PARTNERSHIP FOR MARKET READINESS

International Carbon Action Partnership

EMISSIONS TRADING IN PRACTICE:

A Handbook on Design and Implementation

SECOND EDITION

WORLD BANK GROUP

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ACRONYM LIST

Acronym	
AB	Assembly bill (California)
AFOLU	Agriculture, forestry, and other land use
APCR	Allowance Price Containment Reserve
BAU	Business as usual
BECCS	Bioenergy with carbon capture and storage
CARB	California Air Resources Board
CCER	Chinese Certified Emission Reduction
CCR	Cost Containment Reserve
CCS	Carbon capture and storage
CDM	Clean Development Mechanism
CEM	Continuous emissions monitoring
CER	Certified Emission Reduction
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
CPF	Carbon price floor
CPLC	Carbon Pricing Leadership Coalition
CPM	Carbon Pricing Mechanism
CPS	Carbon price support
DACCS	Direct air carbon capture and storage
EAAC	Economic and Allocation Advisory Committee
EC	European Commission (EU)
ECR	Emissions Containment Reserve
EDF	Environmental Defense Fund
EEA	European Economic Area
EI	Emissions intensity
EITE	Emissions-intensive, trade exposed
EMAC	Emissions Market Assessment Committee
EPA	Environmental Protection Agency (United States)
ERU	Emission reduction unit
ESD	Effort Sharing Decision
ESR	Effort Sharing Regulation
ETS	Emissions Trading System
EU	European Union
EU ETS	European Union Emissions Trading System
EUAs	EU allowance units
GDP	Gross domestic product
GHG	Greenhouse Gas
Gt	Gigaton
$GtCO_2e$	Gigaton of carbon dioxide equivalent

Acronym	
GVA	Gross value add
GWP	Global warming potential
HFC	Hydrofluorocarbons
IAP2	International Association for Public Participation
ICAO	International Civil Aviation Organization
ICAP	International Carbon Action Partnership
IEA	International Energy Agency
IETA	International Emissions Trading Association
IPCC	Intergovernmental Panel on Climate Change
ITL	International Transaction Log (Kyoto Protocol)
ITMO	Internationally transferred mitigation outcome”
JCM	Joint Crediting Mechanism (Japan)
JI	Joint Implementation (Kyoto Protocol)
$ktCO_2e$	Kiloton of carbon dioxide equivalent
LRF	Linear reduction factor
MAC	Marginal abatement cost
MfE	Ministry for the Environment (New Zealand)
MoU	Memorandum of understanding
MRV	Monitoring, reporting, and verification
MSR	Market Stability Reserve
Mt	Megaton
$MtCO_2e$	Megaton of Carbon Dioxide equivalent
MRR	Monitoring and Reporting Regulation (Croatia)
MW	Megawatt
N_2O	Nitrous oxide
NCV	Net calorific value
NDC	Nationally Determined Contributions
NDRC	National Development and Reform Commission (China)
NET	Negative emissions technology
NGO	Non-governmental organization
NZ ETS	New Zealand Emissions Trading Scheme
NZU	New Zealand Units
OBA	Output-based benchmarked allocation
OECD	Organisation for Economic Co-operation and Development
PCU	Price ceiling units
PMI	Partnership for Market Implementation
PMR	Partnership for Market Readiness
PSAM	Price or supply adjustment measure
RGGI	Regional Greenhouse Gas Initiative

Acronym	
SB	Senate bill (California)
SEMARNAT	Mexican Ministry for Environment and Natural Resources
SINAMECC	National Climate Change Metrics System
t	Ton (= metric ton, in the United States)
tCO_2	Ton of carbon dioxide
tCO_2e	Ton of carbon dioxide equivalent
TCI	Transport and Climate Initiative
TE	Trade exposure
TNAC	Total number of allowances in circulation
UK	United Kingdom
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
US	United States
VAT	Value added tax
WCI	Western Climate Initiative

SYNTHESIS
Emissions Trading: Bringing It All Together

BOXES

FIGURES

WHY EMISSIONS TRADING?

Currently, about 46 national jurisdictions and 35 cities, states, and regions — representing almost a quarter of global greenhouse gas (GHG) emissions — are putting a price on carbon as a central component of their efforts to reduce emissions and place their growth trajectory on a more sustainable footing.[1] An increasing number of these jurisdictions are approaching carbon pricing through the design and implementation of Emissions Trading Systems (ETS). As of 2021, ETSs were operating across four continents in 38 countries, 18 states or provinces, and six cities covering over 40 percent of global gross domestic product (GDP), and additional systems are under development.[2]

As jurisdictions adopt increasingly stringent climate targets, the question as to which policy package reliably puts them on track to deliver the required emissions reductions is becoming ever more prevalent. To move to a low-carbon future and achieve the aim of holding the increase in the global average temperature to well below 2 degrees above preindustrial levels, action will be needed on multiple fronts, from decarbonizing electricity and electrifying transport to moving to low-carbon industry and protecting and enhancing carbon sinks in forests and soils. This will require a shift in investment patterns and behaviors, as well as innovation in technologies, infrastructure, financing, and practice. Policies will be needed that achieve this change through reflecting local circumstances, creating new economic opportunities, and supporting all citizens' well-being.

For many jurisdictions, GHG gas emissions pricing (or, as it is more commonly referred to, "carbon pricing" or "emissions pricing") is emerging as a key driver of this transformation. By aligning profits with low-emission investment and innovation, a uniform price on carbon can channel private capital flows, mobilize knowledge about mitigation within firms, and tap the creativity of entrepreneurs in developing low-carbon products and innovations, thereby driving progress towards reducing emissions. A price on carbon makes clean energy more profitable, allows energy efficiency to earn a greater return, makes low-carbon products more competitive, and values the carbon stored in forests. An increasing number of firms and investors are advocating for carbon pricing policies from government and applying an internal carbon price to guide investment in advance of government policy to that effect.

Carbon pricing by itself cannot address all of the complex drivers of climate change; some combination of regulations, standards, incentives, educational programs, and other measures will also be required. However, as part of an integrated policy package, carbon pricing can harness markets to drive down emissions and help build the ambition needed to sustain a safer climate. ETSs in particular can provide a backstop to ensure that a policy package achieves set climate goals. An ETS imposes a cap on the total emissions in one or more sectors of the economy. The regulator issues a number of tradable allowances not exceeding the level of the cap. Each allowance typically corresponds to one ton of emissions. Entities covered by the ETS are then allowed to trade these allowances, resulting in a market price for the allowances.

To maximize effectiveness, any ETS needs to be designed in a way that is appropriate to its context. This handbook is intended to help decision makers, policy practitioners, and stakeholders achieve this goal. It explains the rationale for emissions trading and sets out the most important steps of ETS design. In doing so, it draws both on conceptual analysis and on some of the most important practical lessons learned to date from implementing ETSs around the world, from the European Union to the Regional Greenhouse Gas Initiative, California, and Québec; and from New Zealand to Kazakhstan, Korea, and China.[3]

1 World Bank 2020.

2 International Carbon Action Partnership 2021.

3 As of January 2021, ETSs in force include the European Union ETS, the United Kingdom ETS, the German National ETS, the Swiss ETS, the California Cap-and-Trade Program, the US Regional Greenhouse Gas Initiative, the Massachusetts Limits on Emissions from Electricity Generators, the Québec Cap-and-Trade System, the Nova Scotia Cap and Trade Program, Mexico's ETS, the Kazakhstan ETS, the New Zealand ETS, the Chinese National ETS, the Korean ETS, Japan's Saitama Target Setting ETS, and the Tokyo Cap and Trade Program. A range of regional pilot ETSs are also in force in China and are expected to be gradually transitioned into the national system. See https://icapcarbonaction.com/en/ets-map for a continuously updated list of ETSs in-force, under development, or under consideration.

ETS DESIGN IN 10 STEPS

This handbook sets out a 10-step process for designing and implementing an ETS (see Figure 0-1). These steps are interdependent, and the choices made at each step will have important repercussions for decisions in the other steps. In practice the process of ETS design will be iterative rather than linear. The need to adjust and adapt policies over time is reflected in the update of this handbook, which was first released in 2016. New insights, approaches, and designs have proliferated adjusting the way ETSs operate and further developing our understanding of them.

- **Prepare and engage:** Before implementing an ETS, it is important to prepare (Step 1). This includes understanding carbon pricing options and what role they may play in a jurisdiction's climate policy mix. This should be followed by stakeholder engagement (Step 2), including communication, and capacity building with stakeholders in government, business, and civil society. Engagement should continue throughout the design and operation of the ETS, with stakeholder input into evaluations helping to guide improvements to ETS design over time.

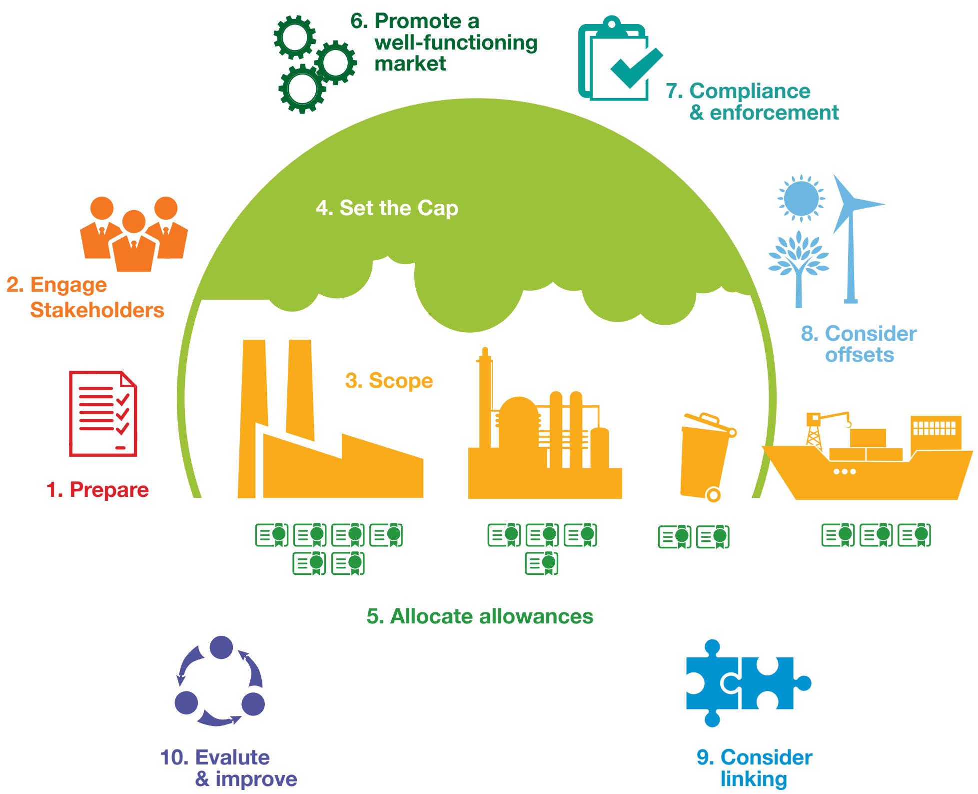
Across the remaining steps, a series of initial high-level decisions define the fundamental shape and direction of the ETS. These can be broadly grouped as follows:

- **Create the market:** First, policymakers should decide which sectors to cover and where to place the points of regulation for covered sectors (Step 3). A second set of decisions concerns the type and ambition of the cap, both initially and over time (Step 4). These decisions will influence the way in which emissions allowances are distributed (Step 5).
- **Operate the market:** A successful carbon market will require appropriate rules for managing the use of allowances across time, and to promote participation in the market. The use of price or supply adjustment measures (PSAMs) can also improve market functioning and help the system better weather shocks (Step 6). It will also require effective compliance and enforcement mechanisms that discourage noncompliance (Step 7).
- **Cooperate and expand:** Broadening incentives from carbon pricing can reduce costs and provide other benefits. Given this, policymakers should consider whether the use of offsets (Step 8) or linking with other ETSs (Step 9) are appropriate options for their market.

Even with good initial design, an ETS will need to change over time to remain fit for its purpose. Ongoing evaluation and improvement (Step 10) can ensure that change occurs in a robust and predictable way.

Throughout the handbook, we provide checklists, summarized in Box 0-1, to provide guidance on the key decision points and insights on ETS design and implementation.

Figure 0-1 ETS design in 10 steps



Box 0-1 Checklist for the 10 steps of ETS design

Step 1: Prepare

- ✔ Understand what carbon pricing and emissions trading are and how they work
- ✔ Determine the objectives for your ETS
- ✔ Decide the ETS's role in the climate policy mix
- ✔ Understand the ETS's interaction with other policies
- ✔ Select criteria to assess ETS design options

Step 2: Engage stakeholders, communicate and build capacities

- ✔ Map stakeholders and respective positions, interests, and concerns
- ✔ Coordinate across departments for a transparent decision-making process and to avoid policy misalignment
- ✔ Design an engagement strategy for consultation of stakeholder groups specifying format, timeline, and objectives
- ✔ Design a communication strategy that resonates with local and immediate public concerns
- ✔ Identify and address ETS capacity-building needs

Step 3: Decide the scope

- ✔ Decide which sectors to cover
- ✔ Decide which gases to cover
- ✔ Choose the points of regulation
- ✔ Choose the entities to regulate and consider whether to set thresholds
- ✔ Choose the point of reporting obligation

Step 4: Set the cap

- ✔ Determine the ambition of the cap, type of cap, and approach to cap setting
- ✔ Create a robust foundation of data to determine the cap
- ✔ Choose time periods for cap setting
- ✔ Agree upon formal legal and administrative governance arrangements
- ✔ Agree on a long-term cap trajectory and strategy for providing a consistent price signal

Step 5: Distribute allowances

- ✔ Match allocation methods to policy objectives
- ✔ Define eligibility and methods for free allocation
- ✔ Define treatment of entrants, closures, and exits
- ✔ Set up auctions to play an increasing role over time while reducing free allocation

Step 6: Promote a well-functioning market

- ✔ Establish the rationale for, and risks associated with, market intervention
- ✔ Establish rules for banking and borrowing
- ✔ Establish rules for market participation
- ✔ Identify the role played by a robust secondary market
- ✔ Choose whether to intervene to address low prices, high prices, or both
- ✔ Choose the appropriate price or supply adjustment measure

Step 7: Ensure oversight and compliance

- ✔ Identify the regulated entities
- ✔ Manage emissions reporting by regulated entities
- ✔ Approve and manage the performance of verifiers
- ✔ Establish and oversee the ETS registry
- ✔ Design and implement the penalty and enforcement approach
- ✔ Regulate and oversee the market for ETS emissions allowances

Step 8: Consider the use of offsets

- ✔ Outline the potential role of offsets within an ETS
- ✔ Decide on the type of offsets allowed within the system (both geographical scope and governance of program)
- ✔ Weigh costs of establishing a domestic offset program versus making use of an existing program
- ✔ Decide on qualitative and quantitative limits on the use of offsets

Step 9: Consider linking

- ✔ Identify potential linkage partners
- ✔ Determine the type of link
- ✔ Identify the benefits and risks associated with the link
- ✔ Discuss compatibility of key program design features
- ✔ Form and govern the link

Step 10: Implement, evaluate, and improve

- ✔ Decide on the timing and process of ETS implementation
- ✔ Decide on the process and scope for reviews
- ✔ Identify why the design of the ETS may need to change over time
- ✔ Evaluate the ETS to support future improvement

STEP 1: Prepare

Checklist for Step 1: Prepare

- ✔ Understand what carbon pricing and emissions trading are and how they work
- ✔ Determine the objectives for your ETS
- ✔ Decide the ETS's role in the climate policy mix
- ✔ Understand the ETS's interaction with other policies
- ✔ Select criteria to assess different ETS design options

Before proceeding to designing their ETS, policymakers need a clear understanding of what carbon pricing is and what it can and cannot do. Considering this, they need to define the ETS objectives for their jurisdiction. They must establish the system's priorities: how much it should contribute to the low-carbon economic transformation and sustainable development; the level and cost at which they want to achieve emissions reductions; the importance of co-benefits; and whether the system should raise revenue. They must also build public awareness and acceptance of the need to reduce emissions to make it easier to adopt and implement an effective ETS.

All ETSs are developed within a broader policy and legal framework, including other climate change policies. To position the ETS strategically within the broader policy portfolio, it is important to have a clear view of how the ETS will contribute to a jurisdiction's climate policy objectives and its relationship with other current or planned policies. Other policies in the climate change portfolio and in other relevant sectors (together called "companion policies") can affect the operation of the ETS, including the level of emissions reductions, the carbon price, and the system's distributional impacts. These policies can help improve the effectiveness of the ETS. For example, they may remove non-price barriers to reducing emissions by providing enabling infrastructure. On the other hand, they may duplicate incentives provided by the ETS, or in some cases, counteract the intended effect of the ETS. The ETS can also positively or negatively affect the functioning of other policies, including the achievement of economic, social, or environmental goals. These policy interactions must be managed carefully and considered when designing the ETS.

Policymakers may wish to assess different ETS designs against a range of criteria, the most crucial of which are the system's environmental integrity, ability to deliver cost-effective mitigation, and appropriateness to local context. Other criteria jurisdictions may consider include accountability and transparency, robustness, compatibility with other policies, fairness, policy predictability, policy flexibility, administrative cost, and compatibility with other jurisdictions.

Lessons learned: An ETS works best as part of a well-thought-out policy package to achieve climate targets and drive sustainable development. Jurisdictions have taken different approaches to positioning their ETS relative to other policies. In the case of California, the ETS was adopted within a broad climate change policy portfolio, and the ETS price signal was expected to serve as a backstop to ensure that emission targets would be met if the other measures proved less effective than hoped. In contrast, New Zealand currently employs an ETS as its primary mitigation instrument. Ensuring the right policy mix can improve overall outcomes and help build public support for the introduction of an ETS.

STEP 2: Engage stakeholders, communicate, and build capacities

Checklist for Step 2: Engage stakeholders, communicate, and build capacities

- ✔ Map stakeholders and respective positions, interests, and concerns
- ✔ Coordinate across departments for a transparent decision-making process and to avoid policy misalignment
- ✔ Design an engagement strategy for consultation of stakeholder groups specifying format, timeline, and objectives
- ✔ Design a communication strategy that resonates with local and immediate public concerns
- ✔ Identify and address ETS capacity-building needs

Developing a successful ETS requires enduring public and political support. It also depends on practical collaboration across government and market players. This collaboration should be based on shared understanding, trust, and capability. The manner and, in particular, the transparency with which ETS policymakers engage with others in government and external stakeholders will determine the long-term viability of the system. Engagement should start at the beginning of ETS planning and continue throughout the design, rollout, and operation of the ETS.

Communication about an ETS needs to be clear, consistent, and coordinated, and the government needs to maintain integrity and credibility throughout the process. Major changes to the system should be announced well in advance, and the government should consider carefully how to manage commercially sensitive information.

Developing an ETS also requires strategic capacity building. Government decision makers and administrators need to build specialized technical expertise and administrative capacity to develop and operate an ETS. ETS participants, market service providers, business associations, and civil society representatives hold specialized knowledge that can help policymakers design an effective system, but these stakeholders also need to build sufficient capacity to participate in the system. Investing time and resources for capacity building will generate valuable returns.

Lessons learned: Government decision-making can be facilitated by strong executive and ministerial leadership, the clear allocation of responsibilities across departments, and the designation of interdepartmental working groups. Governments typically underestimate the strategic importance of meaningful stakeholder engagement and public communications in securing enduring support for an ETS. Some jurisdictions have found that it took 5 to 10 years of engagement and capacity building on climate change market mechanisms to enable informed and broadly accepted ETS policymaking. Tapping stakeholder expertise will improve ETS design and help gain trust, understanding, and acceptance. Creating and executing a communications strategy can help broaden support for an ETS. Developing a suitable and persuasive narrative about the ETS will be vital to gaining popular support. Because the ETS will need to change and be adapted over time, it is important to continue to engage stakeholders to identify when circumstances change and promote enduring broad support for the ETS.

STEP 3: Decide the scope

Checklist for Step 3: Decide the scope

- ✔ Decide which sectors to cover
- ✔ Decide which gases to cover
- ✔ Choose the points of regulation
- ✔ Choose the entities to regulate and consider whether to set thresholds
- ✔ Choose the point of reporting obligation

The scope of an ETS refers to the geographic area, sectors, emissions sources, and greenhouse gases for which allowances will have to be surrendered, as well as which entities will have to surrender them. The ETS scope defines the boundaries of the policy. It therefore has implications for the number of regulated entities, the share of emissions facing an allowance price, and effort sharing between the covered and non-covered sectors to meet economy-wide emission reduction targets.

In determining ETS scope, important differences across sectors and emissions sources should be considered. Key considerations include the jurisdiction’s emissions profile and its expected evolution; the market structure of emissions-intensive industries; the ability and cost of monitoring, reporting, and verification across emission sources; and, the existing regulatory structures and policies. Consideration should finally be given to the potential for non-price barriers to limit carbon price pass-through, exposure to international markets, and the potential for co-benefits.

Generally, broader system coverage is desirable as it increases the range of low-cost mitigation options, allowing emissions reductions to be achieved at the least cost. Broader coverage also reduces competitive distortions (as competing firms and sectors operate within the same market rules) and enhances market liquidity. However, sectors differ in their ease of coverage under an ETS, with the electricity industry being easier to cover and others, like the waste and land sectors, typically presenting more challenges. A broader system may impose a greater regulatory burden on small and diffuse emissions sources, which may also be relatively difficult to regulate. Therefore, the benefits of broader coverage must be balanced against any additional administrative effort and transaction costs. Using thresholds to exclude small emitters and placing the point of regulation at the most concentrated part of the supply chain can help manage this trade-off.

Lessons learned: There is a great diversity across existing ETSs in terms of scope, suggesting there is no single “right” approach. Almost all systems cover at least the power and industrial sectors. A phased approach can be useful to allow time to build the capacity to include smaller or more complex sectors. All systems cover carbon dioxide; many cover other gases as well. While some jurisdictions have placed the point of regulation for emissions from fuel combustion upstream to reduce administrative costs (for example fuels in California, Québec, and New Zealand), others have opted for regulation at the point where emissions are generated for alignment with existing regulatory or reporting systems (for example the European Union). Still other systems have opted for hybrid coverage because energy prices are regulated and carbon price signals would otherwise not pass through the supply chain (for example the Korean ETS and ETSs in China).

STEP 4: Set the cap

Checklist for Step 4: Set the cap

- ✔ Determine the ambition of the cap, type of cap, and approach to cap setting
- ✔ Create a robust foundation of data to determine the cap
- ✔ Choose time periods for cap setting
- ✔ Agree upon formal legal and administrative governance arrangements
- ✔ Agree on a long-term cap trajectory and strategy for providing a consistent price signal

The ETS cap sets a limit on the total amount of emissions produced by the regulated entities, which is then reflected in the number of allowances issued over a specified time period. All else equal, the lower the cap, the higher the carbon price will be and the stronger the incentive to reduce emissions. However, other design features such as access to offsets, linking, and different PSAMs interact with the cap to determine the overall emissions constraint and the resulting carbon price. In practice, cap setting is a balancing act, as it accounts for environmental integrity and ambition, cost constraints, and fairness within the broader policy context.

Setting the cap requires an assessment of the jurisdiction's historical emissions, its projected emissions (which depend on both anticipated improvements in emissions intensity and projected economic growth and development), and mitigation opportunities and costs. It should reflect considerations of how other current or planned policies could influence ETS outcomes.

The cap should be aligned with the jurisdiction's overall mitigation target, such as those expressed in a Nationally Determined Contribution (NDC). In setting the cap, policymakers need to manage trade-offs between emissions reduction ambition and system costs, aligning cap ambition with target ambition, and assigning mitigation responsibility across covered and uncovered sectors. Absolute caps set targets for the level at which emissions should be limited for each compliance period. However, flexibility can be provided by banking provisions, allowance reserves, offset credits, linking, and PSAMs. Intensity caps prescribe the number of allowances to be issued per measure of output (for example gross value added or kilowatt-hour of electricity), which allows them to adjust automatically to fluctuations in economic output but provides less certainty over emission outcomes. Absolute caps are by far the more common type of cap. Jurisdictions that choose intensity caps will have a smaller body of knowledge and experience to draw on and might face challenges when considering linking.

Lessons learned: A cap should rest on a solid foundation of robust underlying data and assumptions. Cap setting will benefit from early data collection and greater reliance on historical data as compared to counterfactual projections. While most jurisdictions have chosen absolute caps to facilitate alignment between caps and targets as well as linking, they have also built in some flexibility over allowance supply to maintain price predictability (see Step 6). In practice, partly because of a concern about high prices, initial caps in many existing ETSs were relatively loose, which contributed to prices that were significantly lower than expected. To support effective market operation and build confidence among market participants, a long-term cap trajectory should be combined with a transparent, rules-based process of possible modifications to the cap and advance notice of future changes.

STEP 5: Distribute allowances

Checklist for Step 5: Distribute allowances

- ✔ Match allocation methods to policy objectives
- ✔ Define eligibility and methods for free allocation
- ✔ Define treatment of entrants, closures, and removals
- ✔ Set up auctions to play an increasing role over time while reducing free allocation

Whereas the cap determines the emissions impact of an ETS, allowance allocation is an important determinant of the distributional impacts of an ETS. It can also affect the efficiency of the system through influencing abatement incentives. It therefore merits careful attention.

The government can distribute allowances for free, auctioning, or through some combination of the two. Free allocation methods vary according to whether they are based on entities' historical emissions — referred to as grandparenting — or are based on an emissions benchmark, and depend on whether allocation changes when output changes. To differing degrees these options can protect against leakage (the concern that carbon pricing causes geographic relocation of emissions rather than genuine emissions reductions) and can also help compensate for economic losses that compliance with the ETS might otherwise cause.

Auctioning generates government revenue, which can be used to meet a number of objectives: pay for cuts in distortionary taxes, reduce debt, support spending on public programs (including other forms of climate action) or be returned to households directly to address adverse social outcomes. Auctioning also supports the operation of the secondary market through enabling price discovery.

The risk of carbon leakage in emissions-intensive, trade-exposed sectors has been a major concern in ETS design and implementation and is likely to remain a core political consideration in the short- to medium-term, although empirical evidence on leakage is limited to date. This issue will also decline in importance as carbon pricing is adopted more widely or harmonized globally.

Lessons learned: Because large amounts of resources are at stake, allocation decisions can become highly contentious and a key focus of stakeholder attention and political discussion. The objectives of allocation (for example, reducing carbon leakage risk or preserving incentives for cost-effective abatement) should be transparently stated upfront and subsequent decisions on allocation design issues should be explained and justified by reference to these objectives. Both the objectives of allocation and allocation design features can be expected to evolve over time. Decisions on entities' individual allocation should be made separately from decisions on the cap. Auctioning has typically been introduced on a limited scale initially, but with the intention that it will gradually displace free allocation over time. Allocation methods can vary across sectors; for example, the power sector is a typical candidate for auctioning as it is often less prone to carbon leakage than other ETS sectors, while manufacturing sectors have typically received some form of free allocation at least in their initial years. Using auction revenue strategically can be a powerful selling point for an ETS.

STEP 6: Promote a well-functioning market

Checklist for Step 6: Promote a well-functioning market

- ✔ Establish the rationale for, and risks associated with, market intervention
- ✔ Establish rules for banking and borrowing
- ✔ Establish rules for market participation
- ✔ Identify the role played by a robust secondary market
- ✔ Choose whether to intervene to address low prices, high prices, or both
- ✔ Choose the appropriate price or supply adjustment measure

After the initial allocation, ETS participants can trade their allowances. The allowance price depends on the balance between the policymaker-controlled supply on the one hand, and demand among market participants on the other, which in turn depend on a host of broader economic and technological trends. This means that the allowance price can vary substantially over time.

A well-functioning market that sees prices adjust predictably to external events and changed information is important for an ETS to operate as intended. Policymakers should therefore work to ensure market depth and liquidity, as well as transparent rules facilitating price discovery.

Fluctuations in the carbon price are often desirable as they represent the transmission of price signals about abatement costs to market participants. However, large price variability can occur as a result of exogenous shocks, regulatory uncertainty, or market imperfections. Policymakers can support the development of a well-functioning market through rules for temporal flexibility and regulatory and governance structures that support secondary market development.

Temporal flexibility is determined by the degree to which banking (reserving allowances in the current period for use at a later time) and borrowing (using allowances from future allocations) are allowed. Banking is generally seen as positive since it encourages earlier reductions and helps smooth costs (and allowance prices) across compliance periods. In contrast, borrowing carries the risk of delaying mitigation action and is typically avoided. The length of the compliance period determines the length of time during which firms need to monitor, report, and verify their emissions and then surrender the relevant number of allowances.

Policymakers must decide on who can participate in the market and the institutions that will support market development. Financial market players can play an important role in adding liquidity and providing access to risk-management products but can add complexity to the market. The degree to which the government itself participates in the market is also something that should be considered.

Even with a relatively well-functioning secondary market, there remain risks of excessive price variability in carbon markets. As such, it is now common practice for ETSs to adopt some form of PSAM. PSAMs help jurisdictions achieve a predictable and effective market that ensures prices are consistent with those necessary for longer-term decarbonization, while avoiding periods of excessive costs. Examples of PSAMs addressing low prices include auction reserve prices, hard price floors, or the levying of additional fees and charges on top of the allowance price. PSAMs addressing high prices include cost containment reserves, or hard price ceilings. Alternatively, PSAMs can also help manage supply by responding to quantity-based criteria like the number of banked allowances.

Lessons learned: Excessive price variability risks undermining mitigation in an ETS and reducing public confidence in the system. Rules regarding temporal flexibility and market participation affect how markets operate. Banking can help smooth fluctuations over time, while the inclusion of financial market participants in the carbon market can reduce volatility and help provide access to risk-management products. Even so, policymakers now generally adopt PSAMs to ensure the resilience of ETSs to exogenous shocks while achieving underlying emissions reductions objectives.

STEP 7: Ensure oversight and compliance

Checklist for Step 7: Ensure oversight and compliance

- ✔ Identify the regulated entities
- ✔ Manage emissions reporting by regulated entities
- ✔ Approve and manage the performance of verifiers
- ✔ Establish and oversee the ETS registry
- ✔ Design and implement the penalty and enforcement approach
- ✔ Regulate and oversee the market for ETS emissions allowances

Like other climate policies, an ETS needs rigorous enforcement of participants' obligations and effective government oversight of the system. A lack of compliance and oversight can threaten not just emissions outcomes by noncompliant entities, but also the basic functionality of the market, with high economic stakes for all participants.

Implementing effective systems for monitoring, reporting, and verification (MRV) of greenhouse gas emissions early in the process of ETS development will greatly support compliance and the operation of markets. This includes legal and administrative considerations around identifying regulated entities and developing detailed methodologies and guidance for emissions monitoring. Emissions reporting can utilize existing data collection activities for energy production, fuel characteristics, energy usage, industrial output, and transport.

Depending on the strength of existing auditing systems, government regulators may need to play a stronger role in verification during the early phases of implementation while third-party verifiers are building their capacity to fulfill new functions. The approach to ETS compliance and oversight needs to balance the costs to regulators and regulated entities against the potential risks and consequences of noncompliance. The existing regulatory culture will influence the optimal balance for each jurisdiction. Regulators can draw from experience with other markets dealing in commodities and financial instruments.

Lessons learned: A robust compliance regime is the backbone of the ETS and a precondition for its credibility. The government may need to actively identify new regulated entities as firms are established and change over time. It can be costly to monitor emissions with high levels of accuracy and precision; lower-cost approaches such as using default emissions factors can provide unbiased estimates for predictable sources of emissions. Regulators should take advantage of existing local environmental, tax, legal, and market systems where relevant when establishing ETS compliance and oversight. Making emissions data transparent strengthens market oversight but data management systems must protect potentially confidential or commercially sensitive information. Under-regulation of the trading market may allow for fraud and manipulation, while over-regulation may increase compliance costs and eliminate many of the flexibilities that give carbon markets their efficiency. In some systems, the reputational implications of noncompliance, especially when reinforced by public disclosure of ETS performance, have proven to be a strong deterrent, but a binding system of penalties is still needed. When problems with compliance arise, the ETS regulator and the government should respond quickly to safeguard the integrity and liquidity of the market and maintain the trust and confidence of market participants.

STEP 8: Consider the use of offsets

Checklist for Step 8: Consider the use of offsets

- ✔ Outline the potential role of offsets within an ETS
- ✔ Decide on the type of offsets allowed within the system (both geographical scope and governance of program)
- ✔ Weigh costs of establishing a domestic crediting mechanism versus making use of an existing crediting mechanism
- ✔ Decide on qualitative criteria and quantitative limits on the use of offsets

An ETS can allow offsets — credits for emissions reductions or removals in uncovered sources and sectors — to be used by regulated entities to meet their compliance obligations. This can enable emissions from regulated entities to be higher without compromising overall environmental outcomes. The increase in emissions is counterbalanced, or offset, by emissions reductions elsewhere. This provides a new pool of low-cost compliance units for regulated entities and can significantly reduce ETS compliance costs.

Offsets can come from a variety of sources: uncovered sectors or sources within the jurisdiction (for example depending on the system: transport, waste, forestry, or agriculture); unregulated entities outside the jurisdiction's borders; and early (pre-ETS) reductions from covered sources. Jurisdictions may choose to establish their own domestic crediting mechanism, or rely on externally administered mechanisms.

Crediting mechanisms, if designed and implemented properly, broaden the carbon price signal to uncovered sectors and provide an avenue to generate abatement incentives in sectors that are difficult to include in the scope of the ETS for technical, political, or other practical reasons. This increases the economic efficiency of the ETS by expanding the set of mitigation opportunities available and facilitates investment flows into sectors where financial support is needed to stimulate low-carbon development. By lowering compliance costs and creating a new, supportive political constituency for the ETS in the form of project proponents, the use of offsets may make an ETS more attractive to the private sector, community groups, or local governments that may choose to participate. This may allow policymakers to set a more ambitious cap and broaden coverage as sectors develop their MRV capabilities and may support policy stability. Crediting mechanisms can also be designed to target specific policy goals including improved air quality, restoration of degraded land, and better watershed management. Finally, crediting mechanisms can also support low-carbon investment, learning, and engagement among uncovered sources.

At the same time, the acceptance of offsets presents potential challenges. Offsets represent a risk to environmental integrity if they are not additional (for example if an actor would have undertaken an activity even in the absence of the crediting mechanism), not real (for example, if the emissions reductions did not actually occur), or not permanent (for example if they are reversed and released into the atmosphere at a later stage). The inclusion of offsets may also create an incentive for jurisdictions to implement lax climate commitments in offset-generating sectors and sources, weakening global environmental outcomes. Robust and transparent accounting measures should be employed to prevent double counting.

Lessons learned: Offsets can provide a tool for containing compliance costs, expanding mitigation incentives beyond the covered sectors, and generating co-benefits. Policymakers need to decide whether to make use of an externally administered crediting mechanism or whether to set up a domestic crediting mechanism, which requires additional effort. In either case, valuable experience gained with the use of offsets to date highlights the need to maintain credibility and environmental integrity through robust rules and methodologies. Quantitative limits may be used to control the inflow of low-cost offset credits and the relocation of mitigation co-benefits, and qualitative criteria may be designed to achieve specific policy objectives and to address environmental integrity risks.

STEP 9: Consider linking

Checklist for Step 9: Consider linking

- ✔ Identify potential linkage partners
- ✔ Determine the type of link
- ✔ Identify the benefits and risks associated with the link
- ✔ Discuss compatibility of key program design features
- ✔ Form and govern the link

Linking occurs when an ETS allows regulated entities to use allowances issued by another jurisdiction for compliance or permits its own allowances to be used for compliance in another system, with or without restrictions. Linking broadens flexibility as to where emissions reductions can occur, and so takes advantage of a broader array of abatement opportunities than those available domestically. This lowers the aggregate costs of meeting emission targets. It can also improve market liquidity and price predictability, help address leakage and competitiveness concerns, and facilitate international cooperation on climate policy.

Linking can also incur risks. It reduces jurisdictions' control over the carbon price, potentially exposes the jurisdiction to external shocks, reduces control over the level of domestic abatement effort (including the potential loss of local co-benefits) and limits the jurisdiction's autonomy over ETS design features. The changes in the allowance price due to the linkage could raise distributional concerns and may imply large financial transfers.

While unrestricted linkage may bring greater economic benefits, restricted linking (typically implemented through limits on the quantity or quality of foreign allowances that can be used for compliance) may allow jurisdictions to retain some control over design features, and safeguard against risks associated with linking.

Linking requires mutual trust between systems, and a degree of compatibility between design elements. Structural elements that must be tightly aligned, if not identical, include the voluntary or mandatory nature of the system and type of cap. Other elements that do not require strict compatibility but must deliver comparable outcomes in the linking systems include PSAMs, the use and environmental integrity of offsets, rules on borrowing and banking allowances, and potential for linking with additional systems.

Lessons learned: Linking requires clear understanding and acceptance of the current and future levels of ambition in partnering jurisdictions' ETSs. In successful links to date, partners have had strong existing relationships that facilitated the negotiations leading up to the link and the subsequent joint governance of the market. Key design features need to be made compatible to ensure environmental integrity and price stability when linking. For other features, there needs to be confidence that the linking partner or partners' ETS designs will deliver comparable outcomes. This alignment will take time and may need to be phased in. In practice, linking partners to date have aligned system design to a greater extent than strictly necessary for market functioning. Poorly managed links can have unintended consequences, so jurisdictions should start thinking about and preparing for linking as early as possible, but link strategically and only when suitable.

STEP 10: Implement, evaluate, and improve

Checklist for Step 10: Implement, evaluate, and improve

- ✔ Decide on the timing and process of ETS implementation
- ✔ Decide on the process and scope for reviews
- ✔ Identify why the design of the ETS may need to change over time
- ✔ Evaluate the ETS to support future improvement

Operating an ETS requires regulators and market participants to assume new roles and responsibilities, embed new systems and institutions, and launch a functional trading market. Gradually introducing an ETS can facilitate capacity building and learning before full implementation. This can be done by ETS pilots and/or phasing in sector coverage, ambition, and the degree of government intervention in the market.

ETS design is an evolutionary process that should facilitate change over time as circumstances evolve and experience increases. Policymakers should therefore design their policy and institutions to facilitate change over time in a predictable and constructive manner. Reviews of ETS performance, both frequent targeted reviews and less-frequent comprehensive reviews, are important to enable this continual improvement and adaptation. Targeted reviews are used to assess specific aspects of the ETS, covering more technical details. Comprehensive reviews assess the ETS at a higher level to investigate whether the ETS has met its objectives and assess how fundamental design elements could be improved.

Any possible changes resulting from these reviews need to be balanced against the risks of policy uncertainty. The latter can be mitigated by establishing transparent and predictable processes through which ETS changes are communicated and implemented.

Lessons learned: Every ETS has required an extensive preparatory phase to collect data and develop technical regulations, guidelines, and institutions. Relying on existing institutions where possible can control costs. ETS pilots can generate valuable learning, but they also risk leaving a legacy of negative public perceptions if they encounter difficulties, and not all lessons may be applicable when the ETS is fully launched. Phasing in an ETS can ease the burden on institutions and sectors but can reduce the ETS's initial environmental impact and can anchor stakeholder expectations on lower ambition in the future. Providing a predictable review process and schedule can reduce policy uncertainty, a major barrier to low-emission investment, but additional unanticipated changes may be unavoidable. Reviewing an ETS's performance can be challenging; data is often limited, and external drivers of economic activity and emissions make it hard to distinguish the effect of the ETS from that of other policies or macroeconomic developments. Starting data collection before the ETS starts, making entities' data public where possible, and encouraging external evaluations will provide the best chance for successful reviews. Good governance and stakeholder engagement processes are key to successful implementation.

SHAPING THE FUTURE OF ETS DESIGN

The goal of this handbook is to draw on the experiences of jurisdictions with an ETS to assist other jurisdictions with the design, implementation, and operation of an effective and credible ETS. The fundamental concept of emissions trading is as simple as it is powerful. By drawing on the lessons outlined in this handbook, over the next decade decision makers, policy practitioners, and stakeholders can implement ETSs tailored to their specific geographic and socioeconomic contexts. In doing so, learning from existing systems and finding creative new design solutions that can be shared globally will be key to improving the effectiveness of carbon pricing as a driver of low-emission development.

The handbook was originally published in 2016. An updated edition was published in 2021 to reflect the developments that have taken place in the world of emissions trading, including the launch of new systems and significant changes to existing systems.

STEP 1
Prepare

BOXES

FIGURES

TABLES

STEP 1
PREPARE

AT A GLANCE

Checklist for Step 1: Preparation

- ✔ Understand what carbon pricing and emissions trading are and how they work
- ✔ Determine the objectives for your ETS
- ✔ Decide the ETS's role in the climate policy mix
- ✔ Understand the ETS's interaction with other policies
- ✔ Select criteria to assess different ETS design options

Carbon pricing aims to make it more expensive to emit carbon dioxide and other greenhouse gases, to ensure that market actors take account of the costs of emissions when making commercial decisions. When facing a carbon price, firms will seek to minimize costs by investing in the most cost-effective abatement solutions, and consumers will change their behavior to substitute away from emissions-intensive goods. Carbon pricing instruments therefore help channel economic activities toward a low-carbon future.

An emissions trading system (ETS), also referred to as a "cap and trade" system, is one of the main policy instruments used to price carbon (alongside carbon taxes and crediting mechanisms). An ETS imposes a limit (cap) on the total emissions in one or more sectors of the economy, and issues tradable allowances not exceeding the level of the cap. Each allowance typically corresponds to one metric ton of emissions. Entities covered by the ETS are then allowed to trade them, resulting in a market price for these allowances.

The primary objective of an ETS is simple: it limits total covered emissions while providing incentives for mitigation to be achieved at the lowest possible cost. It also aims to drive a sustainable economic transformation by aligning profits with low-emission investment and innovation. These objectives relating to reducing greenhouse gas (GHG) emissions go hand in hand with achieving a wide range of positive outcomes including improved air quality, increased energy security, induced technological change, the creation of green jobs, and other benefits. Finally, by auctioning allowances rather than distributing them for free, an ETS also generates revenue for general use or to be earmarked to support programs and policies targeted at specific environmental or social outcomes.

An ETS alone, however, cannot address all of the barriers to cost-effective emissions reductions; for example, where non-price barriers like consumer preferences or information gaps exist, or where providing a strong-enough incentive requires undesirably high allowance prices. An ETS therefore works best as part of a well-thought-out policy package to achieve climate targets and drive sustainable development.

To position the ETS strategically within the broader policy portfolio, it is important to have a clear view of how the ETS will contribute to achieving a jurisdiction's climate policy objectives and how it relates to and interacts with other current or planned policies. Ensuring the right policy mix can improve overall outcomes and help build and maintain public support for the ETS.

Other policies in the climate change portfolio and in other relevant sectors (called here "companion policies") can affect the operation of the ETS, including the level of emissions reductions, the carbon price, and its distributional impacts. These policies can help improve the effectiveness of the ETS (complementary policies) but can also duplicate incentives provided by the ETS (overlapping policies), or in some cases, counteract incentives provided by the ETS (countervailing policies). Conversely, the ETS can also positively or negatively affect the functioning of other policies in a jurisdiction, including the achievement of economic, social, or environmental goals.

Before designing an ETS, policymakers should clearly establish the objectives that they want the ETS to deliver. This in turn will guide choices in ETS design. The most crucial criteria for an ETS are the system's environmental integrity, ability to deliver cost-effective mitigation, and appropriateness to local context. In addition, broader good governance considerations regarding accountability and transparency, robustness, compatibility with other policies, fairness, policy predictability, policy flexibility, administrative cost-effectiveness, and compatibility with other jurisdictions should be considered.

Section 1.1 lays out the fundamental principles behind carbon pricing, how it works, and the different policy instruments that can be used to implement it. Section 1.2 provides insight into the potential benefits of an ETS and the objectives it can serve. Section 1.3 then presents a framework to understand the ETS's role within a wider climate change mitigation policy portfolio, and its interactions with the policy landscape. Section 1.4 describes criteria against which ETS design options can be evaluated. Finally, Section 1.5 gives an overview of the theoretical basis for carbon pricing and emissions trading.

1.1 UNDERSTAND EMISSIONS TRADING

1.1.1 HOW CAN POLICYMAKERS PRICE CARBON?

Carbon pricing aims to make emitting carbon dioxide and other greenhouse gases more expensive and ensure that market actors take account of the true costs of emissions when making commercial decisions. Businesses and households are incentivized to change their production and consumption behavior, promoting lower-emissions outcomes. Firms and businesses will seek to minimize the costs associated with a carbon price by investing in the most cost-effective abatement solutions. At the same time, consumers will substitute lower-emissions products as these gain a relative cost advantage. Through this process, over time low-emissions producers will gain market share over high-emissions producers. Carbon pricing can therefore play a critical role in decarbonizing the economy.

The three main policy instruments used to price carbon are:

- **Carbon taxes:** Carbon taxes set a fixed price per unit of emissions to help internalize the cost of emissions and provide incentives for emissions reductions.
- **Emissions trading systems:** An Emissions Trading System (ETS) imposes a cap on the total emissions in one or more sectors of the economy. The regulator issues a number of tradable allowances not exceeding the level of the cap.[4] Each allowance typically corresponds to one ton of emissions.[5] Entities covered by the ETS are then allowed to trade these allowances, resulting in a market price for the allowances. This type of ETS is also called a "cap and trade system."[6]
- **Crediting mechanisms:** These mechanisms credit emissions reductions or carbon sequestration. They come in various forms, but generally operate by establishing a reference emissions level or intensity (called the baseline) and generating "credits" if firms reduce emissions to below the baseline level, or by permanently sequestering carbon. Crediting mechanisms thus create a supply of verified credits but cannot operate in the absence of sources of demand, which often comes from linking these to an ETS or a carbon tax (where credits can be used for compliance).

An important theoretical difference between ETSs and other carbon pricing instruments is that the level of emissions reduction is more certain (because the cap dictates the total emissions from covered sectors), but the price is not fixed and is determined by the demand for allowances.

In practice, most carbon pricing mechanisms act as a hybrid, including elements of carbon taxes, ETSs, and crediting systems. For instance, most ETSs employ price or supply adjustment measures (PSAMs) to control the price or quantity of allowances, leading to more certain prices and less certain emissions reductions (see Step 6). This makes the distinction between ETSs and taxes less clear. Different carbon pricing policies can also exist alongside each other at the same time: for instance, a carbon tax could apply in the transport sector, while emissions trading operates in the industry and power sectors.

