines the measures needed to mobilize the financial resources and institutional frameworks required to achieve a just transition to decarbonization (Talbot-Wright et al., 2024). Through these mechanisms, the strategy seeks to overcome the barrier of high capital costs and lack of financing for investment in technologies that are essential for decarbonization and their adoption. The specific objectives of Chile's Climate Change Finance Strategy include *(i)* facilitating public–private cooperation and *(ii)* promoting and fostering the design and development of instruments (Ministry of Finance, 2019).

Since Chile updated its NDC in 2020 and increased its climate change commitments, it updated this strategy in 2022. The update includes an assessment of the measures proposed in the 2019 version and potential new measures.

Among the specific measures adopted is the development of a portfolio of projects in four eligible categories: clean transportation, renewable energy, water resource management, and green buildings. By 2021, this portfolio was valued at approximately US$7.9 billion, of which nearly US$7.7 billion was financed by sovereign green bonds. These bonds are the main financial instrument developed by the government to overcome the barrier of financing difficulties. These instruments have helped to incorporate electric public transportation, extend subway lines, and implement solar panels in homes, among other actions.

Among the measures proposed in the 2022 strategy are the design and issuance of new financial instruments, such as sustainability-linked bonds (in which Chile is a pioneer) and blue bonds. In addition, the current portfolio of projects for these bonds will be expanded to include new initiatives that are consistent with the established mitigation and adaptation objectives.

In addition to implementing these initiatives, Chile recently conducted an analysis of the barriers facing different sectors when seeking to reduce emissions or decarbonize their activities in response to the tax. In the electricity generation sector, it identified bottlenecks in the country's electricity transmission. Solar energy generated in the north is not transmitted to the large urban areas in the center of the country. In addition, low water and storage capacity forces the use of fossil fuels to meet electricity demand at night. In the industrial sector, branches such as cement were found where alternatives for significant CO_2 emission reductions in the short term are limited and the risks of carbon leakage make the design of the CO_2 tax an essential measure.

The Case of Colombia

Colombia's tax is distinctive because the revenue is allocated to environmental purposes through funds, as detailed in the case description in Section I: Defining tax objectives and analyzing policy options. Since 2023, the government has allocated 80 percent of the revenue to the Fund for Sustainable Development and Climate Resilience (Fonsurec), which supports climate actions aligned with nationally determined contributions, such as reducing and monitoring deforestation, conserving water sources, and protecting, preserving, restoring, and sustainably using strategic areas and ecosystems (Article 49 of Law 2,277 of 2022). During 2022, the carbon tax raised COL$423,904 million (approximately US$101 million), bringing the total to COL$2,275 million (DIAN, 2024a). This revenue has generated resources for the environmental sector that even exceed the previous budgets of the Ministry of Environment and Sustainable Development (Talbot-Wright et al., 2024).

As mentioned above, one of the barriers that significantly limits the effectiveness of a carbon tax and climate policies is access to financing. To overcome this, Colombia created the Green Finance Subcommittee under the Green Growth Policy (CONPES, 2018), which aims to strengthen the capacities and coordination of national development banks to mobilize resources for green projects.

Colombia also promoted a green bond market as a public financing instrument for projects to mitigate the impact of climate change. Similarly, in April 2022, Colombia became the first country in the Americas to adopt a national green taxonomy. This classification tool allows lenders and borrowers to identify economic activities that contribute to specific environmental objectives by defining what constitutes a green investment and which activities are environmentally sustainable. By creating a common language for green finance, this system facilitates the mobilization of public and private resources toward green investments.

Another barrier that weakens the effect of price intervention is the lack of rules and regulations that favor the adoption of green technologies. To reduce this barrier, Colombia enacted Law 1,715 of 2014 and its amendment, Law 2,099 of 2021, which establish incentives for electricity generation and research, development, and investment in energy production from unconventional sources.

The Case of Mexico

Mexico’s carbon tax is based on the premise that in the short term, demand for fossil fuels is inelastic and in the medium term, the path to decarbonization requires actions to replace these sources with others. Consequently, complementary policies aimed at encouraging investment in clean technologies are essential. Faced with this challenge, measures and initiatives have been implemented to overcome the barriers that may prevent the achievement of the objective.