Table 1-1 provides a brief comparison of an ETS and a carbon tax, the two main instruments employed by jurisdictions with a carbon pricing regime. Box 1-1 discusses the difference between cap and trade style ETSs and baseline and credit systems.

4 Alberta Carbon Competitiveness Incentive Regulation (CCIR) sets a facility-level emissions intensity target (as opposed to an absolute cap).

5 Allowances can be issued in units of tons carbon dioxide, or tons of carbon dioxide equivalent. The latter includes carbon dioxide as well as other GHGs (for example methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, sulphur hexafluoride, and nitrogen trifluoride) on the basis of their relative global warming potential. It is also possible that an allowance could correspond to a different mass of GHGs, for example, in Regional Greenhouse Gas Initiative (RGGI), an allowance corresponds to a short ton, which is approximately 0.9 metric tons.

6 The remainder of this report uses the term ETS to specifically mean a cap and trade system. However, it should be noted that, in theory, any mechanisms by which participants can trade emissions commitments is an ETS. The most notable is a baseline and crediting system, where firms have either credits or liabilities depending on their performance relative to a baseline function like an ETS — credits are traded between firms to meet any liabilities. However, it is distinct from a cap and trade system as it does not have a set limit or cap on emissions.

Table 1-1 Comparison of carbon taxes and ETSs

Element	Carbon Tax	ETS
Certainty of emissions levels	It is difficult to estimate emissions reductions achieved through a tax ex ante, making it hard to align to an emissions target.[7]	The cap provides certainty on an upper limit of emissions for the ETS, enabling its alignment to a certain policy target (for example carbon budget).[8]
Cost-effectiveness	A tax does not reap the economic efficiency gains of trading between entities and across sectors and offers less temporal price flexibility for regulated entities.	An ETS allows for economic efficiency between and within sectors (as a result of trading) and over time. However, market power, lack of liquidity, and excessive volatility in allowance prices can reduce cost-effectiveness.
Ease of administration and scope	Like an ETS, a tax requires a robust monitoring, reporting, and verification (MRV) system. However, it does not require setting up an infrastructure for trading allowances, and the ability to rely on existing tax infrastructure makes it easier to implement in a broad range of sectors.	An ETS is more complex to implement because in addition to the infrastructure required for a tax it also involves a secondary market for trading allowances. The regulator and regulated entities therefore need to have additional capabilities. This might make it more difficult to include certain sectors in the scope.
Price predictability	The carbon price is set by predefined tax rates. This provides a stable price signal to inform investment decisions.	The carbon price is determined by the market. This automatically adjusts for economic conditions but might lead to price volatility.[9] PSAMs can be used to increase price predictability in an ETS.

Box 1-1 Technical note: Comparison of cap and trade and baseline and credit systems

Theoretically, there are two types of emissions trading systems: cap and trade, and baseline and credit.[10] However, in practice, references to ETSs generally mean cap and trade systems.

The primary difference between the two systems is that under cap and trade, an upper limit on emissions is fixed (and emission allowances are either auctioned or distributed for free according to specific criteria), while there is no fixed limit on emissions under a baseline and credit system. Entities have either credits or liabilities depending on their performance relative to a baseline. Under both systems, emissions reductions or excess allowances can be traded between entities.[11]

Additionally, baseline and credit schemes are more complex, and generally more costly to administer. They involve calculating a baseline for every emitting activity or sector under the system, and then measuring the performance of each entity relative to the baseline. Cap and trade systems, on the other hand, do not require the calculation of a baseline. Instead, the key decision that drives mitigation ambition within these schemes is the level of the cap.

Some baseline and credit mechanisms use facility-specific targets to determine emissions baselines for crediting. While simple, this approach can be detrimental to more efficient facilities within an industry. This can lead to adverse effects, whereby less emissions-intensive facilities are made less competitive relative to more emissions-intensive facilities.

7 It can also be difficult to set an economically "optimal" tax rate, which suitably prices carbon but does not introduce market distortions. See the World Bank's *Carbon Tax Guide: A Handbook for Policy Makers* for further details.
8 However, PSAMs that permanently remove or add allowances to the cap may alter the emissions reductions achieved.
9 A dynamic price set by market forces will vary with the supply and demand of ETS allowances. Assuming the emissions level corresponds to economic activity, an economic contraction would lead to reduced demand for allowances from regulated entities, and therefore lower prices. Conversely, allowance prices would rise with a growing economy and growing emissions. However, rapid change in demand or supply can cause price volatility.
10 Organisation for Economic Co-operation and Development (OECD) 2019.
11 The presence of a system-wide cap is the main theoretical difference between a cap and trade and a baseline and credit system, but in practice, they can be made equivalent if all allowances are allocated for free using grandparenting (see Step 4).

The remainder of this handbook focuses on developing and maintaining an effective ETS. See also the forthcoming Partnership for Market Readiness (PMR) *Guide on Developing a Carbon Pricing Roadmap* for a step-by-step approach to selecting the right instrument for varying jurisdictional circumstances.[12]

1.1.2 WHY EMISSIONS TRADING?

Carbon pricing instruments help channel economic activities toward a low-carbon future. The attractiveness of an ETS in particular is simple: it sets a limit on total emissions while providing incentives for mitigation to be achieved at the lowest possible cost (see Section 1.5 for the theory behind an ETS's cost-effectiveness).[13]

1.1.3 HOW DOES AN ETS WORK?

This section sets out a nontechnical explanation of how an ETS works. See Section 1.5 for detail on the economic theory behind an ETS, and why it delivers cost-effective emissions reductions.

Under an ETS, the government imposes a limit (cap) on the total emissions in one or more sectors of the economy and issues a number of tradable allowances not exceeding the level of the cap. Each allowance typically corresponds to one ton of emissions.[14] The regulated entities in an ETS are required to surrender one allowance for every ton of emissions for which they are accountable. Entities that hold additional allowances after surrendering the allowances needed for compliance can sell them or bank them for future use; entities that require additional allowances may buy them on the market. They may also be able to use eligible emission allowances from other sources, such as domestic or international offsets mechanisms or other ETSs.

Placing a cap on allowances and establishing a market to trade them generates a uniform allowance price (the "carbon price"). The price incentivizes businesses to reduce the emissions from their operations if the cost of reducing emissions is lower than this price. The price reflects the stringency of the cap: a more stringent cap means fewer allowances are issued. All else being equal, this results in higher prices and therefore a stronger incentive for businesses to avoid the carbon price by reducing their emissions. In this way, the allowance price acts as a signal that favors lower-emission goods and services. Setting the cap in advance provides a long-term market signal so participants can plan and invest accordingly (for example, sourcing lower emission options when scheduled equipment upgrades occur).

Allowances can be allocated for free — based on some combination of historic emissions, output, and/or performance standards — or sold at auction. Auctioning allowances generates revenue for the government that can help pay for cuts in distortionary taxes, support spending on public programs (including other forms of climate action or to remedy adverse distributional effects of carbon pricing), or be returned to affected stakeholders directly.[15] Additional mechanisms can be used to support price predictability, cost containment, and effective market operation (see Step 6).

Confidence that an ETS is reducing emissions can be ensured through ambitious caps, robust MRV requirements, and the enforcement of penalties for noncompliance. This is facilitated by registries that are responsible for issuing allowances, tracking them as they are traded between different participants, and canceling them when they are used for compliance. Market oversight provisions safeguard the integrity of trading activity.

Different jurisdictions can choose to link their ETSs directly or indirectly through mutual recognition of allowances and other emission reduction units. Linking broadens access to least-cost mitigation, supports market liquidity, increases price stability, and enables political cooperation on carbon pricing.[16]

1.1.4 ETS DESIGN IN 10 STEPS

This handbook sets out a 10-step process for designing an ETS (illustrated in Figure 1-1). Each step involves a series of decisions or actions that will shape major features of the system. However, as stressed throughout the handbook, the decisions and actions taken at each step are likely to be interlinked and interdependent, which means that the process for working through them will not necessarily be linear.

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12 PMR (forthcoming).

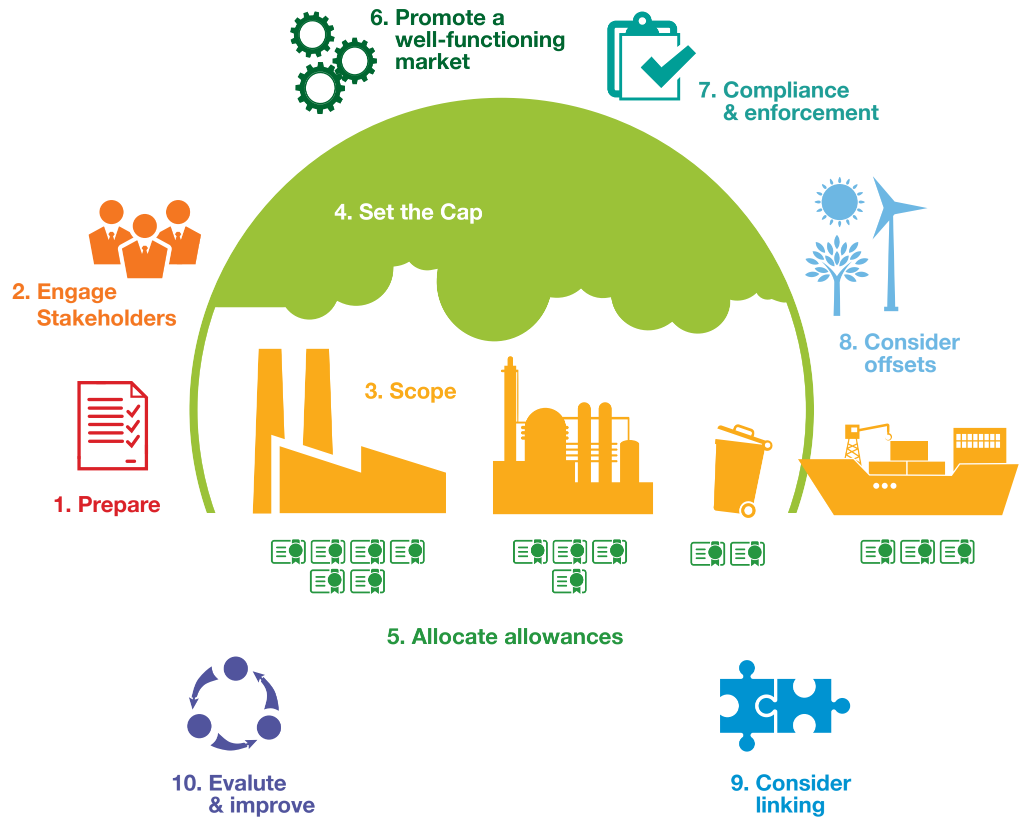
13 For the specifics around assigning property rights, see Coase (1960). Among practical policy instruments, emissions trading is the instrument that most directly implements a Coasian solution. See Crocker (1966), Dales (1968), and Montgomery (1972) for discussion on the effectiveness of trading allowances. See Fischer and Newell (2008) for a comparison of environmental policy instruments and their relative performance on emissions reduction, efficiency, and other outcomes.

14 Allowances can be issued in units of tons carbon dioxide, or tons of carbon dioxide equivalent. The latter includes carbon dioxide as well as other GHGs (for example methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, sulphur hexafluoride, and nitrogen trifluoride) on the basis of their relative global warming potential. It is also possible that an allowance could correspond to a different mass of GHGs; for example, in RGGI, an allowance corresponds to a short ton, which is approximately 0.9 metric tons.

15 See the PMR's *Using Carbon Revenues* report and ICAP's report *The Use of Auction Revenue from Emissions Trading Systems* for further detail.

16 ICAP has developed a series of ETS briefs that provide a basic introduction to emissions trading and its benefits. These are available at https://icapcarbonaction.com/en/icap-ets-briefs.

Figure 1-1 ETS design in 10 steps



1.1.5 EXTENSIVE EXPERIENCE WITH EMISSIONS TRADING

Emissions trading for GHGs originated in attempts to control local air pollutants from power plants in the United States in the 1970s.[17] It was implemented in earnest during the phase down of leaded gasoline in the United States during the 1980s, leading to an eventual phase out. The US Clean Air Act Amendments of 1990 established the first large-scale trading program with an absolute limit on emissions of sulfur dioxide emitted by power plants.[18]

Soon thereafter, the focus shifted toward climate, and some countries began experimenting with GHG emissions trading. The 1997 Kyoto Protocol established provisions for the trading of emissions/emission reductions among its parties. In 2005, the European Union (EU) and Norway established domestic ETSs and Japan instituted a voluntary trading program to help implement its Kyoto commitments. Some large companies have also gained experience with internal carbon pricing, which is not covered in this guide. GHG trading has spread since then, and jurisdictions have used a variety of different designs and approaches, as indicated in Figure 1-2. As of 2020, 28 different ETSs have been implemented or are under development globally (see Figure 1-3).[19] Important lessons can also be drawn from detailed policy proposals that were drafted but not implemented (as in the case of the US federal-level proposals) or implemented and then repealed (for example in Australia).

The development of ETSs occurs within the broader global climate policy context. Article 6 of the Paris Agreement of December 2015 affirmed the role of voluntary mitigation cooperation between countries, tying it to provisions to ensure its environmental integrity (see Box 1-2). Art. 6 therefore sends an important signal that is likely to accelerate the spread of carbon pricing, the establishment and linkage of ETSs (see Step 9).

17 Cap-and-trade was first introduced by Dales (1968). For a history of emissions trading in the United States, including these early years, see, for example, Ellerman, Joskow, and Harrison (2003).
18 Schmalensee and Stavins (2013) provide a good history.
19 See the *State and Trends of Carbon Pricing 2020* report (World Bank 2020).

Figure 1-2 Establishment of ETSs worldwide over time

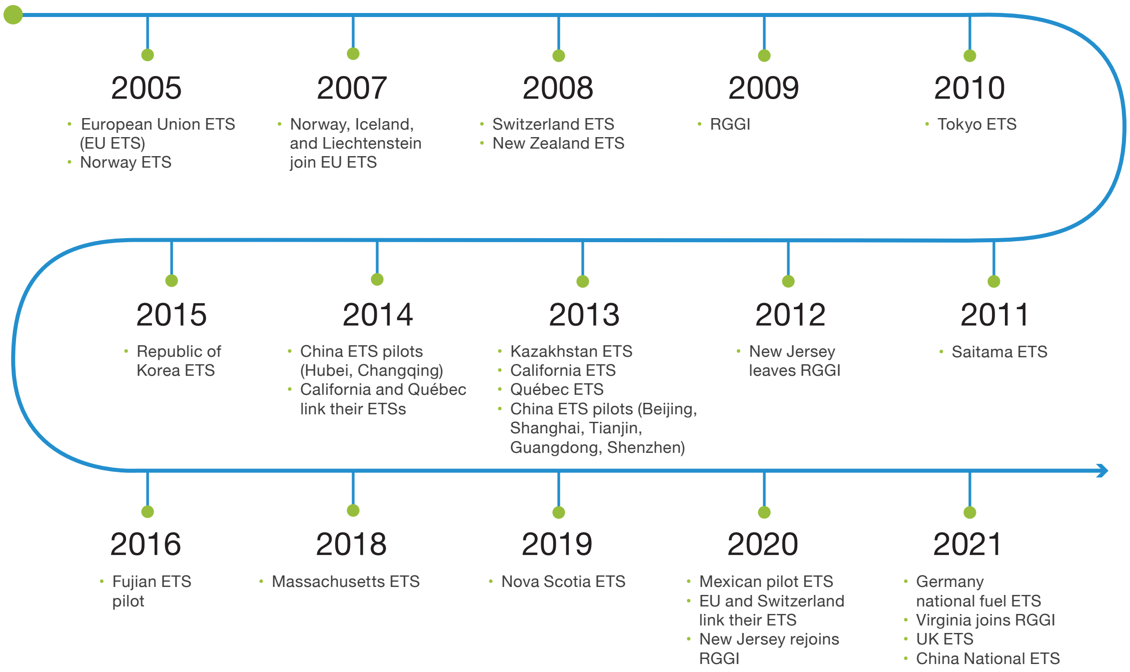
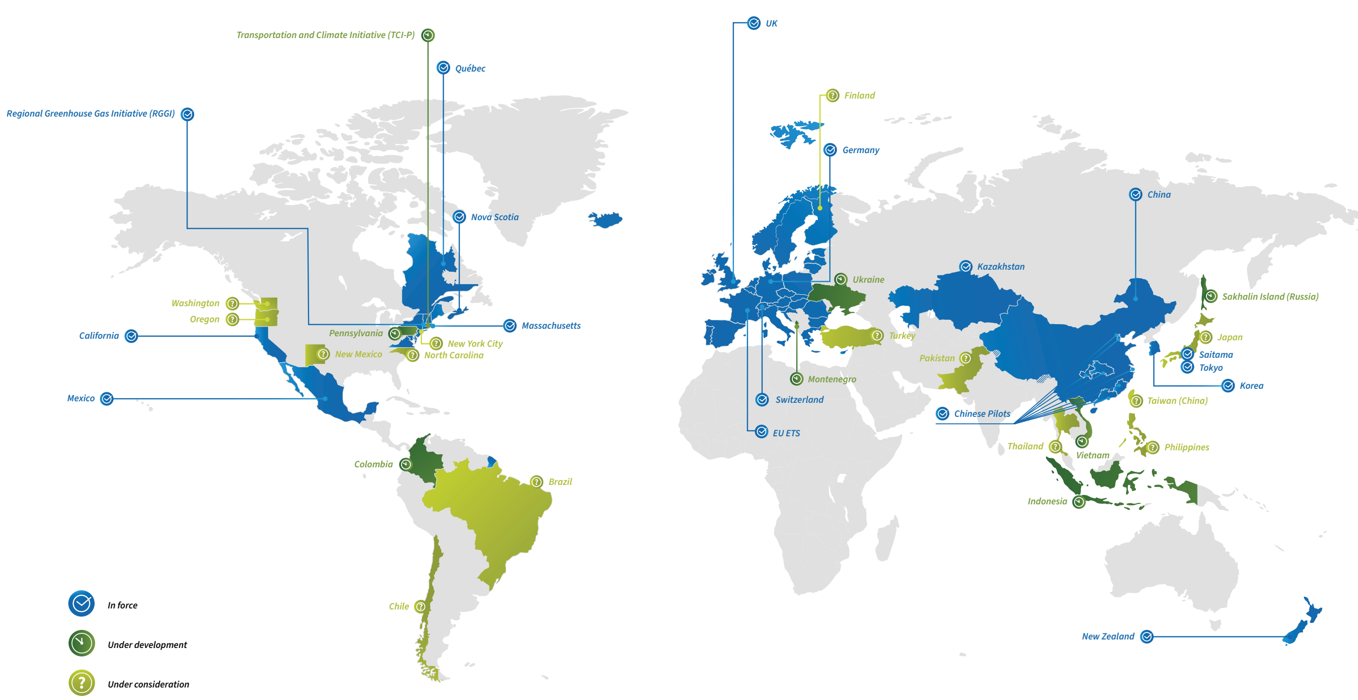


Figure 1-3 Emissions trading around the world



Source: Adapted from International Carbon Action Partnership (ICAP) 2021.

Box 1-2 Technical note: What the Paris Agreement means for markets

The Paris Agreement,[20] adopted by 195 nations in December 2015 under the auspices of the United Nations Framework Convention on Climate Change (UNFCCC), recognizes the role of international cooperation through carbon markets in its Article 6. The article stipulates that parties to the Paris Agreement can voluntarily cooperate in achieving Nationally Determined Contributions (NDCs) to "allow higher ambition … and to promote sustainable development and environmental integrity" (Article 6.1).

International cooperation includes:

- Cooperative approaches involving the use of "internationally transferred mitigation outcomes" (ITMOs) toward NDCs[21] under Article 6.2, which is largely understood as a channel of international cooperation, including an international accounting framework, under the authority of the parties involved. Article 6.3 requires that the use of ITMOs toward NDCs are authorized by all parties involved.
- Emission reductions generated by a central crediting mechanism under Article 6.4. This new mechanism, sometimes called a "sustainable development mechanism," will operate under UNFCCC oversight. It will "contribute to the mitigation of GHG emissions and support sustainable development," must "deliver an overall mitigation in global emissions," and will generate a share of proceeds to assist developing countries in adapting to the impacts of climate change.

In both approaches, double counting is to be avoided. In the decision accompanying the agreement, countries agreed to develop guidance for cooperative approaches under Article 6.2 (paragraph 36), as well as the rules, modalities, and procedures for the sustainable development mechanism (paragraphs 37–38). Rules for Article 6, however, have proven highly contentious: as of the end of 2020, parties under the Paris Agreement have yet to reach agreement on detailed rules for Article 6, and continue to work toward agreement. It is important to note that the Paris Agreement does not prevent parties commencing international cooperation under 6.2 in the absence of agreed rules.

In the meantime, jurisdictions are likely to continue work on domestic emissions trading, generating knowledge, standards, and practical experience, which will be critical to the development of guidance under the UNFCCC. Some parties are already pursuing ETS linking, and jurisdictions are also likely to continue to engage across different carbon markets. "Pilots" under Article 6.2 of the agreement have also been initiated through bilateral cooperation between countries. These, in turn, may facilitate future linkages and international trading.

1.2 DETERMINE OBJECTIVES FOR THE ETS

The fundamental objectives of an ETS are twofold: limiting emissions to a determined quantity and providing a robust price incentive for long-run investment in low-carbon technology. In addition to these objectives, policymakers can design an ETS to support other environmental, economic, and social goals consistent with their jurisdiction's priorities. Some of the objectives frequently stated for ETSs include driving sustainable development, reducing emissions at low cost, promoting innovation and competitiveness, delivering co-benefits like reducing air pollution, and finally, raising revenue through auctioning allowances. These objectives are described in more detail in the following subsections.

The design of an ETS is an evolutionary process, and goals and circumstances may mature with time. For example, policymakers' and participants' ability to handle complexity could increase through learning and experience, jurisdictional ambition could rise, or the global climate policy landscape might evolve. This means policymakers should review the ETS design periodically along with the system's goals and anticipate improvements to their ETS over time (see Step 10). For example, an ETS may wish to graduate from free allocation to a greater use of auctioning as businesses and policymakers develop sufficient readiness.

1.2.1 DRIVE ECONOMIC TRANSFORMATION AND SUSTAINABLE DEVELOPMENT

Accelerating the low-carbon economic transformation requires a shift in investment patterns and behaviors, as well as innovation in technologies, infrastructure, and

20 UNFCCC 2015b.
21 Article 6.2 only speaks of the use of ITMOs toward NDCs. Paragraph 77(d) of decision 18/CMA.1, however, broadens this to parties that authorize the "use of mitigation outcomes for international mitigation purposes other than achievement of its NDC."

financing. In particular, action is needed to decarbonize the production of electricity, electrify transportation or switch to cleaner fuels, improve efficiency and reduce waste in all sectors, and preserve and increase natural carbon sinks like forests. Policies need to achieve these changes in ways that reflect local circumstances, create new economic opportunities, and support the well-being of all citizens.

For many jurisdictions, carbon pricing is emerging as a key driver of this transformation.[22] By aligning profits with low-emission investment and innovation, a price on GHG emissions can channel private capital flows, mobilize knowledge about mitigation within firms, tap the creativity of entrepreneurs in developing low-carbon products and innovations, and hence drive progress toward reducing emissions intensity.

A price on emissions makes clean energy more profitable, allows energy efficiency to earn a greater return, makes low-carbon products more competitive, and, depending on the sectoral coverage, can value the carbon stored in forests and other greenhouse gas sinks. Firms are able to leverage industry-specific private knowledge in order to reduce emissions efficiently, without the need for governments to provide detailed regulation. An increasing number of firms and investors are advocating for carbon pricing policies from government, and some are applying an internal carbon price to guide investment in advance of government policy to that effect.[23]

1.2.2 REDUCE GREENHOUSE GAS EMISSIONS AT LOW COST

In international negotiations, most recently through the Paris Agreement, countries have agreed on the need to reduce global GHG emissions to limit temperature rise and avoid the worst impacts of climate change. Governments have also increasingly recognized the benefits from a green economic transition for economic growth and sustainable development. Governments at all levels have set targets for reducing their GHG emissions over time, on either an absolute or an intensity basis.

In this context, carbon pricing can be a key driver of decarbonization. Both theory and empirical studies suggest that carbon pricing is one of the most cost-effective tools for reducing emissions, especially in the short- to medium-term.[24, 25] In turn, these lower costs open the opportunity to take more ambitious action.

1.2.3 PROVIDE CO-BENEFITS OF MITIGATION

Reducing GHG emissions goes hand in hand with a wide range of benefits that can include improved air quality, increased energy security, induced technological change, the creation of green jobs, preservation of forests, and lower urban congestion from the reduced use of passenger vehicles.

A notable source of co-benefits is the improvement of local air quality. Air pollution has detrimental impacts on public health and productivity and is a major issue in urban areas in both the developed and developing worlds. Emissions-intensive processes are associated with high levels of local pollutants and poor air quality, notably due to coal-fired power plants and road transportation. One study estimates that a 50 percent reduction in GHGs by 2050 relative to 2005 levels could lead to a 20 to 40 percent reduction in premature deaths due to air pollution over the same time period.[26] The potential for reducing air pollution has been among the most important considerations in establishing ETSs in California and China alike.

Preserving local environments can be similarly important, in particular when forests and land-use change are either included in the ETS or linked via offsets (see Step 8). For example, avoiding carbon losses from tropical forest destruction can help reduce flooding and drought, contribute to the preservation of biodiversity and other ecosystem services, and support the livelihoods of forest-dependent communities.

22 Martin, Muûls, and Wagner (2016) find that firms are responding to climate policy in the EU, with industrial firms reducing emissions by as much as 10–26 percent in France and Germany. Wilson and Staffel (2018) found that the United Kingdom's carbon price was a primary driver for its rapid switch from coal to natural gas. Murray and Rivers (2015) also found significant effects of carbon pricing, estimating that British Columbia's carbon tax resulted in an emissions reduction of 5–15 percent reduction compared with the counterfactual. Best et al. (2020) analyzed data from 142 countries over two decades, finding that the average annual growth rate of CO_2 emissions from fuel combustion has been around two percentage points lower in countries that have had a carbon price compared to countries without one.

23 Recent examples of engagement of public–private coalitions advocating for carbon pricing include the statement "Putting a Price on Carbon" (June 2014) supported by over 1,000 companies and investors along with national and subnational jurisdictions (see World Bank 2014); an open letter to governments and the United Nations from six major oil companies (June 2015) calling for an international framework for carbon prcing systems (see UNFCCC 2015a); the launch of the Carbon Pricing Leadership Coalition (November 2015), whose government and private sector participants are committed to building the evidence base for effective carbon pricing (see Carbon Pricing Leadership Coalition 2015); and a pledge from the CEOs of the world's largest oil and gas companies and investment funds to adhere to the Paris Agreement (see Fortune 2019).

24 In order to avoid the risk of lock-in of carbon-intensive assets over the longer term, policy signals that are complementary to a carbon price will also be important. This is discussed further in Section 3.4 below.

25 Fischer and Newell (2008) provide evidence on the cost-effectiveness of carbon pricing compared to other policies like performance standards, renewables subsidies, renewables share requirements, and research and development subsidies.

26 Bollen et al. (2009) survey the literature on co-benefits of climate change policies, mainly focusing on local air pollution. Their empirical analysis shows that a global reduction of 50 percent in GHG emissions in 2050, relative to 2005 levels, could reduce the number of premature deaths due to air pollution by 20 to 40 percent in 2050. Under this scenario the benefits in China were valued at 4.5 percent of GDP. Parry, Veung, and Heine (2014) find that domestic environmental benefits exceed the CO_2 mitigation costs, even leaving aside climate benefits.

Further information on potential co-benefits from carbon pricing is included in the PMR's forthcoming *The Co-benefits of Carbon Pricing*.[27]

1.2.4 RAISE REVENUE

ETS allowances can be distributed through auctioning, free allocation, or a combination of the two (see Step 5). Allowances allocated through auctioning generate revenue for the government, which can flow into the fiscal budget for general use or be earmarked for environmental or social purposes.[28] For example, revenues from the RGGI have been used to offer low-income customers assistance with electricity bills and to fund job-training programs.[29] Raising funds for the pursuit of developmental objectives like health and education, to ease adverse distributional impacts of carbon pricing, or to increase investment in low-carbon technology or research might be important objectives for the ETS.

As the price of ETS allowances has increased, global revenues from carbon pricing have grown significantly. By the end of 2019, ETSs globally had raised over USD 78 billion (EUR 70.3 billion) in cumulative auction revenue.[30] Fluctuations in the carbon price can have a large effect on the size of revenues (as evidenced by the dip in allowance prices and carbon revenues due to the global coronavirus pandemic in 2020). However, it is expected that revenues will generally continue to grow as carbon prices rise in conjunction with jurisdictions' ratcheting ambitions under tightening climate goals and the Paris Agreement.[31] Additionally, the number of allowances auctioned will also increase as more established ETSs transition from free allocation to auctioning.

Further discussion on raising revenue and guidance on using revenue to address any distributional impacts of the ETS can be found in Steps 2 and 5. The PMR's *Using Carbon Revenues* report and International Carbon Action Partnership's (ICAP) *Use of Auction Revenue from Emissions Trading Systems* report also provide an in-depth look into the ways in which revenue from carbon pricing has been and can be used.

1.3 CONSIDER INTERACTIONS BETWEEN AN ETS AND COMPANION POLICIES

The design and introduction of an ETS will invariably take place in a broader context of climate and energy policies, as well as other public policies that will either support or run counter to mitigation objectives (collectively called "companion" policies). Policymakers will therefore face trade-offs between the benefits of an ETS and those of other policies, and must choose the role of the ETS within the wider policy mix to best suit their jurisdictional context. As such, it is important to conduct a systematic assessment of potential policy interactions with a focus on four key areas:

1. the role of the ETS in the climate policy mix;
2. the impact of companion policies on ETS outcomes;
3. the impact of the ETS on the attainment of companion policy objectives; and
4. understanding where additional companion policies may be needed to achieve overarching climate targets and drive sustainable development.

Each of these four issues is explored in more detail below.

To support an assessment of this sort, it is crucial to begin identifying and classifying (or "mapping") companion policies and assessing their potential interactions with the ETS.[32] While the most obvious policies to include in such a mapping exercise are other policies focused on climate change mitigation or energy (see Box 1-3) it may also be helpful to include policies relating to other issues. These include, among others, policies related to environmental issues, financial market regulation, energy market regulation, taxation, international trade, foreign affairs, industrial development, transportation, infrastructure, research and innovation, economic development, social welfare, and education.

27 PMR (forthcoming).
28 The possible options for revenue use will also depend on the jurisdiction's legal framework. Some jurisdictions have strict rules about *ex ante* earmarking of revenues.
29 See RGGI 2018.
30 ICAP 2020b.
31 This is discussed further in the PMR's *Using Carbon Revenues* report.
32 The PMR's forthcoming *Guide to Developing a Carbon Pricing Roadmap* provides a template for mapping policy interactions. Hood (2013) provides a comprehensive list of questions to assist in mapping the potential interactions between emission pricing and existing energy policies, while OECD's (2015) *Aligning Policies for a Low-Carbon Economy* provides a comprehensive overview on low-carbon policy alignment.

Box 1-3 Technical note: Other climate policy instruments

Carbon taxes set a price on carbon emitted, without a firm emissions limit. Taxes, along with emissions trading (together known as "market-based approaches"), are widely regarded as the most cost-effective policies to reduce emissions.

Standards and other "command and control" regulation typically set uniform rules that new and/or existing emitting facilities must follow, with regard to levels/rates of GHG emissions and/or co-pollutants, technologies used in production, energy efficiency, or the end product itself. Targets for renewable energy or renewable fuels production and energy efficiency are especially relevant for GHG emissions, as well as building codes and land-use zoning and regulations. Depending on how standards are set, they can be complemented by market-based elements that enable obligations to be met in a more flexible way (for example, US renewable portfolio standards for renewable electricity generation with tradable credits across systems or India's Perform, Achieve, and Trade system for energy efficiency). Such combinations of standards and flexibility mechanisms have similarities to an ETS, except the quantitative target is on a different measure (for example renewable energy as a percentage of energy production or consumption) rather than on emissions themselves.

Government provision of public goods and services includes funding research, strategic infrastructure, public transportation services, conservation of state-owned resources, or any other government action with the intent and result of reducing emissions.

Subsidies, tax rebates, concessionary finance, or risk guarantees can be used to encourage renewable energy production, energy efficiency, or other investments that will allow emissions reductions. They may also correct for market failures in the research, development, and deployment process by supporting new technologies. Subsidies for high-emitting industries can perversely increase their output.[33]

Information and education programs include raising awareness about impacts of emissions on decisions and about mitigation opportunities and increasing the salience of price signals. Environmental certification or labeling programs, for example, help consumers make more informed decisions.

Voluntary measures refer to any agreement by private parties to achieve environmental goals above and beyond what is regulated. Examples might include companies focusing on achieving carbon neutrality or other sustainability goals across their own supply chains and procurement practices. Policy measures may be designed to encourage such steps.

1.3.1 THE ROLE OF THE ETS IN THE CLIMATE POLICY MIX

The climate policy landscape can differ greatly from one jurisdiction to another. This means the most suitable carbon pricing approach for one jurisdiction may not be appropriate for another jurisdiction, with local context being a key consideration in choosing the best policy instrument. Further discussion on this can be found in the PMR's report *Developing a Carbon Pricing Roadmap*.[34]

An ETS works best as part of a well-thought-out policy package to achieve climate targets and drive sustainable development. It provides a price incentive for abatement, but this may not be fully effective in all circumstances; for example, where non-price barriers exist, or where creating a strong enough incentive requires undesirably high allowance prices. Section 1.3.4 provides more detail on identifying areas where companion policies may be needed.

To position the ETS strategically within the broader policy portfolio, it is important to have a clear view of how the ETS will contribute to achieving a jurisdiction's climate policy objectives and its relationship with other current or planned policies. Ensuring the right policy mix can improve overall outcomes and help build and maintain public support for the ETS.

Jurisdictions have taken different approaches to positioning their ETS relative to other companion policies. The EU ETS was established to help meet EU-wide emissions reductions targets cost-effectively by introducing a common emissions price signal across Member States. The EU ETS covers electricity generation and energy-intensive industries. In parallel, emissions from sectors outside the scope of the EU ETS are regulated through targeted policies at the EU or Member States level. The EU climate targets are reflected in the EU ETS emissions cap and national emissions reductions targets for uncovered sectors, and are integrated within a broader

33 For example, Tsao, Campbell, and Chen (2011) study renewable portfolio standards, concluding that increasing their level not only would not reduce emissions reduction, but could also benefit coal and oil, and make natural gas units worse off. Levinson (2011) discusses the interactions of different traditional regulations with an ETS and suggests that the administrative costs involved in traditional regulations would hamper the cost-effectiveness of the latter. See Fischer and Preonas (2010), who draw a similar conclusion.

34 PMR (forthcoming).

set of objectives at the EU level (which also include energy efficiency and renewable energy). However, Member States have a clearly defined ability to define their own energy mix, ensure security of supply, and determine the way in which to achieve these targets.[35]

In the case of California, the ETS was adopted within a broad climate change policy portfolio, alongside an array of sector-specific regulations and programs. The ETS price signal was expected to primarily impact those parts of the economy that could not be reached by targeted regulation, while serving as a backstop to ensure that emission targets would be met if the other measures proved less effective than hoped.[36] In contrast, New Zealand currently employs an ETS as its primary mitigation instrument, emphasizing that it offers an equitable approach by covering all sectors and gases over time, and enables linkages to international markets that would support meeting its international commitments at least cost. In other jurisdictions, for example China, ETSs are designed in a way that reflects specific regulatory arrangements for certain sectors (for example the electricity sector) and the respective emission abatement levers.

In some cases, a gradual start to the introduction of an ETS may be appropriate, with the role of the ETS taking on greater importance over time (see Step 10). For instance, a gradual start to an ETS may be appropriate while a jurisdiction develops its MRV systems, or while it engages in capacity building for liable firms.

Each of these approaches is legitimate and reflects the specific circumstances of the implementing jurisdictions. Taking the time to consider the role of an ETS at an early stage can help clarify objectives and ensure that later design decisions on specific elements reflect these objectives.

1.3.2 THE IMPACT OF COMPANION POLICIES ON ETS OUTCOMES

Existing and new companion policies can affect the operation of the ETS, including the level of emissions reductions, the emissions price, and the system's distributional impacts. These policies can help improve the effectiveness of carbon markets (complementary policies), duplicate incentives provided by carbon markets (overlapping policies), or in some cases, counteract incentives in carbon markets (countervailing policies).

Figure 1-4 summarizes the types of potential effects companion policies can have and provides examples of specific interactions. The types of companion policies are then discussed below.

Complementary policies

Complementary companion policies enhance the impact of an ETS in constructive ways. For instance, they can

- provide greater policy certainty to participants about the transition to a low-emission economy;
- facilitate the pass-through of carbon prices across the supply chain to change behavior;
- put in place enabling infrastructure;
- reduce the disproportionate or regressive impacts of emission pricing;
- provide incentives for innovation and early commercialization of mitigation technologies; or
- reduce other non-price barriers to mitigation (for instance information problems, skills gaps, or non-price behavioral barriers).[37]

Figure 1-4 The impact of companion policies on ETS outcomes

	Examples	Likely impact on allowance demand and carbon price in an ETS
Complementary improve functioning of carbon markets	• energy market reform (e.g. facilitating cost pass-through) • infrastructure upgrades • energy efficiency labeling • pollution/emissions measurement	↓
Overlapping duplicate incentives in carbon markets	• feed in tariffs • green certificate programs, such as renewable energy targets	↓
Countervailing oppose incentives in carbon markets	• fossil fuel subsidies • industry tax breaks and special treatment	↑

35 Article 192 of the Treaty on the Functioning of the European Union.
36 California Air Resources Board 2017.
37 For further discussion on developing an effective package of emission pricing and complementary policies, refer to Matthes (2010), Hood (2013), and Schmalensee and Stavins (2015).

Box 1-4 Technical note: Incentives for innovation to complement ETS

Potential innovators do not account for the social benefit their innovations will achieve, leading to less innovation activity than is socially optimal. Just as pricing carbon can effectively internalize the negative externality and make emitters face the true cost of their actions, *subsidizing innovation* can internalize this positive externality. When, for example, governments support the research and development of low-carbon and energy efficiency technology, innovators face price signals that better reflect the true social value of their ideas and activities. Once the technology is deployed, the subsidies can decrease.

This process is known as "directed technical change." By providing additional incentives for new technologies, through policies external to the ETS, and reducing those incentives as the learning-by-doing spillover takes hold, governments can help stimulate innovation within the market to a much greater extent than under an ETS alone. The key challenges with this approach are to limit the support given to technologies that will ultimately prove to be socially unproductive, and to enable the reduction or removal of subsidies when a technology is mature and no longer needs support.

Practice shows that in some circumstances direct intervention over and above the incentive provided by the ETS may well be justified. California's Solar Initiative alongside its comprehensive Cap-and-Trade Program is one notable example of directed technical change.[38] German feed-in tariffs have had a similar effect, subsidizing large-scale renewables deployment, alongside the European Union ETS. However, the impact of such companion policies on system functioning needs to carefully assessed and accounted for in cap setting (see also Section 1.3.2).

Overlapping policies

Companion policies may be overlapping, particularly if they are not reflected appropriately in the design of the ETS. This is most likely to be a challenge in relation to energy-sector policies and regulations, especially those addressing energy efficiency, low-carbon energy, or technology innovation. If these policies lead to emission reductions in sectors already covered by the ETS and not accounted for in the cap, then this causes the allowance price to fall (as demand for allowances will be lower) and dilutes the price signal. It also allows emissions from other covered sectors under the emissions cap to rise. This stops the ETS from delivering short-term, least-cost mitigation.[39]

There are often good reasons for operating overlapping policies in parallel with an ETS, including supporting the penetration of certain transformational technologies, addressing behavioral biases, or avoiding lock in of capital in assets that may be stranded in the future. Vehicle fuel efficiency standards, for example, may overcome consumer inertia or motivate changes in purchasing behavior where the carbon price is not sufficient to do so.

Countervailing policies

In general, jurisdictions should try to avoid countervailing policies (like fossil fuel subsidies) that oppose carbon market incentives. However, this too requires careful analysis, as these policies may achieve other policy objectives that may be of value. Policymakers must trade off achieving emissions reductions with the importance of other objectives. As such it is important that countervailing policies are considered on a case-by-case basis. This is discussed further in Section 1.3.3 below.

Managing policy interactions

An approach to managing the ETS's interactions with companion policies can include ensuring that:

- Policy interactions are analyzed carefully, and the impacts of complementary policies are taken into account in the design features (such as cap setting and PSAMs) that affect the emissions reductions achieved by the ETS. This enables the different policies to support each other as much as possible.
- Overlapping policies should be reviewed to ensure their goals are clearly defined and to identify potential changes that could improve interactions. Overlapping policies often pursue important objectives such as encouraging the deployment of mitigation options to lower their long-term costs, inducing changes in behavioral patterns that the ETS price signal cannot address, or other objectives such as improved air quality. Where overlapping policies do not seek to address issues in addition to those targeted by the ETS, or if detrimental impacts of overlapping policies are large, then policymakers should consider redesigning or removing these policies.
- Countervailing policies should be removed, unless there are compelling strategic objectives (such as security of energy supply) that they seek to achieve. In many

38 See Acemoglu et al. (2012), who show that optimal climate policy involves both a carbon price and research subsidies. See also van Benthem, Gillingham, and Sweeney (2008), who look specifically at the case of solar subsidies in California.

39 Alternatively, if an ETS forces greater emission reductions than would happen under coexisting policies, the latter may be rendered redundant, at least from the point of view of cost-effective mitigation, at an administrative cost to both the government and regulated entities. This type of impact is described in Section 3.3.

cases, these policies can be amended to ensure they continue to serve these objectives, while reducing negative effects on the ETS.

Finally, policy interactions do not occur solely between an ETS and other climate — or even energy and environmental — policies. An ETS has to be implemented through a legal framework consisting of different rules and procedures (see Step 7). This, in turn, can be affected by or conflict with rules and procedures in a number of other areas of law, such as financial market regulation, property law, contract law, tort law, tax law, and financial accounting law. Before elaborating the legal framework of the ETS, therefore, regulators have to carefully consider all such interactions and overlaps to ensure coherence and consistency with the broader legal system.

1.3.3 THE IMPACT OF THE ETS ON THE ATTAINMENT OF OTHER POLICY OBJECTIVES

As well as considering the impact of companion policies on the cost-effectiveness and environmental efficacy of an ETS, the effect of an ETS on these policies should also be considered. Again, the ETS's effect on these policies could be complementary, overlapping, or countervailing.

The ETS may affect the achievement of economic, social, or environmental goals. For instance, the promotion of energy efficiency facilitated by an ETS may facilitate meeting policy objectives related to energy security by lowering energy consumption. An ETS that prices emissions from the forestry sector may also complement environmental regulation by creating a further financial incentive for landowners to enter into long-term forest protection covenants. On the other hand, the potentially regressive impacts of carbon pricing on low-income households and small and midsize enterprises, or carbon-leakage effects for exposed industries, could run counter to other policies supporting their advancement (see Step 5, Section 1.1.2).

The revenues raised from ETS allowance auctions can also be used to promote other policy objectives or counteract the regressive distributional impacts of carbon pricing (by, for example, reducing distortionary taxes or providing funds to identified policies and programs in line with policy objectives). A more detailed discussion on the use of revenues from ETS auctioning can be found in the PMR's Using Carbon Revenues report and in ICAP's *Use of Auction Revenue from Emissions Trading Systems* report.

1.3.4 UNDERSTANDING WHERE ADDITIONAL COMPANION POLICIES MIGHT BE NEEDED

As well as considering the interactions, in both directions, between an ETS and existing policies, the introduction of an ETS may prompt policymakers to consider whether additional companion policies are needed to increase the effectiveness of the ETS and/or to meet related policy objectives. These policies may be introduced in covered or uncovered sectors. Each of these cases is discussed below.

Covered sectors

An ETS aims to reduce emissions by transmitting a price signal (in the form of the allowance price) to regulated entities, which then find cost-effective ways to abate emissions. Policymakers may wish to support these entities by implementing additional policies that, for example, reduce transaction costs, establish enabling infrastructure, or overcome non-price barriers to implementing abatement solutions. They may also wish to support certain sectors with additional policy measures to ease the transition to carbon pricing, and align with national development strategy. However, benefits from doing so might come at the cost of increasing the complexity of the regulatory environment and diluting the price signal (as a result of downward pressure on allowance prices).

Reasons for implementing companion policies in covered sectors include

- **Overcoming non-price barriers:** Even for sectors covered by an ETS, various market and regulatory barriers can prevent the diffusion of cost-effective technologies and practices.[40] For example, electricity grid management regulations may not easily accommodate distributed generation from solar panels, or building developers may not be able to recover cost savings from energy efficiency investments that would provide benefits to future tenants.[41] The introduction of complementary policies such as energy efficiency standards can reduce these regulatory or market barriers that would otherwise discourage the use of low-cost mitigation options from covered sectors.
- **Incentivizing innovation and investment in long-term solutions:** In the longer term, complementary measures can pave the way for additional emissions reductions, even if applied to sectors covered by the ETS. While an ETS provides a price signal that at least partly addresses the externality associated with GHG emissions, it does not address another positive externality: the spillover from low-carbon innovation,

40 Fischer and Newell (2008) and Lehmann and Gawel (2013), for example, suggest that policies to support renewables development and deployment would be good complements to ETSs.

41 See Jaffe and Stavins 1994, Scott 1997, and Schleich and Gruber 2008.

in the form of increased knowledge and other social benefits. This may well provide a justification for additional policy action to create incentives for private investment in research and development for clean energy and other abatement technologies.

- **Directing strategic outcomes in certain industries:** As a broad price instrument, an ETS cannot necessarily be used to guarantee specific strategic outcomes in covered sectors. The government may wish to consider whether additional policies are desired to influence where, how, or when specific types of mitigation investments, technology changes, or structural reform occur.