To reduce barriers linked to the lack of infrastructure and credit restrictions, the government introduced various tax benefits for production and investment, including 100 percent deductions on the cost of machinery and equipment for energy generation from renewable sources, tax credits for the installation of electric vehicle charging equipment (covering up to 30 percent of the investment), and tax incentives

for technology research and development projects through credits of up to 30 percent of total expenses, among others (Podestá et al., 2022). The National Bank of Public Works and Services created guarantees and financial solutions for investment in infrastructure. Similarly, the Energy Transition Law of 2015, which promotes efficient energy use and sets clear targets for increasing the share of clean energy in the national energy mix, supported the creation of the Fund for Energy Transition and Sustainable Energy Use (Fotease), a public trust. Green bonds are among the measures designed to overcome financing barriers. Complementing the carbon tax, Mexico created the Clean Energy Certificate Market through the Electricity Industry Law, enacted in 2014. Based on the clean energy use targets and guidelines established in the Energy Transition Law, companies trade clean energy certificates (CELs) on the market (a CEL certifies the production of a certain amount of electricity with 1 megawatt-hour (MWh) of clean energy). The Clean Energy Certificate Market is an offset mechanism that allows companies that fail to meet their clean energy obligations to do so by purchasing them from those that over-comply.

Table 8. Summary of Consideration 4: Enhance Carbon Price Interventions

Consideration	Issues	Possibilities
4. Strengthen carbon pricing interventions	Transformations needed to achieve carbon neutrality.	Overcome barriers that often affect the effectiveness of taxes in all sectors, such as financial constraints, lack of infrastructure, absence of regulations, and scarcity of information.
	Mechanisms to enhance the effectiveness of carbon pricing.	Three ways to enhance the effectiveness of carbon pricing: 1. Mix of public policies. Including carbon pricing within a set of public policies makes it possible to address the various barriers to decarbonization. 2. Sectoral approach. Implementing specific prices for different sectors can have a greater impact on reducing emissions. 3. Expansion of spending on climate action with revenue. Based on best practices, follow the principle of no net impact.
	Subsidy reform as an alternative.	Reform fossil fuel subsidies by managing distributional impacts.

Source: Authors' elaboration.

Table 9. Strategies to Enhance the Effectiveness of Carbon Pricing in Chile, Colombia, and Mexico

Ways to enhance taxes	Chile	Colombia	Mexico
Financing measures/ tax	Climate Change Finance Strategy. To contribute to the implementation of the NDC targets, in 2019 Chile developed its first Climate Change Finance Strategy, which identifies and defines the measures necessary to mobilize the financial resources and institutional frameworks required to achieve a just transition towards decarbonization. Its objectives include: *(i)* facilitating public–private cooperation, *(ii)* promoting and encouraging the design and development of instruments, and *(iii)* promoting the design and issuance of new financial instruments, such as sustainability-linked bonds or blue bonds.	Creation of the Green Finance Subcommittee. This subcommittee aims to strengthen the capacities and coordination of national development banks to mobilize resources for green projects.	Tax benefits for production and investment for the purchase of machinery and equipment for energy generation from renewable sources, tax credits for the installation of electric vehicle charging equipment (covering up to 30% of the investment), tax incentives for technology research and development projects through credits of up to 30% of total expenses, among other measures. Guarantees and financial solutions for investment in infrastructure. Implementation of a green bond framework.
Energy transition policies	Analysis of bottlenecks in renewable energy generation.	Enactment of laws that promote electricity generation and encourage research, development, and investment in energy production from unconventional sources.	Energy Transition Law of 2015. The law promotes efficient energy use and sets clear targets for increasing the share of clean energy in the national energy matrix. Creation of Fotease, a public trust.
Tax allocation		Specific allocation of tax revenue for environmental purposes through funds. 80% goes directly to Fonsurec, which supports climate actions aligned with NDCs, such as reducing and monitoring deforestation, conserving water sources, and protecting, preserving, restoring, and sustainably using strategic areas and ecosystems. The remaining 20% is allocated to financing the PNIS.	
Market creation			Creation of the Clean Energy Certificate Market. Established by the Electricity Industry Law, enacted in 2014. Based on the law's clean energy use targets and guidelines, companies trade clean energy certificates on the Market.