Uncovered sectors

Policymakers might consider the use of complementary policies in uncovered sectors for two reasons:

- **Preventing leakage:** Complementary policies (like efficiency standards) can be introduced in sectors that are politically or logistically difficult to regulate through an ETS. While covering them in the ETS (and therefore equalizing carbon price across these sectors) is the best option to reduce domestic leakage, other policies can also help level the playing field between ETS and non-ETS sectors.
- **Reducing emissions:** Typically, a mix of policies will be required to deliver on overarching climate targets. Complementary policies applied in uncovered sectors help increase abatement effort and drive sustainable development in the wider economy of the jurisdiction.

The advantages and disadvantages of considering complementary measures are summarized in Table 1-2.

Table 1-2 Advantages and disadvantages of complementary measures

	Advantages	Disadvantages
Covered sectors	▲ Can help overcome high transaction costs and other barriers to adopting energy efficiency and other low-emissions technologies ▲ Possible additional GHG emissions reductions in the long run due to targeted technological innovation, enabling stricter future ETS caps ▲ Easier to target *where* emissions occur and, thus, target reductions in areas where there were preexisting air quality concerns, provide other local co-benefits, and support just transition for heavily affected sectors	▲ Can reduce price under ETSs and, thus, lead to weaker emissions reductions signals in other sectors under the cap if the cap is not adjusted to account for reductions made through complementary policies
Uncovered sectors	▲ Emissions reductions in sectors or sources not otherwise included in ETS ▲ Lower potential leakage from covered sectors	▲ Typically less cost-effective than including sectors or sources under the cap at least for the short- and medium-term

1.4 KEYS TO EFFECTIVE ETS DESIGN

Once objectives for the ETS have been determined, policymakers may wish to decide a set of criteria consistent with those objectives against which to assess ETS design options. These must be reviewed regularly after implementation to ensure they continue to reflect the latest best practices, improved capacity, and local policy landscape.

Some of the most important criteria are discussed below.[42]

- **Contribution to mitigation by limiting emissions.** Environmental integrity is perhaps the key criterion for assessing whether an ETS is successful. This requires a sufficiently tight emissions constraint coupled with effective MRV to ensure that reported emissions are accurate, the cap is being enforced, and there is enough confidence in the level of long-term prices to drive investment in low-carbon solutions. Minimizing the risk of carbon leakage (the shifting of production or investment to areas outside the cap, resulting in an increase in global emissions) is another determinant of environmental effectiveness, as is ensuring the integrity of emission units, such as offset credits entering the system from outside the cap.
- **Cost-effectiveness of mitigation.** Economic efficiency and cost-effectiveness are at the core of ETS design. Emissions trading is intended to minimize abatement costs given a particular mitigation goal. The greater the flexibility as to when and where emission reductions take place, the higher the potential for low-cost emissions reductions. The effectiveness of an ETS in

42 For alternative criteria, see Government of Australia (2008b), California Market Advisory Committee (2007), US Environmental Protection Agency (2003), Goffman et al. (1998), and Weishaar (2014), among many others.
Further discussion on effective design is provided by the FASTER Principles for Carbon Pricing (Fairness, Alignment of policies and objectives, Stability and predictability, Transparency, Efficiency and cost-effectiveness, Reliability and environmental integrity), which were jointly developed by the OECD and World Bank Group.

delivering least-cost abatement across covered sectors can also be influenced by how well it is integrated with other policies (for example energy) affecting emissions in those sectors (see Section 1.3).

- **Accountability and transparency.** Strong MRV, enforcement principles, and robust registry design ensure the accountability and transparency of the system. Design decisions must also be made transparently to help build trust in the system and allow market participants and investors to plan ahead.
- **Appropriateness to local conditions.** ETS design is driven by local objectives and context. While a common set of building blocks can be used to construct an ETS, in order for it to function effectively the precise features of each system must be tailored to the jurisdiction. This includes the preexisting regulatory and market context; the size, growth rate, and composition of the economy; the emissions and abatement opportunity profile of the economy; the ambition of the jurisdiction's climate target; and the capacity and strength of relevant institutions.
- **Robustness.** Experience with existing ETSs shows that appropriate mechanisms to manage price and quantity shocks must be built into the system and need to be considered at the design stage. While some volatility in prices is to be expected, and is in fact desired in order to transmit signals about abatement costs to market participants, excessive price variability as a result of exogenous shocks, regulatory uncertainty, and market imperfections might necessitate intervention in the market. Policymakers must gauge the acceptable level of variability for their local conditions and design PSAMs to ensure a consistent price signal for investment and robustness of the system.
- **Compatibility with other policies.** An ETS that has a well-defined place within the jurisdiction's climate policy ecosystem is more likely to achieve the desired mitigation most efficiently. A review of existing and proposed climate and energy policies is necessary to avoid duplicating effort through overlapping policies, and higher than necessary costs due to countervailing policies. ETS design should also be aligned with existing companion policies in order to maximize benefits and minimize costs (see Section 1.3).
- **Maintaining policy alignment over time.** As well as seeking policy alignment at the time at which an ETS is introduced, policymakers will need to ensure that policies remain aligned over time. As part of a broader process for establishing and maintaining policy alignment, policymakers should initiate regular energy policy and carbon pricing policy reviews, and establish institutional setups that facilitate policy coordination.
- **Fairness.** Equity and fairness are inherently important concepts to consider in the design of environmental policies. Furthermore, emissions trading is not possible without political support. Ensuring fairness to all involved, especially in the distribution of costs and benefits, is at the core of gaining and maintaining that support, and hence giving stakeholders confidence that the system will endure.
- **Policy predictability.** The more predictable the system, the smoother its operation and the more cost-effective emissions reductions will be. Deciding on, and effectively communicating, key design features early in the process, and providing clear processes and parameters for future changes, enhances predictability.
- **Policy flexibility.** Given the long-term nature of the climate challenge and various economic and scientific uncertainties, there is a need to preserve policy flexibility and allow decision makers to adjust the overall target or the schedule for achieving the target and specific design features in response to changing conditions. However, there will often be some tension between policy flexibility and ensuring predictability.
- **Administrative cost-effectiveness.** Administrative costs are most directly affected by the scope of the system, the choice of point of obligation, the frequency with which data needs to be reported and compliance proven, and the requirements for compliance and enforcement. There is a careful trade-off to be made between reducing transaction costs and achieving ideal accountability and transparency outcomes, particularly with respect to MRV requirements.
- **Compatibility with other jurisdictions.** Consistent ETS design features across jurisdictions allow for a coordinated climate policy architecture, most directly in the form of linking, which can enable emissions units from other systems as valid compliance instruments within an ETS. Greater compatibility can also reduce regulatory and administrative burdens for companies operating in multiple jurisdictions and allow for greater transparency, as systems and outcomes are comparable.

The World Bank and the Organisation for Economic Co-operation and Development (OECD) have also developed a more succinct set of criteria for successful carbon pricing policies, the FASTER Principles, which can be found in Box 1-5 below.

Box 1-5 The FASTER Principles for Successful Carbon Pricing

The FASTER Principles for Successful Carbon Pricing[43] were developed jointly by the World Bank and the OECD based on the practical experience of different jurisdictions with implementing carbon taxes and emissions trading systems. The FASTER Principles include

- Fairness: Reflect the "polluter pays" principle and contribute to distributing costs and benefits equitably, avoiding disproportionate burdens on vulnerable groups;
- Alignment of Policies and Objectives: Use carbon pricing as one of a suite of measures that facilitate competition and openness, ensure equal opportunities for low-carbon alternatives, and interact with a broader set of climate and non-climate policies;
- Stability and Predictability: Implement carbon prices as part of a stable policy framework that gives a consistent, credible, and strong investment signal, the intensity of which should increase over time;
- Transparency: Be clear in design and implementation;
- Efficiency and Cost-Effectiveness: Ensure that design promotes economic efficiency and reduces the costs of emission reduction; and
- Reliability and Environmental Integrity: Allow for a measurable reduction in environmentally harmful behavior.

1.5 EMISSIONS TRADING AND ECONOMICS: A PRIMER

While designing an ETS policy in practice entails a certain amount of complexity, the economic theory of emissions trading is quite simple. The rest of this chapter provides a brief overview of the basic economics behind emissions trading as a policy tool. It proceeds through three steps:

1. an explanation of what a marginal abatement cost curve is,
2. an illustration of how trading facilitates cost-effective abatement using the simplest possible example involving two firms, and
3. a brief section comparing the regulation of quantities (ETS) versus the logic of regulating prices (carbon taxes).

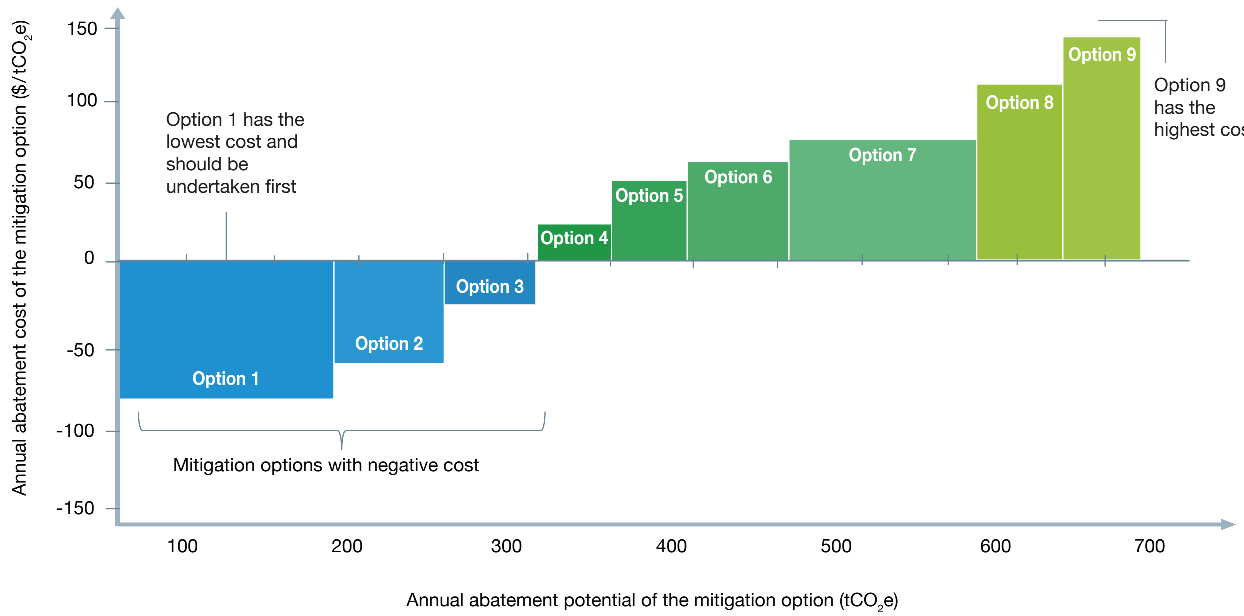
1.5.1 INCREASING MARGINAL ABATEMENT COST CURVES

Different abatement opportunities have different costs per ton of abatement (i.e., emission reduction) achieved. An abatement opportunity will be undertaken only if it is cheaper than the carbon price. Firms are profit maximizing, and will therefore choose the lowest-cost option available to them; in this case, if the compliance cost of emitting (that is, buying an allowance) is lower than the cost of investing in abatement, they will choose to pay the compliance cost. As a result, absent other policy signals, the carbon price will determine which abatement opportunities will be profitable to undertake. Some abatement technologies are cheap and, in some cases, may even have "negative" costs, which means that they would be profitable to implement without any carbon price — although in these cases there are likely to be non-price barriers that prevent the abatement being undertaken. Energy efficiency measures are a typical example. These solutions (like energy-saving lightbulbs) are slightly more expensive than their conventional counterparts in terms of upfront cost, but result in significant cost savings over their lifetime through lower electricity bills (i.e., they are the profit-maximizing choice). However, uptake of these measures can be low due to non-price barriers like consumer preferences, behavioral biases, transaction costs, or information failures. By contrast, other abatement technologies are more difficult to implement — and, thus, more expensive.

Depicting these technologies in the sequence of abatement cost in order from lowest to highest cost results in an increasing marginal abatement cost (MAC) curve. The first unit of emissions reductions costs very little, perhaps even less than zero, but the cost per ton of reductions rises with emission reductions as more expensive opportunities are pursued. A simple MAC curve is presented in Figure 1-5, with cost of technologies increasing from left to right. The size of the box represents the size of the mitigation opportunity.

43 World Bank and OECD (2015).

Figure 1-5 MAC curve plotting abatement options in order of their costs



The same logic applies to companies as well as economies: the first unit of emissions reductions a company might pursue can be undertaken cheaply, but as more ambitious emission reductions are sought, the cost per unit of emission reduction rises. For example, installing energy-efficient lighting or lowering heating needs through insulation might be relatively cheap or even prove financially beneficial. On the other hand, deeper emissions cuts might require capital-intensive solutions such as updating equipment for a lower emissions production process. Moreover, different companies will at different points in time face different marginal abatement costs; for some companies, reducing emissions will be cheaper than for others.

1.5.2 A TWO-COMPANY EXAMPLE

Next we look at the simplest example: two companies in the same industry, producing the same products, that might be called High-Cost Corp. and Low-Cost Inc. High-Cost Corp. does not have many options for reducing emissions at a certain point in time (for example, due to the structure of capital stocks, or because it is at the latest stage of the equipment modernization cycle). Low-Cost Inc., on the other hand, has several cheap carbon-reducing ideas that it has not yet adopted. This is shown in the back-to-back graph depicted in Figure 1-6, where both companies' emissions are plotted on the X axis, but oriented in opposite directions.

Without regulation, both companies pollute — even Low-Cost Inc. finds it cheaper to emit than to install its clean energy innovations and basic efficiency ideas. A government might decide to reduce the emissions of these two companies. For instance, rather than allow both firms to emit 100 units, the government might limit total emissions across the two firms to 100 units.

The simplest way to achieve the limit may be to set a uniform standard (see Figure 1-7): both companies are required to limit their emissions to the same amount (50 units apiece). Low-Cost Inc. will find it relatively easy (and cheap) to comply, but this will be considerably more costly for High-Cost Corp. This can be seen by comparing the vertical height of the curves at the point where each has delivered 50 units of emission reductions: it is significantly higher for High-Cost Corp than for Low-Cost Inc. As such, with this requirement, emissions are limited to 100, but total compliance costs could be high.

It is in this context that cap and trade can be valuable. The government still sets an overall limit on emissions equal to 100 units. But instead of telling each company how much to emit directly, it distributes or auctions allowances to each regulated entity as well as potentially to other parties. Each allowance provides the right to emit one unit. The total number of allowances adds up to the overall cap of 100.

Next comes trade (see Figure 1-8). Regardless of how allowances are distributed, it is unlikely that the initial allocation process will have resulted in the allocation that establishes the least-cost ("cost-effective") distribution of emissions across the two companies. For example, in a case in which the allowances have been allocated equally to both firms, High-Cost Corp. will want to find extra allowances while Low-Cost Inc. will be willing to sell — for a price.

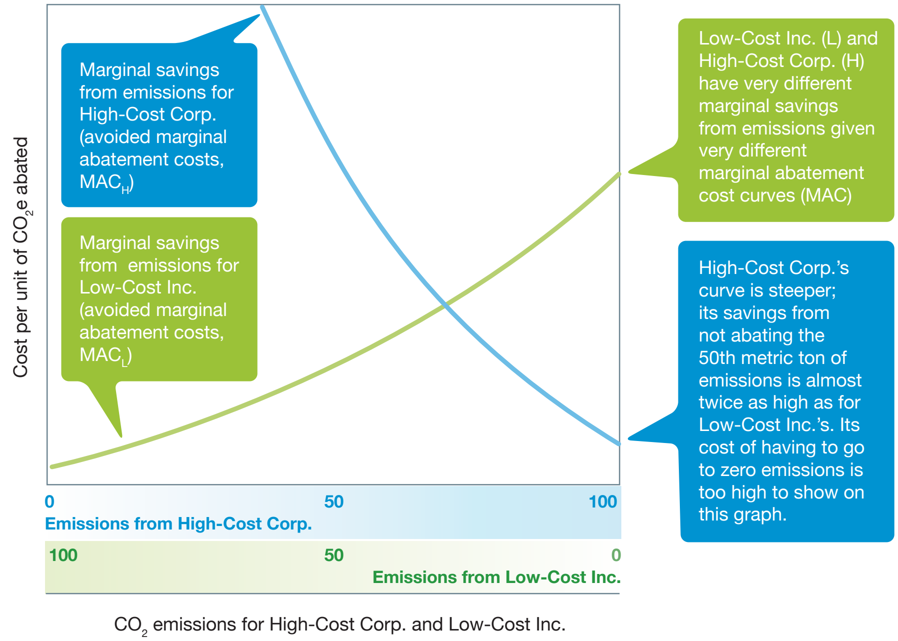
The price that will emerge will ensure that emissions are reduced in the least-cost manner. High-Cost Inc. will be willing to buy allowances until the point where the cost for reducing emissions is equal to the price of allowances on the market. Similarly, Low-Cost Inc. will be willing to reduce emissions and, thus, sell surplus allowances until the point where its costs for installing its own emissions-reducing measures equal the allowance price borne by the market.

The overall outcome will be that Low-Cost Inc. will pursue significant emission reductions, limiting emissions to 30, leaving it with around 20 to sell. High-Cost Corp., on the other hand, takes a handful of measures on its own (limiting emissions to 70 units) but then buys on the open market the rest of the allowances (20) that it needs to cover its emissions. The result is that the same total level of emissions is achieved — but at lower total cost for both companies as well as the system as a whole.

In reality, of course, things are more complicated, including the existence of many more firms, questions around market power, and administration/transaction costs. But even this simple example raises some important questions:

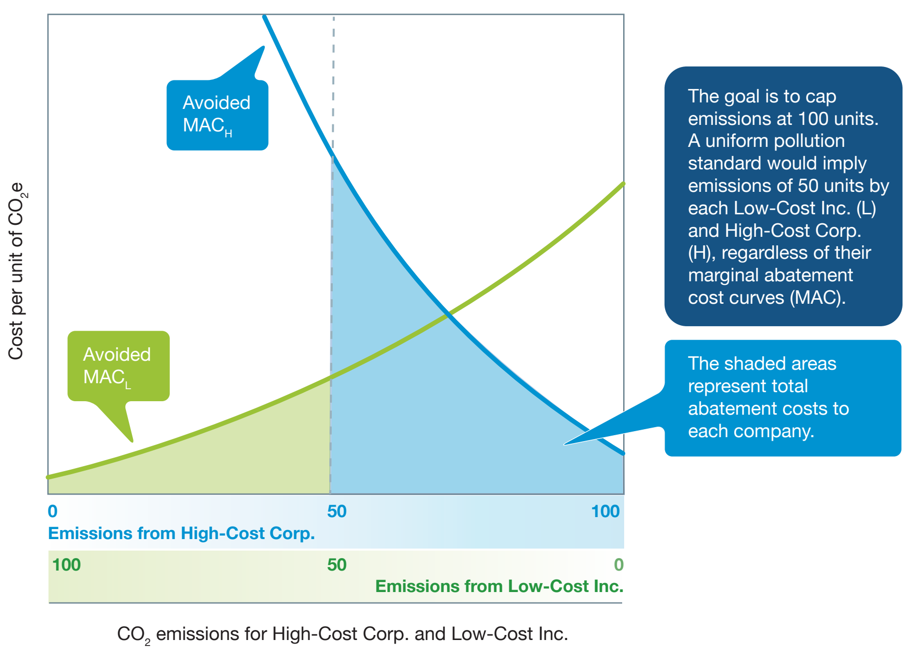
- Is it fair to give each company an equal number of allowances?
- Should allowances be given away — "freely allocated" — or

Figure 1-6 An example of two firms with different abatement costs



Note: Two firms with different "abatement" (emission reduction) costs: High-Cost Corp., with emissions shown from left to right, and hence abatement from baseline emissions in reverse, has a steeper incremental or marginal abatement cost curve and thus steeper marginal savings from emissions; Low-Cost Inc., with emissions plotted from right to left, has a flatter curve. Note that the total emissions are the same (and equal to 100) at every point along the horizontal axis; what changes is how those emissions are allocated between the two firms.

Figure 1-7 Applying a uniform standard to each company



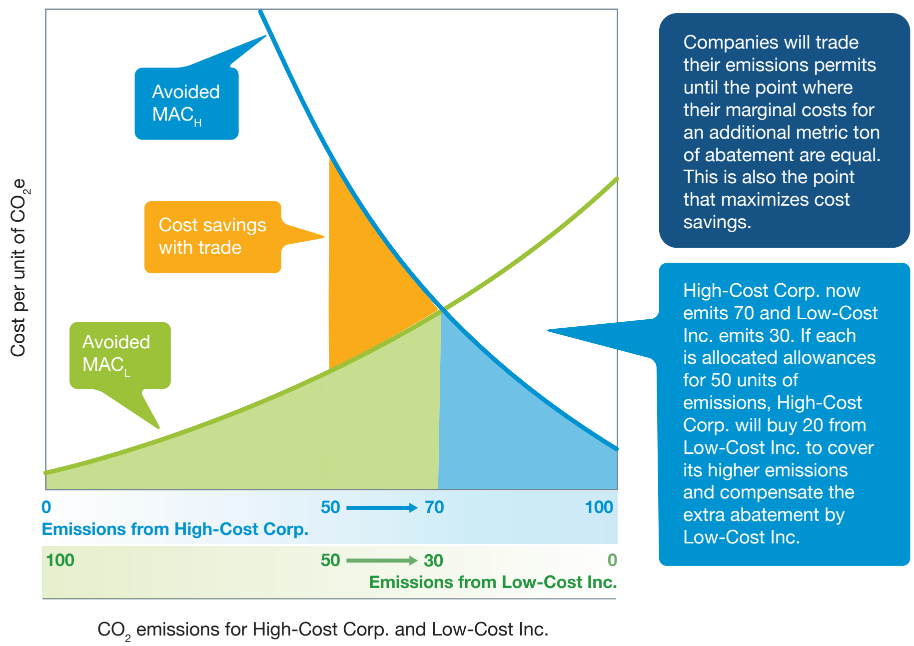
Note: A uniform standard limits each company to the same amount of emissions: Low-Cost Inc. and High-Cost Corp. each emit 50 units, for a total of 100.

should they instead be auctioned off?

- If auctioned, should the proceeds be used to reduce taxes elsewhere, or should the money be spent on other measures to reduce emissions, protect vulnerable consumers, or compensate stakeholders under the program?

One of the important features of cap and trade is that while the answers to these questions are crucially important from political and distributional perspectives, they do not change the overall effectiveness of the cap. Regardless of how a fixed number of allowances are distributed, total emissions do not exceed the limit.

Figure 1-8 Trade saves costs relative to an allocation that prescribes equal emissions by each company

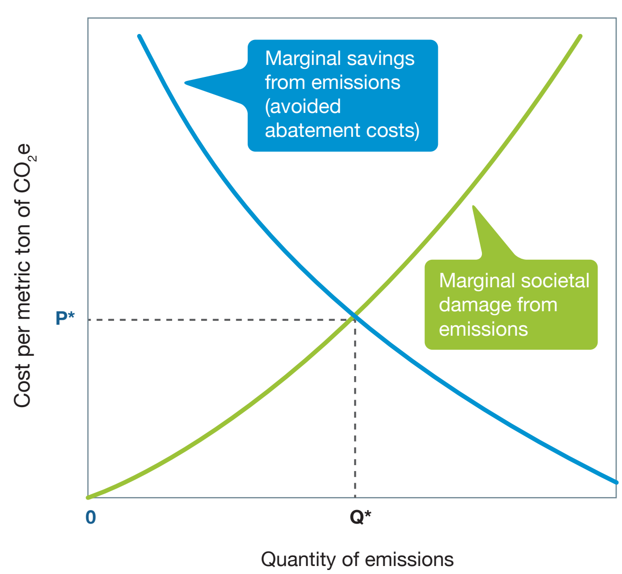


1.5.3 REGULATING PRICES VERSUS QUANTITIES

Emissions trading is only one policy instrument available to combat climate change. The most direct alternative is to tax GHG emissions. Price-based mechanisms (like a tax) and quantity-based mechanisms (like an ETS) both have theoretical advantages and disadvantages, as discussed in Section 1.1.1. Which is preferred (on economic efficiency grounds) will depend on the relative importance of being certain about marginal costs (favoring a carbon tax) or being certain about marginal benefits from improved environmental outcomes (favoring a cap and trade system).[44] The political feasibility of either approach will also differ across different contexts.

A cap and trade system, in its purest form, ensures that the emissions limit is firm, but keeps the price flexible. By contrast, a tax sets the price, keeping emissions flexible. In a world of certain and known marginal abatement costs and social benefits, either approach could be designed to achieve the same outcome, as shown in Figure 1-9. However, the world is uncertain; there is imperfect knowledge regarding both the marginal abatement cost curve and the marginal social benefits curve. As a result, an ETS and a tax — even if

Figure 1-9 Damages and savings from emissions



Note: With no uncertainty around marginal abatement costs and damages from emissions, by setting a cap at Q*, the market price will adjust to P*. Setting a tax at P* will result in emissions level of Q*.

44 Under a cap, if marginal abatement costs are higher than expected, the market price for one ton of CO_2 — and, thus, the overall cost of the policy — will be higher than expected. Under a tax, a higher-than-expected marginal abatement cost will not affect the price, but it will lead to fewer emissions reductions than expected.

designed to be equivalent in expectation — will likely have different outcomes. Which one is preferred (on economic efficiency grounds) will depend on the relative importance of minimizing marginal costs (favoring a carbon tax) or being certain over environmental outcomes (favoring a cap and trade system).

PSAMs seek to balance objectives regarding the carbon price and the quantity of emissions reductions by altering the supply of allowances (see Step 6). These measures blur the distinction between a "pure" ETS, which controls only quantity, and a tax, which controls only price. While a "hybrid" design provides policymakers with greater control over the carbon price (and therefore marginal cost), it may reduce certainty around the achievement of the initial cap.

However, despite the differences between an ETS and a carbon tax, there is widespread agreement among economists that a price on emissions, created through either approach (or through a combination — for instance, using price floors and ceilings) is critical to reducing GHG emissions in a cost-effective manner.

1.6 QUICK QUIZ

Conceptual Questions

1. How does an ETS work?
2. What is the difference between an ETS and a carbon tax?

Application Questions

1. What might be the key goals of an ETS in your jurisdiction?
2. What existing regulations in your jurisdiction could help or hinder an ETS?
3. What policies might be useful in addition to an ETS in your jurisdiction?

1.7 RESOURCES

The following resources may be useful:

- State and Trends of Carbon Pricing 2020
- Carbon Tax Guide: A Handbook for Policy Makers
- Benefits of Emissions Trading: Taking Stock of the Impacts of Emissions Trading Systems Worldwide
- Emissions Trading Worldwide: Status Report 2020
- Carbon Pricing Assessment: A Guide to the Decision to Adopt a Carbon Price (forthcoming)
- The Co-benefits of Carbon Pricing (forthcoming)

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STEP 2
Engage stakeholders, communicate, and build capacity

BOXES

FIGURES

TABLES

AT A GLANCE

Checklist for Step 2: Engage stakeholders, communicate, and build capacities

- ✔ Map stakeholders and respective positions, interests, and concerns
- ✔ Coordinate across departments for a transparent decision-making process and to avoid policy misalignment
- ✔ Design an engagement strategy for consultation of stakeholder groups specifying format, timeline, and objectives
- ✔ Design a communication strategy that resonates with local and immediate public concerns
- ✔ Identify and address ETS capacity-building needs

Implementing an emissions trading system (ETS) requires enduring public and political support, as well as practical collaboration across government actors and market players. This should be based on shared understanding and trust, alongside consideration of the respective capabilities of government and regulated entities. ETS impacts can be significant and far-reaching, making their development and operation politically sensitive and of interest to a broad array of stakeholders. Stakeholders are those who will in some way be affected by the ETS policy. Stakeholders are not only those that will be directly regulated by the ETS, like regulated entities and industries, but include those that contribute to the shaping of policy and those who are more widely affected, including indirectly affected firms, other government agencies, and environmental advocacy and civil society groups.

Stakeholder engagement plays an important role in all stages of an ETS from the initial assessment, design, and implementation of an ETS through to stakeholder input as part of a post-implementation review cycle. Engagement opens communication channels between policymakers and stakeholders. Policymakers can help stakeholders understand the ETS policy to build acceptance, while receiving stakeholder input. The results from engagement should be used to improve ETS design to ensure it is appropriate for the local circumstances. Some jurisdictions have found that it takes 5 to 10 years of engagement and capacity building on climate change market mechanisms to build knowledge and promote acceptance across stakeholder groups. For this reason, the topics discussed in this chapter hold key lessons that are relevant to all other steps of ETS design.

Stakeholder engagement normally begins by clarifying the key objectives from the stakeholder engagement process and developing a comprehensive map of relevant stakeholders. This mapping exercise can go beyond simply identifying stakeholders by also working to understand the profiles, interests, and values of affected parties. In doing so, a stakeholder engagement process can illuminate key priorities for engagement.

Developing a stakeholder engagement and communications strategy from the outset can be of enormous value. The strategy, and subsequent engagement, should consider the different forms of engagement available and which forms may be most effective for different stakeholder profiles. By drawing on stakeholders' expertise it is possible to improve ETS design and help build trust, understanding, and acceptance. Stakeholder engagement is not without risk, which should be proactively managed to avoid poor outcomes. Publicly documenting the engagement increases transparency and improves stakeholder confidence in the process.

Communication with stakeholders aims to improve information flows as well as awareness and acceptance of the ETS. Communication strategies can build on stakeholder inputs and profiles to develop tailored narratives that will resonate with different audiences, considering different means of communication. While developing and running the ETS, the government's communication strategy should be clear, consistent, and coordinated.

Developing an ETS also requires strategic capacity building for specific stakeholder groups. Policymakers and ETS service providers, in addition to ETS participants, need to build the specialized technical expertise and administrative capacity to develop and operate an ETS.

Section 2.1 guides policymakers through the objectives of stakeholder engagement. Section 2.2 then presents an approach to understanding relevant stakeholders. Section 2.3 elaborates on the guiding principles and key aspects of engagement strategies. Section 2.4 looks specifically at the design of a communications strategy. Section 2.5 outlines the most important aspects of managing the stakeholder engagement process. Section 2.6 presents an approach to building the capacity of policymakers, regulators, ETS participants, service providers, and other stakeholders.

2.1 OBJECTIVES FOR ENGAGEMENT

Mapping key stakeholders and engagement strategies should be based on the main objectives for engagement. These may include:

- **Meeting statutory obligations:** Each government is likely to have statutory requirements and standard practices for public engagement on major policy and legislation.[45] Whatever approach is applied to the ETS should be consistent with local requirements. However, it will be important to consider whether any changes or additions to the standard approaches are required.[46] For example, extra time may be needed to allow stakeholders to consider particularly complex ETS elements. Governments may need to make a special effort to reach out to stakeholder groups that are not often involved in policymaking and simplify complex technical information.
- **Building understanding and expertise:** Regulated entities need to learn about an ETS, how it works, and its potential impacts before they can support it and participate in it. Potential entities to be covered by the system will also have access to better information than regulators about their emissions, mitigation potential and costs, and competitiveness concerns. They may also have valuable sector knowledge that could positively affect program design. For example, recent technology developments that reduce the cost of abatement may influence the degree of support offered to the sector. Access to information from multiple well-informed stakeholders, such as industry players, environmental regulators, climate experts, and jurisdictions already operating an ETS allows for smoother implementation and better integrates business processes and existing regulatory markets. Wide-ranging stakeholder information is an essential precondition to creating effective regulatory bodies.[47]
- **Building credibility and trust:** Long-term goals need to be credible, and rules and enforcement mechanisms should be clear. ETS participants and other stakeholders are more likely to have confidence in an ETS if they receive, and have the chance to review, pertinent information. Conversely, they are more likely to be suspicious of the government's assessments if these are conducted confidentially and without independent review. External, peer-reviewed research can help ensure that conclusions are as transparent as possible. Ensuring the predictability of the decision-making processes and ETS operation is equally important. Unexpected changes to ETS design will reduce trust in the system and could discourage investment in low-greenhouse gas (GHG) technology (see Step 10), so engagement on changes can improve acceptability and efficiency.
- **Building acceptance and support:** A sustainable ETS does not require universal support, but it does require enduring social acceptance.[48] This can take the form of a "quiet majority," even if it is overshadowed by a vocal opposing minority.[49] Broad political support will help ensure the long-term viability of the system through political cycles, and will also be key to the overall legitimacy of the system and public authority. Perceived long-term viability and legitimacy of the ETS will also likely have positive effects on investments in abatement technologies (see Step 10).

2.2 UNDERSTANDING YOUR STAKEHOLDERS

Understanding stakeholders is key to successful policy. It is particularly important for ETSs, which aim to be in place for the long term. For this reason, stakeholder engagement is of paramount importance and is required throughout the lifetime of an ETS. By understanding stakeholders, policymakers can tailor the ETS, and the broader environmental policy landscape, to better respond to the needs and preferences of different stakeholders, thereby increasing the chances of the ETS being a success.

This section presents an approach to stakeholder mapping. It covers the identification of relevant stakeholders in Section 2.2.1 and how to build stakeholder profiles in Section 2.2.2. These profiles can then be used to

45 Organisation for Economic Co-operation and Development 2009.

46 During the development of the EU ETS, the German government identified the need to create a new institution for more in-depth stakeholder engagement than would be achieved under standard practice (Matthes 2013).

47 A case in point is the treatment of space heating in Beijing's ETS. Government analysts assumed that boilers would be more efficient in the richer central city and allocated emission allowances based on that assumption. However, extensive stakeholder engagement revealed the opposite: in fact, boilers in the outlying areas were more efficient. The large range in emissions intensity for space heating influenced the eventual choice to forgo a standard benchmark for the entire industry.

48 Caron-Malenfant and Conraud 2009.

49 For a description of a "silent majority" refer to Government of South Australia (2013).

prioritize stakeholders for engagement, as described in Section 2.2.3. An overview is provided in Figure 2-1.

2.2.1 IDENTIFYING STAKEHOLDERS

ETS stakeholders include individuals and organizations that affect, are affected by, or have an interest in, ETS design and implementation. Identifying relevant stakeholders will help the design and implementation of an effective engagement strategy.

Relevant stakeholders for an ETS are listed below.

- **Regulated entities** are an important group as they are directly affected by the ETS. They will be fundamental to gaining access to the robust information and data on which the operation of an ETS is based. Their participation and compliance are also required once the system is in place. Engagement can be targeted toward both gaining executive commitment to constructively participate in the ETS and securing the involvement of operational staff in designing effective monitoring, reporting, and verification (MRV) procedures and other systems.
- **Government stakeholders** play a key role in ETS design and implementation. Government stakeholders include bodies with legislative functions, departments involved directly in ETS design and implementation, departments whose operations will be affected by the ETS, and departments whose support is essential, as well as other national and subnational authorities. The government departments and agencies that are likely to be most involved include those with responsibilities for environmental, energy, and economic affairs; treasuries; accreditation bodies; and market regulation and oversight. An ETS can be a broad instrument, which may also raise issues in areas such as transport; industrial policy; forestry; or property rights, tax, or law. The departments responsible for these policy areas will also be important bodies to engage with. At the political level, a broad range of stakeholders are relevant, including legislators, whose support will be needed to pass the ETS into law and who are vital to engage with early, to explain the key concepts and build support. Opposition parties will be important to engage with, particularly if partisan politics are a feature within the jurisdiction. Bipartisan political support can help to depoliticize the policy and to maintain ETS ambition through political cycles.
- **Firms affected but not regulated directly by the ETS**, including manufacturers and suppliers at different points in the supply chain, will have an interest. Trade and industry associations can play an important role in presenting aggregate views on business interests and serve as a conduit of information to their members and consumers.
- **Market service providers** could include banks, exchanges, and other financial intermediaries such as specialized consultancies, brokers and trading houses, verifiers and auditors, offset project developers, and

Figure 2-1 ETS stakeholders and key considerations in stakeholder mapping

legal advisors, and verifiers, all offering professional services that can support the development and effective operation of an ETS. For instance, by developing secondary market products, as well as guarding against market manipulation and fraud (see Step 7).

- **Civil society organizations**, such as environmental, social justice, health, and governance nongovernmental organizations (NGOs); labor organizations; and consumer groups will have an interest in the ETS. They can provide valuable input on understanding and managing ETS impacts, as well as communicating with members or other stakeholders to build support for an ETS.
- The **media** is crucial to building acceptance and support for an ETS. Accurate and objective media coverage can help build broad-based credibility and trust, whereas persistent biases and misreporting may yield the opposite effect.
- **Academics and researchers** are an important resource that policymakers can leverage to evaluate and improve ETS design and can help explain to the public the rationale for and benefits of an ETS. As experts, their involvement and studies can help build credibility and trust in the system. Leveraging their expertise to help build long-term and robust models, as well as other analyses for the ETS can help support government policymaking.
- The support of the **general public** is key for building the enduring social acceptance and broad political support necessary for a sustainable ETS.
- **Other jurisdictions with an ETS** may be engaged early and throughout the design process to share their experience and knowledge. They can also identify and resolve potential barriers to linking — if that is an objective of the ETS. Other jurisdictions can also be engaged by participating in international fora such as the Partnership for Market Readiness (PMR) and International Carbon Action Partnership (ICAP), through formal fact-finding missions, and through informal contacts.
- **Trading partners** who place a premium on mitigation ambition, or who are considering trade measures such as border carbon adjustments, should be consulted to streamline and integrate future policymaking on international mitigation action and trade impacts.

2.2.2 UNDERSTANDING THEIR INTERESTS

Once stakeholders are identified, it is important to understand their respective interests by building a stakeholder profile so policymakers can strategically design their ETS engagement.[50] This helps policymakers understand how each group will be affected and what is important to them. Knowing this, policymakers can start to prioritize groups that may require more engagement to reduce opposition to policy introduction. Opposition may come from not only those opposed to action on climate change, but also those that support climate action but are opposed to an ETS. Stakeholder profiles can cover groups of stakeholders or individual stakeholders, as appropriate. They may answer questions such as:

- What role will they play in ETS implementation?
- How will they be affected by the ETS, and how significant will that impact be?
- What is their understanding of emissions trading and broader climate change policy?
- What are their priority issues or concerns regarding an ETS?
- What will they expect from the government? For instance, stakeholders might wish to be informed of major decisions and developments, have an opportunity to influence policy, give feedback on how the ETS is operating, or simply understand the rules of the ETS.
- What is the government's current relationship with them, and how willing are they to engage?
- How might they interact with other stakeholders on these issues?

Once policymakers understand how stakeholders will be affected, modeling, or another quantitative analysis such as cost benefit analysis, can be used to understand the scale of impacts on affected parties. The potential impact of an ETS on business competitiveness and distributional impacts (see Step 5) are often a focus of analysis. Various types of modeling can be used to identify the impacts of a carbon price on business competitiveness, industry output and employment. Similarly, analysis may consider how an ETS alters household costs, for instance through increased electricity bills, use of gas for heating, or fuel for transport.[51] This analysis can be used to refine the ETS design to reduce negative impacts. Presenting the findings from the analysis and how potentially negative impacts have been addressed can allay concerns regarding the impacts of an ETS and provide evidence that policymakers have thought through its potential impacts.[52]

50 For an example of stakeholder mapping of positions and concerns in the context of the introduction of California's Global Warming Solutions Act (AB32), see Table 2 in PMR (2013).

51 For example, Adelphi (2018) looks into the distributional impacts of carbon pricing and how they can be addressed.

52 The potential ways in which these impacts can be assessed are considered in further detail in the PMR's forthcoming *Developing a Carbon Pricing Roadmap* guide.

The costs of an ETS are important to understand, but so are the potential benefits from using carbon revenues and wider benefits that arise from a carbon price. Any policy that reduces GHG emissions has the benefit of not only mitigating the effects of climate change but also producing local benefits such as improved air quality, attracting low-carbon investment, innovation, and employment. Carbon pricing is increasingly recognized as an important source of government revenue. If used wisely, carbon revenues can support further climate mitigation; industry competitiveness; and pursuit of other economic, distributional, and developmental objectives. For example, in California, the Cap-and-Trade Program works to address existing social issues by leveraging investments made with auction revenue, 35 percent of which must directly benefit disadvantaged and low-income communities, also referred to as "priority populations."[53] Options for how to leverage auction revenue are discussed further in Step 5.[54]

2.2.3 PRIORITIZING ENGAGEMENT

The last step of stakeholder mapping is to prioritize the stakeholders to engage and the level of engagement. As human and financial resources are likely to be limited, engagement should be targeted at the most important stakeholders. Priority may, for example, be assessed by the extent to which a lack of engagement would pose a risk to the successful design, implementation, and sustainable operation of the ETS. This assessment can be based on the stakeholder profiles drafted in the previous step. Given limited resources, outreach activities that can be targeted to multiple audiences, or can be scaled up and replicated without additional cost — such as an online information platform — can help maximize the impact of engagement efforts.

2.3 DESIGN AN ENGAGEMENT STRATEGY

Engagement activities need to be undertaken strategically at each stage of ETS design and implementation. The potential complexity of this effort warrants the development of a formal strategic engagement plan that involves, and has buy-in, across government departments. The components of the engagement plan should be customized to local circumstances, but some of the main aspects that might be considered are the guiding principles of engagement (Section 2.3.1), the different forms of engagement (Section 3.2), and the engagement needed within government (Section 2.3.3). The PMR's *Guide to Communicating Carbon Pricing* provides further insights into the design of an engagement strategy. Aspects like extensive market research to understand the reasons behind stakeholder groups' beliefs, clear and jargon-free communication, and picking the right communicators are all relevant to designing a successful engagement strategy.

2.3.1 GUIDING PRINCIPLES

An effective engagement plan should be guided by several core principles, including:

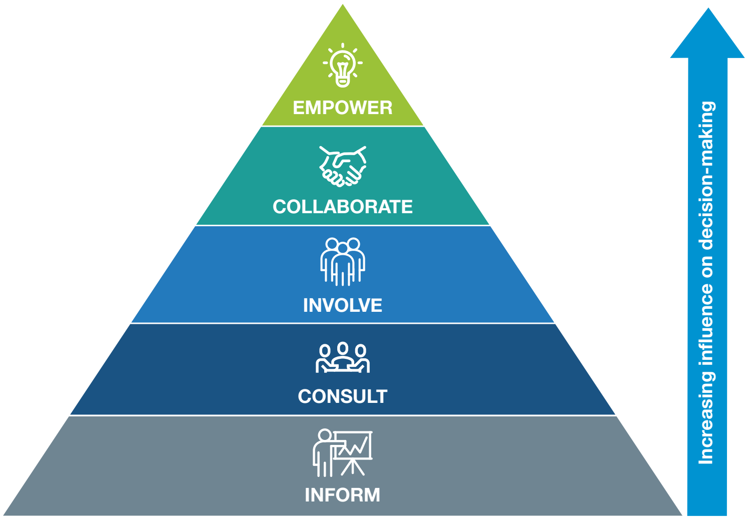
- **Timely**
  - Engage early, sufficiently often and in a well-targeted manner, so that the government can make well-informed decisions at each step of the process.
  - Coordinate engagement on similar issues across government to avoid duplicative efforts and "consultation fatigue."
- **Transparent**
  - Clearly define the goals, target audience, and timeline for each engagement activity.
  - Engage in good faith, providing enough time and information for stakeholders to evaluate government proposals and for the government to incorporate substantive feedback into final decisions.
- **Inclusive**
  - Engage broadly where possible so that both majority and minority views can be considered.
  - Accommodate engagement to the needs and capabilities of the target audience (for example, providing multiple channels for engagement such as written submissions, public meetings, or different media channels).
- **Accountable**
  - Ensure public accountability by maintaining a public record of engagement and reporting back what information was received and how the government took it into consideration.
  - Evaluate and continually improve the effectiveness of engagement activities.

53 California Air Resources Board 2020c.
54 Further details on these and other options for revenue use and how they can affect a range of stakeholders are detailed in the PMR's *Using Carbon Revenues* report and ICAP's paper *Use of Auction Revenue from Emission Trading Systems*.

2.3.2 DIFFERENT FORMS OF ENGAGEMENT

Different forms of engagement are appropriate for different stakeholders and at different stages of ETS development. The International Association for Public Participation (IAP2) has developed a useful framework for considering engagement options in its public participation spectrum (see Figure 2-2).[55] It distinguishes five forms of engagement, ranging from those that are appropriate for a low level of public influence over decision-making ("Inform") to those that involve a high level of influence ("Empower"). The IAP2 framework can be applied to ETS design and implementation as follows:

Figure 2-2 Role of stakeholders in ETS decision-making



Source: Adapted from IAP2 (2014)

- **Inform:** Defined as "to provide the public with balanced and objective information to assist them in understanding the problem, alternatives, opportunities and/or solutions."[56] In the ETS context, this may involve:
  - producing green/white papers[57] that explain the government's proposals with supporting discussion and analysis;
  - creating a central website, hotline, or help desk where information can be obtained about the ETS;
  - releasing modeling results and other government analysis;
  - issuing regular updates on the progress of ETS planning; and
  - providing plain-language summaries of technical documents, legislation, and regulations.
- **Consult:** Defined as "to obtain public feedback on analysis, alternatives and/or decisions."[58] This may involve:
  - meeting with staff of companies that are likely to be ETS participants;
  - engaging with consultants and researchers;
  - inviting general public input on government proposals during ETS design; and
  - mandating public consultation on legislation, regulations, and ETS reviews.
- **Involve:** Defined as "to work directly with the public throughout the process to ensure that public concerns and aspirations are consistently understood and considered."[59] This may involve:
  - commissioning independent experts to assess ETS design and operation;
  - enabling substantive dialogue with stakeholders, formally and informally; and
  - holding multi-stakeholder workshops for the public exchange of views.
- **Collaborate:** Defined as "to partner with the public in each aspect of the decision including the development of alternatives and the identification of the preferred solution."[60] This may involve:
  - inviting stakeholders and technical experts to work with the government in modeling ETS impacts by reviewing data, assumptions, and outcomes; and
  - creating joint government/stakeholder working groups to discuss key issues and develop related regulations and guidelines for ETS participants.
- **Empower:** Defined as "to place final decision making in the hands of the public."[61] This may involve:
  - ensuring that the introduction of an ETS is identified early and clearly in campaign platforms, political programs, and legislative dockets to facilitate a robust civil society debate;

55 From informing to empowering, including consulting, involving, and collaborating, the IAP2 Public Participation Spectrum is a useful tool to better understand the role stakeholders can be given (IAP2 2007).
56 Ibid.
57 In this context, a green paper is a government document presenting preliminary or tentative policy proposals that is circulated among interested parties for consultation. The ensuing government white paper presents firm policy proposals for further testing and refinement prior to the introduction of legislation.
58 IAP2 2007.
59 Ibid.
60 Ibid.
61 Ibid.