Source: Authors' elaboration.

Conclusions

An analysis of the theory and comparison with experiences of implementing carbon taxes in Chile, Colombia, and Mexico leads to the following conclusions on the use of complementary instruments to enhance their impact and identify greater or lesser convergence between the practices of the three countries.

Adoption of complementary approaches. The three countries clearly understand that carbon taxes alone cannot overcome all the existing barriers to decarbonization. In line with economic theory, they have implemented complementary measures that address multiple obstacles, particularly financial barriers. Chile, Colombia, and Mexico have developed financial and fiscal instruments such as green bonds, specialized funds, and tax benefits that facilitate investment in clean technologies.

Development of specific financial instruments. There is strong convergence in the development of financial mechanisms to overcome the barrier of access to capital. Chile's Financial Strategy for Climate Change, Colombia's Green Finance Subcommittee and national green taxonomy, and Mexico's tax incentives and funds such as Fotease demonstrate that countries have prioritized the mobilization of financial resources, both public and private, for climate investments.

Variation in implementation of the sectoral approach. Economic theory suggests that carbon taxes may be more effective if they are designed for sectors. In this regard, varying degrees of implementation can be observed in the countries analyzed. From the outset, Chile adopted a more tailored approach, applying the tax only to fixed emission sources and focusing on the energy sector. The cases of Colombia and Mexico show a more generalized application of the tax, that is, without a sectoral approach.

The experience of these countries suggests, therefore, that there is still an opportunity to develop more differentiated tax schemes that consider the particularities of each economic sector, its barriers to decarbonization, and its competitive context. This context could significantly increase the effectiveness of these instruments.

Use of revenue for climate purposes. Colombia is distinctive for its strategy of earmarking a significant percentage (80 percent) of the revenue collected for the Climate Sustainability and Resilience Fund. To some extent, this approach contrasts with the budgetary principle of non-earmarking indicated by theory, but it demonstrates how revenue can directly strengthen climate policies.

Enabling regulatory frameworks. All three countries have recognized that the lack of adequate regulation is a major barrier. They have sought to modify regulatory frameworks to promote the adoption of green technologies. The renewable energy incentive laws in Colombia, the Energy Transition Law in Mexico, and the reforms to electricity transmission in Chile show progress in this regard, albeit with different approaches and scopes.

Areas of opportunity. Despite the progress made, there are areas where practical implementation could be strengthened to aligning it more closely with theory. Specifically, measures to overcome information and training barriers in the private sector appear less developed than financial and regulatory measures. Similarly, although theory considers reforming fossil fuel subsidies to be an important alternative step, initiatives in this area show varying levels of progress in the three countries.

Consideration 5

Integrating Carbon Taxes and Credits

Theory

A carbon tax can be linked to a carbon market by allowing those affected by the tax to offset their emissions. Through this tax avoidance mechanism, a source of GHG emissions subject to the tax can offset its emissions and thus avoid paying the tax, through projects in other sectors that reduce, eliminate, or avoid emissions:

- **Projects or actions that permanently reduce emissions.** Some examples are replacing lighting, accelerating the closure of a thermal power plant, or other actions that reduce GHG emissions by replacing carbon-intensive inputs with cleaner ones, adopting new production processes, or incorporating technology.
- **Projects or actions that permanently remove CO_2 from the atmosphere** and store it in geological, terrestrial, oceanic, or product reservoirs. This includes existing and potential anthropogenic enhancement of biological or geochemical sinks and direct capture and storage of air but excludes natural absorption of CO_2 not directly caused by human activity.
- **Projects or actions that permanently prevent emissions.** An example is the conservation of a forest that was about to be cut down or the replacement of a thermal power plant with a lower-emission energy source.

Emissions offsetting, and the resulting non-liability for the tax, occur through the purchase of carbon credits that certify the mitigation of a specified amount of CO_2 through a specific project in another sector. These carbon credits acquired by the emitting source can be used to avoid paying the tax on its emissions for the amount corresponding to the offset tons.

The mechanism of avoiding the tax through the purchase of carbon credits can be important for increasing acceptance of the carbon tax, expanding coverage, and mobilizing private resources toward decarbonization. The following are some of its advantages:

- Carbon taxes can generate the demand that carbon credit markets need to emerge and develop, and these can provide sources covered by the tax with cheaper carbon removal alternatives than they could implement themselves in their industries.
- Linking a carbon credit market to a carbon pricing instrument allows resources to be mobilized for climate action, as firms affected by the tax can offset their emissions and the credit market can finance climate action without engaging in fiscal misbehavior.
- To date, sectors such as steel, cement, and aviation are considered difficult to decarbonize. Thus, installing the technology necessary to decarbonize their activities is not economically viable. In these sectors, carbon credit markets offer an alternative for these activities to mitigate their emissions in the short term.

To be effective, carbon tax offset systems need a certain market volume and an institutional framework capable of guaranteeing them.

- They must provide real CO_2 removal or capture or real GHG emission reductions or avoidance in sufficient quantities. This requires carbon credits to be certified as credible offsets. An essential condition for this is that the rules governing the issuance of credits are transparent, backed by scientific evidence, empirically validated, and verifiable, so that they can be agreed upon. It also requires continuous monitoring of the permanence of the claimed CO_2 removal or capture credits or the avoidance or reduction of recovered emissions.

- They must have an institutional framework that properly accounts for, audits, and adjusts tax collections from firms that purchase carbon credits. In addition, for carbon credits to play a meaningful role in the decarbonization pathway, they also need a transparent and verifiable system for registering credits and trades. Finally, the system must have a credible and well-designed enforcement regime to deter participants from violating these rules.

- Carbon credit systems must follow the principle of additionality, meaning that the reductions, removals, or avoidance of emissions contained in a carbon credit would not have materialized in the absence of the incentive created by the revenue from carbon credits.

Practice

The Chilean Offset System

In 2020, Article 16 of Law 21,210 introduced amendments to Article 8 of Law 20,780 (which established the green tax in Chile). In subsection t, this article incorporated the possibility for taxpayers subject to the CO_2 tax to offset all or part of their emissions used to determine the amount of tax payable with emissions reduced or removed through projects, if these are "additional, measurable, verifiable, and permanent." The reductions or removals must be complementary to those required by current legal regulations.

For an emission reduction project to be eligible, an application must be submitted to the Ministry of the Environment (MMA). The MMA will define, through regulations, the manner and background information required to certify the characteristics necessary for the eligibility of such projects, as well as to endorse the emission reductions before the Superintendency of the Environment. Once Superintendency has accredited the project, it will calculate the net emissions of the taxpayer who used this compensation mechanism and forward the information to the SII for the calculation of the tax.

Supreme Decree 4 of 2023 regulated the emissions offset system and if emissions can only be offset by "emission reduction projects implemented in the national territory" (Article 6). In addition, reductions cannot come from emission sources subject to the tax.

The regulation also stipulates that to offset emissions subject to the CO_2 tax, an emission reduction project must have a CRE. This certificate, issued by the MMA, certifies the reduction or absorption of 1 ton of CO_2 by the project. To obtain CREs, the project owner

must apply to the ministry for approval. In the first stage, the MMA will only approve CREs from external certification programs approved for use in offsetting. To date, the MMA has recognized three CREs: the CDM of the United Nations Framework Convention on Climate Change; the Verified Carbon Standard of Verra; and the Gold Standard for the Global Goals of the Gold Standard Foundation (MMA, 2023b; 2024).