- establishing public legitimacy, for instance, through extensive community engagement or potentially through devolved decision-making such as a public referendum on whether to proceed with an ETS;[62] and
- delegating authority for technical aspects of allocation plan development to experts.
- In developing the Tokyo ETS, government officials tailored the format of engagement to meet the evolving needs of different stakeholder groups across different phases of work. (See Box 2-1.)

Box 2-1 Case study: Stakeholder engagement during design and implementation of the Tokyo ETS

In developing the Tokyo ETS government officials tailored the format of engagement to meet the evolving needs of different stakeholder groups across different phases of work.[63] The Tokyo ETS was established after two prior phases of mandatory reporting and revised reporting.[64] The mandatory reporting program, started in 2002, provided the backbone of data needed for the later stages. Under the revised reporting program, staff from the Tokyo Metropolitan government visited almost all facilities to discuss emissions reduction opportunities, which resulted in a strong foundational understanding of emission trading.

In designing its ETS, the Tokyo Metropolitan government held stakeholder meetings between July 2007 and January 2008. Business groups, companies with interests in climate change, environmental NGOs, and the Tokyo Metropolitan government took part in meetings that were open to the public. Each meeting attracted over 200 attendees.[65] Stakeholder meetings were held after the initial design of the ETS, but before the detailed program regulation was drafted. Through these meetings, the Tokyo Metropolitan government was able to respond to the concerns of the public, build trust, and enrich the design of the ETS.

The meetings directly helped shape the design of the ETS. For instance, companies that had already made reduction efforts expressed concerns that allowance allocation would not reflect their past efforts.[66] As a result, the Tokyo Metropolitan government established a "Top-Level Facility Certification," allowing qualifying facilities with the greatest progress in energy efficiency to face less-onerous targets under the ETS.[67] Similarly, property owners were concerned about their ability to control the emissions from tenants. In response, a system was developed that obliged tenants of large floor areas or high electricity use to cooperate in mitigation efforts, including the requirement to submit their own reduction plans.

ETS phase	Stakeholders engaged	Format
Pre-cap and trade reporting	Facility managers and engineers at regulated companies	Publications Report submissions and feedback Seminars
Draft program design and proposal	Experts Facility managers, experts, and engineers at regulated companies Local business groups	Expert panels Environmental councils Questionnaires Stakeholder meetings
Introduction	Business groups (local and national) NGOs General public	Thematic meetings Collection of public comments Forums
Detailed program design	Local business groups Leaders in building sector Engineers at regulated companies Experts (for example, academia, lawyers)	Negotiations Discussions (one-to-one, one-to-some) Seminars and forums
Implementation and improvement	Facility managers and engineers at regulated companies	Report submissions and feedback Help desk

Source: Adapted from PMR (2013)

62 For example, holding a public referendum played a key role in the development of the ETS in California.
63 See Kimura (2014, 2015) for accounts of stakeholder meetings in the design of the Tokyo Cap and Trade Program. For a discussion of Tokyo's larger approach to stakeholder engagement, see PMR (2013). Also of interest is Environmental Defense Fund (EDF) and International Emissions Trading Association (IETA 2015h).
64 See Kimura (2014, 2015) for accounts of stakeholder meetings in the design of the Tokyo Cap and Trade Program. For a discussion of Tokyo's larger approach to stakeholder engagement, see PMR (2013). Also of interest is Environmental Defense Fund (EDF) and IETA (2015h).
65 Kimura 2015.
66 Kimura 2015.
67 EDF and IETA 2015d.

Laying out an engagement schedule in advance, allocating sufficient time and resources to complete each stage of work, and aligning engagement activities with policymaker deadlines will all help make engagement more manageable.

Box 2-2 provides a specific example of engagement with a stakeholder group, looking into California's process of acquiring input on its ETS from experts.

Box 2-2 Case study: California's formal expert engagement in ETS design

The design process for the California Cap-and-Trade Program included regular public meetings from its inception. In total, more than 40 public meetings were held between 2009 and 2012.[68] The California Air Resources Board (CARB) also relied on experts and economic analysis from different committees established for this purpose to inform the design and implementation of the system on specific issues:

- The Market Advisory Committee (MAC) was appointed in 2007 to advise on creating a market-based mechanism for reducing greenhouse gases and was composed of experts who had experience in creating other ETSs, including the European Union (EU) ETS and the Regional Greenhouse Gas Initiative.[69]
- The Economic and Allocation Advisory Committee (EAAC) was appointed in May 2009 to provide recommendations on the provision of allowance value and allowance distribution. The EAAC was composed of 16 economic, financial, and policy experts, split across different subcommittees — economic impacts, allocation methods, allowance value provision, legal issues, and constraints.[70]
- The Emissions Market Assessment Committee (EMAC) was commissioned in order to identify market issues in the California Cap-and-Trade Program. EMAC held public meetings with stakeholders and conducted confidential meetings with CARB staff. The committee worked particularly on the price containment reserve, information sharing, resource shuffling, and linking with Québec.[71]
- The Market Simulation Group was established in June 2012 to identify, through simulation analysis, specific concerns with market rules.[72] Risks of market disruption or potential for market manipulation were assessed, especially regarding the allowance price containment reserve. The work of the group was presented publicly and released for stakeholder comment. Its work led to the report *Competitive Supply/Demand Balance and the Potential for Market Manipulation*.[73]

Taken together, this process enabled a broad cross-section of experts and stakeholders to contribute on various details of ETS design and operation and helped create buy-in to the system. The work of the committees, which brought together experts with different backgrounds, improved ARB's knowledge base for decision-making.

STEP 2 STAKEHOLDERS

68 See California Air Resources Board (2015c) for archived and scheduled meetings.
69 See California Market Advisory Committee (2007) for a description of the role of Market Advisory Committee (MAC) and the committee's findings.
70 See Economic and Allocation Advisory Committee (2010) for the full report of EAAC's recommendations to CARB.
71 See California Air Resources Board (2014) for a description of the role of EMAC.
72 CARB 2015b.
73 Borenstein et al. 2014.

Box 2-3 provides an example of the benefits of stakeholder engagement, outlining Germany's positive experiences with setting up a permanent working group to support ETS engagement.

Box 2-3 Case study: Germany's experience with the Emissions Trading Working Group

Stakeholder outreach in Germany has a long tradition through industry associations. In the context of the EU ETS, this took the form of an Emissions Trading Working Group (AGE), established in 2000. The founding members were major industrial and energy companies, the federal government (represented by the Ministry for the Environment), and environmental NGOs. Including representatives of civil society in the process from the start was important in establishing an open and trusted exchange of views. This was also helped by the fact that the group operated under the Chatham House Rule.

The working group was established as a permanent and continuous stakeholder process on all matters related to emissions trading, and as a platform for examining the interactions of the EU ETS with other climate policy instruments. Particularly during the establishment and early phases of the EU ETS, the group proved very helpful for sharing information, discussing stakeholder concerns, or, in other cases, better understanding the practical impact and challenges associated with EU ETS implementation and compliance. The timing and sequencing of engagement also helped make the group more effective. For example, detailed technical discussions took place only after political decisions on overall targets had been made.

The working group operates with its own budget (financed jointly by the Ministry for the Environment and the participating companies) and a secretariat. The group is headed by the Ministry for the Environment and co-chaired by the Ministry for Economic Affairs and Energy. It now consists of 75 members engaged in regular sub-working and plenary group dialogues on a range of technical, political, and crosscutting issues. The plenary convenes seven times a year.

As of 2020, the working group continues to focus on implementation of the EU ETS, currently in its third phase, but also discusses other regulatory developments and prospects in German and EU climate policy, such as measures under development to meet Germany's 2030 targets, the German national ETS for fuels, issues at the intersection between ETS and the German energy transition policy (*Energiewende*), and the potential future use of offsets and linking of the EU ETS.

2.3.3 ENGAGEMENT WITHIN GOVERNMENT

The government is an important stakeholder, as a range of different ministries, departments, and agencies will be needed for the design and implementation of an ETS. Equally, several government functions may be affected by an ETS.

A key question to consider is how the leading policy designers will engage with other departments and with political decision makers to garner support and deliver successful outcomes at each stage of the design and implementation process. To this end, each department's needs, priorities, and concerns must be taken into account, noting that emissions trading may be perceived to run counter to some departments' goals. The stakeholder-profiling exercise described above will facilitate this process.

Providing clarity about the range of roles in ETS design and implementation may help engage other government departments (see the experience with the New Zealand ETS in Box 2-4). Some elements to consider include:

- **Ensure appropriate leadership:** Clear executive and ministerial leadership and commitment help in securing departmental engagement and support.
- **Designate decision makers:** Assigning a specific department, team, or manager to lead ETS development and be accountable for delivery, including to other government departments, will help define clear lines of authority and avoid uncertainty.
- **Establish special working groups:** These can facilitate interdepartmental collaboration at different levels, enabling challenging issues to be raised and discussed.
- **Develop communication channels:** Coordination can be supported by establishing regular channels to communicate progress, share information, and document decisions.
- **Document outcomes:** Documenting technical and policy decisions and their rationales at different levels and stages of the process will facilitate final political decision-making and provide a solid information base for future reviews of, or legal challenges to, the ETS.

Box 2-4 Case study: Government coordination in New Zealand ETS design

In preparing the New Zealand ETS (NZ ETS), the government established an intragovernmental Emissions Trading Group to lead the design and implementation of the system. This team included officials seconded from the Ministry for the Environment (MfE), the Treasury, and the Ministries of Economic Development, Transport, and Agriculture and Forestry. It was based at the Treasury and led by an MfE manager with joint oversight by the chief executives of both the Treasury and MfE. This allowed a small and highly qualified group of officials from key departments to collaborate directly on technical ETS design while helping to secure support from their wider departments.

These arrangements enabled the economy-wide NZ ETS to be developed rapidly with alignment of technical design and political decision-making across government. The Emissions Trading Group started work in April 2007 and legislation for the NZ ETS was passed in September 2008. However, this should be seen in the context of New Zealand having considered both emissions trading and carbon taxes since the 1990s, and having previously begun to develop the institutional capacity to implement a carbon tax, before political support for this earlier initiative receded.

At the time of the second review of the NZ ETS, the government employed a different model, with a focus on setting a climate framework in legislation and then turning to the nuts and bolts of implementation. The process occurred in two stages: the first was the mandated second review (more information can be found in Box 10-8, Review Process in the New Zealand ETS) and the second was the process of drafting and legislating the Climate Change Response (Zero Carbon) Amendment Act and the Climate Change Response (Emissions Trading Reform) Amendment Act. The first point of focus was to develop the Zero Carbon Bill to set robust greenhouse gas emissions reduction targets, and thus a framework and context to then develop reforms to the New Zealand ETS. The MfE facilitated a series of sprints — one- or two-day meetings — that brought together key government officials from the MfE, the Ministry for Primary Industries, the Treasury, and others. The sprints were led by one of the MfE Directors of Climate Change and focused on addressing a list of relatively uncontentious issues quickly, as well as providing an entry point for particularly difficult topics such as how to set New Zealand's domestic emissions targets given the goal of reducing net emissions to zero, and how to incorporate methane into the target. These discussions, and the resulting decisions, laid the groundwork for subsequent public consultations in September 2018 on key ETS policy issues, such as phasing down free allocation and a strategy to incorporate the agriculture sector in the NZ ETS.

The Climate Change Response (Zero Carbon) Amendment Act became law on November 13, 2019, and the Climate Change Response (Emissions Trading) Amendment Act was passed on June 16, 2020.

2.4 COMMUNICATION STRATEGY

It is important to build a communications strategy alongside the engagement and ETS design process. Communications strategies can reach a wide variety of stakeholders and look to increase awareness, provide information, and build acceptance of the ETS. The messages conveyed in a communications campaign are varied, addressing topics including the reason for the policy and its benefits, the impact of ETS on prices or preempting opposition messages. Without proactive, well-considered communications around carbon pricing, disinformation and negative publicity could take its place, which would harm the public's perception of the ETS and may lead to opposition. Communication differs from stakeholder engagement in that it places a greater emphasis on informing and awareness, while stakeholder engagement focuses on the dialogue between policymakers and stakeholders. However, both the communications strategy and stakeholder engagement will have lessons that can be shared between them. The PMR's *Guide to Communicating Carbon Pricing* provides extensive guidance on this topic. Box 2-5 summarizes the key steps discussed in the guide.

Box 2-5 Technical note: Communicating carbon pricing

The *Guide to Communicating Carbon Pricing* draws on case studies, research, and best practice to provide guidance on the design and implementation of effective carbon pricing communications strategies. The Guide outlines eight steps for communications design:

1. **Preparing for communications design** should be done early in the process and in parallel with designing the policy. The communications design should outline what the government wants to achieve from the communications campaign and be tailored to the local context. For example, the level of polarization in politics will dictate how varied the communications will need to be between different groups.

2. **Identifying audiences** is necessary to effectively communicate to different groups. The Guide identifies three main audiences: internal government policymakers, priority stakeholders, and the general public. These audiences can be separated into four different segments according to their attitudes and demographics: base audiences, open audiences, opposing audiences, and disengaged audiences. Open audiences are those who have intermediate views and are open minded. They are the audience to focus on in communications because their opinion can be swayed toward favoring carbon pricing. Opposing audiences should have different strategies depending on the nature of their opposition to the policy. Those who believe there should be a response to climate change but oppose carbon pricing will need a different strategy than those who are fundamentally opposed to any response to climate change. Base and disengaged audiences are a lesser focus; however, base audiences can be encouraged by the communications.

3. **Research** should aim to understand the attitudes, values, and concerns of target audiences. It is important to get a mix of quantitative and qualitative research in the process. Quantitative research (for example polls and surveys) can provide a broad, population-level opinion; qualitative research (for example focus groups) can provide a deeper understanding of why people hold certain views. Research should be done in two phases, with the first being an exploratory phase to map the values and profiles of different audiences. This is followed by the second, testing phase, which assesses what communications approach works best and is a central to guiding overall communications design.

4. **The messages in the communications** campaign should be designed in a way that speaks to the values of the target audience(s). Communications that focus on cost and use economic terminology may not work in winning support, whereas positive narratives that speak to the audiences' worldviews have had some success. There are two primary strategies for communications. Carbon pricing can be presented as either an effective solution to climate change or as part of a broader narrative focused on the benefits of reducing reliance on fossil fuels. When talking about carbon pricing, successful cases to date have centered on three core narratives: fairness, common sense, and a shift to clean energy. Fairness speaks to the fact that carbon pricing presents a fair way to share responsibility for carbon pollution. Common sense focuses on the balance and flexibility carbon pricing provides. A shift to clean energy emphasizes the modernizing of the energy sector with new, clean energy. Learning and building from previous communication campaigns will help ensure a successful campaign.

5. **Explaining how carbon pricing works** is central to dispelling public concern. Plain language must be used, with different explanations for different audiences. While explaining carbon pricing to regulated companies may be important for their future compliance, policymakers need to decide on the degree to which carbon pricing will be explained, or alternatively to focus on what the carbon pricing achieves instead, for example stimulating investment toward low-emissions technology and raising funds for government services.

6. **Choosing communicators** who are trusted is of central importance for effective communications. Public trust in government may be low, with trusted peer communicators allowing engagement to increase support of the carbon pricing by tapping into the social cues used to form decisions on topics that people do not fully understand. Equally, governments may not be expert communicators, focusing more on the technical design and solutions. Having communicators outside government can help depoliticize issues and can help get buy in from a broader audience, giving policymakers time to help rebuild trust in government. For instance, conversations around early ETS design elements or involving certain sectors could be done by non-governmental groups. Targeting specific groups will require using trusted individuals within that group.

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7. **Integrating communications with policy** enables governments to design carbon pricing that is communicable and ensures coherence between policy and narratives. Engagement with ministers, legislators, and relevant government departments is crucial for building broad support for carbon pricing and developing a coordinated and consistent position on carbon pricing within government. External consultation with stakeholder groups, for example industry, and civil society provides a way of testing how acceptable the policy is and the reaction to the communication narratives given to support the policy. Public consultation can be beneficial in cases where development of the carbon price is expected to become a high-profile issue.
8. **Designing a communications campaign.** This is discussed step by step in the Guide.

The guide provides tips for successfully communicating carbon pricing. These include:

- **Incorporate communications throughout the process:** Strategic communications should be considered equal to the policy design and thus incorporated throughout the process.
- **Set clear objectives:** These will guide the communications strategy.
- **Define and engage priority audiences across the political spectrum:** Early definition of the audiences will inform the communications strategy and help build the narrative.
- **Base communications on robust research:** This will help understand different audiences and the best strategies. This research should include a testing phase to avoid counterproductive communications.
- **Be consistent:** The narrative and framing of communications should remain consistent throughout and stay tied to the objectives to avoid undermining the integrity and trust in carbon pricing.
- **Keep it simple:** Public discussion should refrain from technical language to keep the communications accessible.
- **Anticipate opposition early:** Strong opposition can severely undermine carbon pricing policy. Identifying opposition early and designing communications to avoid generating opposition is therefore important.
- **Engage and listen to stakeholders:** This can help design and revise the policy and communications strategy, as well as providing information on where the policy may be challenged.
- **Use trusted messengers:** These will have detailed knowledge on the needs and concerns of different audiences that can be used to develop trust in the policy.

In avoiding unsuccessful strategies, the guide outlines the following framing to avoid:

- **Cost:** Narratives built on cost appeal only to economic audiences and are unnecessarily negative in their framing of carbon pricing. Instead, communications should focus on the positive benefits.
- **Expert consensus:** There is no evidence that this is an effective strategy for the wider public, and in other fields there are cases where overreliance on expert consensus was counterproductive. Expert support may be effective with specific stakeholder groups.
- **Threat of climate change:** If climate change is seen as a contentious issue, communications can instead focus on other benefits that arise from carbon pricing, like reductions in air pollution and generating jobs.

2.5 STAKEHOLDER ENGAGEMENT PROCESS MANAGEMENT

Once the stakeholder engagement process is underway, sound management must keep the activities on course. Policymakers need to manage risks (Section 2.5.1), ensure transparent outcomes (Section 2.5.2), and finally evaluate and review the overall process (Section 2.5.2).

2.5.1 RISK MANAGEMENT

Stakeholder engagement can give rise to risks. Proactively identifying potential risks and responding rapidly to risks that eventuate can help ensure the effectiveness of engagement activities. Box 2-6 provides an example of how Mexico's stakeholder engagement managed these risks. The types of risks that must be managed include

- **Procedural risks.** Some stakeholders may feel overlooked or marginalized, statutory obligations may not be adhered to, or formal processes may be disrupted by opposing entities.
- **Political risks.** Formal engagement activities can raise the public profile of issues and create focal points for public opposition and demonstrations.
- **Communication risks.** Misinformation can be disseminated through inaccurate media or stakeholder reporting. Table 2-1 outlines the common assertions against ETSs that may proliferate.
- **Legal challenges.** Stakeholders whose concerns are not fully addressed may choose to challenge the government on legal grounds. Litigation can block or delay ETS implementation. The government should thoroughly assess the legal context in which it is operating, and any potential for legal challenges regarding the ETS. Box 2-7 discusses California's experience of legal disputes regarding its Cap-and-Trade Program.

Table 2-1 Assertions against an ETS and possible counterarguments

Assertion	Response supporting an ETS
An ETS imposes additional costs on the economy.	Notwithstanding their benefits, all emission reduction policies impose costs on emitters and therefore on the economy. This cost, however, needs to be weighed against the likely severe long-term cost of inaction against climate change and the local benefits of these policies. By providing a single and clear price signal to regulated entities, a well-designed ETS can deliver targeted emission reductions at a lower cost than other interventions, such as command-and-control policies or technology standards that target the same level of emission reductions. Moreover, it can incentivize regulated entities to innovate, making them more productive in the long run and reducing their costs. Compared to other policies, an ETS can save money for regulated entities as they can choose how to reduce their emissions.
A carbon tax is better than an ETS.	A carbon tax and an ETS each have strategic merits and differences that should be individually considered by each jurisdiction based on its own domestic circumstances (see Step 1).
Emissions trading allows polluters to avoid responsibility for reducing their emissions.	An ETS limits the system's total emissions but leaves it up to individual regulated entities to decide whether it is better for them to reduce their emissions or purchase allowances to comply with their obligations under the system. Entities that choose not to reduce their emissions always bear the full cost of that decision by having to purchase an allowance at the market-determined price.
Polluters can simply surrender offsets and buy their way out.	Though not a necessary part of an ETS, a well-designed offset program with a high degree of environmental integrity can provide additional flexibility and help regulated entities manage their costs (for more information on offset programs see Step 8). It can support emissions reduction activities domestically and internationally in sectors and jurisdictions not covered by an ETS. All current ETSs place an upper limit on the use of offsets for compliance, which ensures that most of the abatement occurs inside the scope of the ETS.
An ETS will place businesses' competitiveness at risk and send production overseas.	An ETS can avoid or mitigate adverse and disproportionate impacts on emissions-intensive, trade-exposed industries during the transitional period before carbon pricing is more widespread among trade competitors. Free allocation of allowances, price or supply adjustment measures, and incremental changes to the cap can all help address business competitiveness and carbon leakage risk. Importantly, an ETS provides financial advantages to firms that improve their emissions intensity and innovate. This can help improve their competitiveness in the longer term, especially as carbon regulations and climate policy develop around the world.
Free allocation is a subsidy from the government to polluters.	Well-targeted free allocation, whether permanent or temporary, can help firms and other affected entities adapt more smoothly and gradually to carbon pricing. It can reduce pressure to shift production and investment offshore and prevent job losses in the regulated jurisdiction or sector. The share of free allocation is generally reduced over time as ETSs mature and the incentive to reduce emissions is maintained (see next argument). Free allocation in an ETS is not considered a subsidy under international trade rules.
Participants who receive free allocation have no incentive to reduce their emissions.	Free allocation helps recipients manage the costs of ETS obligations while maintaining the economic incentive to reduce emissions. If participants do not reduce emissions, they have to buy allowances if their share of free allowances is insufficient. They also lose the opportunity cost of not being able to sell their allowances as they need them for compliance.
Market mechanisms cannot be trusted to solve the problems created by market failures.	As with all forms of regulation, an ETS requires strict monitoring and enforcement to maintain environmental integrity. While an ETS alone will not solve the market's failure to price the environmental impacts from emissions, a well-designed, sufficiently stringent market mechanism is a critical component of the solution.
ETSs are unfair and administratively burdensome for smaller emitters.	Small emitters may indeed face relatively higher transaction costs when complying with ETSs. However, jurisdictions generally have addressed this when designing the scope and compliance mechanisms of the ETS (see Steps 3 and 7).

Mexico engaged in extensive stakeholder consultations prior to the launch of its ETS. Box 2-6 illustrates how Mexico handled some of the risks of stakeholder engagement.

Box 2-6 Case study: Stakeholder engagement in the lead-up to the introduction of ETS in Mexico

Stakeholder engagement was a key component in developing the Mexican ETS pilot. It allowed regulated entities to be part of the design of the instrument and raised support and trust in a measure that is now a central component of Mexican climate policy.

The engagement process began in 2016, when the Ministry of Environment (SEMARNAT) announced plans to implement an ETS. This announcement led to informal meetings between SEMARNAT and representatives from sectors likely to be covered by the ETS, such as the steel, cement, mining, and chemical industries. Initial reactions by the private sector were critical and negative. In response, SEMARNAT emphasized the importance of sectorial contributions and the fact that the reality of the Mexican Nationally Determined Contribution ruled out the possibility of inaction. By 2018, SEMARNAT consolidated the engagement process into a working group with private-sector representatives to maintain a continuous dialogue on policy design. The working group met frequently, allowing regulators to identify industry concerns and incorporate their comments and suggestions into the draft ETS regulations. Private-sector support for the ETS grew to the point that, when a new administration took office in 2018, industry representatives supported the implementation of the pilot ETS. As the Mexican pilot is implemented, stakeholder engagement will continue: the ETS regulation establishes a consultative committee that was installed in June 2020 with the objective of supporting SEMARNAT in issuing recommendations on ETS design, evaluating the pilot phase, and other tasks.

Throughout this process, SEMARNAT — with the support of the PMR and the German Corporation for International Cooperation — commissioned a wide range of studies on technical ETS aspects, such as cap setting, policy interactions, carbon leakage risks, offsetting mechanisms, and ETS evaluation, among others. These studies have been fundamental not only to building on international best practices and adjusting policy design to the national context, but also as an additional channel of engagement with the private sector and, importantly, with other stakeholders within the Mexican government. The studies were also important within the government in the final stages of ETS policy approval and preparations for the implementation of the ETS, as they helped maintain institutional memory on policy choices. Several capacity-building activities were also carried out, including an eight-month-long ETS simulation exercise with key emitters, workshops for regulated entities, training programs for government officials, and study trips to learn from international experience.

Altogether, the stakeholder engagement process is seen by both policymakers and private-sector representatives as a mechanism to find common ground and to position the ETS as a feasible option for GHG mitigation in Mexico.

Legal challenges are far more likely when ETS are introduced in a politically contentious environment. Box 2-7 discusses California's experience of legal disputes regarding its Cap-and-Trade Program.

Box 2-7 Case study: Overcoming legal challenges: The case of the California Cap-and-Trade-Program

In California, political disputes led to lawsuits challenging the Cap-and-Trade Program, as well as a political referendum. However, the strong record that California created over years of planning, learning, and outreach, which carefully identified each decision and why it was reached, provided a strong foundation for defending these challenges. California has ultimately prevailed in every legal challenge adjudicated to date. Three of the key legal challenges include:

- **Initial Scoping Plan Challenge.** In 2009, a coalition of environmental justice groups, which favored a carbon tax over cap and trade, brought a lawsuit challenging whether California's proposed approach laid out in the Scoping Plan would adequately protect low-income, pollution-burdened communities as required by Assembly Bill (AB) 32.[74] After first requiring further analysis under the California Environmental Quality Act, the court ultimately declared the authority of CARB under AB 32 as broad and sufficient to encompass the cap and trade approach. While many environmental justice groups still have concerns, equity issues have been further addressed by ensuring that at least 35 percent of all revenue from the Cap-and-Trade Program benefits low-income, pollution-burdened communities.
- **Offsets Challenge.** In 2012, the Citizens Climate Lobby and Our Children's Earth Foundation challenged the use of offsets under California's Cap-and-Trade Program, claiming the design of the Cap and Trade Regulation and Compliance Offset Protocols did not conform to statutory and regulatory requirements, particularly related to permanence and additionality. In 2013, the state trial court ruled in favor of California, offering unequivocal support for the legality of the offset program. After an appeal by Our Children's Earth, the state appellate court upheld the trial court's ruling. The California Supreme Court denied a petition for review.
- **Auctioning or "Cap and Trade vs. Taxes" Challenge.** Lawsuits filed by the California Chamber of Commerce and the Morning Star Packing Company, an entity regulated by the Cap-and-Trade Program, were consolidated into a single legal challenge in 2013 alleging that auctioning allowances exceeded the authority delegated to CARB in designing a market-based mechanism to tackle greenhouse gas emissions. Furthermore, they claimed that the revenues generated at auction amounted to a tax, which violated the necessary legislative requirements for the enactment of taxation. In 2017, California's Third District Court of Appeals ruled in favor of CARB, upholding its authority to auction emission allowances in its Cap-and-Trade Program and rejecting the interpretation that the auctioning system constituted a tax. The California Supreme Court denied a petition for review.
- **Linking Challenge.** In 2019, the US federal government filed a lawsuit in the federal district court for the Eastern District of California challenging the constitutionality of California's linkage of its Cap-and-Trade Program with the Province of Québec's cap and trade system. The lawsuit claimed that the linkage of California's and Québec's cap and trade programs violated the US Constitution for four reasons: the linkage regulations and agreement violated the US Constitution's Treaty Clause, the Compact Clause, the Dormant Foreign Commerce Clause, and the Foreign Affairs Doctrine.[75] Over the course of two briefing schedules in early and mid-2020, the federal district court ruled in favor of California on all claims. The United States may still appeal the district court's decision.

2.5.2 TRANSPARENCY AND REVIEW

Transparency is an important component of stakeholder engagement. It helps ensure that stakeholders have confidence that their concerns are considered in the design and operation of the ETS. However, creating a platform for discussion is not sufficient in and of itself. For engagement to be credible, the information obtained from the engagement should be documented transparently by policymakers and the planned use of the information should be made clear to stakeholders. The government should ensure that it is accountable to stakeholders and the public for its response to this information.

Stakeholder engagement also requires evaluation and review. This can follow standard guidelines of evaluation and review of government activities. Good practices can include facilitators seeking immediate feedback after meetings with stakeholders, and surveys among ETS participants to solicit feedback on the stakeholder engagement process.

74 The environmental justice movement started in the United States in the 1980s and is a social movement that focuses on the fair distribution of environmental benefits and burdens, recognizing that low-income and minority communities have traditionally born disproportionate pollution burdens.

75 US Department of Justice 2019.

2.6 CAPACITY BUILDING

Designing and implementing an ETS will require capacity building, particularly in jurisdictions unfamiliar with market mechanisms for climate mitigation. This section covers key capacity-building needs (Section 2.6.1), possible approaches to meeting those needs (Section 2.6.2), the possibility of introducing pilot or voluntary systems first and the necessity to evaluate and review capacity-building activities (Section 2.6.3).

2.6.1 IDENTIFYING CAPACITY-BUILDING NEEDS

"Capacity" is the specialized understanding, skills, institutions, processes, and resources required to design and implement an ETS. All stakeholders will need the capacity to make informed judgments about the acceptability of an ETS and the degree to which they will be involved or affected. This requires familiarity with the objectives of the ETS, its design features, and its potential impacts.[76] There is a need to build capacity early in the process so stakeholders can effectively engage in the policy design process. A deeper level of understanding will be required for those more closely involved in design, decision-making, implementation, and technical advice. For example:

- **Government departments** involved in ETS design and implementation will need the capacity to fulfil new functions, such as
  - identifying and evaluating ETS design options;
  - drafting ETS legislation, regulations, and technical guidelines;
  - administering core ETS functions, including cap setting, allocation, monitoring, reporting, verification, enforcement, verifier accreditation, registry, and record keeping;
  - designing and administering offset mechanisms, if applicable;
  - managing ETS fiscal implications and impacts on other government policies, measures, and administrative systems; and
  - negotiating linking agreements, if applicable.
- **Regulated entities** will need the capacity to fulfil their obligations under the ETS for MRV and unit surrender. They will also need to develop new skills and processes for factoring carbon prices into business decisions, developing overall mitigation and investment strategies, applying for free allocation, operating a registry account, acquiring and trading allowances, managing the accounting and tax implications of ETS obligations, and hedging against new risks and uncertainties.[77]
- **Other market participants** will need the capacity to analyze the implications of government decisions on the marketplace, design facilitative services, and engage in the development of supporting processes and institutions such as offsets mechanisms, trading exchanges, and third-party verification of entities' emissions reporting. Legislators will need to understand the implications of decisions on ETS and other environmental legislation to effectively represent the interests of their constituents.

2.6.2 METHODS AND TOOLS FOR CAPACITY BUILDING

After assessing the current capacity of relevant stakeholders, policymakers can identify the gaps that need to be filled. A program for ETS capacity building can be designed based on a gap analysis. This program can build on existing ETS materials and tools from other jurisdictions and organizations; governments do not need to start from scratch. Key elements may include:

- **providing basic educational materials** with plain-language information about ETS design, impacts, and obligations;[78]
- **developing guidelines** and technical documentation through a process of participant input and review to ensure they are comprehensible and practical;
- **holding workshops and events** that create an opportunity for information sharing;
- **providing training** to staff who will be involved in ETS-related activities;
- **running ETS simulations** to provide experience with trading and compliance in a controlled setting made to be as realistic as possible (see Box 2-8);
- **engaging researchers** to help develop an ETS design tailored to the local context, based on experiences gained elsewhere; and
- **encouraging learning from other systems** by engaging those with prior experience in ETS design. Study tours and inviting outside experts to present can be helpful in showing stakeholders how other ETSs are operating. The PMR, ICAP, and other organizations, as well as donor countries, can assist with capacity

76 Hausotter and Mehling 2012.
77 For case studies on companies' practical experience in preparing for emissions trading, see PMR (2015e).
78 See, for instance, the ICAP ETS Briefs, short leaflets that are available in several languages from the ICAP website at www.icapcarbonaction.com, which provide a general overview of the basics of ETS design, arguments for emissions trading, and information about the systems in operation and under planning worldwide.

building through information resources, technical training, and country-to-country exchanges. Box 2-9 provides an example of how these resources were used in China.

Box 2-8 Technical note: ETS simulations for capacity building

Carbon market simulations are programs, models, virtual environments, and/or games that allow stakeholders to participate in a fictitious process of designing or participating in an ETS.[79] A number of jurisdictions have used them as a relatively low-cost tool to engage, train, research, and test designs, particularly in the early stages of carbon market development. Most ETS simulations are designed as "games" where participants assume specific roles and enact trading in a market or simulate a policy design process. While some simulations are developed for one specific user group others target multiple ETS stakeholders including industry, government, academia, and civil society. Most simulations to date focus on either ETS policy design, where participants take on various stakeholder roles to simulate the design and engagement process, or trading, in which participants simulate trading and compliance obligations for regulated companies. Over the years, simulations have taken place nationally in Brazil, China, Turkey, the EU, the Nordic region, Germany, Mexico, Japan, and Korea, as well as at the subnational level in Alberta and California.

The experiential learning for participants from these exercises increases ETS literacy and illustrates how policy outcomes are a function of design. Simulations can also strengthen relationships among key stakeholders and help build support for emissions trading as a policy option. Finally, simulations provide participants with a safe and risk-free opportunity to try out new ideas, make mistakes, and draw lessons that can serve to speed the adoption of effective ETSs.

Box 2-9 Case study: Building capacity for the Chinese national ETS

While building capacity is a key step to the launch of any domestic carbon market, the challenge has been nowhere as big as it is in China, the world's largest ETS. Already in its initial phase, the Chinese carbon market will cover more than 2,200 companies. All participating entities need in-house expertise on emissions management, abatement options, and how to comply with the system. The same is true for officials at the national level, who assume policy coordination, and in the provinces, who are responsible for allowance allocation and enforcement.

Various actors contribute to supporting capacity development in China, including the PMR, the EU, the German government, the Asian Development Bank, ICAP, the Environmental Defense Fund, the Energy Foundation, and the governments of Norway, the United Kingdom, and the Netherlands. Initial capacity-building efforts focused on supporting the Chinese ETS pilots and included bringing in experiences and lessons learned from existing ETSs into specific local and regional contexts. The experiences from the pilots and the capacity built there in turn helped inform discussions and progress preparations for the national system. Overall, capacity-building efforts have contributed to knitting together different pieces of knowledge, both international and domestic, to support the development and implementation of the national ETS as well as identify knowledge gaps.

The shift in responsibilities for the national ETS from the National Development and Reform Commission to the Ministry for Ecology and Environment in 2018 proved a temporary damper on the rollout of capacity building across China. Many actors who had been trained for assuming roles in management of the ETS at national and provincial levels were no longer responsible for this issue, and new counterparts required renewed capacity building. At the end of 2019, the Ministry for Ecology and Environment coordinated a large-scale capacity-building initiative focusing on the National ETS Allowance Allocation Plan and other ETS policies. The objective was not only to enable all participants' understanding of allowance allocation standards, but also to receive their feedback for the sake of continuous improvement of China's national ETS allocation methods and overall design. Nearly 5,000 participants were trained in seven weeks at 17 training sessions across China, enhancing the readiness of public and private-sector stakeholders to engage in the construction and ultimately operation of the Chinese national ETS.

Taken together, the Chinese experience illustrates that capacity building remains relevant well beyond the launch of a system, using multiple formats and methods, and gradually shifting from international expertise-sharing to domestic stakeholders acting as multipliers, thus consolidating and broadening the domestic knowledge base.

79 ICAP and Carbon Pricing Leadership Coalition 2020.

2.6.3 EVALUATION AND REVIEW

Evaluation and review of capacity-building programs can be a valuable exercise. Capacity-building needs will evolve as ETS development moves from scoping to design, authorization, operation, review, and amendment. Collecting information within and outside of government on the effectiveness of capacity-building activities and materials, as well as remaining gaps in capacity, can assist in the process of continuous improvement of the ETS. In the longer term, standardized ETS capacity-building activities can become part of the routine training for new staff in both government departments administering the system and entities fulfilling ETS obligations. There may be a place for learning by doing through a pilot or voluntary ETS while regular reviews and independent evaluation of an ETS will also support learning. These are discussed in Step 10 of the handbook.

STEP 2 STAKEHOLDERS

2.7 QUICK QUIZ

Conceptual Questions

1. Why is it important to engage with stakeholders throughout development of an ETS?
2. What are different methods of engagement that could be used during development of an ETS?

Application Questions

1. What would be the key stakeholder groups to engage with in your jurisdiction? What would be their key interests?
2. What type of capacity building would be needed to build sufficient understanding and acceptance of climate change market mechanisms for decision-making on an ETS by key government and other stakeholders?
3. Who might be potential "champions" of an ETS both within government and outside of government?

2.8 RESOURCES

The following resources may be useful:

- Guide to Communicating Carbon Pricing

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STEP 3
Decide the scope

BOXES

FIGURES

TABLES

STEP 3
SCOPE

AT A GLANCE

Checklist for Step 3: Decide the scope

- ✔ Decide which sectors to cover
- ✔ Decide which gases to cover
- ✔ Choose the points of regulation
- ✔ Choose the entities to regulate and consider whether to set thresholds
- ✔ Choose the point of reporting obligation

The scope of an emissions trading system (ETS) refers to the sources of emissions and types of GHGs covered by the system. Decisions about scope are some of the most critical design elements of an ETS.

There are several arguments in favor of making the scope of an ETS as broad as possible. A broad scope means the ETS encompasses a greater portion of the jurisdiction's emissions, providing more certainty on attaining jurisdiction emission targets. It can also have several additional benefits including lowering the overall cost of emissions reductions to society, reducing compliance costs for entities, reducing competitiveness impacts between sectors, and improving the depth and performance of the secondary market.

On the other hand, an ETS with a broad scope can involve higher administrative costs because of the higher number of entities involved. This trade-off can be managed by instating a minimum level or threshold, so that only entities of a certain size are covered by the ETS. This excludes small emitters and lowers the administrative burden. Additionally, the point of regulation, or the part of the supply chain at which emissions must be monitored and allowances surrendered, can be placed where there are the fewest number of firms. Expanding the ETS to sectors with comparatively high marginal abatement costs should also be carefully considered, as it can result in significant distributional effects and may be better addressed by an alternative policy instrument.

Consideration of the scope of an ETS raises the following important questions:

- ▲ **Which sectors and gases to include?** In general, it is preferable to include sectors and gases that account for a significant share of greenhouse gas (GHG) emissions, provided those emissions can be monitored easily. Often, the areas worth including in the scope are those where there is otherwise insufficient financial incentive to reduce emissions and where co-benefits may be realized from achieving emission reductions.
- ▲ **At what point should regulation be introduced?** Emissions should be regulated at a point where they can be monitored accurately with low uncertainty, compliance can be enforced most easily, and where regulation can generate a price signal that incentivizes behavioral change (either directly or through cost pass-through). While measurement of emissions is usually most accurate at the point where GHGs are released into the atmosphere (the "point source"), there are good reasons to regulate emissions further up or lower down the supply chain ("upstream" and "downstream" respectively). The administrative costs of monitoring emissions are usually lowest at the point where the supply chain is most concentrated (i.e., where the fewest firms operate). In some markets, particularly the energy sector, this will be upstream; however, this may differ by sector. Regulating closer to the point source of emissions may involve higher transaction costs if the supply chain is more diffuse. However, these additional costs may be mitigated if there is existing regulatory infrastructure in place, such as existing emissions monitoring and reporting requirements for other air pollutants. Hybrid designs are used in many ETSs, where certain sectors are covered at the point source, while others may be covered upstream or downstream of the emissions source. Selecting the point of regulation also requires careful consideration of carbon leakage risks, other competitive distortions, and distributional effects.
- ▲ **Should there be emissions thresholds to avoid including too many small entities?** Thresholds are commonly used to help reduce compliance costs for small entities, as well as lower the administrative costs of operating an ETS. However, a desire to reduce costs must be balanced against the fact that thresholds reduce the number of actors incentivized to reduce emissions, thereby forgoing some of the environmental effectiveness of the ETS. Thresholds may also cause competitive distortions between entities on either side of the threshold. Any threshold needs to be calibrated to jurisdiction-specific factors. Opt-in provisions can offer some flexibility.
- ▲ **Where should the reporting obligation be placed?** A further important design characteristic concerns who is legally responsible for complying with the ETS regulations, that is, for surrendering to the regulator an allowance for each ton of emissions. The choice depends on which entities can be held legally liable and where data is available and auditable. Often these factors depend on existing regulatory structures.

The ETS scope may evolve over time to reflect the jurisdictional context, including changes in ambition, capacity, or the role of the ETS in the policy mix. Policymakers will also need to integrate lessons learned from implementation, which might involve changes to scope (see Step 10).

This chapter considers the sources of emissions and types of GHGs that might be covered by an ETS and how their regulation might be affected. Section 3.1 introduces the issue. Section 3.2 considers some of the general design questions that policymakers need to address. Section 3.3 examines some of the specific issues that are likely to arise when considering covering certain emissions sources.

3.1 INTRODUCTION

The scope of an ETS refers to the sources of emissions and types of GHGs covered by the system. Decisions about scope are some of the most critical design elements of an ETS.

A number of factors point toward considering as broad a scope as possible. The advantages of a broad coverage include:

- **Certainty on predefined emissions target.** By ensuring coverage is broad (i.e., more emissions are included in the ETS cap), policymakers can be more confident about meeting a predefined national emissions reduction target.
- **Enhanced cost efficiency.** Including a larger number of sectors increases the potential to achieve cost-effective emissions reductions because there is a wider array of abatement options (with varying costs). This increases the probability of entities being able to achieve gains from trading emissions allowances (see Step 1). Including as many sectors as possible might also have some positive economies of scale, where administrative costs can be spread across a larger number of entities, reducing the cost per regulated entity.
- **Intersectoral competitiveness impacts or domestic leakage.** Broad coverage can reduce the likelihood of competitiveness impacts that may arise if one sector or type of emitter is included but another is not. These distortions are most likely to occur between products that can be easily substituted for one another. For example, steel and aluminum may be substitutable building materials, and gas and oil could be substituted for electricity generation. Substitutions may also arise because of technology change — for example, electrification of transport or the development of the wood-pellet industry. While substitutions away from emissions-intensive industries and processes are an intended result of an ETS, those that arise only because one sector is included in the ETS but another is not may be undesirable and distortive. They may result in emissions simply "leaking" from a covered sector to an uncovered sector as a result of product substitution, without the desired abatement action.
- **Market operation.** A broader scope may improve the operation of the resulting carbon market: a greater number of (diverse) trading entities in a market generally makes for higher liquidity, a more stable price, and a reduced potential for any one entity to gain market power.[80]

However, there are four key reasons why broad coverage may not be appropriate:

1. **Transaction and administrative costs.** Despite economies of scale associated with broad coverage, technical and administrative barriers can make a broad scope infeasible — the logistics and cost of monitoring emissions in particular differ across sectors and sources (which do not scale easily). Benefits of broad coverage may be outweighed by administrative or other monitoring, reporting, and verification (MRV) costs faced by the regulated entities and the regulator.
2. **Distributional challenges.** Including sectors with comparatively high marginal abatement costs in an ETS could result in undesirable distributional effects. This is because compliance costs may end up concentrated in sectors that are not able to achieve a reasonable degree of cost pass-through. The political and social implications of these distributional effects need to be carefully considered when deciding on the scope.
3. **Carbon leakage risk.** While a broad scope minimizes the risk of domestic leakage, coverage of certain industrial sectors may put emissions-intensive, trade-exposed entities at risk of carbon leakage internationally. If some jurisdictions regulate emissions but others do not, there is a risk of production relocation or changes in investment patterns to unregulated jurisdictions.[81] This can have undesirable economic, environmental, and political consequences. However, these concerns can be addressed, including by establishing transitional free allocations for sectors particularly susceptible to international carbon leakage, or in the extreme case, excluding the sector from the

80 Geographic extension of the ETS through linking can also lessen competitiveness impacts and improve market operation; see Step 9 – Consider Linking.
81 A detailed discussion of leakage issues is given in PMR 2015g.

scope of the ETS. A further discussion on carbon leakage and tools to address it is provided in Step 5.

4. **Complexity of regulatory environment.** In most if not all jurisdictions, some sectors will already be subject to other policies and measures aimed at reducing GHG emissions. The combination of existing policies and measures with an ETS might lead to a regulatory environment that is overly complex. However, ongoing reviews of, and updates to, the policy mix to maximize mitigation is still desirable.

Policymakers must balance the benefits of broader coverage against the additional administrative effort and transaction costs when deciding on the scope of an ETS. They must also consider the effectiveness and availability of alternative or companion policies. Design features such as using thresholds to exclude small emitters and placing the point of regulation at the most concentrated part of the supply chain (therefore reducing the number of regulated entities while maintaining sectoral scope) can help manage this trade-off. Hence, there are four key questions that policymakers need to consider when determining the scope of the ETS:

- What sectors or emission sources will the ETS cover?
- What should the points of regulation be in those sectors?
- What is the emissions threshold below which an entity should not be regulated by the ETS?
- With whom does the compliance responsibility lie: companies or installations or a combination of both?

The ETS scope may evolve over time to reflect the jurisdictional landscape, including changes in ambition, capacity, or the role of the ETS in the policy mix. Policymakers will also need to integrate lessons learned from implementation, which might involve changes to scope (see Step 10).

3.2 SCOPE DESIGN

This section discusses factors policymakers must consider when deciding the scope of an ETS:

- sector and gas coverage,
- point of regulation,
- threshold, and
- level of reporting obligation.

Effective governance of an ETS involves a regular review of design choices. Accordingly, the scope might be expanded or revised in future periods. It is possible, and even prudent, to start with a narrow scope that is later expanded and deepened as capacity among businesses and regulators increases.