The CRE is submitted to the RETC. The certificates registered in the RETC constitute the supply of offset opportunities for sources affected by the tax, which make up the potential demand. Sources request offsets from the Superintendency of the Environment, which must approve them and send the information to the Ministry of Finance to proceed with the corresponding tax adjustment.[19]

The first compensation period is the 2024 tax year, when emissions from 2023 are offset. So far this period, 250,000 tons of CO_2 have been offset, corresponding to 1 percent of taxable emissions. The energy sector submitted most of the certificates.

The challenges for the coming years are: *(i)* to generate a greater supply of emission reduction projects that include the forestry sector (this objective is part of the strategy to promote the mechanism) and *(ii)* to create a national certification program that establishes rules, requirements, and methodologies for local pollutants (PM, NOx, and SO_2), since there are no international certification programs for these pollutants, as is the case with CO_2.

The Non-liability Mechanism in Colombia

In Colombia, emission sources covered by the carbon tax may request non-liability for up to 50 percent of their tax obligations. According to Decree 926 of 2017, which regulates the procedure, the taxpayer must: (i) indicate the amount of fuel neutralized and its equivalent in tons of CO_2 and (ii) attach the verification statement and proof of voluntary cancellation of GHG emission reductions or removals canceled in their favor by consumers or end users or the owner of a GHG mitigation initiative. Regarding the verification statement, Article 1.5.5.5 of the decree indicates that the requirements must contain at least the following information: (i) identification of the holder and name of the GHG mitigation initiative, (ii) amount of GHG emission reductions or removals expressed in tons of CO_2 equivalent, and (iii) methodology implemented by the GHG mitigation initiative to verify emission reductions and removals (Minambiente, 2017).

GHG verification/validation bodies provide certification and verification. These are third-party or independent entities that develop methodologies to verify and validate mitigation initiatives and act as certifiers of mitigation results. Within this framework, they are responsible for issuing the GHG removal verification statement of the responsible party. In the case of the Colombian non-causation mechanism, these entities must be accredited by the Colombian National Accreditation Body or an accreditation body that is a member of the International Accreditation Forum. In verifications carried out under international accreditation schemes, the body must issue a verification statement indicating that the GHG emission reductions or removals comply with the requirements of ISO 14064-3 and ISO 14065 (GHG and key activity for environmental protection and creation of opportunities in the carbon market).

[19] According to Article 15 of Decree 4 of 2023, to apply for approval, the owner of an emission reduction project must submit information on the project owner and its legal status, the assessment methodology used, and the project design document. In addition, they must provide a description of the emission reduction or absorption activities, the emissions baseline based on historical and projected emissions, the geographical location in KMZ format, and the calculation of the emissions reduced or absorbed. They must also include the project life cycle, the credit period, and the emission reduction verification protocol, among other things (MMA, 2023a).

GHG emission reductions or removals eligible for certification must meet the following characteristics: *(i)* they must come from mitigation initiatives developed within the national territory, *(ii)* they must have implemented accepted methodologies, and *(iii)* the reductions must not result from activities required by an environmental authority and must be previously cancelled and registered in the National GHG Emission Reduction Registry. Only reductions generated after January 1, 2010, are accepted, and projected reductions are not permitted.

Instruments in Mexico

There are several carbon market mechanisms in Mexico. Two of them are under development: the emissions trading system (ETS) and the voluntary carbon market. Both IEPS on carbon and the ETS consider compensation mechanisms for compliance with obligations. This implies the challenge of coordinating the instruments with rules that do not erode the signal expressed by a consistent carbon price.

In December 2017, the government published the General Rules for the Optional Payment of the Special Tax on Production and Services on Fossil Fuels through the Delivery of Carbon Credits (DOF, 2017). These rules establish that the credits must be endorsed by the United Nations CDM, must originate from projects developed in Mexico, and must have been issued on or after January 1, 2014. To make the payment, taxpayers must transfer the credits to the Tax Administration Service on the tax payment date and detail in the payment declaration the unit value of the credits in euros and their equivalent in national currency, the number of credits transferred, and the transfer identification number.