3.2.1 SECTOR AND GAS COVERAGE

Differences across sectors and emissions sources can affect the extent to which they are worth covering within an ETS. Important considerations include:

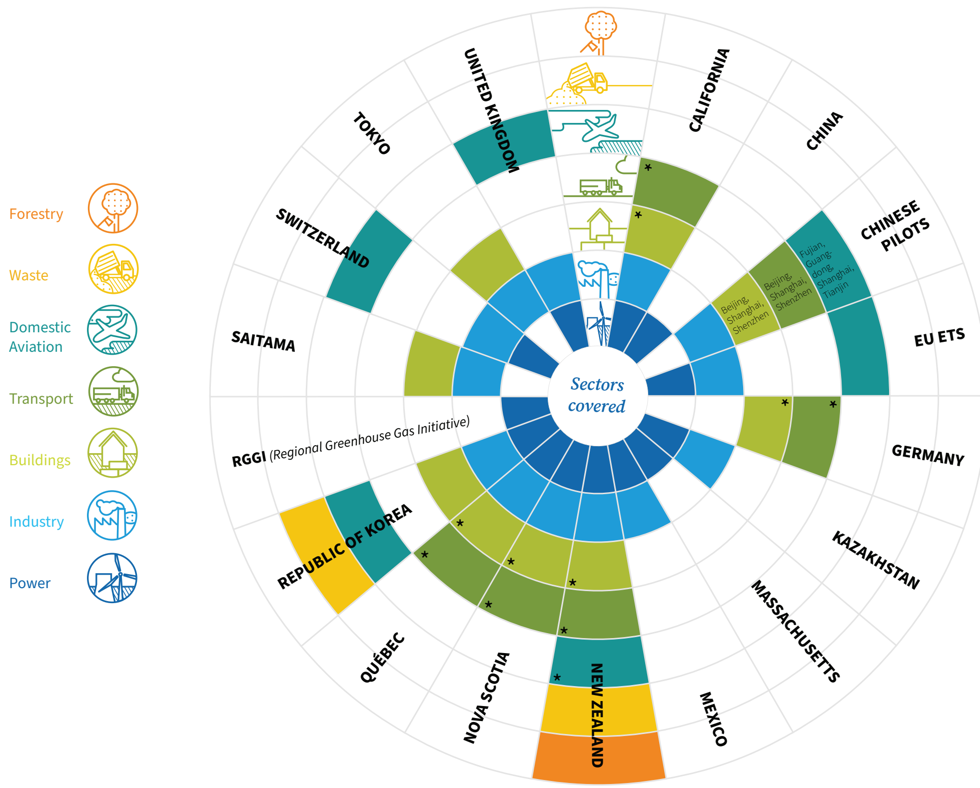
- **The share of a jurisdiction's GHG emissions a sector represents.** The benefit of including a sector depends on the proportion of emissions it accounts for. In many industrialized countries, for instance, land use or waste may account for less than 5 percent of GHG output while power and industry account for 40 or 50 percent. Conversely, in developing countries or developed countries with a large agricultural sector (like New Zealand), land use might account for a significant share of emissions. These jurisdiction-specific circumstances must be considered when determining sector coverage, with a focus on including sectors that account for significant shares of emissions.
- **Currently available and future mitigation options.** While some sectors may seem to have more low-cost mitigation options, this is hard for regulators to understand and predict. This difficulty is one of the major justifications for using carbon pricing: it allows businesses to find the cheapest solutions based on industry knowledge, and incentivizes innovation. In the longer run, abatement options are even harder to predict, and all sources need to reduce emissions to achieve the global goal of net zero emissions. If short-term mitigation opportunities seem to be expensive and scarce, the sector may be a good target for research and development assistance to unlock its abatement potential.
- **Market structure (i.e., number and size of emitters).** To be effective, an ETS requires that emissions can be measured and monitored with low uncertainties and at reasonable cost. Covering sectors dominated by a small number of large regulated entities can provide high benefits relative to administrative effort. These emitters can be included, while smaller emitters can be excluded (for example, through minimum emission thresholds). By contrast, covering sectors composed of many small or diffuse emission sources may involve high administrative costs relative to benefits. The waste sector is a typical example. It often consists of a number of small landfills accepting waste from local communities. Tracking the emissions from each landfill and holding owners of small landfill sites accountable can increase the regulatory

burden of the system. However, in some sectors, such as transport, it might be possible to regulate emissions higher up in the supply chain, where the number of market players is smaller. The transport sector is difficult to cover at the point source of emissions (for example at the level of each vehicle), but emissions can be regulated upstream (for example at the fuel distributor level, as is the case in California's and Québec's ETSs).

- **Regulation and transaction costs.** Some sectors might be particularly cost-effective and easy to regulate due to existing data on emissions and MRV infrastructure. Even when these sectors account for only a small share of emissions, they can be included with little additional cost.
- **Co-benefits of coverage.** Co-benefits can also play an important role when determining sectoral coverage. Although the benefits from GHG emission reductions are completely independent of the location of the reductions, many co-benefits are location specific. For instance, co-benefits from covering road transport may include reduced air pollution or traffic congestion, both of which primarily benefit urban areas. While the mitigation benefits alone might be insufficient to justify the cost of including a particular sector in the ETS, factoring in co-benefits could tip the scale in favor of covering it.
- **Regulatory environment.** If the regulatory arrangements for certain sectors do not allow the reflection of carbon prices for operational or investment decisions, these sectors might be of secondary importance for the scope of an ETS. The electricity sector is a possible example, where existing regulations might require careful consideration of carbon pricing design (see Section 3.3.1).

Figure 3-1 shows the global experience in terms of sector coverage. It shows that nearly all ETSs globally cover electricity generation and industrial emissions — both process emissions (for example from cement and steel) and emissions from fossil fuel combustion in industry. Coverage of emissions associated with building use is relatively common, while road transport and domestic

Figure 3-1 Sector coverage by ETS



* indicates which sector represents upstream coverage

Note:
Agriculture is a major source of biological emissions; however, the sector does not yet face direct compliance obligations under any existing ETS. Currently, in New Zealand, agricultural emissions must be monitored and reported under the ETS, and some offset programs (e.g. California) allow for offset projects in the sector.

Adapted from ICAP 2021.

aviation are less so. Only a minority of ETSs cover emissions from waste or activities in the forestry sector.

The decision on which sectors to include is closely related to the question of which gases to include. Considerations are broadly the same: increasing the scope increases the possibility for low-cost abatement and jurisdiction-wide environmental certainty. However, depending on the local emissions profile, these benefits may be exceeded by the administrative cost. Table 3-1 shows the range of choices made by current ETSs in terms of gas coverage.

Table 3-1 Gases covered in existing ETSs

Jurisdiction	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	NF_3
California	●	●	●	●	●	●	●
China national and pilots*	●						
EU	●		●		●		
Kazakhstan	●						
Massachusetts	●						
Mexico Pilot	●						
New Zealand	●	●	●	●	●	●	
Nova Scotia	●	●	●	●	●	●	●
Québec	●	●	●	●	●	●	●
Republic of Korea	●	●	●	●	●	●	
Regional Greenhouse Gas Initiative (RGGI)	●						
Switzerland	●		●		●		
Toykyo-Saitama	●						

* With the exception of Chongqing, which covers all the above gases.

Globally, carbon dioxide makes up by far the largest portion of GHGs and all ETSs include this gas. Many systems also include other gases. As methane and nitrous oxide are sometimes a significant portion of domestic emissions (for example from industrial processes, fossil fuel extraction, landfills, and agriculture), coverage of these gases may be important to consider, especially in developing countries and economies with large agricultural sectors.

Despite the smaller volume of other gases, it is important to consider including them within the ETS scope because they might have a greater ability to absorb heat (i.e., a higher "radiative efficiency"). The global warming potential (GWP) of a gas combines both radiative efficiency and how long the gas stays in the atmosphere into a score, calculated relative to carbon dioxide, which has a GWP of 1. For example, methane, which has a high radiative efficiency but short lifetime, has a GWP of 28 over 100 years; for nitrous oxide the GWP is 265 over 100 years.[82]

3.2.2 POINT OF REGULATION

Once policymakers decide to include a sector or source of emissions in an ETS, a critical design feature is the point at which those emissions are regulated. There are several points in the supply chain at which emissions can be regulated. These include:

- **At the source of emissions.** This is where the GHGs are physically released into the atmosphere. The European Union (EU) ETS, for example, covers emissions at the point source by regulating power generation and industrial facilities.[83]
- **Upstream.** This is a point in the supply chain before the point source of emissions. It is often used for energy emissions, where a fossil fuel is covered at the point at which it is first commercialized by extractors, refiners, or importers. For example, in the California Cap-and-Trade Program, the point of regulation for transportation fuels that will be combusted and thus cause GHG emissions is where they *enter commerce*. In practice, the point of regulation is at terminal racks and large refineries where transportation fuels are physically transferred. The German fuel ETS regulated fuel distributors and final consumption suppliers, which are also upstream of the point of combustion. In both cases, the owners of these facilities pass the costs reflecting the embedded carbon dioxide (CO_2) through to the consumer in the form of higher fuel product prices. Figure 3-2 illustrates this cost pass-through.
- **Downstream.** This is a point in the supply chain after the point source of emissions. For instance, the Tokyo-Saitama ETS covers emissions from electricity used in buildings, which is downstream of the source of emissions. Downstream coverage has also been considered for emissions from other sectors, such as agriculture, where coverage at the point of emissions would have significant administrative costs.

The appropriate point of regulation will differ depending on the sector and sources of emissions, as well as the regulatory environment in each jurisdiction. Ideally, the point of regulation should be placed where:

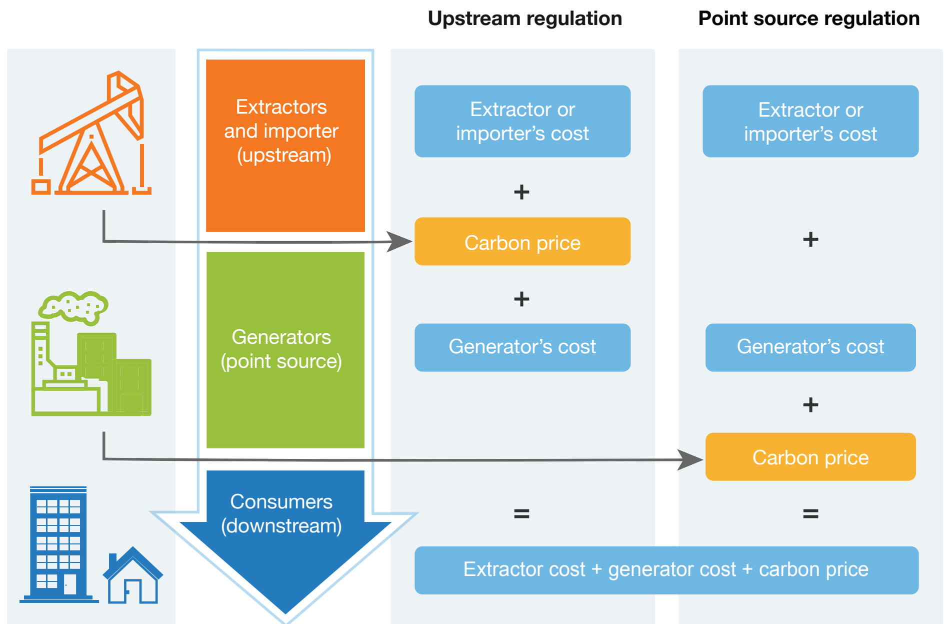
- **Emissions can be measured with high accuracy.** Accurate emissions monitoring ensures that the

82 This refers to the GWP values for methane and nitrous oxide from IPCC's *Fifth Assessment Report*, 2014 (AR5). However, in some ETSs GWPs from IPCC's *Fourth Assessment Report*, 2007 (AR4) are still used (25 for methane and 298 for nitrous oxide).

83 While the point of regulation in the EU ETS is at the source of emissions, this is often referred to as "downstream" because the point of regulation is downstream from where the fuel is produced.

carbon price is providing the appropriate level of liability for a given level of emissions, and therefore is accurately targeting incentives to reduce these emissions. Changing the point of regulation may alter the accuracy of monitoring because different data sources will be available at different points in the supply chain. For instance, in the energy sector upstream measurement can be quite accurate because the carbon content of fuels is known, whereas for industrial process emissions the diversity of processes can make it difficult to accurately measure emissions except at their point source.

Figure 3-2 Cost pass-through at different points of regulation



Note: This assumes 100 percent pass-through of the carbon price at extractor/importer and generator levels.

- **A direct price signal can be generated or cost pass-through is possible.** For the ETS to be effective in changing behavior, the point of regulation must be able to influence behavior, and therefore, emissions. This can occur either directly or via passing the cost through to subsequent links of the supply chain. For example, electricity suppliers must be able to reflect the carbon price in consumers' electricity prices in order to incentivize lower consumption, investment in energy efficient appliances, or switching to electricity generated by renewable sources.
- **Monitoring costs are lowest and compliance can be most easily enforced.** The administrative costs of monitoring emissions are lowest at the point where the supply chain is most concentrated since it is easier to regulate a smaller number of large entities.[84] Energy markets are usually most concentrated upstream, but for other sectors this may not be the case (see Figure 3-3).
- **It is most efficient to deal with issues of carbon leakage.** To address the risk of carbon leakage, free allocations or other support measures are often provided to emissions-intensive, trade-exposed industries (discussed further in Step 5). Free allocations are often calculated at the facility or company level, implying that there can be administrative efficiencies from also having the point of regulation at this level.

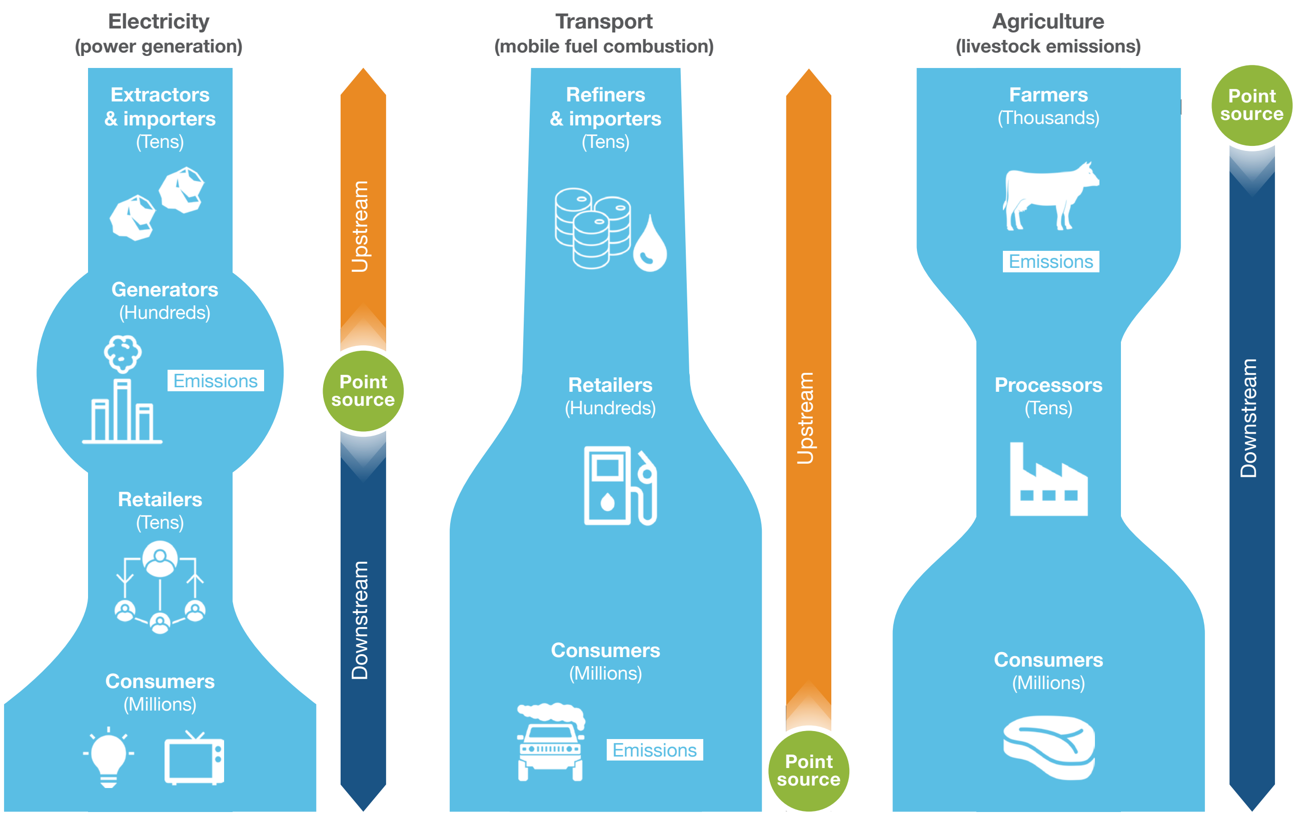
To date, most jurisdictions have chosen to cover emissions at the point source or upstream in the supply chain.

There are several advantages to having the emissions regulated at their point source:

- Ensures that polluters face "visible" incentives to reduce emissions. As emitters see a direct cost to pollution, they face a clear incentive to adopt emissions reductions technologies and processes or to change their consumption choices. Regulating upstream or downstream relies on the additional costs being passed through into the price that is passed down the supply chain. If this is not considered likely, for instance due to the market power of suppliers, then these incentives will be reduced.[85] Even where costs are passed through, organizational and behavioral factors mean that regulating at the point of emissions may be considered more effective in incentivizing entities to reduce emissions (see Box 3-1).

84 Only including large emitters might come at the cost of market depth and some increase in market power for large entities trading allowances, but this depends on the relative size of sectors trading and overall liquidity in the market.
85 Kim and Lim 2014.

Figure 3-3 Examples of market concentration across sectors



Box 3-1 Technical note: Regulation and behavioral impacts

Regulating energy use at the point of emissions is sometimes seen as more effective in incentivizing emissions reduction behavior. Emissions sources (for example, large installations) face identical economic incentives regardless of whether the carbon price is placed directly at the point of emissions, or indirectly through increased fuel prices. However, this theoretical equivalence may not hold in practice because visibility of the regulation — its "saliency" — might be important in its own right. That is, the increase in cost must be clearly and directly associated with carbon pricing to stimulate a behavioral response.

However, it is possible to address these behavioral concerns through means other than placing the point of regulation where emissions occur. Direct engagement, technical advice or mandatory reporting, and emission reduction plans can improve decision makers' understanding of the potential to benefit from mitigation as well as the economic costs of not doing so. These additional measures could help shed light on the opportunities for companies to mitigate at any point in the energy supply chain and could be cheaper than changing the point of regulation to be at the point of emissions. For example, one of California's complementary policies from the 2008 Scoping Plan required large industrial facilities (for example, refineries, cement kilns, and food processors) to do energy efficiency audits. The policy also required the facilities to assess the GHG and local pollutant co-benefits for energy efficiency measures identified during the facility audits. The policy was designed to encourage facilities, many of which received updated output-based allocation under the Cap-and-Trade Program, to consider GHG-saving measures that could reduce energy and ETS compliance costs. The value of direct regulatory signals in terms of institutional incentives varies by culture and organizational form.

- **Can better align with allowance allocations and other reporting requirements.** If company- or facility-level data is required in order to freely allocate allowances (see Step 5) or provide other compensation, then there can be administrative efficiencies from aligning the point of regulation to this level. While this can require covering a large number of facilities, in some cases existing permitting and licensing regulations can provide an existing source of high-quality data. For example, in the EU, the 1996 Integrated Pollution Prevention and Control Directive established a set of common rules for permitting and controlling industrial installations that facilitated regulation at the point source of emissions.[86] Finally, in some cases institutional capability to monitor and enforce compliance may be stronger at the point of emissions, particularly if there is a small number of large emitters.
- **Allows emissions to be measured more accurately.** Measuring emissions at the point source is typically more accurate and nuanced, as it requires fewer assumptions than estimating emissions upstream. For example, point source measurement accounts for fuels that are extracted but not combusted (and therefore do not emit GHGs). This includes natural gas that can be used as a feedstock rather than as fuel. Non-combustion emissions in industrial processes can only be measured at point source.

On the other hand, upstream regulation can have some key advantages:

- **Administrative costs can be lower.** This is particularly the case in the energy sector, where there are often far fewer entities involved in fossil fuel extraction and commercialization than in final consumption. In this case, upstream entities are also more used to operating in complex regulatory environments, which can reduce administrative costs and increase market efficiency. However, this depends on the specific nature of the source of emissions, as not all sectors' supply chains will be most concentrated upstream.
- **It can enable higher coverage across sectors and avoid thresholds within sectors.** Linked to the above point, upstream regulation may not require the thresholds often necessary in downstream systems in order to avoid high transaction costs (discussed in Section 3.2.3). Thresholds can result in market distortions, including intra-sector leakage between firms on either side of the threshold. As thresholds are based on the amount of firm's emissions, not their emissions intensity, they can have the effect of increasing emissions if production moves from a regulated entity to an unregulated entity that is more emissions intensive. These problems may be avoided by adopting upstream regulation.[87] For example, California's ETS applies to 80 percent of the state's emissions by covering around 350 entities. New Zealand's regulation covers 100 percent of fossil fuel emissions by regulating just 128 firms. By contrast, the EU ETS covers 45 percent of total greenhouse gas emissions with over 11,500 entities covered.[88]

Systems will often take a mixed approach to the point of regulation, covering some sectors or activities upstream and others downstream, at the source of emissions. The California Cap-and-Trade Program and the Québec Cap-and-Trade Program both have used a mixed approach, as discussed in Box 3-2.

STEP 3 SCOPE

Box 3-2 Case study: Upstream regulation

A number of jurisdictions have included upstream coverage of emissions, meaning that emissions are regulated at the point of extraction or distribution, rather than when and where they are emitted into the atmosphere. Upstream emissions coverage can be an effective way to incorporate sectors with many small final emitters without requiring that final emitters actually participate in the ETS. However, the effectiveness and viability of upstream emissions coverage will to some extent be constrained by the ability of upstream entities to pass through the carbon price signal to downstream emitters.

New Zealand has chosen a system that is as far upstream as possible for all energy-related emissions, while still dealing with emissions from forestry, waste, and industrial emissions downstream. Fossil fuels, whether for transport, electricity, or direct energy use, are regulated upstream at the point of production or import. In total, the government enforces compliance for 128 entities in the energy, liquid fuel, and industrial sectors, yet covers 100 percent of CO_2 emissions from fossil fuel use.[89] This can be compared to the other 2,281 entities covered mainly downstream in other sectors of the New Zealand ETS (NZ ETS), the majority of which are for post-1989 →

86 Directive 96/61/EC, which was subsequently replaced by the Industrial Emissions Directive (directive 2010/75/EU of the European Parliament and the Council on Industrial Emissions).

87 Choosing an upstream point of regulation for energy so that emissions from more sources are covered reduces leakage across firms within and between sectors. See Bushnell and Mansur 2011.

88 There are factors other than whether regulation is introduced at an upstream or downstream point that affect this comparison including whether it is installations or companies that are regulated (see Section 2.4).

89 New Zealand Emissions Trading Register 2019.

forestry activities. The upstream approach to fossil fuels has allowed for administrative simplicity while ensuring comprehensive coverage. However, a few large downstream firms felt that their upstream fuel suppliers — to whom they are tied because of small markets — were not managing the GHG liabilities efficiently and hence were passing on a GHG cost that was too high. In a few cases, this has been resolved through private contracts that allow the downstream firm to manage its GHG liabilities and provide units to the upstream regulated party as it buys fuel. Moreover, the government has enabled some downstream firms to "opt in" as a point of regulation, avoiding double counting by providing a rebate to the upstream point of regulation for emissions associated with the fuel sold to these downstream firms.[90]

The systems of California and Québec mix upstream coverage of transportation fuels with downstream coverage for the power and industrial sectors. Upstream coverage of transportation fuels reduces administrative costs by regulating a relatively small number of fuel distributors, while downstream coverage of the in-state power and industrial sectors directly regulates emissions at their source, which aligns better with existing regulatory practices and increases the visibility of the carbon price for these sectors. This approach of "mixed coverage" allows these systems to capture 80 percent or more of the emissions in their jurisdictions.

One consideration for mixed stream coverage is to ensure there is no double regulation — for example, no instances where emissions are regulated both upstream and downstream. This can occur where fuel distributors sell fuels to downstream industrial facilities that are also covered by the ETS. In this case double counting is avoided through the use of a GHG accounting procedure allowing upstream fuel suppliers to reduce their surrender obligation by the amount of fuel sold to downstream regulated entities.

3.2.3 THRESHOLDS

In order to minimize administrative and MRV costs while maximizing the number of sectors covered in an ETS, policymakers have tended to introduce thresholds on ETS participation. This means that entities below a certain size are not subject to the ETS's requirements. Thresholds can significantly reduce the number of regulated entities while excluding a relatively small quantity of emissions sources and mitigation opportunities. Thresholds play a particularly important role when energy or industrial emissions are regulated at the point source of emissions.

The size of a regulated entity (and therefore the threshold) can be measured using a number of different indicators, including GHG emissions per year, energy consumption level, production level, imports, or capacity. The Korean ETS, for example, uses a threshold of 25,000 tons of CO_2 per year at facility level, or 125,000 tons of CO_2 per year at company level. Entities with emissions exceeding these thresholds are deemed to be within the scope of the ETS.[91] Similarly, the Mexican pilot ETS has a threshold of 100,000 tons of CO_2 per year at facility level.[92] The EU ETS, on the other hand, regulates power sector entities with a capacity of over 20 megawatts (thermal rated input).[93]

The appropriate threshold depends on each jurisdiction's context, including its specific mitigation goals, the capacity of firms to manage ETS compliance, and the government's capacity to enforce compliance. Sector-specific issues, like the market structure, distribution of emissions across entities in each sector, and the range of mitigation options available to local entities of different scales, also play a significant role in the decision. The market structure can affect both the number of entities (and thus the level of emissions) covered, and the risk of production leakage from covered to unregulated entities.

Key considerations for the choice of threshold include:

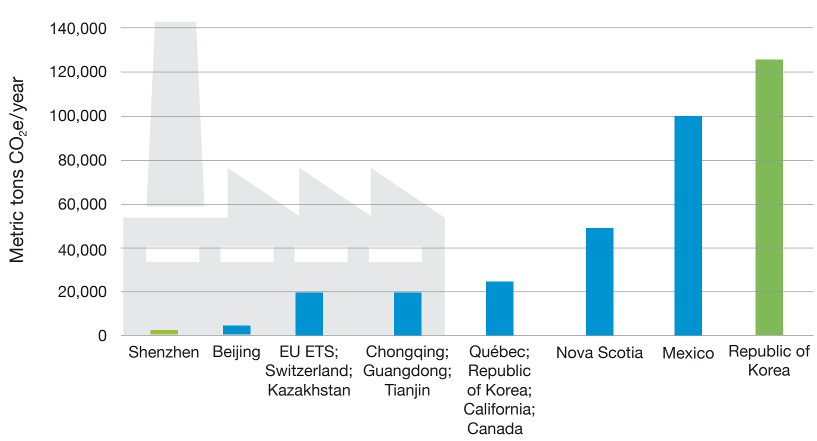
- **Number of small sources.** If there are many small sources of emissions then a relatively low threshold may be needed in order to ensure that, in total, a large proportion of emissions is covered. The benefit of including a sector where a low threshold is needed must be carefully weighed against the potentially high administrative cost of including such a sector.
- **Capabilities of firms and regulators.** If small firms have limited financial and human capacity, the additional costs of complying with an ETS may be significant and could influence their decision to operate. In this case a threshold set at a higher level (thereby covering fewer entities) may be preferred.[94]
- **Likelihood of intersectoral or domestic leakage.** A threshold above which entities are subject to a carbon price, and below which they are not, may

90 Kerr and Duscha 2014.
91 Korea Ministry of Environment, State Affairs Coordination Office, Ministry of Strategy and Finance 2020; ICAP 2020d.
92 ICAP 2020d.
93 European Council 2003.
94 While the ETS should result in firms exiting the market if they are not viable when the true cost of their emissions is taken into account, this is generally not a politically or socially acceptable outcome. Furthermore, Betz, Sanderson, and Ancev (2010) find that partial coverage, by excluding firms below a threshold, can reduce social costs while maintaining emissions reductions, compared to blanket coverage.

distort competition between the two groups. The additional carbon price could lead to substitution away from the covered firms to the uncovered firms without a reduction in emissions. Choosing a suitable threshold therefore requires balancing the potential administrative costs of a lower threshold that enables greater coverage, with the potential competitiveness impacts of a higher threshold resulting in less coverage. Alternatively, entities that do not meet the threshold for coverage under the ETS could also be regulated by a different form of carbon pricing (for example, a carbon tax) or other climate policy. Under Phase 3 of the EU ETS, small emitters (defined as those emitting less than 25,000 tons of carbon dioxide equivalent (CO_2e) per year) were able to opt out of the ETS obligations so long as they are covered by measures that will achieve an equivalent contribution to emissions reductions.[95] Inclusion thresholds across a range of selected jurisdictions are illustrated in Figure 3-4.

- **Other market distortions as a result of thresholds.** Related to the point above, a threshold for entity inclusion can create an incentive to break up existing production facilities into smaller units in order to bring each unit's emissions below that threshold to avoid compliance obligations. Similarly, firms just below the threshold may choose to stay there, curbing their growth. In many cases this can be dealt with through the reporting obligations discussed in Section 3.2.4.

Figure 3-4 Variation in thresholds across selected jurisdictions (metric tons CO_2e/year)



Note: This figure shows only jurisdictions where the inclusion threshold is measured in tons CO_2e of in/direct emissions per year.

Inclusion thresholds can vary by sector and type of entity. In Québec, for instance, fuel importers distributing > 200L are also subject to inclusion. The same threshold applies to Nova Scotia, where electricity importers and natural gas distributors with emissions > 10,000 tCO_2/year are included. Other systems set thresholds at both the facility and company level (e.g. Korea ETS). With certain exceptions (e.g. Shenzhen pilot), thresholds set at the company level are usually highest.

3.2.4 LEVEL OF REPORTING OBLIGATION

A further important design characteristic concerns who is legally responsible for complying with the ETS regulations — that is, surrendering to the regulator an allowance for each ton of emissions. Some of the main options might be

- a company;
- a company at a specific plant site (called a "facility" or an "installation"), or used for a specific production line or process; or
- a specific plant site or facility (which could contain several processes and/or companies).

The choice depends on which entities can be held legally liable and where data is available and auditable. Often these factors depend on existing regulatory structures.

Regulating a more aggregated unit like a company can reduce administrative costs for both the government and the companies. It allows more flexibility regarding where emissions occur within the entity without the need to report or trade units.

On the other hand, in cases where multiple companies interact within one installation, the attribution of emissions and liabilities to companies can be difficult. These problems may be particularly pronounced, for example, in highly integrated chemical/fuel production sites, where several companies or subsidiaries may be involved in numerous interlinked production processes and where — in order to improve the overall efficiency of production — different processes may constantly exchange energy (for example, in the form of waste heat, waste gas, cooling capacity, power) or products (for example, hydrogen, pre-products, hydrocarbons).

The level of reporting obligation is a question of administrative efficiency and ease, and independent of decisions on coverage and MRV. Reporting and data collection can still be mandated or encouraged at a granular level (for example, at the installation level), while the obligation to surrender allowances is placed at a higher level (for example, the company level). For example, a company might have two installations or facilities — a coal mine and an electricity generator, both of which are covered under a hypothetical ETS. If the reporting obligation is placed at the company level, the company must

95 Directive 2009/29/EC of the European Parliament and of the Council.

surrender allowances for aggregate emissions produced at both facilities. It may be asked to report aggregate emissions, or to provide a split between its facilities. On the other hand, if the reporting obligation is placed at the installation level, the electricity generator and coal mine must separately surrender obligations.

In Kazakhstan, Korea, and China, the regulated entity is the company. In the case of China, energy statistics have traditionally been collected at the company level, making this approach a logical extension of the existing policy framework. By contrast, in the EU existing environmental permitting, licensing, and regulations are focused on individual installations. Adopting the same approach for the EU ETS means that it is possible to combine the procedures for regulating air pollution and emissions trading.[96] It is also consistent with a desire to place the liability at the point where technical mitigation can be achieved.

3.2.5 SUMMARY

Table 3-2 summarizes considerations in relation to each of the four aspects of scope design discussed above.

Table 3-2 Decisions on scope

Sectors/ Gases Covered	More	Fewer
	▲ Greater opportunity for low-cost reductions ▲ Avoids risk of leakage between sectors ▲ Greater ability to align carbon pricing with economy-wide emissions reduction targets	▲ Lower administrative and transaction costs ▲ Less risk of leakage between jurisdictions
Point of Regulation	Point source of emissions	Upstream
	▲ Provides direct incentives for polluters to reduce emissions ▲ Possible behavioral benefit of regulating at the point of emission ▲ Can build on existing regulatory frameworks	▲ Can be cheaper and simpler to administer, particularly in the energy sector ▲ Potentially greater coverage with fewer points of regulation ▲ Can reduce competitive distortions between and within sectors
Threshold Level	Low	High
	▲ Greater opportunity for low-cost reductions ▲ Reduces risk of leakage between firms above and below the threshold	▲ Lower administrative costs ▲ Protects smaller firms where administrative and transaction costs might be prohibitive
Level of Reporting Obligation	Installation	Company
	▲ Can simplify reporting when multiple companies are operating at the same installation	▲ Allows companies to choose how they manage internal reporting and data collection/management and compliance costs

3.3 SCOPE CONSIDERATIONS IN PRACTICE

This section considers the main issues that may arise when deciding on the scope and point of regulation in some key sectors often covered in an ETS.

3.3.1 ELECTRICITY GENERATION

There are three possible options for the point of regulation in the electricity supply chain:

1. **At fuel source (upstream).** This is the approach used by the New Zealand ETS and involves directly covering all fuels that are used in electricity generation by regulating them at their source (production, import, or distribution). As with any upstream coverage, it is essential that costs can be passed through to the subsequent stages of the supply chain in order to provide a price incentive for behavior change. This may not always be the case, particularly where electricity markets are strictly regulated (see Box 3-3). When cost pass-through is possible and all producers and importers can be identified and regulated, this option allows for high-quality, comprehensive monitoring of emissions. By monitoring fuel, it is possible to monitor emissions in the electricity sector as well as other sectors using those fuels (see Step 7). However, fuels may realize different levels of emissions depending on their end use, particularly if they are not

96 European Commission 2000.

combusted and are used as inputs in processes like the manufacture of chemicals. Therefore, assumptions may need to be made on the end use of the fuels when regulating emissions at this point in the supply chain. A similar issue may occur if facilities are using technologies such as carbon capture, and storage, which prevents emissions reaching the atmosphere. MRV processes can be developed to account for this (see Step 7). Furthermore, it is important to cover all fuel sources to prevent market distortions. Finally, there may be concerns that regulating a small number of entities may allow for monopoly power in the allowance market. These concerns may be addressed by separate regulation (see Step 5).

2. **Generators (point source of emissions).** Used in the EU, California, Kazakhstan, and China, this option allows for more accurate reporting of emissions. In some cases, where there are fewer generators than fuel sources, it may involve less overall regulation and administrative cost than the fuel source option described above. If it is accompanied by thresholds to reduce transaction costs on smaller generators, it may miss some small generation sources. In California the price is also imposed on electricity imported from generators outside the state's jurisdiction (see Box 3-3).
3. **Electricity consumers (downstream).** Used in China and the Tokyo and Saitama ETS, this option requires electricity consumers to surrender units associated with their consumption of electricity. It provides incentives for energy efficiency and conservation, and tends to focus only on large energy users to avoid high administrative costs. Given this weakness, it tends to be used in cases where emissions costs would otherwise not be reflected in electricity prices (for example, in regulated markets where cost pass-through is not possible) or where generators are outside the jurisdictional reach of the ETS.

Box 3-3 Case study: Electricity imports in the California Cap-and-Trade Program

As a high share of California's electricity is imported from neighboring states, policymakers decided to include emissions from electricity generated outside of California and sold to Californian electricity consumers within the scope of the California Global Warming Solutions Act, also known as AB 32. The act authorized the adoption of a Cap-and-Trade Program by the California Air Resources Board (CARB) and directed CARB to minimize leakage to the extent possible.

The regulators require "first deliverers" of electricity into California to report emissions associated with the production of that electricity and, consequently, to surrender the appropriate amount of allowances in the ETS. Both producers and importers of electricity must account for the emissions associated with electricity consumed in California. When the source of electricity delivered are unknown (for instance when there is no existing power purchase agreement from a specific power plant), importers are required to use a fixed "default emissions factor," which is roughly equivalent to an older gas-fired power plant.

Regulatory characteristics concerning how electricity generators dispatch their electricity, how they recover their operational and investment costs, and how electricity prices are set at the wholesale and retail levels can influence which of these approaches is most attractive.

If electricity suppliers are permitted to pass through cost increases to consumers, placing regulation upstream or at the point source incentivizes mitigation throughout the supply chain: fuel switching, investment in renewables, efficiencies in generation, efficient dispatch and transmission, efficiency in use, and conservation.

However, in some regulatory frameworks, electricity prices are set (or heavily regulated) by the government, such that emissions liabilities imposed on generators will not be reflected in higher prices downstream. Box 3-4 provides more detail on the primary barriers to ETS functioning in these markets and potential policy solutions.

Box 3-4 Technical note: Emissions trading in jurisdictions with regulated electricity market

Emissions trading has typically been designed to operate within liberalized and competitive markets, where the cost of emission allowances can be freely reflected in the price of carbon-intensive goods and economic entities are free to adjust their operations and investment decisions. For the electricity sector, this implies customers are free to choose their electricity supplier; there is unbundling of supply, generation, and networks ensuring competition in wholesale and retail markets; power plants are dispatched based on their economic merit; and independent regulators are assigned to monitor the market.[97]

Under these conditions, the allowance price drives decarbonization of the electricity sector through several channels. First, where the cost of emissions is internalized through the ETS, low-carbon electricity generation becomes more competitive and a shift away from fossil-based generation technologies is encouraged (production lever [clean dispatch]). Second, carbon-intensive electricity use becomes more expensive, encouraging consumers to increase their energy efficiency or switch to low-carbon sources. Third, low-carbon generation assets generate higher profits, incentivizing their investments. Conversely, high-carbon assets earn lower margins and are faced with declining capacity factors (i.e., amount of running hours), encouraging early closure (decommissioning lever).[98]

However, the structure and regulation of the electricity sector is important for the impact of carbon pricing. Jurisdictions will have different underlying energy mixes and related opportunities to switch between fuel sources, affecting the magnitude of response to a given allowance price. For example, the response to an ETS will be stronger in electricity systems that are dominated by coal but also have access to gas and renewable sources compared to systems that are partially decarbonized through hydropower but are still reliant on fossil fuels for backup capacity.[99] Similarly, jurisdictions with older fossil fuel fleets will face fewer stranded assets and therefore lower cost and social resistance to carbon pricing.

Electricity regulation may dampen the carbon price signal through the electricity supply chain. The main regulatory practices, their impact on the carbon price signal, and potential solutions are explored in the points below.[100]

- **Wholesale price caps.** In many liberalized markets price caps still constrain the ability for electricity generators to increase their bids in wholesale markets at times of excessive demand and rising electricity prices. This can create a barrier to underlying allowances costs being passed through to electricity prices and result in a "missing money" problem with insufficient investment in generation capacity, which is often addressed through the creation of separate capacity markets. Furthermore, price caps can limit incentives for consumers to use electricity more efficiently or to shift their demand patterns. As carbon prices rise, consideration should be given to where electricity price caps are set and the impacts of these caps on the mitigation signal, noting that some consumers can be compensated for increased electricity bills through alternative means.[101]
- **Regulated tariffs.** Where electricity prices are set based on a predefined set of rules, the tariff methodology together with the method of allocation of allowances will determine how the allowance price is transmitted to electricity generators. Tariff methodologies may need to be adjusted to ensure that allowance costs are reflected in final tariffs.
- **Administrative electricity dispatch.** In a system with regulated power production, planning agencies instruct electricity dispatch based on predetermined technical, economic, or political considerations or criteria. Under these conditions, an allowance price will affect dispatch decisions only if it is explicitly considered under the administrative dispatching criteria. This type of "climate friendly" dispatch has been trialed in China and is under consideration in Korea.
- **Regulated retail prices.** The incentive for end consumers to reduce their emissions depends critically on the levels and structure of electricity rates. Where little or no pass-through occurs, there is no incentive to reduce electricity consumption or switch to less carbon-intensive goods and services. The regulatory barrier to cost pass-through can be overcome by including electricity consumers within the scope of the ETS, such that large electricity consumers are required to hold and surrender allowances for the indirect emissions from their electricity consumption. This has been the approach in the Korean ETS and the Chinese pilots, where carbon →

97 Matthes, 2017; Organisation for Economic Co-operation and Development (OECD)/International Energy Agency (IEA), 2016; Acworth et al. 2018; and Acworth et al. 2019.
98 IEA, 2020; Acworth et al. 2019; and Acworth et al. 2018.
99 Acworth et al. 2019.
100 For a comprehensive overview on aligning ETSs with energy market regulations and policy instruments, please also see De Gouvello et al. 2019.
101 Acworth el al. 2019.

costs cannot be freely reflected in electricity prices.[102] Under such circumstances, special attention must be given to avoid unintended effects of double regulation.

- **Regulated electricity investments.** Electricity-sector investment and planning are seldom left to the market alone. Where governments centrally plan the expansion of electricity infrastructure, the role for an ETS in guiding low-carbon investments may be more limited. However, in systems with regulated investments, governments could mandate that the planning body consider expected allowance prices when making investment decisions. For example, carbon costs could be included as additional charges or shadow prices (without an actual charge in the cost-benefit analysis that governs investments).

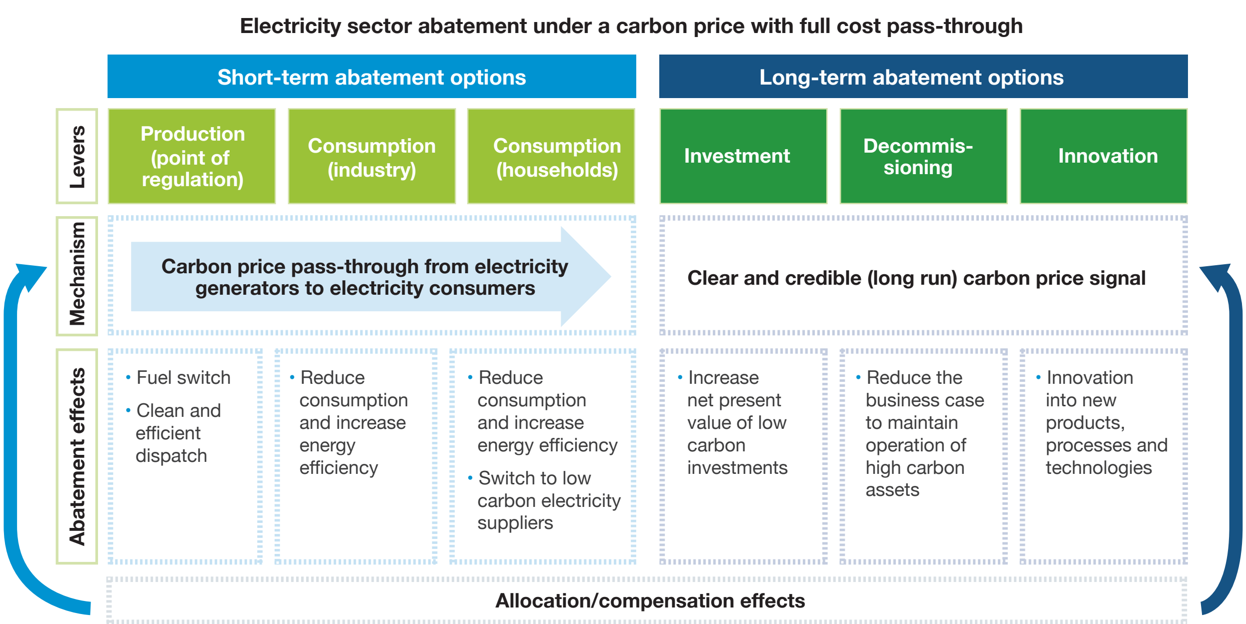
In regulated electricity markets, it can be valuable to provide incentives for emission reductions through both reducing the emissions intensity of generation and, separately, reducing the overall consumption of electricity. Several systems (for example the Chinese pilots and Korea), therefore, combine regulations at the point source and downstream at the consumer level in order to provide an otherwise lacking incentive to reduce electricity consumption.[103] In these cases, combining the regulation of generators (so long as free allowances are allocated appropriately; see Step 5) with coverage of indirect emissions by electricity users strengthens the emission reduction incentive of the ETS — although it still may not promote efficient dispatch across generators with different emissions factors.

Producers and consumers across the supply chain can be compensated for additional costs imposed by the carbon price. Such measures may help decrease costs associated with devalued assets, shield industry against reduced competitiveness, and protect end-consumers from electricity price increases. However, these measures should be designed to preserve the carbon price signal created by the ETS in order to maintain abatement incentives.

Using an ETS to reduce electricity consumption by end users may need to be complemented by other measures to address related barriers to emission reductions. For example, requirements for electricity reduction plans by landlords and regulation of electricity consumers in Tokyo and Saitama have in part overcome split incentive problems in the commercial building sector (see Box 3-5).

Even systems with deregulated electricity markets do not generally have perfect real-time price (and hence carbon cost) pass-through. This suggests a potential role for complementary policies to improve emissions cost pass-through in electricity or directly reducing peak demand.

Figure 3-5 Abatement channels under a carbon price signal in liberalized electricity sectors with full cost pass-through



102 Munnings et al. 2014.
103 This is different from the case in Tokyo where electricity is imported so there is no "direct" point of regulation, only regulation of large energy and heat users. Tokyo only applies a downstream point of regulation.

Box 3-5 Case study: Inclusion of the commercial building sector in Asian ETSs

Direct inclusion of the building sector is an important tool to incentivize demand-side abatement for jurisdictions where electricity and heating generation may lie outside the geographic bounds of the jurisdiction or where the power sector faces strict price regulations that limit the potential to pass on carbon costs to consumers.