The ETS was created in the 2018 reform of the General Law on Climate Change. Article 94 stipulates that the Ministry of the Environment and Natural Resources, with the participation and consensus of the Inter-Ministerial Commission on Climate Change, the Climate Change Council, and representatives of the participating sectors, shall progressively and gradually establish an emissions trading system. The preliminary foundations of the ETS were developed in 2019, and the pilot phase began in 2020. It lasted two years (2020–21) and consisted of two compliance periods, one per year. Two permits were allocated, one in 2020 and another in 2021. The third allocation of emission allowances took place in 2022. Currently (2023–2024), the ETS is in a transition phase.

The 2019 agreement, which defines the preliminary basis for the Emissions Trading Scheme Pilot Program, formalized the essential characteristics of its operation: *(i)* emission permits are called emission rights (DEM); *(ii)* each DEM entitles its holder to emit 1 ton of CO_2 in one year; *(iii)* allocation is free of charge; *(iv)* the federal government, through the Ministry of the Environment and Natural Resources, is responsible for allocating permits; and *(v)* DEMs can be saved in one year for future use. Currently, there is debate over whether to include the possibility for sources affected by the ETS to also have the option of purchasing carbon credits on the voluntary market as an alternative to purchasing a DEM. This possibility could not exceed 10 percent of their emissions. The technical analysis of this initiative includes the rules for its operation.

The sources covered by the Mexican ETS include facilities that meet two requirements: *(i)* they belong to the power generation or industrial sector, the main emitters in the country, and *(ii)* they cause emissions exceeding 100,000 tCO_2 per year. These two restrictions result restrictions result in a universe of 300 facilities, covering more than 90 percent of

CO_2 emissions reported to the National Emissions Registry. The reason why the ETS is limited to two sectors and large sources is that reducing the number of participants to 300 reduces the administrative burden and operating costs of the ETS.

The emissions cap set for all ETS participants (the cap) was 272 $MtCO_2$ for 2020 and 273 $MtCO_2$ for 2021. The allocation of permits in 2020 was 272 $MtCO_2$, but in 2021 it was lower: 228 $MtCO_2$.

The possibility of offsetting the IEPS carbon tax with credits and the incorporation of this option in the development of the ETS may have driven the growth of projects. Since 2017, 4,625,058 CREs have been issued in Mexico, representing 1.7 percent of the ETS's emissions cap in 2021. There are 248 project owners in 21 states. The average annual increase in offsets is 148 percent.

Tablet 10. Summary of Consideration 5: Integrating Carbon Taxes and Credits

Consideration	Issues	Possibilities
5. Integrate carbon taxes and credits	The theory	To be effective, offset systems require a certain market volume and an institutional framework capable of guaranteeing them. They should consider the following: 1. Provide real CO_2 removal, capture, reduction, or avoidance: credits must be credibly certified. 2. Have a reliable institutional framework that accounts for, audits, and adjusts tax collections from firms that purchase credits. 3. Follow the principle of additionality: The emissions contained in a credit would not have materialized if it were not for the money obtained from its sale.

Source: Authors' elaboration.

Table 11. Integration of Carbon Taxes and Credits in Chile, Colombia, and Mexico

Carbon taxes and credits	Chile	Colombia	Mexico
Offset system	Law 21,210 allows taxpayers subject to CO_2tax to offset all, or part of their emissions covered by the tax with emissions reduced or removed through projects, if these are "additional, measurable, verifiable, and permanent." The reductions or removals must be complementary to those required by current legal regulations. To offset emissions subject to CO_2 tax, an emission reduction project must have a CRE issued by the Ministry of the Environment.	Decree 926 of 2017 regulates the possibility of non-liability for emission sources covered by the carbon tax. To do so, the taxpayer must indicate the amount of fuel neutralized and its equivalence in tons of CO_2 and attach the verification statement and proof of voluntary cancellation of emission reductions or GHG removals canceled in their favor by consumers or end users or by the owner of a GHG mitigation initiative.	There are different market mechanisms: the Emissions Trading System and the Voluntary Carbon Market. Both the carbon IEPS and the ETS consider compensation mechanisms for compliance with obligations. ETS emission permits are called emission rights, or DEM, and grant the right to emit 1 ton of CO_2 in one year. Allocation by the regulator is free of charge. The federal government, through the Ministry of the Environment and Natural Resources, is responsible for allocating permits. DEMs can be saved in one year for future use.

Table 11. Integration of Carbon Taxes and Credits in Chile, Colombia, and Mexico *(continuation)*

Challenges	Generate a greater supply of emission reduction projects that include the forestry sector.		Coordinate the different instruments with rules that do not erode the signal expressed by a consistent carbon price.

Source: Authors' elaboration.

Conclusions

The use of offset mechanisms to complement carbon taxes is based on reducing emissions through the purchase of certified credits. To be effective, this system requires: *(i)* a market with adequate volume and credible certification that guarantees additionality and permanence of reductions, *(ii)* reliable institutions with regulatory systems that account for and monitor emissions appropriately, and *(iii)* flexibility to be a profitable alternative for sectors that are difficult to decarbonize by facilitating the mobilization of private resources toward mitigation projects.

Chile, Colombia, and Mexico have implemented systems that incorporate various theoretical elements by linking their carbon taxes to carbon credits. However, these systems are still in the development and/or consolidation phase, with challenges ahead, such as increasing coverage, developing more mitigation projects, and effectively coordinating with other climate policy instruments. Nevertheless, the experiences of these countries offer valuable lessons for other Latin American and Caribbean economies considering the implementation or strengthening of similar instruments. In terms of theory vs. reality, the cases of Chile, Colombia, and Mexico show areas of greater and lesser convergence.

Convergence with Theory

Robust certification and verification. All three countries have implemented systems that emphasize the credibility of credits through rigorous certification mechanisms. Chile and Colombia have adopted recognized international standards that ensure reductions are real and verifiable.

Additionality. All three countries have incorporated the principle of additionality into their regulatory frameworks to ensure that reduction projects represent actions that would not have materialized without the financial incentive provided by carbon credits.

Territorial focus. Chile, Colombia, and Mexico have limited eligible credits to those generated within their national territories, which facilitates verification and promotes the development of local mitigation projects.

Institutional structure. The three countries have established institutional systems for accounting for, and auditing credits used to offset tax obligations by assigning clear responsibilities to specific government entities.

Areas for Improvement and Divergence

Limited coverage. In the cases presented, especially in Chile, emissions offsetting through carbon credits has had a limited scope (only 1 percent of taxed emissions), suggesting that there is room to expand its use.

Development of local markets. While theory highlights that carbon taxes can drive the development of credit markets, this potential has not yet been fully realized. Mexico shows more significant progress with an average annual growth of 148 percent in the issuance of offsets.

Integration with other instruments. Mexico faces the challenge of coordinating multiple instruments (carbon IEPS, ETS, and voluntary market) to avoid carbon price signal erosion, an issue that theory identifies as critical, but which has not been fully resolved.

Lessons Learned and Recommendations

Carbon taxes are a tool that, to a certain extent, can contribute to reducing GHG emissions. At the same time, they have limitations in driving technological changes consistent with decarbonization. Based on the experiences of Chile, Colombia, and Mexico in developing and implementing this tool, the following lessons have been learned.

The objectives of implementing carbon pricing should be realistic and aligned with its effectiveness. Evidence indicates that there are multiple barriers that reduce the effectiveness of the tax. In addition, several obstacles prevent the adoption of clean technologies and the transition to a net-zero emissions economy in countries, such as regulatory constraints, lack of available infrastructure, lack of information, and insufficient technical and technological capacity. Therefore, when defining the objectives of such policies, it is important to consider these barriers to determine how effective a price incentive could be.

A carbon tax cannot be the only environmental policy instrument. In practice, a carbon tax can be an additional instrument in the climate change economic policy toolbox.

To enhance the impact of the tax, complementary measures are needed to overcome barriers that reduce its effectiveness. In the case of a lack of financing for the decarbonization of the region's economies, for example, complementary measures will be required. These include linking the tax to a carbon market, identifying a portfolio of projects eligible for financing, issuing new public debt instruments, direct subsidies, tax credits, or preferential credit lines, and others. Overcoming the other barriers identified, such as regulations, also involves promoting similar additional measures.