In Tokyo electricity is imported from surrounding prefectures, meaning the Tokyo Metropolitan government has no authority to mandate low-carbon generation. At the same time, heating and electricity consumption by large commercial and industrial buildings accounts for about 20 percent of Tokyo's emissions. This led the Tokyo Metropolitan government to enact a cap and trade system that includes commercial buildings. In the Tokyo ETSs, building owners have a compliance obligation for their buildings' indirect emissions. In addition, large tenants (renting spaces larger than 5,000 square meters or consuming more than 6 million kilowatt-hours of electricity on a yearly basis) are required to submit an annual emissions reduction plan and can also assume obligations jointly with or in place of building owners, incentivizing them to invest in demand-side abatement options themselves.

The commercial building sector is also covered under the Korean ETS and some Chinese ETS pilots, which require building owners to surrender allowances for the indirect emissions associated with electricity consumption.[104,105] Since electricity prices in China and Korea are heavily regulated as part of a broader socioeconomic strategy, policymakers there also focus on the demand side to reduce emissions through cap and trade, in combination with incentives to reduce the carbo-intensity of power generation.

Electricity consumers could also be compensated for additional costs imposed by the carbon price. Such measures may help decrease costs associated with devalued assets, shield industry against reduced competitiveness, and protect end consumers from electricity price increases. However, these measures should be designed to preserve the carbon price signal created by the ETS in order to maintain abatement incentives.

3.3.2 INDUSTRY

Stationary energy use

As in electricity generation, emissions from industrial fossil fuel combustion can be regulated further upstream (California/Québec) or downstream (EU, China, and Korea). While in many jurisdictions electricity generators are large (such that regulating them up- or downstream may involve a similar number of entities), by contrast, industry typically features a combination of some large sources and many small sources. If the point of regulation is at the source of emissions, thresholds will often need to be used to keep administrative costs manageable. A careful choice of legal entity between companies and installations is also important. If an upstream point of regulation is chosen, these issues are largely avoided.

Industrial processes

Except for the Regional Greenhouse Gas Initiative and Massachusetts, all systems cover some form of industrial process emissions — the emissions intrinsic to chemical processes beyond the combustion of fuels, primarily cement (clinker), steel, and aluminum. Globally, these industrial processes cause about 21 percent of GHG emissions.[106]

For process emissions from cement, aluminum, and steel, there is no real choice for point of reporting obligation — emissions can only be monitored at the point of emission. Producers are generally large. In ETSs that choose to regulate emissions from energy use at the downstream level, such producers will generally already be the points of regulation for energy-related emissions.

Chemical manufacturing can also create process emissions. Where small industrial facilities are emission sources, they are sometimes exempted to avoid excessive administrative costs.

Finally, some industrial processes emit fluorinated greenhouse gases. While these account for a relatively small proportion of total greenhouse gas emissions, their high global warming potential makes them an important contributor to climate change. Emissions of these gases from industrial facilities are included in a number of ETSs (see Figure 3-1 above).

104 ICAP 2020c.
105 Asian Development Bank 2018.
106 IPCC 2014.

3.3.3 TRANSPORT

Globally, transport accounts for about 14 percent of greenhouse gas emissions. Despite this, a majority of ETSs do not cover transport emissions.

The perceived limited short-term mitigation potential of the sector is one reason for this: for essential travel, the behavioral response of drivers to fuel prices is low, meaning a relatively strong change in fuel prices causes relatively weak changes to the amount vehicle owners drive and little impact on the choice of vehicle (for example, choosing to invest in an electric vehicle). However, for nonessential travel, price responsiveness may be greater. For freight transport, carbon pricing may stimulate intermodal substitution between, for example, road and rail use. A key determinant of the price responsiveness of transport users to fuel prices is the availability of alternatives, such as public transport and low-emission options for transporting freight; these alternatives in turn depend on longer-term infrastructure developments and innovation in electric transport. The effectiveness of carbon pricing in stimulating this abatement therefore depends on other transport policies (see the discussion of complementary and competing policies in Step 1).

The presence of effective companion policies can be another reason to exclude (road) transport emissions from the scope of an ETS. In the EU, ambitious vehicle emission standards, high fuel taxes, and other regulations are currently used to achieve emissions reductions. Therefore, including vehicle emissions in the cap would have limited additional impact on promoting cost-effective abatement. Other jurisdictions (for example California) use inclusion of transport in the ETS as a backstop for emission reductions primarily triggered by efficiency standards, low-carbon fuel requirements, and other transport-specific policies. In other cases, it may be preferable to replace existing regulation or fuel taxes with inclusion of the sector under the ETS cap, in order to achieve more cost-effective mitigation and ensure absolute limits on emissions.

As transport sector GHGs are emitted by millions of end users, it is simpler, and less costly, for the point of regulation to be upstream. In New Zealand, California, and Québec, for example, this is done at the point of fuel producers or importers. The Transportation and Climate Initiative (TCI), a regional ETS for transport emissions in the United States (expected to implement a cap on road emissions starting in 2022), proposes to implement regulation at the state fuel supplier level. This regulation is upstream of the point of emissions — vehicles — but downstream of the importer or producer of the fuel (which is usually outside its jurisdiction). Germany has introduced an ETS that will cover fuel emissions from the transport and building sectors starting in 2021. These sectors are not covered by the EU ETS, which covers Germany's power and industry sectors. It also places the regulation upstream, at the level of fuel distributors and suppliers.

In contrast, in Korea and in two of the Chinese pilots (Shenzhen and Beijing), emissions associated with the vehicles owned by regulated entities (only public transport operators in the case of the Chinese pilots) are also covered as part of compliance obligations set at the entity level. These systems regulate all energy emissions downstream, so this approach is consistent. However, it carries the risk of intra-sectoral leakage. For example, if a firm reduces the use of its fleet cars but switches to (unregulated) private taxi use, behavior may change but emissions may actually rise.

In jurisdictions, like New Zealand, where fuel use is regulated at the producer, domestic aviation and shipping can be easily covered, although differentiation between fuel sold for domestic and international purposes may be required. In sectors where regulation is not upstream, covering aviation and shipping needs to be separately considered. Some systems, like the TCI, explicitly exclude aviation and shipping. Shanghai, on the other hand, has included aviation, in part because it is a large contributor to emissions there. Since airlines have detailed energy consumption records, it is relatively simple to measure these emissions. The EU ETS covers intra-European Economic Area (EEA) aviation sector emissions and might expand coverage to include other sectors such as maritime transport, road transport, and direct emissions from the buildings sector as part of amendments under the European Green Deal. The latter two could be included through upstream coverage of heating and transport fuels, either through the existing EU ETS or as a separate ETS combining the two sectors.[107] Box 3-6 describes the experience of regulating global aviation emissions.

107 European Commission 2020e.

Box 3-6 Case study: EU aviation and international measures to regulate aviation emissions

In 2008, the EU ETS Directive was amended to include the aviation sector in the scope of the EU ETS as of 2012. Airlines operating flights within the EEA as well as international flights to and from non-EEA countries were included in the scope of the system. All such flights were to surrender allowances under the EU ETS, with airlines facing a fine of EUR 100 per ton of CO_2 emitted when failing to do so. Persistent offenders faced the possibility specter of being banned from EU airports.

When the directive came into effect in 2012, the inclusion of third-country flights faced strong opposition from several developed and emerging economies, including the United States, China, India, and Russia. Despite the European Court of Justice ruling the directive legal,[108] these countries met in February 2012 to discuss measures they would take if the EU proceeded with the extension of the scope of Europe's ETS to international aviation.[109]

To provide momentum for agreement on a global measure to tackle emissions from aviation in the International Civil Aviation Organization (ICAO), as first called for in the Kyoto Protocol in 1997, the EU agreed on a temporary derogation from including international flights in the EU ETS. This decision, known as the "stop-the-clock" provision, was initially set to apply until the ICAO Assembly in October 2013.

In 2013, the ICAO Assembly agreed to develop a global scheme for reducing emissions from aviation through market-based measures by 2016 to be implemented by 2020. In response, the EU extended the intra-EEA scope for the aviation sector under the ETS for the years 2013–2016, and in 2017 prolonged the provision to 2023.[110]

The basic parameters of the ICAO measure were agreed in October 2016 as the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), which initially aimed at offsetting CO_2 emissions of international aviation above 2019 and 2020 average levels through international credits and sustainable aviation fuels. Against the backdrop of decreased aviation emissions following the COVID-19 pandemic, the ICAO Council decided in July 2020 to use 2019 emission levels as the sole baseline year for the pilot phase.[111]

CORSIA is implemented in several phases: a pilot phase (2021–2023), a first phase (2024–2026), and a second phase (2027–2035). During the pilot and first phases, offsetting requirements apply only to flights between states that have decided to participate, whereas the second phase will apply to all flights between covered ICAO Member States. In all cases, states need to implement national legislation to comply with CORSIA provisions. As of July 2020, 81 states amounting to about 75 percent of international aviation activity expressed their intention to participate in the CORSIA pilot phase starting in 2021.[112]

Since 2019, airplane operators with international flights producing more than 10,000 tons of CO_2 annual emissions from all International Carbon Action Partnership (ICAP) Member States are required to monitor, report, and verify their emissions. Since the scheme is route based, airlines not participating are still required to comply with these obligations.

In March 2020, the ICAO Council approved six carbon offsetting programs as eligible for delivering carbon credits to airlines during the pilot phase and decided that carbon credits must come from projects that started operations on or after January 1, 2016.

In 2017, the EU agreed that CORSIA implementation would take place through the EU ETS Directive.[113] In July 2020, the European Commission announced it would put forward a proposal addressing CORSIA implementation in the EU as well as other aspects of the EU ETS for aviation by June 2021 in the context of the European Green Deal and increased climate ambition.[114] EU legislation provides for the European Commission to assess CORSIA's environmental integrity, including its compatibility with the Paris Agreement, and to consider ways for the provisions under CORSIA to be implemented through the EU ETS. Without amendments to the EU ETS, it would revert to its full scope for aviation activities on January 1, 2024.

To ensure the effective functioning of CORSIA, remaining uncertainties will have to be addressed surrounding baseline provisions, the quality of offset units and use of alternative fuels, double counting, and full participation of countries. Brazil, Russia, India, and China, for example, have repeatedly voiced fundamental concerns with the scheme and filed formal reservations and differences on CORSIA in ICAO.

STEP 3 SCOPE

108 Court of Justice of the European Union 2012.
109 ICAP 2019.
110 European Union 2017.
111 ICAO 2020b.
112 ICAO 2020a.
113 European Union 2017.
114 European Commission 2020e.

3.3.4 WASTE

The waste sector is usually not directly covered by ETSs.[115] It is a relatively small source of emissions in most of the jurisdictions that have currently adopted ETSs, MRV can be difficult and expensive due to the large number of small and dispersed sources, and mitigation options can be limited if stringent regulation of waste disposal is already in place. For these reasons, to date, only the ETSs in Korea and New Zealand feature design elements that cover parts of the waste sector.[116]

Emissions from waste, and potential for mitigation, may be much larger in emerging economies. There may be significant emissions, and abatement potential, associated with wastewater disposal, waste incinerators, and landfills — further abatement potential may come from reducing the production of waste. For example, emissions of methane and nitrous oxide from the disposal and anaerobic treatment of industrial wastewater are relatively straightforward to measure and abate. There may also be co-benefits with reductions in other pollution associated with better overall waste management. Covering these sectors will require innovation and robust MRV systems, but might have a considerable benefit in countries where the waste sector is a significant source of emissions.

A challenging issue with landfill methane is that emissions arise over long periods as the waste decomposes. During this period, the technology for managing emissions can change — while it may be attractive in terms of administrative costs to place the emissions obligation at the point and time of waste disposal, the emissions factor may not be well aligned with actual emissions, making it difficult to apply a price to consumers. Further, applying a charge at the time of disposal would provide no incentive to reduce emissions from waste *already* in the landfill. A tailored approach may be needed to incentivize uptake of improved technology and reduction of emissions from new and historical waste streams.

3.3.5 LAND USE–RELATED ACTIVITIES

Agriculture, forestry, and other land use are together responsible for just under one quarter of emissions globally.[117] Regionally, however, this percentage varies strongly — as does the cost-effective mitigation potential within each sector. The discussion below focuses on emissions from forestry and agriculture.

Forestry, land use, and land use change

Emissions changes related to land use are largely a result of afforestation or deforestation. However, the management of other types of land (for example savannas and peatlands) will also be relevant for some regions.

To date, most ETSs have not covered changes to land use, including it only as a potential source of offsets (see Step 8). Forestry is an administratively more complex sector to include in an ETS: there are often a large number of entities and there is a need for an efficient tracking system over the lifetime of a forest to monitor both sequestration (uptake) as forests grow and emissions in the case of harvest. Precise monitoring, to ensure targeted incentives requires site-specific information, and/or detailed Earth observation data from satellite imagery.

However, as jurisdictions with significant emissions associated from the forestry and land use sectors consider ETSs, the benefits from including the forestry sector could be high. The example of New Zealand described in Box 3-7 shows that it is possible to include emissions from deforestation.

115 It may be indirectly covered, if waste is used to generate heat or electricity (as is the case in Sweden).
116 Australia's former ETS also covered the waste sector.
117 IPCC 2014.

Box 3-7 Case study: Deforestation in the New Zealand ETS

Owners of plantation forests that were established before 1990 become compulsory participants in the New Zealand Emissions Trading Scheme if they deforest their land.[118] Deforestation is deemed to occur if they clear more than two hectares of pre-1990 plantation forest and convert it to a non-forest use or do not meet minimum replanting or regeneration requirements. They are obliged to either surrender allowances to cover the emissions that deforestation caused, which are calculated using look-up tables to estimate the carbon stock at the time of harvest, or undertake "offset planting" by planting an equivalent new forest on non-forest land. Most pre-1990 forest landowners were eligible to receive an allocation of units to compensate them for the potential loss of land value due to the ETS. Landowners with fewer than 50 hectares could apply for an exemption from the deforestation obligation.

Deforestation rates have varied in New Zealand over recent decades. Large-scale deforestation of plantation forests began in the early 2000s in response to the perceived increased profitability of some forms of pastoral farming (particularly dairy farming).[119] The anticipated introduction of the NZ ETS saw many forest owners bring their deforestation intentions forward to avoid liability. This resulted in high rates of deforestation between 2004 and 2008. It was expected that the scale of deforestation would fall after the introduction of the NZ ETS in 2008, and indeed, deforestation fell sharply between 2008 and 2011. However, the allowance price went into steady decline starting in 2011, and a combination of high dairy prices and very low carbon prices, further exacerbated by policy uncertainty, resulted in higher levels of deforestation than previously expected. The exclusion of international units from the NZ ETS in June 2015, along with planned ETS reforms, has led to a steady increase in the allowance price, strengthening incentives to maintain and increase forest sinks in New Zealand (which allow for the generation of units). Modeling studies from 2016, taking into account external factors such as the price of timber, estimated that a carbon price of NZD 7.00 would slow deforestation, while a price of NZD 15.00 would mostly halt deforestation.[120]

Agriculture

No ETS currently covers agriculture's "biological" emissions, primarily nitrous oxide from fertilizer, manure and livestock, and methane from ruminant animals. There are five reasons why these direct emissions from agriculture tend to be excluded from existing ETSs:

1. agricultural emissions are a small share of total emissions in most jurisdictions that currently have an ETS;
2. actions taken to reduce the intensity of biological emissions from agriculture per unit of product can only be measured on-site, and many farms are small and remote;
3. mitigation options are typically limited and are often poorly understood, meaning that even high mitigation costs may drive only limited changes in emissions intensity;
4. existing policy in some jurisdictions may be focused on increasing agricultural output, whereas a carbon price may drive relative reductions in agricultural output, or changes in composition; however, a carbon price can still incentivize a fall in emissions intensity alongside growing output; and
5. the carbon price may cause competitiveness concerns where these agricultural products are traded.

To date, New Zealand is the only country that has attempted to cover agricultural non-CO_2 emissions. The New Zealand government recently decided to put a price on agricultural emissions starting in 2025; pricing will be at the farm level for livestock and at the processor level for fertilizer. Key considerations are outlined in Box 3-8 below.

118 New Zealand Ministry for Primary Industries 2015.

119 Dorner and Hyslop (2014) report that only 0.1 percent of plantation forest was cleared for pasture between 1996 and 2002 and 1.5 percent between 2002 and 2008.

120 Manly 2016.

Box 3-8 Case study: New Zealand and agricultural emissions

Unusually for a developed country, in 2017 agricultural emissions of methane from ruminant livestock and nitrous oxide from crop fertilizers made up 48 percent of gross GHG emissions in New Zealand. The country's ETS was intended to be an "all sources, all gases" system but it has struggled to include these biogenic emissions from agriculture. Although legislation was in place in 2008 to include these emissions starting in 2015, their entry into the ETS was suspended in 2009, only to be put back on the political agenda with a change of government in 2018. The recent push for analysis and public consultation on the matter has resulted in New Zealand agreeing on a pathway to full carbon pricing of agricultural (biogenic) emissions by 2025 or sooner, with the framework legislature to be in place in 2020. The agreed approach aims at a mix of ETS coverage and a farm-level carbon pricing instrument based on a levy/rebate scheme that will be only partly integrated into the NZ ETS.

Analyses have identified the point of obligation to be a key design hurdle, with a clear trade-off between administrative costs and delivering accurate mitigation incentives.[121] Original legislation would have made meat and milk processors and fertilizer manufacturers the points of obligation, not the farms. Administratively, this approach would be less complex and costly, as there are only a few hundred meat and dairy processing plants and even fewer nitrogen fertilizer suppliers to cover, compared to the 20,000 to 30,000 individual farms in New Zealand with a huge range of sizes, types, and productivity levels. Nitrogen fertilizer manufacture is potentially suitable to be brought under the NZ ETS, as it is upstream of the farms and the carbon price passed through would incentivize farmers to optimize its use, with a corresponding effect on emissions. However, pricing biogenic methane emissions at the processor level (downstream from the farms) means that livestock farmers would face a carbon price at the point of sale — per kilo of meat or milk and not per ton of CO_2e. This would provide incentives to shift farm production patterns away from ruminant livestock but little incentive for farmers to reduce the emission intensity of livestock production.[122]

The preferred point of regulation, both from the perspective of policy design and in the opinion of New Zealand's farming community, is at the level of the individual farm. This would allow farmers to apply management techniques and new technologies to reduce the emissions intensity of production, thereby providing incentives for a wider range of mitigation options beyond cutting production. However, this creates challenges in terms of monitoring and compliance, with time and effort needed to build capacity on farms. The challenge is to give farmers the tools to be able to realize abatement options and comply with the carbon price regulation while limiting distributional impacts on farming families and rural communities.

In the initial phase, the agricultural sector has been promised 95 percent free allocation (or the equivalent of this under a different pricing mechanism). Any revenues from pricing agricultural emissions are to be reinvested in the sector. Furthermore, a public–private collaboration between the agricultural sector and the government has been established to foster capacity and prepare for farm-level carbon pricing over the next five years. Already in 2022, this readiness will be assessed, and the government has maintained the right to introduce pricing at the processor level in 2025 if progress on farm-level pricing is not made.

As a more diverse set of economies, some with significant agricultural emissions, consider carbon pricing, coverage of agriculture may increase. There is potential to cover larger operations like intensive feedlots more easily than smaller, dispersed operations practicing open grazing. However, potential competitive distortions within the industry as a result of coverage should be considered. To the extent that downstream coverage of emissions at the food-processor level accurately reflects emissions, this may prove an attractive means to extend coverage while avoiding these competitive distortions.

121 New Zealand Interim Climate Change Committee 2019.
122 Kerr and Sweet 2008.

3.4 QUICK QUIZ

Conceptual Questions

1. What are the relative benefits of "upstream," "point source," and "downstream" choices in the point of regulation for emissions from the energy sector?
2. What factors should be considered when deciding whether to include sources from an additional sector in an ETS?

Application Questions

1. How do existing regulatory frameworks affect price pass-through, especially in the electricity sector?
2. Which emission sources or sectors are likely to be the most important to cover?
3. How strong is the capability of your administrators to manage participation of (and enforce compliance by) additional points of regulation — both new emission sources and small facilities or companies?

3.5 RESOURCES

The following resources may be useful:

- Emissions Trading and Electricity Sector Regulation
- Striving to Keep ETS Simple

STEP 4
Set the cap

BOXES

FIGURES

TABLES

AT A GLANCE

Checklist for Step 4: Set the cap

- ✔ Determine the ambition of the cap, type of cap, and approach to cap setting
- ✔ Create a robust foundation of data to determine the cap
- ✔ Choose time periods for cap setting
- ✔ Agree upon formal legal and administrative governance arrangements
- ✔ Agree on a long-term cap trajectory and strategy for providing a consistent price signal

The emissions trading system (ETS) cap is the maximum quantity of allowances issued by the government over a defined period of time, which limits how much covered sources can add to global emissions. An allowance, supplied by the government, allows the holder to emit one ton of emissions under the cap in compliance with the rules established by the program. A "tighter" or "more ambitious" cap is one that issues fewer allowances, which results in greater scarcity of allowances and a higher carbon price.

ETS caps are usually absolute caps, meaning they set an up-front limit on the quantity of emissions allowed within each compliance period. This is by far the most commonly used approach and provides certainty on the emission reductions resulting from the ETS. Some jurisdictions, however, have adopted intensity-based caps, which prescribe the number of allowances issued per unit of output or input (for example, gross domestic product [GDP], kilowatt-hour of electricity, or ton of raw material).

The fundamental consideration underlying the ambition of the cap is how quickly the jurisdiction wants to reduce emissions within the covered sectors.[123] This consideration, in turn, presents three key issues that policymakers should consider:

1. **Aligning cap ambition with jurisdictional targets.** An ETS is typically one of several instruments that may be used in reaching an overarching economy-wide, subnational, or even sectoral emissions reduction target. The ambition of the ETS cap should align with this overarching strategy.
2. **Effort sharing between regulated and uncovered sectors.** The decision on how much mitigation responsibility to assign to sectors under the cap should account for the relative capacity of regulated versus uncovered sectors to reduce emissions.
3. **Balancing ambition and system costs.** The level of cap ambition will need to be perceived as environmentally credible and fair by stakeholders to gain (and maintain) political acceptability. External stakeholders, particularly international trade and potential linking partners, are likely to judge the system's cap ambition in relation to the level of mitigation effort and price in comparable jurisdictions. However, system compliance costs should not be so high as to cause disproportionate harm to jurisdiction competitiveness and welfare in the context of the broader commitment to addressing climate change and achieving other ETS policy goals. Allocation of allowances can help address competitiveness and welfare concerns and is further discussed in Step 5.

Policymakers must also consider their approach to cap setting, depending on economy-wide ambition and jurisdictional circumstances. The two main options available are:

1. **A top-down approach.** The government sets the cap based on its overall emission reduction objectives and a high-level assessment of mitigation potential and costs across sectors regulated by the ETS. This approach makes it simpler to align the ambition of the ETS with the jurisdiction's broader mitigation goals and the contributions from other policies and measures. This is by far the most common approach.
2. **A bottom-up approach.** The government bases the cap on an assessment of emissions, mitigation potential, and costs for each sector, subsector, or participant, and determines an appropriate emission reduction potential for each. The overall cap is then determined by aggregating the emissions/emission reduction potential for those sectors, subsectors, or participants. This is not a common approach, and thus far has only been implemented in China.

A range of data can help policymakers make informed decisions on the ambition of the cap and adopt an appropriate approach to cap setting. These include historic emissions data, estimates of future emissions, estimates of the technical and economic potential to reduce emissions in covered sectors, and impacts of other existing or planned policies on emissions.

Policymakers will also need to consider legal issues and administrative processes relevant to cap setting. This includes designating the appropriate government authority with responsibility for administering and, in some cases, setting the level of the cap. The merits of establishing an independent body to provide advice on setting or updating the cap must also be considered.

123 "Capped" and "covered" are considered synonyms and are used interchangeably throughout the handbook.

In addition, implementing a cap requires:

- Designating allowances to be issued. ETSs issue domestic allowances in units (for example, tons) of greenhouse gas (GHG), either carbon dioxide (CO_2) or CO_2 equivalent (CO_2e). In addition, policymakers need to decide on whether to recognize external units for compliance and whether to limit their use in the system.
- Choosing the time period for a cap, as well as how far in advance these periods are set. Caps may be defined on an annual or multiple-year basis. The cap period will usually correspond to a time period during which other major program design features do not change.

Policymakers must also lay out processes to manage the cap and its interactions with other elements of the ETS. They need to consider how to accommodate an evolving scope, how to ensure that methods of allocating allowances are consistent with the cap, whether and how to accommodate shocks to the system that may destabilize the market, potential interactions with offset credits, and how the cap type and ambition will affect potential linking with other systems.

In addition to this, policymakers need to reflect on how cap setting can be aligned with the potentially dynamic nature of national or international commitments (for example, with respect to the ratcheting up of ambition levels of Nationally Determined Contributions [NDCs] under the Paris Agreement).

Finally, they must balance the trade-off between providing certainty on the cap's trajectory, given its importance to establishing price, against the need to preserve flexibility for adjustments. The cap drives an ETS's total contribution to domestic and international emission reduction efforts. The stringency of the cap and the time period for reducing it are key elements in determining a jurisdiction's emissions reduction pathway. The process for setting and updating caps should provide sufficient predictability to guide long-term investment decisions while maintaining policy flexibility to help respond to new information and evolving circumstances.

Section 4.1 introduces how an ETS cap is defined. Section 4.2 discusses the fundamental decisions policymakers must address when setting the cap: its ambition and associated costs, and the approach to cap setting. Data requirements are detailed in Section 4.3, followed by administrative and legal options for implementing a cap in Section 4.4. Long-term management of the cap, and its interaction with other ETS design elements, are covered in Section 4.5.

4.1 WHAT IS AN ETS CAP?

The ETS cap limits how much regulated entities can contribute to global emissions. An allowance, issued by the government, permits the holder to release one ton of emissions under the cap in compliance with the rules established by the program. Because the ETS limits the total number of allowances and establishes a market, each allowance has value (the carbon price). Entities regulated by an ETS and other market participants trade emissions allowances depending on the value they attach to the right to emit.

There are two types of cap. The first and most common is an absolute cap, which sets an upfront limit on the quantity of emissions. The second type is an emissions intensity-based cap. It prescribes the number of allowances issued per unit of output or input, such as unit of production or GDP, kilowatt-hour of electricity, or ton of raw material. Under an intensity-based cap, the absolute amount of emissions allowed under the cap increases or decreases as a function of the economic activity. Some of the Chinese pilot ETSs use intensity-based caps.

The ETS cap determines the system's emissions reduction ambition. However, a range of other ETS design elements will also influence the total amount that regulated entities are able to emit under the rules of the ETS:

- the rules determining the extent to which allowances can be borrowed from subsequent, or banked from previous, years (see Step 6);
- the existence or otherwise of a price or supply adjustment measure (PSAM) and the impact this has on the supply of allowances, particularly whether such a mechanism can override the cap (see Step 6);
- the approach taken to crediting mitigation activities in the uncovered sectors and the potential for tradable offsets (see Step 8); and
- the rules governing a link with other ETSs and resulting unit flows (see Step 9).

Given these various features, aggregated emissions within the covered sectors in the jurisdiction may be greater or less than the amount of allowances established by the cap in a particular year. As a result, decisions on setting the cap should be made in conjunction with decisions on these other design aspects. Moreover, it should be underlined that some design issues related to cap setting affect not only the general ambition level but also the share of emission reductions that take place within the system (versus uncovered sectors) and the balance of costs between linked jurisdictions and over time.

Given the central role of the cap in determining ambition and the level of the price, engaging with stakeholders is a crucial element of the cap-setting process. Stakeholders may include ETS participants, groups that may be adversely affected by or benefit from the carbon price, authorities responsible for policies interacting with ETS, researchers who can help model the impacts of choices, potential linkage partners, and broader trade partners. These groups can be essential in gathering data, building public confidence in modeling results, and gaining support for the ETS at large. This is discussed fully in Step 2.

4.2 CONSIDERATIONS FOR CAP SETTING

Setting the cap requires decisions on two fundamental issues: the extent of emission reductions that are sought (cap ambition) and the approach to cap setting (top-down or bottom-up) that will be used to achieve this goal. This section highlights the issues involved in setting the cap as part of the system's overall ambition. It also discusses the advantages and disadvantages of absolute and intensity-based caps.

4.2.1 CAP AMBITION AND COSTS

The fundamental consideration underlying cap ambition is how far and how quickly the jurisdiction wants to reduce its GHG emissions. This, in turn, breaks down into three key issues that policymakers should consider when setting cap ambition:

1. aligning cap ambition with jurisdictional targets,
2. the share of mitigation responsibility borne by regulated and uncovered sectors, and
3. balancing emissions reduction ambition and costs.

Aligning ambition with jurisdictional targets

One of the key objectives of an ETS is to achieve a quantity of abatement consistent with a jurisdiction's overarching mitigation commitments. If these commitments are considered the long-term environmental targets of the system, the cap ambition can be thought of as the medium-term or interim goals that are required to step toward the target.

The cap allows ETSs to provide certainty as to the emissions outcome. Several jurisdictions, therefore, align the ETS cap with their jurisdictional target to provide a degree of confidence that the target will be reached and mitigation obligations met. As the covered sectors would be "guaranteeing" the emissions reductions needed to reach the target, this is particularly relevant for jurisdictions that have ETSs with broad scopes and companion policies to reduce emissions in uncovered sectors.

Figure 4-1 Aligning the ETS cap with overarching emissions target

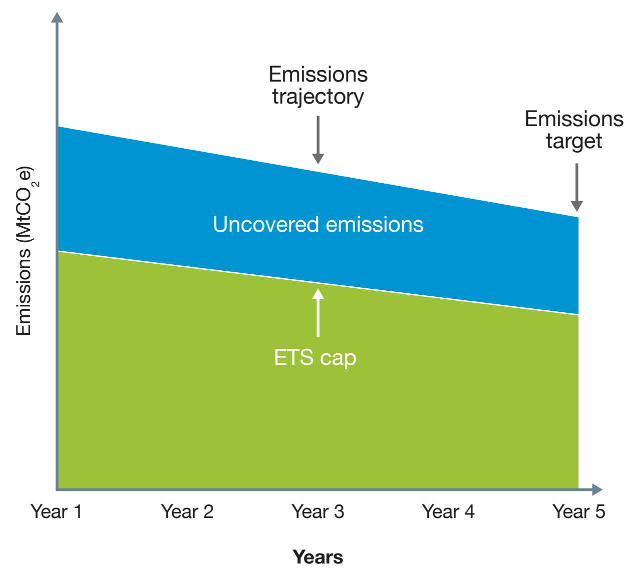


Figure 4-1 shows how a cap can be set in line with a jurisdiction's overarching mitigation target. In this example, the cap is equal to the national target trajectory, less estimated emissions in uncovered sectors. The European Union (EU) adopts a similar approach, implementing several policies to reduce emissions but relying on the ETS cap to provide a degree of certainty in reaching its mitigation targets.

The approach to setting an emissions cap should be considered an ongoing process rather than a static decision. The cap should support increased ambition as systems mature and, in the case of national targets, are ratcheted up in line with the Paris Agreement. Cap ambition should be regularly assessed in the context of economy-wide goals, abatement opportunities, and broader macroeconomic conditions.

Box 4-1 discusses three metrics that can be used to assess how ambitious an ETS is, focusing on quantity and speed of emissions reductions, allowance price, and total cost.

Box 4-1 Technical note: Determining the level of ETS ambition

Three metrics may be used to assess program ambition with regard to GHG reductions:[124]

1. **Quantity and speed of emissions reductions.** The primary goal of an ETS is to reduce emissions. Consequently, a key measure of a system's ambition is the amount of emission reductions achieved under the cap. This should be considered in relation to the jurisdiction's broader emissions reduction targets.
2. **Allowance price.** In theory, the allowance price reflects the marginal cost of emitting a ton of CO_2 or equivalent GHG in an ETS. It thus depends on the overall quantity of emission reductions achieved up to that point and the cost associated with the next unit of reductions. The allowance price indicates the magnitude of the incentive that the ETS is providing to reduce emissions by an additional ton.[125, 126]
3. **Total cost.** Whereas price reflects the cost of reducing an incremental unit of emissions, total cost reflects the overall cumulative resources devoted to achieving a certain amount of emission reductions.[127, 128]

Effort sharing between covered and uncovered sectors

Linked to the discussion above, in cases where an economy-wide emissions reduction target exists, determining the ambition for sectors within an ETS has important consequences for the intended mitigation from sectors that are not covered by the ETS. The government should consider the equity, efficiency, and political implications of decisions on the share of mitigation responsibility borne by covered and uncovered sectors. The decision on how much mitigation responsibility to assign to covered sectors should take into account the relative capacity of regulated and uncovered sectors to reduce emissions.

If marginal abatement costs are relatively low within uncovered sectors, firms could be permitted to access these lower-cost emissions reductions through domestic offsets, which are discussed further in Step 8.

As a practical example, alongside decisions on the caps for the third and fourth phases of the EU ETS (2013–2020 and 2021–2030), policymakers in the EU issued Effort Sharing Decision legislation that expressly defined the level of mitigation responsibility allocated to uncovered sectors across Member States in order to achieve EU-wide mitigation commitments.[129] Greater mitigation effort was required from covered sectors because of the expected lower mitigation costs in power generation (one of the covered sectors) and the effects from companion policies to strengthen the use of renewable energy sources in the power sector.[130] Figure 4-2 illustrates the effort sharing between the covered and uncovered sectors in the EU.

Balancing ambition and costs

The fundamental objective of any ETS is to deliver a desired level of emission reductions cost effectively. For an ETS to be politically acceptable, relevant stakeholders generally need to perceive the level of ambition as environmentally credible and economically fair. Credibility will depend on the level of mitigation required by the cap relative to projections of emissions under business as usual (BAU) and its total expected cost. A more ambitious cap will impose more costs on covered sectors than a less ambitious cap. Fairness has both domestic and international dimensions. Domestic stakeholders will consider whether the cap might cause disproportionate harm to domestic competitiveness (including for firms at risk of carbon leakage, as discussed in Step 5), national income, or welfare.[131] External stakeholders, particularly international trade and potential linking partners, might judge the system's ambition in relation to the level and cost of mitigation effort and carbon prices in comparable jurisdictions.

124 For further discussion of all three, see Aldy and Pizer, 2015. In addition, the Partnership for Market Readiness (PMR) (2015a) provides a practical step-by-step guide for assessing the level of ambition in emissions reduction pathways.

125 Similar price levels do not necessarily imply similar ambition, depending on the historical emissions profiles and abatement options that remain available to the participants in the ETS.

126 Another caveat to using allowance prices as the sole criterion is the fact that ETS prices could be higher due to poor system design. For example, if the market rules impeded the efficient exchange of allowances, higher prices could result. Conversely, lax monitoring, reporting, and verification (MRV) standards could decrease the price.

127 This approach, however, only gives information on the "cost" side, disregarding the "benefit" side. It is important to keep in mind that in a given decarbonization scenario aggregate benefits may equal to or even exceed the costs.

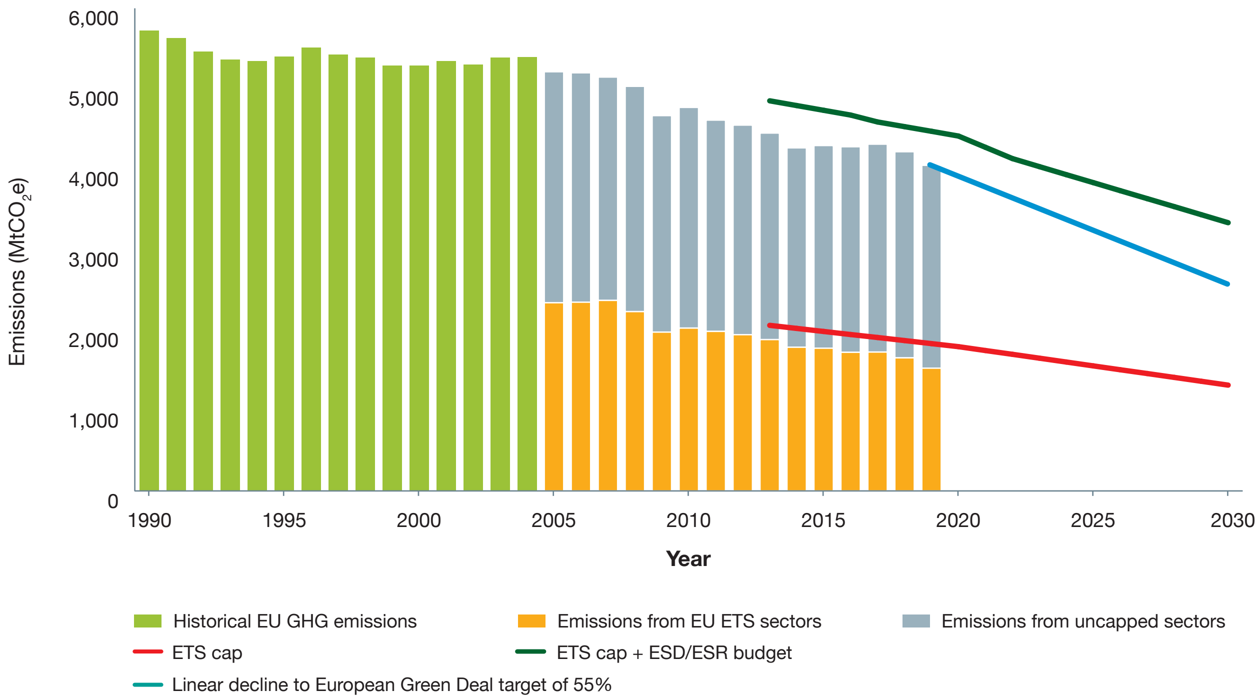
128 For example, where both costs and (co)benefits are considered; see the International Energy Agency's "Sustainable Development Scenario" in IEA 2017.

129 To achieve a goal of reducing the EU's 2030 emissions reduction target of 40 percent below 1990 emissions, covered sectors need to achieve a 43 percent reduction below the 2005 level according to the EU ETS Directive, and uncovered sectors needed to achieve a 30 percent reduction below the 2005 level according to the Effort Sharing Regulation, which also distributes the emission reduction efforts for the non-ETS sectors among the Member States.

130 European Commission (2013) and Decision 406/2009/EC.

131 However, it is possible that, depending on the way in which revenues raised from an ETS are redistributed, and depending on the country context, GDP and/or welfare may rise.

Figure 4-2 EU emissions reduction targets and the EU ETS cap



Note: During the first two phases of the EU ETS (2005–2012) there was no EU-wide cap, but rather country-specific national allocation plans were used to set a cap bottom-up. Starting in Phase 3 in 2013, the European Commission set an EU-wide cap along with targets for sectors outside of the ETS under the Effort Sharing Decision (ESD) and Effort Sharing Regulation (ESR), establishing an aggregate emission reduction target spanning ETS sectors as well as non-ETS sectors. The 2050 long-term strategy first set out the vision for a climate-neutral EU in November 2018, looking at all the key sectors and exploring pathways for the transition. The Communication on the European Green Deal in December 2019 reinforced the ambition to become climate neutral by 2050 and prompted "a process" or "processes" for increasing the EU's 2030 target from 40 percent below 1990 levels to at least 55 percent. The ETS cap reflects the trajectory that was in place in 2021 but was subject to revision to align with the 55 percent 2030 reduction target.

A jurisdiction may choose to maintain the overall ambition of its ETS cap but elect to moderate domestic compliance costs by giving ETS participants access to units outside the covered sectors, through domestic or international offsets (see Step 8) and linking (see Step 9). If marginal abatement costs are low, ETS participants could be enabled to sell domestic allowances to another system through linking. Linking does not alter the overall ambitions of the linked ETSs, but in this case it would lead to higher domestic carbon prices and more domestic emissions reductions. In either case, the jurisdiction needs to decide how much it wishes to direct ETS-related mitigation investment to achieve reductions within covered (vs. uncovered) sectors and within its borders (vs. globally).

In the early stages of an ETS with often high uncertainties on allowance prices, governments might wish to keep prices, and therefore compliance costs, low and place a higher priority on getting ETS architecture in place, building support for the system, and starting trading. This can be achieved by setting a relatively high cap (less stringent) in earlier periods, which is then gradually tightened.

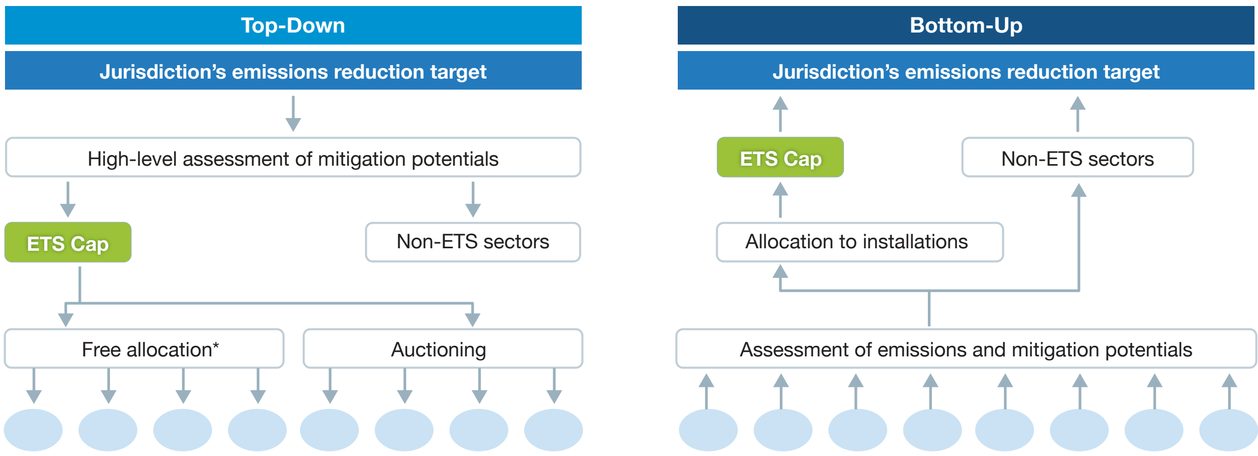
However, an alternative way to manage prices is to use PSAMs. These measures can keep costs low by injecting the market with an additional supply of allowances when prices rise above a predetermined threshold (see Step 6). Using PSAMs allows policymakers to have an ambitious cap as the default and only intervene in the market if prices are untenably high, maintaining the opportunity of meeting higher targets. It also leaves open the option of injecting allowances from outside the cap (thereby permanently raising it), or from future compliance periods (leading to a temporary raising of the cap followed by an equivalent reduction in the future).

Introducing the ETS with a relatively high cap (and therefore lower prices) in earlier periods can also help lower the perceived initial risks to participants and to the economy, reduce competitiveness impacts, and create an enabling framework for the necessary learning processes for regulators, regulated entities, and other stakeholders.[132] Over time, as the infrastructure is established, market participants become more familiar with the ETS regulations, and other jurisdictions adopt similar pricing

132 A relatively high cap may also incentivize firms to "bank" their allowances for use in later compliance periods (in systems where banking is permitted). This banking behavior may lead to an oversupply of allowances, which depresses future prices. This issue is discussed in more detail in Step 6.

STEP 4 CAP

Figure 4-3 Top-down and bottom-up approaches to cap setting



*Potentially aligned to the ETS cap with an adjustment factor

approaches, the system's ambition may rise (through tighter caps), and regulators may not need to intervene as actively as at the earlier stage.

Moreover, starting with an initially loose cap that tightens over time can create incentives for long-term low-carbon investment decisions while, enabling a gradual adjustment to carbon pricing in the short term. This approach must be carefully managed however, to avoid "locking-in" low ambition into the system. For instance, continued investment in emissions-intensive assets could increase political pressure to retain loose caps and result in an inability to ratchet up ambition. To ensure the ETS delivers long-term abatement, policymakers may wish to consider incorporating tighter "futures cap" into the initial design of the system and reflecting planned price increases in PSAMs. This allows the system to build in the ability to ratchet ambition without having to subsequently change legislation, which can be a lengthy and difficult process.

The impacts of differing levels of ambition in future economic scenarios can be assessed through modeling exercises. A wide range of information can be collected to inform this process. This is discussed further in Section 4.3.2.

4.2.2 APPROACHES TO CAP SETTING

Policymakers thus far have taken different approaches to cap setting, depending on economy-wide ambition and jurisdictional circumstances. The two main options available (which are illustrated in Figure 4-3) are discussed below:

1. **A top-down approach.** The government sets the cap based on its overall emission reduction objectives and a high-level assessment of mitigation potential and costs across covered sectors. This approach makes it simpler to align the ambition of the ETS with the jurisdiction's broader mitigation goals and the contribution from other policies and measures. The approach described in Figure 4-1 is a top-down approach.
2. **A bottom-up approach.** The government bases the cap on a more granular assessment of emissions, mitigation potential, and costs for each sector, subsector, or participant, and determines an appropriate emission reduction potential for each. The overall cap is then determined by aggregating the emissions/emission reduction potential for those sectors, subsectors, or participants.

A hybrid approach takes elements from both top-down and bottom-up cap setting. Bottom-up data and analysis might be used as a basis for the cap, which is then adjusted to reflect interaction effects between sectors, and the intended contribution of the covered sectors to top-down mitigation objectives. Many ETSs with a more limited scope use these hybrid approaches.[133] Some Chinese pilot ETSs use a hybrid approach.

Table 4-1 below provides a more detailed account of the caps chosen by different jurisdictions and how they relate to economy-wide targets.

133 This involves adjusting for the possibility that emission savings in one sector might become easier, or more difficult, if they are also being sought in another sector at the same time.