To implement effective carbon tax policies, institutional capacity must be created and strengthened in finance ministries and sectoral ministries. For a carbon tax and any associated credit market to function properly, it must have the capacity to administer and enforce both instruments and their complementary measures.

The socioeconomic and environmental impacts of the tax must be estimated during its design and evaluated periodically during its implementation. When designing an instrument, it is important to assess its impact ex ante, during the design stage, and then during implementation. This assessment, which allows the design to be calibrated to improve the effectiveness and acceptance of the tax, requires the use of tools and methodologies that are the responsibility of the ministries of finance, economy, and finance. However, it will also require the collaboration of sectoral ministries responsible for the environment, energy, industry, and transportation.

Interest in using carbon taxes as an instrument to finance climate action is growing, but this poses a challenge to maintaining good fiscal practices. Earmarking is not a recommended practice, and financing an activity with a specific source of revenue should be avoided, especially if the activity represents a permanent expenditure. In this regard, the use of carbon markets associated with the tax has emerged as an alternative to mobilize financing for climate action, respect the principle of good fiscal practices, and make the instrument viable.

Carbon markets present institutional challenges due to the need to administer and monitor the mechanism, particularly to prevent multiple use of credits. The accrual mechanism through the purchase of carbon credits has proven to be a common option. It is present in the three cases analyzed. The experiences of Chile, Colombia, and Mexico illustrate the challenges of directing the financing generated by the instrument to activities that are suitable for achieving carbon neutrality that would not be carried out without the instrument (additionality), and whose impact lasts after the credit is sold on the market (permanence).

Acceptance of the proposed tax must be managed. Since carbon prices may be unpopular, the political and social support required to implement carbon taxes at a sufficiently high rate is not guaranteed. In this context, it is essential to manage acceptance of the proposed tax. It should also be noted that the initial tax proposal will need to be modified, including the following:

- **Limit coverage** by exempting certain fuels, sectors, or fuel uses and using thresholds (setting the tax above a certain level of emissions greater than zero).

- **Implement the tax gradually by progressively affecting sectors.** An alternative may be to apply a scheme of regular, pre-established rate increases, starting with low values.

- **Establish non-taxation mechanisms.** One mechanism used in the three experiences analyzed is the purchase of carbon credits. Through this mechanism, CO_2 sources covered by the tax can purchase carbon credits and offset (deduct) the corresponding amount from their tax obligations.

- **Strategically manage the use of fiscal resources.** While the direct allocation of carbon tax revenues to finance sectoral decarbonization and compensatory measures may increase social acceptance, this practice contravenes fundamental principles of budget management. In accordance with the principle of non-specific allocation, it is recommended that these resources be integrated into general revenues and that public spending decisions on decarbonization and compensatory measures be based on comprehensive budget planning and fiscal sustainability criteria.

- **Communication as a value.** An additional strategy to improve acceptance of the instrument is to develop communication campaigns that explain the rationale for carbon taxes to citizens and address any misconceptions.

Before implementing carbon pricing, reforming fossil fuel subsidies and tax exemptions for specific polluting activities should be considered. These can represent a significant percentage of the total carbon price and have the opposite effect to carbon taxes, as they encourage the use of fossil fuels. The strategies used to improve acceptance of a carbon tax can be applied to the reform of fossil fuel subsidies. This also increases the net tax on GHG emissions. The goal is that, when all direct and indirect taxes and subsidies are added together, it should not be possible to show that fossil fuel consumption is being financed.

Finally, it is important to strike a balance between concessions and tax objectives. Granting exemptions can reduce the socioeconomic impacts of a carbon pricing instrument, but it can also weaken its effectiveness. However, initial implementation with limited coverage and rates can be an opportunity to build acceptance and embark on a gradual path of modifications that increase the tax's effectiveness. Once the tax is in place, reforms can be proposed to increase coverage, as seen in the cases of Chile and Colombia.

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