Table 4-1 Summary of cap setting approaches

System	Approach to cap setting and cap characteristics
California	*Overall approach to cap setting*: Top-down 2013: 163 $MtCO_2e$ covering electricity and the industrial sectors 2014: 160 $MtCO_2e$ covering electricity and the industrial sectors 2015–20: Cap in 2015 expands to 394 $MtCO_2e$ with introduction of transportation fuel and natural gas distributors and declines to 334 $MtCO_2e$ in 2020 2021–30: Cap declines from 321 $MtCO_2e$ in 2021 to 200.5 $MtCO_2e$ in 2030 *ETS coverage*: ~80 percent of California emissions
EU ETS	*Overall approach to cap setting*: Top-down *Phase 1 (2005–07)* ▲ Cap based on aggregation of national allocation plans of each EU Member State *Phase 2 (2008–12)* ▲ Same as in Phase 1, but much stronger coordination and oversight by the European Commission *Phase 3 (2013–20)* ▲ Cap for stationary sources: 2013–2020: 2,084 $MtCO_2e$ in 2013 and declining by the linear reduction factor (LRF) of 1.74 percent/year; coverage expanded ▲ Cap for the aviation sector: 2013–2020: 38 $MtCO_2e$ per year *Phase 4 (2021–30)* ▲ Revisions in 2018 to EU ETS Directive such that in Phase 4 • the LRF for stationary sources and the aviation sector increases to 2.2 percent per year from 2021 onward • the Market Stability Reserve (MSR) may reduce the cumulative cap starting in 2023 through cancellation of allowances in the MSR that exceed the previous year's auction volume *ETS coverage*: For 2018 it was 40 percent of total EU-27 emissions (the Brexit matters) ~45 percent of EU emissions
Kazakhstan	*Overall approach to cap setting*: Top-down 2013: 147 $MtCO_2$, meaning a stabilization at 2010 levels 2014–15: Cap declines from 155 MtCO2 to 153 $MtCO_2$ 2016–17: System suspended 2018–20: 486 $MtCO_2$, meaning a 5 percent reduction by 2020 relative to 1990 levels (no yearly cap) *ETS coverage*: ~50 percent of Kazakhstan emissions
Mexico (pilot)	*Overall approach to cap setting*: Hybrid 2020–2022: Cap during pilot determined based on historical emissions of participants as well as Mexico's NDC and sectoral targets under its climate change law. This process resulted in an overall cap of 271 $MtCO_2$ for 2020 and 273 $MtCO_2$ for 2021, with annual sectoral distributions and three allowance reserves. This is in line with BAU emissions and Mexico's NDC. *ETS coverage*: ~40 percent of Mexican emissions
New Zealand	*Overall approach to cap setting*: Transitioning to hybrid 2008–15: Operated under its national Kyoto target without a fixed domestic ETS cap 2015–20: Domestic-only system, still without fixed domestic cap 2018: Government decided to develop and introduce an auctioning mechanism within an overall cap on nonforestry sectors; first auctions take place in 2020. These reforms, along with a move toward five-year emission budgets and supply settings, will transition the system toward a hybrid cap-setting approach. 2021-25: Cap declines from 32.8 $MtCO_2e$ in 2021 to 29.6 $MtCO_2e$ in 2025 *ETS coverage*: ~49 percent of New Zealand emissions
Nova Scotia	*Overall approach to cap setting*: Top-down 2019–2022: Nova Scotia set its cap using the federal Environment and Climate Change Canada's carbon pricing guidance and its provincial targets. The 2019 cap was set at 13.68 $MtCO_2e$ and declines gradually relative to BAU projections to 12.14 $MtCO_2e$ in 2022, the last year of the first compliance period. *ETS coverage*: ~80 percent of Nova Scotia emissions
Québec	*Overall approach to cap setting*: Top-down 2013–14: 23 $MtCO_2e$ per year covering electricity and the industrial sectors 2015–20: Cap expands to 65 $MtCO_2e$ in 2015 with introduction of fuel and gas distributors and declines to 55 $MtCO_2e$ in 2020 2021–30: Cap declines from 55.26 $MtCO_2e$ in 2021 to 44.14 $MtCO_2e$ in 2030 *ETS coverage*: ~80 percent of Québec emissions
Republic of Korea	*Overall approach to cap setting*: Top-down 2015–17: 1,686 $MtCO_2e$ including a reserve of 89 $MtCO_2e$ for market stabilization, of which 84.5 percent was used 2018–20: 1,796 $MtCO_2e$, including a reserve of 14 Mt for market stabilization, 5 Mt for market makers, and 134 Mt for new entrants and other purposes *ETS coverage*: ~70 percent of Korean emissions

→

Table 4-1 Summary of cap setting approaches *(continued)*

System	Approach to cap setting and cap characteristics
RGGI	*Overall approach to cap setting*: Top-down 2009–11: 188 million short tons per year 2012–13: 165 million short tons per year 2014: By 2012, emissions were 40 percent below the cap, and the 2014 cap was tightened to 91 million short tons. 2015–20: Reduction of 2.5 percent per year; two interim adjustments have been made to account for banked allowances 2021–30: Cap will decline by 2.275 million short tons per year from 75 million short tons in 2021. The Emissions Containment Reserve (ECR) may reduce the cumulative cap starting in 2021. *ETS coverage*: ~18 percent of emissions in RGGI states collectively
Switzerland	*Overall approach to cap setting*: Bottom-up 2008–12: Voluntary phase 2013–20: Cap declines from 5.6 $MtCO_2e$ in 2013 to 4.9 $MtCO_2e$ in 2020, a linear reduction of 1.74 percent *ETS coverage*: ~10 percent of Swiss emissions
Tokyo	*Overall approach to cap setting*: Bottom-up 2010–14: Cap set at facility level and aggregated to a Tokyo-wide cap. Depending on the compliance category, facilities must reduce emissions by 6 percent or 8 percent below base year (i.e., average of any three-year period from 2002–2007). 2015–19: Similar to above but 15 percent or 17 percent from base year 2020–24: Similar to above but 25 percent or 27 percent from base year *ETS coverage*: ~20 percent of Tokyo emissions

Note: BAU = Business as Usual, RGGI = Regional Greenhouse Gas Initiative, GHG = Greenhouse Gas, $MtCO_2e$ = Megaton of Carbon Dioxide equivalent

4.3 DATA REQUIREMENTS

A range of data can help policymakers make informed decisions on the type and ambition of the cap. These are discussed in this subsection as follows:

- historical emissions and economic data,
- projections for emissions under a baseline (for example, the BAU trajectory),
- technical and economic potential to reduce emissions in covered sectors, and
- roles of existing and new companion policies and barriers to mitigation.

4.3.1 HISTORICAL EMISSIONS AND ECONOMIC DATA

Historical emissions data play an important role in cap setting, as they provide an evidence base from which to project future emissions in the absence of a cap, thereby establishing a baseline. Data at a jurisdictional level may already be available from domestic emissions inventories or can be obtained from international organizations or research institutions.[134] The Partnership for Market Readiness's (PMR) *Guide to Designing Accreditation and Verification Systems and GHG Emissions Quantification* report provides detailed guidance on setting up frameworks for such data collection.[135]

When gathering firm-level data on historical and anticipated future emissions to establish and project trends, policymakers can consider the following:

- Existing firm-level environmental and production reporting systems may offer a useful starting point for emissions data needed to set a cap, but the methodologies applied, or the level of quality control or enforcement, may not be consistent with what is needed for an ETS.
- If adequate data for cap setting are not available from existing reporting systems, prospective ETS participants could be required to report emissions early so that authorities have those data available when determining the cap.
- The data used to set the cap should predate serious consideration of an ETS; otherwise, firms may have an incentive to exaggerate their emissions, or emit more, in the hope of a looser cap, particularly if they anticipate

134 Examples include IEA, the Emissions Database for Global Atmospheric Research, the Carbon Dioxide Information Analysis Center, the Climate Analysis Indicators Tool developed by the World Resources Institute, and the PRIMAP-hist dataset from the Potsdam Institute for Climate Impact Research. Methodological differences between data sets should be taken into consideration.

135 PMR 2016, 2020.

that allocation will be through grandparenting (see Step 5 for more on allocation).

- When using firm-level historical or projected emissions, policymakers should seek an independent assessment of the firm's self-reported information and assess it against sectoral, national, and/or international peers. Aggregate information from national inventories may also be used to sense-check firm-level data. For example, information on the level of emissions from all the coal combusted nationally, which is generally available in national records, should be close to the aggregate self-reported emissions of regulated entities (adjusting for those excluded due to an emissions threshold).

As emissions data is often calculated from energy data, the methodological consistency (including the relevant emission factors) between data calculations for cap setting and other steps in the ETS design process is of crucial importance. This ensures that estimated emissions are comparable across steps.

While it is still possible to proceed with cap setting even if historic emissions data is not available or is incomplete, the specific challenges arising from gap filling need to be addressed carefully. The experience of Phase 1 of the EU ETS, as explored in Box 4-2, illustrates some of the problems that can arise.

Box 4-2 Case study: Accounting for uncertainty of emission projections in cap setting for Phase 1 of the EU ETS (2005–2007)

The availability of historic emissions data is critical when determining an ETS cap based on projections or growth rate. Due to the lack of reliable data on industry-wide and company-specific emissions of installations under the EU ETS prior to 2005, the cap was based on a bottom-up estimate of the allowances required by each installation. These estimates were based partly on incomplete data and partly on inconsistent emissions calculation methodologies, while the data collection also allowed for the opt-out of certain years without considering this carefully enough for the calculation of totals. As a result, in mid-2006, after reports for actual emissions in 2005 were published, it became obvious that most Member States had set too generous caps and allocated too many allowances — almost 4 percent more than business as usual emissions, by some estimates.[136] When entities found that they could comply fully with the pilot phase obligations without using all their allowances and the remaining allowances could be carried over to the next phase, the price of allowances fell to zero. This led to important accounting and allocation reforms for Phases 2 and 3 of the EU ETS with a move to a centralized cap and allocation process based on historical emissions data, generated by the monitoring, reporting, and verification (MRV) obligations.[137] Given that banking was not possible between Phase 1 and Phase 2, any Phase 1 overallocation was not carried over into the next phases.

Grubb and Ferrario examined four lines of evidence on emissions forecasting in the context of cap setting in the first phase of the EU ETS: scenario projections, statistical analyses of past forecasts, the process for official emissions forecasts, and the history of allocation negotiations in the EU ETS.[138] They recommend that future ETSs should be designed with full recognition of "irreducible uncertainty and projection inflation" and a priority should be placed on improving the reliability and accessibility of data used for setting ETS caps. Such issues have been addressed for subsequent phases of the EU ETS. The elimination of the impact of lobbies at the national level and the addition of provisions for a more significant role of modeling enhanced the stringency and accountability of the EU-wide cap, and recent research has found the cap-setting process to be more efficient now.[139]

Developing an intensity-based cap requires macroeconomic or production data in addition to emissions data. The metrics required will depend on the base of intensity calculations (for example GDP, population, kilowatt-hour of electricity, ton of clinker, and so on) and must be chosen according to jurisdictional context and data availability (see Box 4-4 for more detail). This information is generally available from a range of domestic sources and can also be supplemented by information from international sources such as the World Bank.

4.3.2 PROJECTIONS FOR EMISSIONS UNDER BUSINESS AS USUAL

Information on expected emissions without an ETS can also be useful when setting a cap. It can be used as a baseline to compare the potential emission and cost impacts of an ETS under different emission caps.

136 Egenhofer 2007; US GAO 2008.
137 See European Commission 2012 for MRV regulations.
138 Grubb and Ferrario 2006.
139 See Fallmann et al. 2015.

The type of economic and emissions forecasting used for setting jurisdiction-wide mitigation targets can also be useful for these purposes. Four key options are:[140]

1. **Trend extrapolation.** Observed historic trends in output (for example GDP, kilowatt-hour of electricity use, and so on) and emissions intensity as a function of output are extended into the future to define an emission pathway.
2. **Extended extrapolation.** The extrapolation of historic trends is refined by accounting for potential changes in output and/or emissions intensity.
3. **Decomposition projection.** Trends in a small number of key emission drivers (for example, population, economic growth, energy intensity, and structural change) are assessed to define an emission pathway.
4. **Detailed bottom-up analysis.** Drivers of production and emission intensity are analyzed in detail at the sector or subsector level in the context of broader economic projections and the results aggregated to define an emission pathway.

However, emissions and economic projections involve a high degree of uncertainty associated with emission drivers operating independently of the ETS (for example, growth of production, sectoral value added or GDP, volatility in international energy prices, commodity demand, and currency exchange rates). It is therefore useful to develop a range of emission and economic projections that can be used for assessing the potential impacts of an ETS. When using company or industrial association data for projections it should be considered that these projections regularly tend to be overoptimistic for growth assumption and emission trends.[141]

Figure 4-4 Setting the ETS cap with a top-down approach

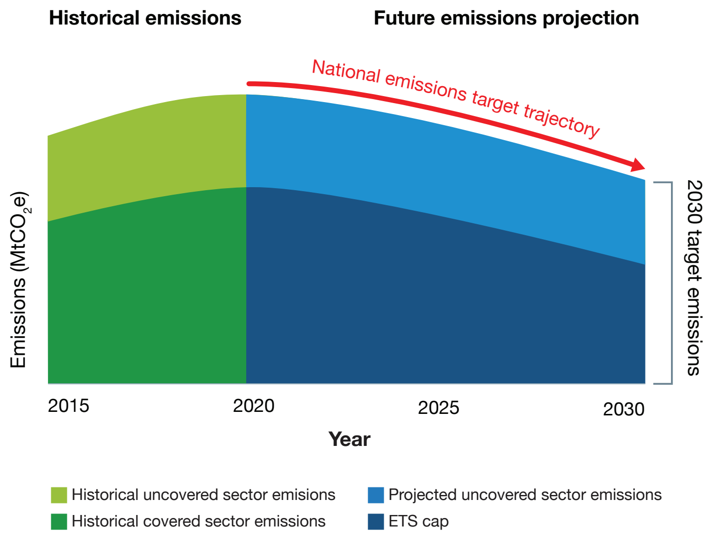


Figure 4-4 illustrates how a simple top-down cap can be set using this information. In this example, policymakers would need to know the trajectory of their jurisdictional emissions reduction targets and projections for uncovered sector emissions (which can be forecasted using the techniques mentioned above). The yearly ETS cap is then simply the target trajectory less the emissions from uncovered sectors.

An intensity-based cap reduces the need for policymakers to develop output projections to predict the cost of compliance with the cap. However, they impose the need to explicitly select appropriate intensity metrics. This is discussed further in Box 4-3.

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Box 4-3 Technical note: Data considerations under an intensity-based cap

Intensity metrics can relate to economic and/or commodity outputs. The appropriate choice of metrics will vary according to sector coverage, the availability of data, and the objectives of the ETS. If an ETS covers a single sector whose emissions are strongly correlated with GDP, like power generation, then either a GDP or a commodity metric could be used. When multiple sectors are covered by an intensity cap, then the output metric of GDP may be the easiest to apply universally. Alternatively, a bottom-up multisector cap could be developed using sector-specific commodity metrics.

Experience with setting emission intensity reference levels in other contexts, such as average performance standards or best-practice emission benchmarks, has highlighted a number of the technical challenges that can be associated with using bottom-up intensity caps in an ETS. While defining emission intensity reference levels may be relatively straightforward in sectors like electricity generation, it becomes more difficult in sectors like specialized product manufacturing, mining, or chemical production. It is also challenging to develop emission-intensity reference levels for processes like cement, steel, and aluminum production when regional differences in resource and technology availability, process methodology, and fuel mix need to be taken into account. →

140 PMR 2015a.
141 Matthes and Schafhausen 2007.

If, however, substitution of commodities is seen as a significant source of emission abatement (aluminum vs. steel, cement vs. other building materials), the use of metrics related to commodities is obviously not suitable as a basis to define the cap for certain sectors that are to be regulated by an ETS. When emissions-intensity reference levels are used as a basis for a cap across a number of sectors rather than for allocation to specific firms or sectors, simpler reference levels could be used, particularly if the output metric is GDP.

4.3.3 TECHNICAL AND ECONOMIC POTENTIAL TO REDUCE EMISSIONS

The magnitude and cost of mitigation opportunities across covered and uncovered sectors constitute a third key category of information. The cap should incentivize innovation and maximize economic mitigation potential to produce cost-effective abatement.

Mitigation potential can be defined as "the amount by which it is possible to reduce greenhouse gas emissions or improve energy efficiency by implementing a technology or practice that has already been demonstrated."[142] Information on technical mitigation potential in key sectors is widely available from international research organizations. For example, studies synthesizing information on technical mitigation potential in key sectors have been produced by the Intergovernmental Panel on Climate Change (IPCC),[143] the International Energy Agency,[144] the Deep Decarbonization Pathways Project led by the Sustainable Development Solutions Network, and the Institute for Sustainable Development and International Relations.[145] However, it is always important to adapt the findings of such studies to local conditions.

Economic mitigation potential can be defined as "the potential for cost-effective GHG mitigation when nonmarket, social costs and benefits are included with market costs and benefits in assessing the options for particular levels of carbon prices and when using social discount rates instead of private ones."[146] Developing marginal abatement cost curves for key sectors can help explain the effectiveness of different mitigation measures and the overall cost of achieving an emissions reduction target. A marginal abatement cost curve presents the potential emissions abatement and associated cost for a set of mitigation measures (see Section 1.5.1 of Step 1 for further detail). Figure 4-5 provides an example marginal abatement cost curve. However, developing accurate marginal abatement cost curves can be challenging and may be easier in sectors that are already regulated or where technical mitigation options are common across countries, so it is possible to draw on others' experiences.

Importantly, while information on marginal abatement cost curves is useful, it is not essential to have comprehensive information on marginal abatement cost curves before setting an ETS cap. The point of an ETS is to create incentives for market participants (consumers and producers), not regulators, to discover the most cost-effective mitigation options across covered sectors. Raising cap ambition gradually and reviewing the cap periodically may be sufficient to moderate the risk of excessive prices and enable the cap to be adjusted as better information on marginal abatement cost curves becomes available.

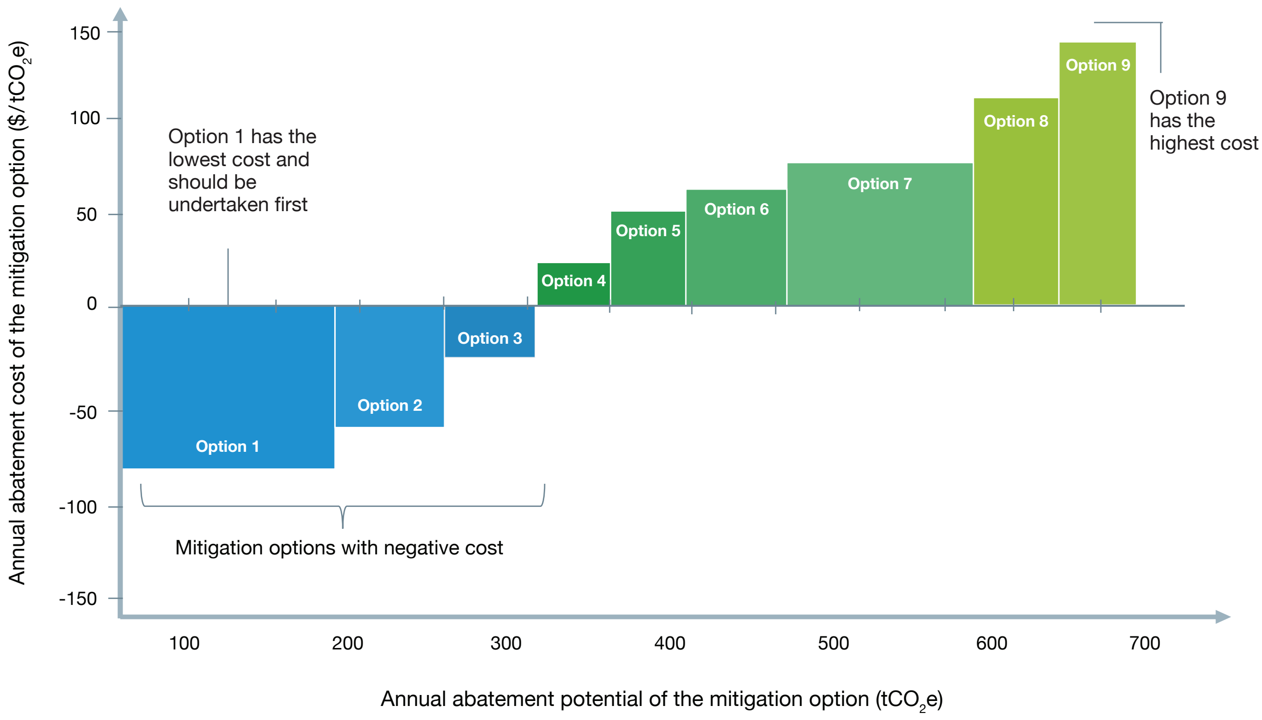
4.3.4 RELATIONSHIP WITH OTHER POLICIES

In many jurisdictions, a new ETS will interact with other policies to drive change. Estimates of MACs and projections for relative emissions and price responses under different cap settings might vary significantly depending on the existence and workings of these policies, and result in either enhancing, duplicating, or negating the impact of an ETS. It will therefore be important to document these policies carefully as a first step to explore these interaction effects and hence determine the appropriate type and ambition of the cap. See Step 1 for a detailed discussion on companion policies.

In existing ETSs (for example, EU ETS and RGGI), significant interactions have been observed between ETSs and other policies, particularly those implemented to promote renewable energy and energy efficiency. For Phases 2 and 3 of the EU ETS these interactions with complementary goals and policies in the framework of the EU's 20-20-20 targets for 2020 efficiency (20 percent emission reduction, 20 percent of energy from renewable energy sources, and 20 percent of energy intensity improvements) were subject to broad modeling exercises that built a robust reference for a cap that considered the additional emission mitigation from the complementary policies.[147] The 2030 emission reduction target (40 percent below 1990 levels) was accompanied by an energy efficiency target of 32.5 percent and a renewables target of 32 percent. In the framework of the European Green Deal all three 2030 targets are adjusted to more ambitious levels.

142 IPCC 2014.
143 IPCC, *Climate Change 2014: Mitigation*.
144 For information on International Energy Agency's (IEA) low-carbon energy technology roadmaps, see IEA 2020b.
145 Deep Decarbonization Pathways Project 2015.
146 IPCC 2007.
147 See Capros et al. 2008.

Figure 4-5 MAC curve plotting abatement options in order of their cost



4.4 IMPLEMENTING THE CAP

Once the fundamental design decisions have been made, informed by the collection of relevant data and modeling efforts, it is possible to set the cap. As discussed in this section, this requires:

- agreeing upon the formal legal and administrative governance arrangements,
- designating allowances to be allocated under the cap, and
- choosing time periods for setting the cap.

4.4.1 CAP GOVERNANCE

An appropriate authority should be delegated the responsibility for setting the ETS cap. It should also ideally coordinate with the bodies responsible for setting NDC targets and other companion policies. The relevant authority may be a regulatory, legislative, or administrative body depending on structures already in place in the specific jurisdiction. Given the importance of the cap to the costs businesses and society will face, a jurisdiction may also wish to consider the merits of establishing an independent body to provide advice on setting or updating the cap. For example, the body could include technical experts, sector stakeholders, and representatives of civil society. This could help improve the objectivity, transparency, and credibility of the cap-setting process (see Box 4-4).

The cap level can be written directly into legislation or, more commonly, the legislation can establish the process for setting the cap. Cap levels could then be set in secondary legislation or similar, which provide sufficient authority but are more easily amended. Fixing the cap level by law makes it harder to adjust, both to water down provisions and also to increase ambition. This certainty may be desirable and allow businesses to plan long-term investment decisions better by providing a credible legal foundation. On the other hand, the legislative process is complex and time consuming. Setting out the process rather than the cap itself provides less certainty but enables more time for data collection and analysis. It could also defer technical cap-setting discussions until later — and less political — stages of ETS development. Most importantly, it would allow for evolution in the ambition and design of the cap as a response to changing circumstances, including political change, ratcheting climate targets, or revision of emissions projections (which inherently carry a level of uncertainty when formulated). The design of PSAMs might also allow for an evolving cap (see Step 6).

Box 4-4 Case study: Jurisdictions have taken a range of approaches to cap governance

For the first two phases of the EU ETS, the governance approach for cap setting was left to the Member States. In some jurisdictions (for example, Germany), cap setting was subject to a full legislative process; in other jurisdictions (for example, France) it was done by administrative orders. Member States' caps were subject to approval by the European Commission as the administrative body of the EU, acting within the legislative framework that defined principles rather than quantitative specifications. In many cases, the commission required changes, in particular to reduce national caps; however, the Member States also challenged these decisions. To avoid the legal uncertainty and safeguard the environmental integrity of the EU ETS, from Phase 3 onward the EU-wide cap is set under EU legislative process.

In the case of the California Cap and Trade Program, state legislation (AB 32) set the requirement that California return to 1990 emissions levels by 2020 and charged the California Air Resources Board (CARB) with developing a Scoping Plan for meeting the 2020 target. The initial Scoping Plan, approved by CARB in 2008, provided for development of an ETS. The cap was set through regulation under a process managed by CARB as the primary implementing agency (see Box 4-7 for details on the California Cap and Trade Program caps).[148]

In Australia, the carbon pricing mechanism (now repealed) required the Climate Change Authority, an independent statutory agency, to make an annual recommendation on where the cap should be set in five years' time. The government was required to take the authority's advice and recommendations into account when setting caps and announce these five years in advance. The process for setting caps was outlined in primary legislation with individual caps set in regulations. The Clean Energy Act provided a default cap if a cap was not set.

In Korea, the ETS cap was set outside of legislation to enable greater flexibility and efficiency. The legal basis for implementation of an ETS was first established in the 2010 Framework Act on Low Carbon, Green Growth followed by the Emissions Trading Act. Secondary legislation, an allocation plan completed by the Ministry of Environment in September 2014, defined the ETS cap and allocation provisions in alignment with the act.

4.4.2 DESIGNATING ALLOWANCES FOR DOMESTIC COMPLIANCE

Every ETS currently in operation issues its own domestic allowances in units of tons of greenhouse gas, either carbon dioxide (CO_2) or carbon dioxide equivalent (CO_2e). All existing ETSs use (metric) tons with the exception of RGGI, which uses US short tons.[149] In addition, policymakers also need to decide whether to recognize external units for compliance. Such external units may derive from offset mechanisms (see Step 8) the ability to buy and sell through linking (see Step 9) or international trading mechanisms like cooperative approaches developed under Article 6.2 of the Paris Agreement. Parties to the agreement will be able to trade emissions reductions in the form of internationally transferred mitigation outcomes (ITMOs). The principles governing the creation and trade of ITMOs remain to be decided by the United Nations Framework Convention on Climate Change.

Not all emissions reduction units issued by the government may be subject to the ETS cap. For example, the government may choose to issue units for removals by sinks. Removals are environmentally equivalent to lower emissions from mitigation, so units are often issued in addition to the cap. In this case, removal allowances would increase unit supply in the market. Policymakers may choose to place quantity limits on the issuance or use of removal units. As noted above, the government may also choose to operate PSAMs that issue allowances beyond the cap in order to provide price protection or hold back allowances for specific purposes (for example, new entrant allocation in the course of a trading phase or allocation for price predictability purposes). These may not be made available to the market if not used for the purpose for which they were originally held back. When these allowances are permanently removed from the market it would implicitly tighten the cap, which is another way to gradually adjust a cap for real emission trends (see Step 6).

The activities associated with specific domestic allowances can be differentiated and tracked, if desired, by assigning a unique serial number to each allowance at the time of issuance into a central registry. For example, New Zealand's government chose to create a single allowance, the New Zealand Unit (NZU), which applied equally to emissions by all sectors and removals by the forestry and industrial sectors. Some market buyers (both domestic and international) were willing to pay a price premium for NZUs associated with forest conservation and afforestation, especially for land under long-term forest covenants. By assigning a unique serial number to each allowance issued

148 California Air Resources Board 2008.

149 The short ton refers to a mass of 2,000 pounds or 907 kilograms (as opposed to a metric ton, which refers to a mass of 1,000 kilograms). Its use is confined to the United States.

into the registry and enabling allowance tracking, sellers could market the attributes of their NZUs to gain a price premium and buyers could verify the sources. By contrast, California and Québec deliberately chose not to publish identifying numbers that would distinguish allowances from the two systems because allowances of the two ETS markets are fully fungible.

4.4.3 CHOOSING TIME PERIODS FOR CAP SETTING

Policymakers need to define the period for which the cap is fixed under a given set of parameters (referred to here as a "phase"). This will usually correspond to a time period under which other major program design features are also specified. The length of phases can change over time. For instance, the EU ETS sets phases lasting several years. Phase 1 of the EU ETS was three years long, Phase 2 was five years long, Phase 3 was eight years long, and Phase 4 will be 10 years long. In addition to the duration of the phase, jurisdictions will need to consider how far in advance the phases should be set. This requires balancing businesses' desire for certainty with the need to retain flexibility and use recent data for cap calculations.

Policymakers also need to define the period for which entities need to surrender obligations (referred to here as a "compliance period").[150] The use of banked and borrowed allowances across compliance periods makes the distinction between each period less relevant (see Step 6). An annual compliance period is a common choice and often seen as the default. However, decisions on compliance periods should be coordinated with other aspects of climate change policy and ETS design. For example, expanding the ETS's scope to incorporate additional sectors, linking with other jurisdictions, and changes in the jurisdiction's international climate change contributions and emission reduction targets will all have implications for cap setting. Transitions between compliance periods can also be scheduled to accommodate milestones, like the entrance of new sectors or new participants, or the commencement of linking.

Examples of phases and compliance periods from a few systems are as follows:

- In RGGI, caps were initially set up front for two 5-year phases (2009–2014 and 2015–2020) with a cap review and adjustment in 2012.
- In California and Québec, annual caps were set up front. These were aggregated into a series of multiple-year compliance periods covering 2013–2014, 2015–2017, and 2018–2020.
- The EU ETS set a new cap prior to each multiyear phase: 2005–2007, 2008–2012, 2013–2020, and 2021–2030. A feature of the EU ETS is that the caps from 2013 onward include an automatic linear reduction factor that defines the annual contraction of the cap (see Section 4.5.6).
- The Tokyo ETS also set a new cap prior to each multi-year compliance period: FY2010–2014, FY2015–2019 and FY2020–2024.
- Most Chinese pilots have an ex post de facto cap depending largely on the benchmarks and the actual outputs/business volumes of the covered enterprises.
- The Australian ETS proposed to set five years of caps initially and to set the next annual cap on a rolling basis each year so that caps were always set five years in advance, as discussed in Box 4-5.

Scheduling formal cap reviews on a periodic basis can enable systematic adjustment of the cap to ensure it remains appropriate while providing certainty about cap settings between reviews. It can also help ratchet cap ambition in accordance with national climate policy, or if mitigation potential is higher than expected while setting the previous cap. Cap reviews may be conducted as part of a comprehensive ETS review, or as a stand-alone exercise. When conducting a formal cap review, the government may wish to evaluate:

- changes in the broader context for an ETS, such as the jurisdiction's overarching mitigation targets, economic development trends, the availability of new technologies, and the relative ambition of carbon pricing or alternative mitigation policies in other jurisdictions;
- how the ETS has performed relative to expectations for allowance prices, compliance costs, and potential for leakage and competitiveness impacts; and
- how much the carbon price has influenced behavior and investment of the regulated entities to reduce emissions, particularly relative to other drivers such as international energy prices, commodity demand, and other policies and regulations.

Reviews of ETS operation are discussed in more detail in Step 10.

A relatively simple approach to cap setting applied by many systems to date is to define annual caps that start at a designated point and decline at a (possibly linear) rate that is fixed for each cap period. The benchmark for defining the cap's starting point typically is either actual emissions in a recent year, average annual emissions over a recent period, or projected emissions in the starting year, although projected emissions are inherently uncertain and subject to pressure for revision. The cap ending point is

150 Each system may use the terms "phase" and "compliance period" differently, or use different terms altogether. It is important to understand the meaning of these terms in the specific context.

defined in alignment with the jurisdiction's mitigation and cost objectives for covered sectors (which will require projections to be made). A straight line is then often drawn between the starting and ending points to set the cap level in each year in between. In other cases, the annual cap may stay constant across individual years within a cap period but decline in a stepwise fashion over the cap periods.

Box 4-5 Case study: Australia's and New Zealand's cap mechanisms

The Australian ETS applied the concept of a rolling cap mechanism. Under the government's carbon pricing mechanism, which started operation in 2012 but was repealed in 2014, the initial three-year fixed price phase was to be followed by a flexible trading phase that provided for fixed five-year caps that were to be extended annually by one year by the government, with advice from the Climate Change Authority, an independent agency. In the event no decision could be reached, a default cap would align with the government's national emissions reduction target for 2020.[151] This process ensured that businesses had a predictable level of certainty on cap duration, the timing of cap setting, and the default level of ratcheting.

The New Zealand government has taken a similar approach in the reforms announced in 2019 to the NZ ETS. The reforms aim to establish a coordinated decision-making process to manage unit supply into the NZ ETS.[152] The process aims to set a limit on the number of NZUs that can be released into the NZ ETS market each year via the auctioning mechanism. To do so, it considers a range of factors, such as allowance quantities from auctioning, free allocation, international units, and a cost containment reserve, as well as projected removals from the forestry sector. The annual NZU supply limit will be announced annually five years in advance and extended each year. Based on the advice of the independent Climate Change Commission, the Minister of Climate Change may still decide to adjust supply volumes up to four years after the initial announcement. However, these quantities become fixed one year in advance. The measure is designed to increase the transparency of unit supply decisions and give all participants greater certainty over market developments, while aligning the unit supply in the NZ ETS with New Zealand's long-term emissions reduction targets and five-year carbon budgets.

4.5 MANAGING THE CAP

Once the cap has been implemented, policymakers must actively manage the cap and its interactions with other steps in the ETS design process. In particular, they must make necessary alterations to the cap due to

1. any changes in the scope (see Step 3),
2. interactions with allocations and allocation mechanisms (see Step 5),
3. market shocks and the operation of PSAMs (see Step 6),
4. interactions with offsets (see Step 8),
5. linking with other ETSs (see Step 9), and
6. ratcheting ambition over time (see Step 10).

4.5.1 CHANGING SCOPE

An ETS's cap will need to be adjusted as sectors enter or exit the ETS, or as participation thresholds change. An operational ETS with phased sectoral entry under an absolute cap (for example, the EU, California, and Québec ETSs) may provide explicitly for step changes in the cap as new sectors enter. In the California and Québec systems, breaks between phases are aligned with the entry of new sectors. In the EU ETS, some sectoral scope changes were made at the transitions between phases, but aviation entered the system midstream during Phase 2. After the further enlargement of the EU in 2007 (when Romania and Bulgaria joined) the cap was adjusted for the ETS-covered sectors in the new Member States in the course of Phase 1. While scope has usually been increased, there have been scenarios where a shrinking scope has necessitated a cap change. In the case of RGGI, the cap was revised downward when one of the participating states — New Jersey — withdrew, and then back up again when it rejoined.[153] In most cases, these kinds of cap changes can be planned and integrated smoothly into cap-setting arrangements.

As well as sectoral changes, individual entities within covered sectors can either enter or exit the market during a compliance period. Further information on accommodating

151 Government of Australia 2011.
152 NZME 2018.
153 See Box 9-6 in Step 9 for more detail on delinking in RGGI.

new entrants and closures during the cap period can be found in Step 5.

4.5.2 INTERACTION WITH ALLOCATIONS

Decisions on the cap will have central implications for decisions on allocation. It is generally preferable for discussions on allocation to take place after the cap has been defined in order to separate discussions on overall system ambition from discussions on the distribution of costs. This can also help avoid the problems seen, for instance, in Phase 1 of the EU ETS where the decision on how many allowances to provide for free ended up determining the overall cap, resulting in a total cap that was above BAU emissions and hence the price falling to zero.

However, given political and administrative pressures, decisions on caps and allocation may become interlinked and iterative, especially in systems that allocate most or all of their allowances for free. In these cases, policymakers will need to ensure that the level of free allocation they plan to supply under a given methodology (for example, on the basis of facilities' historical emissions or emission benchmarks per unit of production) can be accommodated by the cap they have set.[154]

From a procedural perspective, however, a key emerging lesson is that a deep integration of cap-setting and allocation procedures tends to inflate the caps as a result of distributional conflicts on (free) allocation. A clear separation of the cap setting and the allocation process should be seen as the preferable model for the procedural arrangements around the cap setting.

In systems that combine free allocation with auctioning, as long as the cap can safely accommodate committed levels of free allocation, the issue is in principle less significant as the amount of auctioning within the cap can be adjusted to accommodate fluctuations in free allocation. Further details on the trade-offs between allocation methods are in Step 5.

Special considerations arise for cap setting when the point of obligation for surrendering allowances in regard to one emission source is applied at more than one point in the supply chain. For example, in the case of emissions from electricity generation in the Korean ETS, policymakers have assigned unit surrender obligations for both direct emissions at the point of electricity generation and indirect emissions at the point of electricity consumption.[155] A key consideration is the potential for government regulation of energy prices to prevent carbon prices from being passed through the supply chain. The cap in such a system needs to accommodate the need to surrender two allowances for each unit of emissions from electricity generation: one upstream and one downstream.

4.5.3 MANAGING MARKET SHOCKS

Under normal operation, an ETS responds to fluctuations in unit supply and demand through changes in allowance prices, demand for offsets, banking, or borrowing. When systemic shocks (such as major changes in fuel prices or economic activity) drive changes in allowance demand or prices that are out of the ordinary and could destabilize the market, policymakers may need to consider whether to adjust the supply of allowances available. This intervention can be made on an as-needed basis, but is increasingly implemented using automatically triggered, rule-based PSAMs built into the ETS design to automatically expand or reduce supply (See Step 6).

Policymakers implementing PSAMs to manage prices must also decide if these adjustments are temporary or permanent in nature. Temporary measures are counterbalanced by corresponding changes to the cap in future periods, preserving the long-run emissions reduction target of the ETS. On the other hand, changes not reflected in future caps result in a permanent adjustment of the overall ambition. Policymakers may also choose to neutralize some, but not all, of the adjustments.

It is important to note that permanent increases in supply adversely affect the emission reductions achieved by the ETS and may put the country's ability to meet its NDC at risk. Conversely, permanent decreases in supply allow countries to increase the ambition of their ETS and can be a useful mechanism to ratchet up emissions reductions. See Section 6.3.3 of Step 6 for further detail on the relative merits of temporary and permanent adjustments.

Additionally, to improve policy certainty and retain the confidence of market participants, policymakers should define clear triggers and/or procedures for unscheduled cap adjustments as part of initial ETS design and set parameters around the type of adjustments that could be made. Cap adjustment triggers could be defined based on unit supply or unit price.[156] Step 6 provides more information about PSAMs. Alternatives to rule-based cap adjustments would be discretionary mechanisms that could rely on decisions of specific bodies appointed for these purposes. Such discretionary arrangements have been subject to conceptual and theoretical debate but are not typically used for unscheduled cap adjustments in practice.

154 In some of the Chinese ETS pilots, the caps are actually determined by the allocation approaches, as caps have not been announced, and the actual total number of allowances in the market constitutes the actual caps.

155 Kim and Lim 2014.

156 Gilbert et al. 2014b.

4.5.4 INTERACTION WITH OFFSETS

In addition to allowances provided under the cap, policymakers might also allow the use of offsets for compliance within an ETS, albeit often subject to qualitative and quantitative limits (see Step 8). Offsets provide credit for emissions reductions or removal by domestic or international sources not covered by an ETS and, once accepted, are treated as equivalent to allowances within the ETS. This widens the pool of sources of emissions reduction available and generally provides ETSs the ability to achieve the same mitigation outcome at a lower cost.

Although they are generally separate from the ETS cap, offsets can have an impact on unit supply within the ETS, particularly when there are no quantitative limits, or very generous limits, placed on their use. For example, when Certified Emission Reductions from the Clean Development Mechanism (CDM) suffered a steep fall in prices as a result of the financial crisis, these units flooded the compliance market in the NZ ETS (which placed no limits on their use) and the EU ETS. This is one of the factors that led to a significant surplus of allowances, and resultant crash in prices, in both systems. While NZ ultimately delinked from the CDM market, these factors contributed to the EU's decision to "backload" over 900 million allowances over the period 2014–2016. The allowances were withdrawn from the market and ultimately placed in the ETS's market stability reserve.

Offsets also affect the burden sharing between uncovered and covered sectors, allowing for the voluntary participation of unregulated entities in the ETS. Some sectors, like waste management, agriculture, or forestry, are often excluded from the scope of ETSs due to the dispersed nature of the market and the difficulty in quantifying and reporting emissions. However, they represent significant opportunities for emissions reductions and GHG removal. Offset markets allow self-selection of entities within these sectors that can reduce and report emissions into the system. If these uncovered sectors can deliver significant emissions reductions and removals through offsets in the ETS, resulting in excess allowances, it may be possible to tighten the cap further and faster.

4.5.5 LINKING WITH OTHER ETSs

If a jurisdiction has intentions to link its ETS to the ETS in one or more other jurisdictions, then this will be made considerably easier if the linked ETSs have the same type of cap. Moreover, trading between jurisdictions with absolute and intensity caps may result in an increase in overall emissions, relative to the case where no linking is allowed. For this reason, jurisdictions with absolute caps may decline to link with jurisdictions with intensity caps. Indeed, in the example of the US Clean Power Plan, trading between participants in rate-based states (which choose intensity targets) and participants in mass-based states (which choose absolute targets) was not permitted. Linking is more fully discussed in Step 9.

4.5.6 RATCHETING AMBITION OVER TIME AND PROVIDING A STABLE PRICE SIGNAL

As described in Section 4.4.3, it is typical for the period over which a cap is set in advance to be between two and 10 years, although in some cases this is even longer (see Box 4-6 on the EU ETS). At the transition points between cap periods, policymakers have an opportunity to review and make adjustments to the cap as more information on abatement costs, economic fluctuations, and actions by international trading partners becomes available.

However, enabling periodic cap adjustments may create uncertainty among market participants as to the possible long-term trajectory of the cap and the resulting price signal. This may undermine one of the main benefits of carbon pricing, namely, to provide a carbon price signal that can incentivize low-carbon investments.

In this context, ETS participants might benefit from having some additional policy certainty. One option is to define a long-term trajectory for the cap. The trajectory could signal a direction of change and/or a rate of change over time with regard to emission levels and/or carbon prices in alignment with broader long-term mitigation, technology, or economic transformation targets. Possible approaches include setting an indicative cap range or a default pathway in advance to guide future decision-making while building in flexibility for decision-making by future governments (see Section 4.4.3). This was the approach taken by the European Commission (see Box 4-6). Achieving cross-party support for a long-term cap trajectory would help further improve policy certainty. PSAMs may also be used to provide a consistent price signal. Additionally, intertemporal flexibility and bringing forward mitigation when prices are low can make it easier to ratchet ambition in the future (see Step 6 for a detailed discussion).

Box 4-6 Case study: The linear reduction factor for the EU ETS

From 2013 onward, the cap for the EU ETS has been subject to the LRF. The LRF is expressed as a percentage of the average annual total quantity of allowances issued in accordance with the Member States' national Allocation Plans for the period from 2008 to 2012 (adjusted for scope changes) and that marks the annual decline of the cap along a linear trajectory, starting in the midpoint of the 2008–2012 period. The LRF was initially set at 1.74 percent. It was explicitly designed without an expiry date and therefore formed part of the binding ETS legislation for periods beyond 2020. In the context of the structural reform of the EU ETS concluded in 2018, the LRF was increased to 2.20 percent from 2021 onward, again explicitly without a date for expiration. While the original LRF at 1.74 percent would have reduced emissions of regulated entities to 70 percent below 2010 levels by 2050, the adjustment to 2.20 percent from 2021 onward leads to a legally binding emissions reduction of 82 percent below 2010 levels by midcentury. This robust long-term emissions reduction commitment is one of the reasons why prices did not fall to zero as a surplus of allowances accumulated in the EU ETS from 2010 onward. Indeed, a liquid carbon market underpinned by a credible long-term emissions reductions commitment can provide a clear informational signal to investors regarding the type of activities consistent with the long-term regulatory environment even when future policy stringency is not yet reflected in the current price signal.

Box 4-7 provides an account of how policymakers managed the challenge of providing a steady price signal when setting the cap for the California Cap and Trade Program. By identifying clear rules and parameters up front for adjusting caps over time, and signaling future changes well in advance where possible, governing authorities can change the cap over time while still maintaining market confidence and providing a clear price signal to market participants. The balance between predictability and flexibility is relevant throughout the development of an ETS and is detailed further in Step 6.

Box 4-7 Case study: Ambition and cap design in the California Cap and Trade Program

The California Cap and Trade Program was designed to help the state achieve its 2020 target to reduce GHG emissions to 1990 levels by 2020 and by 80 percent below 1990 levels by 2050. Strategically, it was designed as a backstop to reinforce outcomes from a large portfolio of mitigation policies and ensure that mitigation incentives reach the parts of the economy that were not covered by targeted policies. Drawing from assessment of mitigation potential and modeling of economic costs, CARB allocated a share of the statewide emissions reduction responsibility to covered ETS sectors, which account for approximately 80 percent of the state's emissions.

Officials defined an absolute cap to start from a projection for actual emissions in 2013 and to decline on a linear basis to meet the designated 2020 endpoint for total emissions from covered sectors, which was more than 16 percent below starting levels. The state's initial projection for start-year emissions had to be adjusted downward after officials received improved facility-level data under a mandatory reporting regime for industrial sources, fuel suppliers, and electricity importers starting in 2008. The cap was adjusted upward in 2015 to accommodate the entry of new sectors, which were subject to a faster annual rate of decline than earlier entrants. The passage of Senate Bill 32 in 2016 established a 2030 reduction target of 40 percent below 1990s levels, and CARB adopted a cap trajectory for 2021–2030 that aligns with the 2030 goal. The annual rate of decline will average 4.1 percent from 2021 to 2032, reaching 200.5 megatons of carbon dioxide equivalent ($MtCO_2e$).

The program design includes quarterly auctions, with a price floor or "auction reserve price" that increases each year. This escalating floor price provides continuous upward price support, while an allowance price containment reserve and price ceiling hold a portion of allowances out of regular circulation and introduce them during periods of high demand at high fixed prices. The allowance price containment reserve (APCR) also includes allowances that remain unsold for eight consecutive auctions. A large share of unsold allowances from the 2013–2020 period have been added to this reserve that will only be available for potential release from the price containment reserve starting in 2021. Starting for 2021 compliance, a price ceiling at which price ceiling units (PCU) can be purchased by compliance entities will be available in addition to the APCR. PCUs can only be used to meet the remainder of compliance entities' compliance obligation and are available at a fixed price above that of the APCR. The revenue collected from potential sales of the PCUs is used to ensure continued environmental integrity with at least one-for-one emissions reductions. CARB implemented these PSAMs, along with other limits to the number of allowances entities can hold or bank, to help ensure the ETS drives reductions in alignment with the 2030 target[157] (for more on the role of PSAMs, see Step 6). →

157 California Air Resources Board 2017.

For additional supply and flexibility beyond the cap, participants can use a limited number of approved offsets to meet a portion of their compliance obligations and access allowances from linked ETSs.

Through periodic reviews by CARB, legislative oversight, and mandatory updates to the state's Scoping Plan for reductions at least once every five years, California creates opportunities to adjust policies as needed to stay on track toward its reduction goals.[158]

4.6 QUICK QUIZ

Conceptual Questions

1. What is the role of the cap in an ETS?
2. What background information is helpful to set the ETS cap?
3. What is the difference between an absolute cap and an intensity cap?

Application Questions

1. In your jurisdiction, how much should the ETS contribute toward meeting the overall emission reduction targets?
2. Will your jurisdiction need to design a cap that supports linking to another ETS in the near or longer term?

4.7 RESOURCES

The following resource may be useful:

- Achieving Zero Emissions Under a Cap and Trade System

158 Center for Climate and Energy Solutions 2014.

STEP 5
Distribute allowances

BOXES

FIGURES

TABLES

AT A GLANCE

Checklist for Step 5: Distribute allowances

- ✔ Match allocation methods to policy objectives
- ✔ Define eligibility and methods for free allocation
- ✔ Define treatment of entrants, closures, and removals
- ✔ Set up auctions to play an increasing role over time while reducing free allocation

An emissions trading system (ETS) creates allowances that enable the holder to emit a certain amount of greenhouse gases (GHGs), which can then be traded in the market. By capping the number of allowances created, the ETS limits pollution to a level less than would otherwise occur. This scarcity of allowances creates economic value that is expressed through the market price of allowances, the carbon price.

The carbon price flows through the economy, leading to higher consumer prices for emission-intensive goods and services, reducing or increasing the value of assets, and potentially benefiting or adversely affecting different groups of workers across the economy. Even if the total costs to the economy of an ETS are small, there can be large relative winners and losers.

Creating allowances establishes an asset that must be allocated in some way, the choice of which ultimately determines how these costs and value are distributed across society. The allocation method is key to how companies react to the ETS. It can affect how companies decide on production volumes, the location of new investments, and how much of the emissions costs they pass on to consumers. This means that, in some circumstances, certain methods of allocation can distort the carbon price signal and related incentives for emission abatement. Allowances can also be sold, generating revenues for the government that can be channeled to a range of different uses. In these ways, allocation can affect the total costs to the economy from the ETS and their distribution.

In practice there are two broad ways that allowances are allocated: providing them for free or selling them through auctions. When distributing allowances, policymakers will seek to achieve some or all of the following objectives (which are not always mutually compatible):

- ▲ **Preserving incentives for cost-effective abatement.** In attempting to achieve any or all of the objectives, policymakers must ensure that an integral objective of the ETS is maintained: ensuring covered firms are incentivized to abate emissions in a cost-effective manner and as far as possible through the value chain.
- ▲ **Managing the transition to an ETS.** There are numerous issues involved in transitioning to an ETS that a policymaker may wish to manage through the approach to allowance allocation. Some relate to the distribution of costs and value, including possible loss of asset value ("stranded assets"), undesirable impacts on consumers and communities, and a desire to recognize those who have taken early reduction actions. Additionally, the potential to create windfall profits where firms pass on carbon costs to consumers despite receiving free allowances is higher under some methods of allocation, and policymakers can seek to minimize this risk. Other issues relate to risks such as participants initially having a low capacity to trade or resistance to participation among some companies where institutional capability is weak.
- ▲ **Reducing the risk of carbon leakage or loss of competitiveness.** Carbon leakage occurs when production moves from a jurisdiction with a carbon price to another jurisdiction without a carbon price or with a lower carbon price. This can occur in the near term through domestic firms losing market share to international competitors, and over the longer term through firms' decisions as to where to invest in plants and equipment. These risks present a combination of undesirable environmental, economic, and political outcomes for policymakers. Avoiding these factors is always one of the most controversial and important aspects when considering the design of an ETS, and allocation in particular. There is little empirical evidence of carbon leakage to date, with most ETSs having taken steps to reduce carbon leakage risks. This is likely in part due to low carbon prices thus far, but a wide range of other factors also affect investment and production decisions, and are also likely to have played a role in limiting carbon leakage.
- ▲ **Raising revenue.** The allowances created when an ETS is established are valuable. By selling allowances, often through auctioning, ETSs can generate significant amounts of public revenue that can then be used for other purposes.
- ▲ **Supporting price discovery in markets.** The economic efficiency of an ETS results from price discovery by trading allowances. Generally, this occurs in liquid secondary markets; however, in smaller markets with lower liquidity, allocation by auctions can play an important role in price discovery by matching supply and demand in the market and providing transparent information on market conditions.

The distribution of allowances will be a contentious issue, and finding a solution that is acceptable to government, stakeholders, and the general public is critical to getting started. There are three main methods of free allowance allocation, implying four methods in total (auctioning plus three free allocation approaches). Each method involves trade-offs against achieving one or more of the above objectives.

1. **Selling allowances in an auction.** Policymakers create a source of revenue using a method that minimizes the chance of market distortion and lobbying for preferential treatment. Auctioning is a simple and efficient way to get allowances to those who value them most. It can provide flexibility in managing distributional issues for consumers and communities by making use of auction revenues. It also rewards early action, as those that have already undertaken significant reductions will face lower costs of compliance than more emissions-intensive firms that need to buy more allowances. However, auctioning does not protect against leakage and provides no compensation for losses from stranded assets.
2. **Free allocation using a grandparenting approach.** This provides allowances for free based on historic emissions. It is a relatively simple method of allocation that can make it attractive in the early years of an ETS. It provides some compensation for the risk of stranded assets but can also result in windfall profits. It provides only weak protection against carbon leakage, can distort the price signal if applied in combination with updating provisions, and penalizes early action. Given its drawbacks, grandparenting should only be considered as a transitional approach while building the capacity for auctioning or a benchmarked approach to free allocation.
3. **Free allocation using fixed historical benchmarked allocation.** This uses benchmarks to standardize the amount of free allocations provided for each unit of historical output of a particular product, for instance, per ton of steel. This breaks the link between the emissions intensity of a given facility and the level of allocation it receives — allocation remains constant regardless of changes to the facility's production or emissions intensity. This approach provides only partial protection from carbon leakage and can still result in windfall profits but provides protection for early action. This approach is more complex to implement than grandparenting, given the likely need to collect and interpret historical emissions intensity information to set domestic-specific benchmarks and the need to have access to historical output data to facilitate allocation.
4. **Free allocation using output-based benchmarked allocation (OBA).** This also uses product benchmarks, but assistance is adjusted to the actual level of output in a compliance period rather than a fixed historical level of output. This option provides stronger protection against carbon leakage risk and rewards early action. However, this can come at the cost of reduced abatement incentives. Like fixed historical benchmarked allocation, getting the benchmark correct can be challenging, and maintaining the cap requires additional provisions, as the levels of allocations are not known in advance.

Many systems have selected a hybrid approach combining auctioning with free allocation, where entities in some sectors receive some free allowances, but typically not all. Often this is a way to ensure that sectors that are at risk of carbon leakage can receive the benefits of protection through appropriate free allocation approaches. Such sectors are usually identified using two main indicators — emissions intensity and trade exposure; however, these indicators may not capture the risk of carbon leakage as well as intended.

Section 5.1 first explains the four main allocation methods before considering the main objectives. Section 5.2 and Section 5.3 then break down the advantages and disadvantages of each allocation method. Section 5.4 discusses how free allocation can be targeted to those that need it most, discussing the different components of free allocation as well as how to deal with new entrants and closures.

5.1 ALLOCATING ALLOWANCES

This section first presents the ways in which allocation is most commonly done before discussing the objectives that should be considered when deciding between allocation methods.

5.1.1 METHODS OF ALLOCATION

There are two fundamental approaches to allocation: the government can sell allowances at auction, or it can give allowances away for free using a variety of methods. This chapter considers the following four options:

1. selling allowances in an auction,
2. free allocation using a grandparenting approach,
3. free allocation using fixed historical benchmarked allocation, and
4. free allocation using output-based benchmarked allocation.

It can be helpful to break this down first into a decision as to whether to sell allowances through auction (Option 1) or to provide them for free (Options 2–4).

Auctioning involves the allocation of allowances through a competitive bidding process, allowing for price discovery and strong incentives for carbon abatement. It also creates a source of revenue that can then be distributed to a wide range of potential beneficiaries.

Free allocation provides some proportion of a firm's emissions for free. Grandparenting, fixed historical benchmarked allocation, and output-based benchmarked allocation are related, and can be expressed as variants of two basic formulae:

- Free allocation (grandparenting) = applicable historical emissions x adjustment factors
- Free allocation (benchmarking) = applicable output x benchmark x adjustment factors

Free allocation via grandparenting uses historical emissions to determine the allocation. The historical emissions get multiplied by adjustment factors, most commonly the carbon leakage assistance rate and cap decline factor. An explanation of assistance rates and cap decline factors, along with other principles and terms used in free allocation, are explained in Box 5-1.

Free allocation via benchmarking includes fixed historical benchmarked allocation and output-based benchmarked allocation. It uses output, for example tons of aluminum produced, scaled by an emissions-intensity benchmark to convert the output into emissions. This is then scaled by adjustment factors in the same way as grandparenting. The primary difference between fixed historical benchmarked allocation and output-based benchmarked allocation is that the former uses historical output that remains constant for a fixed period, while output-based benchmarked allocation uses current output.

Box 5-1 Technical note: Allocation terminology explained

Emissions intensity

Emissions intensity is a number that provides the quantity of emissions that are released to produce one unit of a product. For example, the emissions intensity of cement could be 0.5 tons of carbon dioxide (CO_2) per ton of cement produced.

Benchmarks

The benchmark is a numerical value that presents an emissions intensity of the production process. The benchmark can be chosen at different levels, which alters the stringency of the allocation. For example, a benchmark for cement could be the average emissions intensity of firms that produce cement. This would mean that some firms are above the benchmark (they produce more emissions than average so receive a smaller allocation than what they need), while some would be below (they produce fewer emissions than average, so receive a larger allocation than they need). An alternative benchmark could be the average emissions intensity for the top 10 percent of the most efficient firms. This means that most firms would have a free allocation below what they need.

In the European Union (EU), the benchmarks are derived from the average emissions intensity of the 10 percent most efficient facilities within a sector. This compares to the New Zealand benchmark (referred to there as an allocative baseline), which is the average emissions intensity of national sectors. Small ETS markets may have too few facilities to calculate a benchmark based on the sector and instead may look to use the emissions intensity at the individual facility level, which is done in Québec for most benchmarks, or look to use benchmarks from other jurisdictions. In general, product-based benchmarks are the preferred option to follow the principle of having one benchmark per product. Benchmarks need to correctly reflect the different divisions of emissions-intensive processes in production to reduce the risk of gaming. This would, for example, entail having sufficient disaggregation in cement benchmarks to distinguish between production with and without the highly emissions-intensive production of clinker.

Adjustment factors

These are a variety of tools that are used to manage the total level of free allocation that is provided and ensure that the number of allowances allocated for free remains at a suitable level relative to the cap over time. There are several adjustment factors that have been applied in ETSs to date:

- **Assistance rates:** These scale the level of emissions that receive free allocation. The value of the assistance rate can be from 0 percent to 100 percent, with 100 percent representing a maximum rate of assistance. In benchmarking, an assistance rate of 100 percent means that the free allocation is not adjusted downward any further. It does not mean that entities receive all their emissions liability for free, since the benchmark is still applied. The assistance rate often varies between sectors, even within the same ETS. This is to adjust for differing severities of carbon leakage risk, with those at most risk receiving the highest assistance rate. In the New Zealand ETS as in some other jurisdictions, the assistance rate is referred to as the assistance factor.

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The assistance factor is 90 percent for highly emissions-intensive activities and 60 percent for moderately emissions-intensive activities.

- **Decline factors:** These seek to ensure that the level or rate of free allocation falls over time. For instance, California uses an overall cap decline factor that tightens over time. The cap decline also varies between different activities to reflect the differing levels of carbon leakage risk.
- **System-wide limits:** These establish a ceiling for the total number of free allocations to industry. The EU uses a cross-sectoral adjustment factor to limit the number of allowances it can provide for free. In calculating the level of free allocation, if the total free allocation exceeds the limit for free allocation, the cross-sectoral adjustment factor is applied. The cross-sectoral adjustment factor allows for adjustments to be made to free allocation to reflect the tightening of the cap and the resulting reduction in the number of total free allowances due to increasing ambition of emissions reduction.

As a number of systems demonstrate, it is possible to use different approaches for different sectors or firms covered by the ETS. It is common to use a mixture of auctions and free allocation; any of the free allocation methods may allocate only a share of the allowances. Table 5-1 summarizes allocation methods used in each ETS to date.

Table 5-1 Allocation methods in different ETSs

ETS	Free Allocation versus Auction	Free Allocation Recipients	Free Allocation Type
California	~50 percent free allocation (significant share through consignment); increasing percentage auctioned	Emissions-intensive and trade-exposed (EITE) sectors and other industries; electric distribution utilities and natural gas suppliers consigned allowances freely on behalf of ratepayers	Output-based benchmarking for industrial sectors (~12 percent) vulnerable to carbon leakage;[159] direct allocation to electric distribution utilities and natural gas suppliers consigned for auction, with proceeds mandated for benefit of ratepayers and mitigation (40 percent)
EU — Phase 3	Mixed: 57 percent auctioned, 43 percent freely allocated	Industry and heat sectors and domestic aviation; declining free allocation for non-EITE sectors from 80 percent to 30 percent in 2020	Fixed historical benchmark set at the average of the 10 percent most efficient installations in a sector/subsector during 2007–2008; fallback approaches through heat or fuel benchmarks, or process emissions
EU — Phase 4	Mixed: 57 percent auctioned, 43 percent freely allocated, with declining free allocation shares toward 2030 based on more stringent allocation rules	Industry and heat sectors, and aviation;[160] free allocation for non-EITE sectors to be phased out by 2030	Fixed historical benchmark based on fixed-period historical activity levels. Activity levels are updated every five years (2019, 2024) or annually following a change of more than 15 percent in activity levels; benchmark set at the average of the 10 percent most efficient installations; fallback approaches through heat or fuel benchmarks, or process emissions; benchmarks adjusted for two separate periods, 2021–2025 and 2026–2030, according to annual reduction rates varying from 0.2 to 1.6 percent to reflect technological progress
Kazakhstan	100 percent free allocation	All	Grandparenting or output-based product-specific benchmarking (voluntary)
Korea	90 percent free allocation in Phase 3	All	Grandparenting, fixed historical product-based benchmarking (for example cement, refinery, domestic aviation)
New Zealand	Mixed, with ~27 percent free allocation for 2021–2025. Auctions from 2021	EITE activities; free allocation gradually reduced for 2021–2030 and at accelerating rate post-2030	Output-based benchmarking

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159 Industrial allocation is about 12 percent of the total allowance budget, with natural gas and electric utilities accounting for about 40 percent.

160 Article 10c of the EU ETS Directive allows for transitional free allocation to thermal-power generators with the condition that Member States invest the worth of free allowances in modernizing their electricity systems. In Phase 3, eight Member States made use of the derogation. Allowances allocated under this derogation are deducted from Member States' auctioning volumes; see European Commission 2015b.

Table 5-1 Allocation methods in different ETSs *(continued)*

ETS	Free Allocation versus Auction	Free Allocation Recipients	Free Allocation Type
Nova Scotia	Free allocation, auctioning from 2020	Industrial facilities Nova Scotia Power Inc; fuel suppliers	Industrial facilities — Output-based benchmarked allocation based on production intensity benchmark for the reference period 2014–2016; fuel suppliers — 80 percent free allocation based on previous year's verified emissions; Nova Scotia Power Inc allocation based on a reduction from business-as-usual projections
Québec	~25 percent free allocation; ~75 percent auctioned	EITE activities	Output-based benchmarking
Regional Greenhouse Gas Initiative (RGGI)	100 percent auctioned	None	N/A
Saitama	100 percent free allocation	All	Grandparenting based on entity-specific baseline set on any consecutive three years in the period 2002–2007
Switzerland	Mixed, but mainly freely allocated	Manufacturing industry	Fixed historical benchmarking using similar methodology to the EU ETS; fallback approaches through heat or fuel benchmarks, or process emissions
Tokyo	100 percent free allocation	All	Grandparenting based on entity-specific baseline set on any consecutive three years in the period 2002–2007

5.1.2 OBJECTIVES WHEN ALLOCATING ALLOWANCES

When distributing allowances, policymakers will likely seek to achieve some or all of the following objectives:

- preserving incentives for cost-effective abatement,
- managing the transition to an ETS,
- reducing the risk of carbon leakage or loss of competitiveness,
- raising revenue, and
- supporting price discovery in markets.

This section discusses each of these objectives and highlights some of the trade-offs that policymakers will need to consider. If it is possible, policymakers should first have clear discussions on competing objectives and agree to a balance among them, then choose the type of mechanism(s) to use and design the specific allocation methodologies based on information and data available in the jurisdiction.

Preserving incentives for cost-effective abatement

Ensuring firms and individuals are incentivized to abate emissions in a cost-effective manner is a fundamental objective of an ETS. There are three types of abatement incentives that policymakers will want to preserve when allocating allowances:

1. **Encouraging substitution from high-carbon to low-carbon producers.** Where the cost of emissions is internalized in an ETS, it is an intended effect that carbon-efficient producers (those with a lower emissions intensity) will benefit over less-efficient ones (triggering the optimal level of production among existing and/or between existing and new installations).
2. **Incentivizing firms to reduce their emissions intensity.** Because lower-emitting firms gain a competitive advantage over higher-emitting ones, this should encourage firms to reduce their emissions intensity (triggering technological improvements).
3. **Promoting demand-side abatement.** The method of allocation should allow the price of emission-intensive goods and services to increase, so that consumers are discouraged from buying polluting goods and encouraged to switch toward cleaner ones.

The simplest way to ensure that all of these incentives for abatement are preserved would be to sell allowances through auctioning,[161] but this may not be the best way to achieve other objectives such as managing the transition to an ETS or addressing carbon leakage risk, both of which are discussed below.

161 This could even be combined with cash-based assistance rather than allowance-based assistance to deal with leakage and/or transitional concerns.

Managing the transition to an ETS

Policymakers may wish to address three key distributional impacts involved in transitioning to an ETS:

1. **Stranded assets.** Stranded assets are assets (such as coal mines, generation capacity, coal-fired boilers) acquired in the past that generated profits before regulation but now leave their owners with high emissions that are hard to reduce. They fall in value with the ETS as operating costs rise and may become obsolete earlier than anticipated. These losses can be partially compensated for through free allocation.
2. **Recognize early investments in emission reductions.** In the time it takes to implement the ETS, firms may be making abatement investments. It is valuable to reward, or at least not penalize, those who have already invested to reduce emissions. The process by which allowances are allocated can influence this. Auctioning rewards early action. If allowances are allocated for free, then either using an early date for measuring historic emissions under a grandparenting approach or using benchmarking approaches from the beginning can help reward early action or prevent delays in emission reductions.
3. **Undesired impacts on consumers and communities.** Emissions costs passed through to consumer prices will have welfare impacts on households. Some value from allowances can be used to protect households' well-being, particularly poorer households. California uses free allocation (with conditions on how the allocation value is used) to protect electricity consumers, while RGGI invests most revenue in energy-efficiency measures to reduce electricity bills.

Two risks could arise early in ETS implementation:

1. **Companies may have a low capacity to trade initially.** A transitional concern could be that companies, especially small companies, may have a low capacity to trade. Concerns about not being able to access allowances on the market or making costly mistakes (for example, by failing to comply with obligations, resulting in fines) are common before an ETS is implemented. This may lead to a preference to provide firms with allowances for free, such that they may not need to substantively participate in auctions and trading in order to meet their compliance obligations, at least in the early phases of the ETS.
2. **Resistance to participation.** If institutional capability is weak early in the ETS, it can make identifying participants and collecting data from them difficult. If allowances are given for free, this resistance may be reduced. Free allocation also helps reduce political opposition among the firms covered by the ETS.

These risks can be mitigated through adopting simple auction design, along with the appropriate period of preparation. A key part of the preparation is capacity building. This can be done via training or through a pilot phase of the ETS (see Step 10). Building capacity early will help avoid the potential for poor functioning of the ETS in the early stages. Through developing understanding of how the ETS works, resistance to participation may also be reduced. Addressing these early issues with large amounts of free allocation may introduce additional problems. For instance, there may be poor price discovery in these early phases of the ETS, which could undermine the operation of the secondary market and create resistance to reducing free allocation in later periods.

Reducing risk of carbon leakage or loss of competitiveness

Implementation of an ETS or other mitigation policies can create the risk of carbon (or emissions) leakage. Carbon leakage occurs when production and emissions move from the jurisdiction with a mitigation policy to one without an equivalent policy or a less-stringent policy. This can lead to an increase in global emissions as production patterns shift.

There is little evidence of carbon leakage to date, although empirical ex post estimates are limited.[162] It is also possible to use economic models to generate ex ante leakage estimates, the results of which are varied, but still find limited evidence overall.[163] This may be because the level of carbon prices to date has not been sufficient to substantively change the relative economics of production facilities, and because carbon pricing systems have adopted policies such as free allocation that have succeeded in reducing the risk of leakage. At low levels a carbon price is likely to be only a minor factor in determining the location of production compared to factors like the availability of labor, tax rates, access to markets, or exchange rates.

The risk of carbon leakage may decline in the longer term with the ratcheting of ambition under Nationally Determined Contributions (NDCs) and the expansion of policies such as carbon pricing. Carbon pricing in one jurisdiction is not carried out in isolation, with at least some form of emissions constraints emerging in most jurisdictions through their adoption of climate targets, for example through NDCs under the Paris Agreement. This means that any loss in competitiveness arising from the ETS will be smaller since trading partners will be implementing measures resulting in similar impacts to their industry. The tightening of NDCs over time means long-term competitiveness will require that conventional, high-emitting industries are phased out by new low- and zero-emission industries. In this sense leakage risk is a concern only if domestic firms are

162 The Carbon Pricing Leadership Coalition's *Report of the High-level Commission on Carbon Pricing and Competitiveness* assesses the existing literature in depth.
163 PMR 2015g.

losing market share to a more emissions-intensive firm. Nevertheless, the risk of leakage presents a combination of undesirable outcomes for policymakers:

- **Environmental.** Leakage undermines the ability of an ETS to deliver on its environmental objectives by causing emissions to rise in jurisdictions beyond the reach of the policy. Leakage is particularly likely to occur if production shifts to a jurisdiction that does not have regulated emissions, for instance if it does not also have an ETS or a stringent NDC. In this case the shift in production would not be matched by equivalent additional mitigation effort in the country to which production shifts, leading to a rise in global emissions. This issue is less likely to exist over the longer term with ratcheting ambition and expanded scope of NDCs.
- **Economic.** The decline in domestic production can affect the balance of trade and lead to structural change with strategic economic implications. Reduced production is likely to be associated with job losses and stranded assets in the affected sectors. It also reduces the cost effectiveness of the ETS in achieving global emission reductions. Structural changes can act to accelerate the decarbonization of the domestic economy and reduce its dependence on emissions-intensive production, but this may have opposing effects in jurisdictions that see emissions increase due to carbon leakage. Furthermore, these processes will be stalled if cheaper fossil fuel-intensive imported products out-compete domestic low-carbon alternatives.
- **Political.** The risk of loss of jobs and asset values can create significant political challenges, particularly as emissions-intensive industries are often clustered in discrete regions.

This confluence of potentially undesirable environmental, economic, and political outcomes means that the risk of leakage is always one of the most controversial and important aspects when considering the design of an ETS, even if leakage is often not realized in practice.

Carbon leakage is thought to occur in two main ways, through production leakage and capital leakage. Box 5-2 explains how leakage through production can be broken down into the domestic and external market channels, and provides further detail on capital leakage. The extent to which each allocation method addresses these channels of leakage is discussed later in the chapter.

Production leakage refers to shifts in production because of changes to the relative operating costs for firms in different jurisdictions. The ETS increases the relative cost of production for emissions-intensive firms when compared to locations without an ETS. EITE firms are unable to pass on their increased costs, while at the same time the cost savings from producing elsewhere increases. Therefore, firms may decide to reduce production or decide against expanding production, and instead choose to increase production elsewhere in response to the higher costs. Importantly, and in contrast to capital leakage, productive capacity is maintained, but the quantity of production at these facilities may be lower. Because productive capacity is maintained, the production leakage may be temporary and could be reversed. Production leakage can be expected to occur in the short term because it does not involve large changes in investment.

Capital leakage refers to a reduction in investment in either existing or new capital. The higher costs from the ETS could reduce the profitability of investments and thus reduce firms' incentive to invest in the domestic jurisdiction, potentially investing elsewhere with less-strict environmental regulation. In the long term, with increasing proliferation of carbon pricing globally, the scope for transferring productive capacity closes; therefore, the risk of capital leakage is reduced. Capital leakage can be expected to occur over a longer term than production leakage and is more likely to be permanent because of the large investment costs involved in moving.

Carbon leakage represents a transfer of either production or productive capacity, with no decrease in emissions on a net basis. The transfer reduces emissions for the jurisdiction from which the leakage originates, but there will be a rise in emissions elsewhere. Thus, the transfer of emissions undermines global ambition to reduce emissions if it goes to jurisdictions unlikely to raise their climate ambition.

Box 5-2 Technical note: Carbon leakage channels

There are three main channels through which competitiveness can be influenced: two types of production leakage, which operate in the short run, and a third (capital leakage) that operates in the long run.

1. **The domestic markets channel** reflects the competitiveness of a firm's production in domestic markets relative to imports from rivals based in external jurisdictions.
2. **The external markets channel** is the firm's competitiveness in external markets to which it exports.
3. **The capital channel** captures the competitiveness of existing productive capacity or new investment that may serve both domestic and external markets.

The first two short-run channels of competitiveness will importantly be driven by the short-run marginal cost of production of domestic producers relative to their rivals across both markets — which depend, in part, on the design of carbon prices. →

In addition, over the longer run, decisions regarding capital investments will be influenced by an assessment of long-run cost of production, which includes the cost of capital. All three channels matter for carbon leakage, with the domestic markets and external markets channels key for short-run risk of carbon leakage, while the capital channel is important for leakage over the longer run.

Over time the importance of the capital channel increases and options to deal with carbon leakage and competitiveness beyond free allocation (typically targeted investment support from auctioning revenues) will be of growing importance, primarily for capital-intensive production processes.

Further details on carbon leakage can be found in the Partnership for Market Readiness's (PMR) *Carbon Leakage: Theory, Evidence and Policy Design* report as well as International Carbon Action Partnership's report *Carbon Leakage and Deep Decarbonization*.

Raising revenue

The allowances created in an ETS have value. By selling allowances through auctioning, policymakers have the potential to raise significant amounts of public funding.

These new resources can be used to either cut (distortionary) taxes elsewhere in the economy; support other public spending needs, for example other policies, to decarbonize the domestic economy; support action on health, education, or infrastructure; or reduce government deficits and/or debts. They can also play a valuable role in compensating disadvantaged households that might otherwise be adversely affected by an ETS.

A more detailed discussion on the use of revenues from ETS auctioning can be found in the PMR's *Using Carbon Revenues* report.

Supporting price discovery

ETSs with high shares of free allocation increase the risk that an ETS will face low liquidity, because fewer firms are likely to engage actively in the market if their needs for allowances are more or less fully satisfied by free allocation, although other factors such as market size also impact liquidity. In the trading process, companies implicitly disclose their assessment of abatement costs. If trading is inhibited, this will therefore create barriers to price discovery. Organizing allocation mechanisms to encourage taking part in trading or auctioning activities will support price discovery, improve the overall efficiency of an ETS, and reduce the costs to meet emissions reduction targets.

5.2 AUCTIONING

Existing ETSs vary substantially in the extent to which auctioning is used. At one extreme, RGGI started with high levels of auctioning — about 90 percent of allowances — and individual states could choose how to spend the revenue. In the EU ETS, the use of auctioning has expanded over time, starting with low shares and introduced primarily to the power sector. About 54 percent of allowances were auctioned or sold in Phase 3 of the EU ETS over the period 2013–2019. In some jurisdictions where the ETS is relatively new (for example, most Chinese pilots and Korea's ETS), virtually no allowances are currently allocated through auctioning, although Korea and China's national ETSs do foresee a rising share of auctioning in the future.

If auctioning is pursued, conducting relatively frequent auctions will help provide transparency and a steady price signal to participants and consumers, and can reduce emissions price volatility. Frequent auctioning means that the quantity for sale at each individual auction is reduced, decreasing the risk of manipulation of the auction itself and making it more difficult for any one participant to gain too much market power in the secondary market. RGGI and California-Québec have quarterly auctions. The large-scale EU ETS auctions are held several times a week. The single-round, sealed-bid, uniform-price auction design is the most commonly used in carbon markets around the world today, due to its simplicity for both users and administrators, and its resistance to market collusion.[164, 165] Box 5-3 discusses ETS auction design issues in more detail.

164 Lopomo et al. 2011 evaluate leading auction formats and conclude the sealed-bid, uniform-price method is most appropriate for carbon markets, in part because of its relative strength against potential collusion among market participants.

165 Cramton and Kerr 2002 and Betz et al. 2010 discuss detailed choice of auction mechanisms for GHG markets.

Box 5-3 Technical note: Auction design for ETSs

In an ETS, allowances are typically sold by the government through multiunit auctions, which are similar to those conducted in other markets such as stocks, bonds, and commodities (for example, energy, flowers, and fish). The key elements of auction design include:

Frequency and schedule. In determining the frequency of auctions and the auction schedule, the regulator must strike a balance between ensuring open access and participation, and minimizing the impact of the auction on the secondary market. Frequent auctions may be desirable to ensure a steady flow of allowances into the secondary market at a rate that does not jeopardize market stability. Yet multiple auctions can also increase transaction costs and the risk of low participation. Several auctions are held for EU allowances every week on different trading platforms, whereas Québec and California hold four joint auctions a year.

Price determination. Prices at auctions are either pay-as-bid (where successful bidders receive the price they bid, so the price can vary between bidders) or uniform price (where all successful bidders receive the same price, the price at which demand equals supply). ETS auctions adopt uniform price formats for two reasons. First, the existence of the secondary market means that bid prices will not vary much beyond the prevailing market price, reducing the benefits of pay-as-bid auctions. Second, uniform pricing limits strategic bidding, as all successful bidders pay the same market-clearing price and are incentivized to bid up to their highest marginal value for allowances.[166] This supports an efficient distribution of allowances and reliable price signals that more closely reflect marginal abatement costs within the economy.

Bidding format. Dynamic versus sealed. Today, most ETSs have chosen an auction design in which participants simultaneously submit a single bid without knowing what others are willing to pay (known as "sealed bid"), with the auction winners paying the auction clearing price (uniform price).

Participation. Jurisdictions will need to determine who can participate in auctions — whether only liable entities should be allowed to participate or also other market participants. As competitive bidding is fundamental to a successful auction, in general, the more participation the better, so long as participants are sufficiently creditworthy. In this way, auctions need to balance the importance of keeping the costs of participating low to maximize participation, with the need to ensure the involvement of only serious participants who have the ability and intention to pay. Other rules that policymakers should consider on participation include reporting requirements when submitting bids, rules for participants acting on behalf of clients (for example, entities with compliance obligations), and other provisions that are typical of financial markets.

Publication of information. To support transparency and price discovery for the secondary market, winning prices and volumes (and sometimes winning participants) are usually published directly after an auction. Auctions work best when the rules of how they work are known by all participants, and so it is important that all stakeholders are well briefed on how the auction will operate.

Market misconduct. Underlying market misconduct laws (for example, regarding collusion) govern auctions and the behavior of participants. Jurisdictions may further more commission independent market monitors to oversee the conduct of the auction participants, identify cases of market manipulation or collusion, and foresee measures to prevent market misconduct (limitations on bids).[167]

Partially subscribed auctions. When demand for allowances is lower than the amount for sale, auctions may not sell out. ETS jurisdictions apply different rules to such situations. In the EU ETS, the auction is cancelled, and the full auction volume is distributed over subsequent auctions scheduled at the same trading platform. In systems with a reserve price at auction (for example, California, Québec, RGGI, Nova Scotia) the auction clears at the reserve price, and unsold allowances are placed in a holding account to be reoffered in subsequent quarterly auctions. When (or if) these allowances are reoffered to the market will depend on predefined market rules. Allowances that are unsold at joint auctions in the California and Québec trading schemes due to the reserve price are returned to auction after two consecutive auctions result in a settlement price above the auction reserve price.[168, 169]

166 Lopomo et al. 2011.
167 See Cramton and Kerr 2002; Evans and Peck 2007;, and Kachi and Frerk 2013 for a summary
168 Western Climate Initiative (WCI) 2018.
169 Québec Environment Ministry stakeholders noted that the rate of reintroduction is set to a maximum of 25 percent of the volume of allowances otherwise offered for sale at auction to avoid reintroduction resulting in a temporary oversupply.

An approach that tries to combine the benefits of auctions and free allocation is a consignment auction. With consignment auctions, eligible entities are allocated allowances for free but must return — or consign — them to the jurisdiction for sale at auction. The entities then receive the revenue from the sale of consigned allowances at auction, but jurisdictions could stipulate how recipients spend it. By using auctions as a means of distributing a portion of free allocation, consignment can help facilitate price discovery, boost liquidity in the market, and reduce differences in access to allowances.[170]

Consignment has been used in limited circumstances, with Box 5-4 discussing consignment allowances from the California allowance budget, available at California-Québec auctions.

Box 5-4 Case study: Partial use of consignment in California auctions

California is currently the only active ETS in the world that uses mandatory consignment of some allowances available at auction, though the mechanism was also used earlier in SO_2 trading. Specifically, some electrical distribution utilities and natural gas suppliers receive allowances each year that must be sent, or "consigned," to California-Québec auctions rather than used to satisfy their compliance obligations. After the allowances are sold, the proceeds from the consigned allowances are returned to each utility and supplier with the requirement that the value must be used "for the primary benefit of" ratepayers.[171] Uses of the value that satisfy this requirement include measures to reduce GHG emissions and direct compensation to customers. Consignment entities must report annually on how they use the proceeds and spend it within 10 years. Any revenue from consignment that has not been spent within 10 years is automatically returned to ratepayers.[172]

Among all entities regulated under the California cap and trade system, only investor-owned electrical distribution utilities and natural gas suppliers are required to consign at least a portion of their directly allocated allowances each year. Investor-owned electrical distribution utilities must consign all freely allocated allowances each year, while publicly owned electrical distributors and cooperatives are able to choose how many of their allowances are consigned and how many they hold onto for compliance. Natural gas suppliers are only required to consign a minimum percentage of their free allocation, which increases 5 percent each year to 100 percent in 2030. Consigned allowances are the first sold at California's quarterly auctions, before the sale of those owned by the California Air Resources Board.

5.2.1 ADVANTAGES

Auctions have several advantages:

- **Raising revenue:** Income raised in an auction can be used by governments to support several objectives, with examples from the EU, California, RGGI, and Québec provided in Box 5-5, including:
  - **Supporting other climate policies:** The government may, for example, wish to invest in low-emissions infrastructure, incentivize industry to invest in energy efficiency and clean energy technology, generate funding for R&D, or reduce emissions in non-covered sectors.
  - **Improve overall economic efficiency:** Revenues could support fiscal reform, such as reducing other distortionary taxes in order to improve overall efficiency or to lower government debt.
  - **Addressing distributional concerns and generating public support for the ETS:** The government could use revenue from the sale of allowances to make offsetting adjustments to the tax and benefit system to ensure distributional impacts are minimized and build public support for the ETS. This might include providing assistance to reduce the risk of carbon leakage and associated structural change or mitigating the effects of the ETS on disadvantaged consumers and communities. Care should be taken to ensure that these measures do not undermine the objectives of the ETS in the long term.
- **Reducing potential for political lobbying:** Auctions can be administratively simpler than free allocation approaches. They also reduce the opportunity for industry lobbying to support specific firms or sectors (although there may still be lobbying for the auction proceeds).
- **Facilitating price or supply adjustment measures (PSAMs):** The majority of PSAMs (see Step 6) are implemented through adjusting the number of allowances that are auctioned. For these mechanisms to be effective, there needs to be a minimum auction volume.
- **Improving price discovery and market liquidity:** Auctions provide a minimum amount of market liquidity and can facilitate price discovery, especially in cases

170 Burtraw et al. 2017.
171 CARB 2018b.
172 See CARB's overview of consignment allocation, "Electrical Distribution Utility and Natural Gas Supplier Allowance Allocation" 2020b.

where there is little trade in secondary markets by those who receive free allowances.

- **Reducing risk of distortions:** As described further below, different forms of free allowance allocation may distort incentives to undertake cost-effective abatement. In an auction all entities pay the full cost of allowances, which should lead to cost-effective abatement. The auction results in an efficient allocation of emission rights and a price reflective of the true value of allowances in the market.
- **Rewarding early action:** Early actions and early movers do not face disadvantages and are fully incentivized, since with auctions early movers need to buy fewer allowances, giving them an advantage over those who do not abate early.
- **Increasing market transparency:** In providing reliable price signals, auctioning also boosts the transparency of the market, which in turn supports the development of a credible, long-term investment framework for regulated entities and establishes confidence in the fairness of the market.

5.2.2 DISADVANTAGES

- **No direct protection against leakage risks or compensation for stranded assets:**[173] The key disadvantage of auctions on their own is that they provide no direct protection against carbon leakage and do not compensate firms for losses from stranded assets. Firms will face the full financial cost associated with their emissions liability. While not commonly used to date, revenues from auctioning could also be used to directly address these risks.
- **Concerns over impacts on small firms:** There may often be concerns that small firms will not be able to easily participate in an auction process, further raising costs. One way of reducing potential negative impacts on small firms is to have a simple auction design, as many jurisdictions have adopted with sealed-bid auctions. An enabling framework for liquid secondary markets could further address this issue, and the acquisition of smaller numbers of allowances from intermediaries might have lower transaction costs than auction participation in some cases.

STEP 5 ALLOCATION

Box 5-5 Case study: Auction revenue use

Looking across established ETSs, auction revenues are often used to support low-carbon innovation and fund additional climate and energy programs. Between 2012 and 2019, the EU Member States collected a total of EUR 50.5 billion through auctions. While they have the authority to decide autonomously on how they use auction revenues, the ETS Directive instructs them to spend at least 50 percent of revenues on climate- and energy-related purposes. Data for 2013–2018 show that EU Member States used 37 percent of auction revenue for renewable energy, 32 percent for energy efficiency, 17 percent for sustainable transport, and 7 percent for R&D.[174] At the EU level, allowances are further set aside and auctioned to capitalize financial support mechanisms aimed at promoting low-carbon innovation and supporting modernization efforts. In Phase 4 of the EU ETS, the Innovation Fund will leverage investment in innovative technologies such as carbon capture and storage or utilization, as well as others targeting industrial processes, renewable energy generation, and energy storage. The Modernisation Fund will support lower-income Member States in modernizing their energy systems, improving energy efficiency, and promoting a socially just transition. These funds replace the NER300 program that supported low-carbon investment in Phase 3. Any unused resources from this program will fuel the Innovation Fund.

California and Québec, which operate a linked carbon market with joint auctions, manage their shares of auctioning revenue independently. By the end of 2019, California had raised an estimated USD 12.5 billion (EUR 11.2 billion) in auction revenue through its cap and trade program. California has strict statutory requirements regarding how auction revenues must be spent.[175] Auction revenues from state-owned allowances are deposited into the Greenhouse Gas Reduction Fund, which funds state programs in clean transportation, sustainable communities, clean energy, energy efficiency, natural resources, and waste diversion. Through the budget process, the California's governor and legislature have directed funds to various state agencies on diverse programs including high-speed rail, affordable housing, and climate adaptation programs. In 2018, 79 percent of Greenhouse Gas Reduction Fund funding went to transport and sustainable communities, 14 percent to natural resources and waste diversion, and 7 percent to clean energy and energy-efficiency programs.[176] →

173 This assumes that the revenue raised from the sale of allowances is not used to address these issues.

174 This data is based on the *EU Climate Action Progress Report 2019*, European Commission 2019. For more information on revenue use, please see the ICAP report: Santikarn et al. 2019.

175 State laws stipulate that revenues be spent on reducing GHG emissions, preferably with cobenefits such as job creation and improved air quality. Thirty-five percent of auction revenue must be used to benefit disadvantaged communities, with 25 percent of revenue to be invested in projects located directly in disadvantaged communities. Sources: California Senate Bill (SB) 1018, see Government of California 2005; Assembly Bill (AB) 32, see Government of California 2006; AB 1532, see Government of California 2012a; SB 535, see Government of California 2012b. The latest requirements, which superseded SB 535, are set out in AB 1550; see Government of California 2016.

176 Santikarn et al. 2019.

California communicates the use and impact of auction revenues by engaging in partnerships and projects that have clear benefits to local communities (such as housing and clean transport). It places high emphasis on effective communications, with a website[177] dedicated to ETS revenue use and a corresponding slogan — "cap and trade dollars at work" — for projects funded through ETS revenue. Semi-annual reports on cap and trade auction proceeds published by the California Air Resources Board include detailed cumulative and project profiles, which are also featured and disseminated online.[178] The showcasing of cobenefits of the Cap and Trade Program has played a key role in ensuring political buy-in and overcoming opposition from industry lobbies.

In the Québec Cap and Trade Program, auction revenues go to the Québec Green Fund, which supports climate change programs and helps achieve objectives set out in the Climate Change Action Plan. By 2019 Québec had raised an estimated CAD 3 billion (EUR 2.7 billion) in auction revenues.[179] Roughly 90 percent of this revenue has been invested in GHG mitigation, 8 percent in adaptation measures, and 2 percent in program coordination. By law, two-thirds of the Green Fund's revenue must be directed to the transport sector.

RGGI, the first ETS in the United States, was launched specifically as a cap and invest program aimed at reducing power-sector emissions and using auction proceeds to support economy-wide energy and climate programs. By the end of 2018, the ETS had generated an estimated USD 3.08 billion (EUR 2.77 billion) in auction revenues. Like the EU ETS, RGGI participating states can decide how they spend their revenues. In 2017, they invested 51 percent of revenues in improving energy efficiency, 14 percent in clean and renewable energy, 14 percent in targeted GHG abatement, and 16 percent in direct bill assistance. RGGI investment proceeds are used to support households and low-income groups, support businesses, create jobs, and reduce pollution. As such, these proceeds play an important role in ensuring tangible cobenefits, which are communicated in a transparent manner through annual investment reports.[180]

Further details can be found in the PMR's *Using Carbon Revenues* report.

5.3 FREE ALLOCATION

Common approaches to free allocation include grandparenting, fixed historical benchmarked allocation, and output-based benchmarked allocation. The most appropriate free allocation approach will depend on the local context. Grandparenting may be appropriate when jurisdictions lack data to implement benchmarking approaches, but should be used as a temporary measure only until the data needed (particularly output data) becomes available. Fixed historical benchmarked allocation and output-based benchmarked allocation both outperform grandparenting in most respects (see Section 5.4).

In jurisdictions with a fixed cap, free allocation approaches might face the need to introduce an additional adjustment factor (see Box 5-1) that aligns the aggregate free allocation to the aggregate cap or the share of the cap that is earmarked for free allocation. This is of special relevance in cases where EITE industries represent a larger proportion of total emissions under the cap or where significant amounts of allowances are withheld for free allocation of new entrants.

5.3.1 FREE ALLOCATION USING GRANDPARENTING

The rate of assistance under grandparenting is determined by historical emissions and the assistance rate. This means that the amount of allocation received remains independent of future output decisions or decisions to reduce emissions intensity, provided that the firm stays open. In some cases, periodic adjustments or updates can be made to take account of large changes in circumstances from when the initial allocation is made. However, updating allocation introduces further issues and negates some of grandparenting's advantages. Prominent examples of grandparenting include the first two phases of the EU ETS, the first phase of the Korean ETS (for most sectors), and various Chinese ETS pilots.

When implementing grandparenting, it is critical to set the base year for the data used early on to avoid incentives for entities to drive up emissions to increase allocation, to ensure equitable treatment of facilities, and to minimize

177 California Climate Investments, http://www.caclimateinvestments.ca.gov/
178 For more information, please see CARB 2020c.
179 Québec Ministry of Environment and Climate Change 2019.
180 For more information, please see RGGI 2018.

lobbying by firms to maximize the benefit to their facilities. Two challenges with this are:

1. **Data availability.** The data may need to be collected and audited specifically for this process and may not be available for earlier years.
2. **Perceived inequity as a result of rapid changes within sectors.** Firms that have contracted since that date may receive more allowances than their current emissions. Firms that have expanded will receive relatively fewer allowances, but also probably have fewer "stranded assets" because their investments were made more recently when the regulation may have been anticipated.

Because of the considerable disadvantages of grandparenting, which are discussed in more detail below, it should be considered only as a transitional arrangement while collecting data to implement benchmarking or to allow time for capacity building for auctions to take place.

Advantages

The key advantages of grandparenting are:

- **Relative simplicity.** Grandparenting uses a firm's historic emissions to calculate free allocation and does not require data on output. This makes it a relatively straightforward approach to undertake allocation, making it a popular method in the initial stages of many carbon pricing systems. Grandparenting can also be simpler for regulated entities, as — unless firms are changing rapidly — their free allocation will be close to their level of emissions and less trading may be required in early years.
- **Can partially compensate for stranded assets.** One-off grandparenting may be a particularly attractive approach where there is a desire to provide transitional support for industries that might otherwise lose significant value from stranded assets. For example, the now-repealed Australian carbon pricing mechanism included a one-off, non-updating allocation of allowances to electricity generators to reduce the financial impact that they otherwise would have faced. Firms are also less likely to resist participation if they receive free allowances.
- **Maintains marginal abatement incentives.** Firms that reduce emissions can sell or bank their surplus allowances; those that increase emissions pay the full cost. As with auctioning, grandparenting should, in the absence of any updating provisions, result in an efficient allocation of emission rights domestically and a price reflective of the true value of allowances in the market. One of the features of grandparenting is that it is a lump-sum financial allocation to firms — the amount that the firm receives is not a function of its current or future output. In the short term, firms should therefore respond to the carbon price in the same way as if they had not received the free allowance allocation.

Disadvantages

However, grandparenting is associated with several disadvantages:

- **Updating of grandparenting reduces incentives to abate.** While grandparenting should maintain marginal incentives to abate, this can be significantly diluted if applied in combination with updating provisions (as widely implemented for Phases 1 and 2 of the EU ETS). In these cases, future allowance allocation will be based on updated emission levels. This means that firms that make emission reductions (by reducing either output or emissions intensity) could receive lower support in the future, significantly decreasing the incentive to abate. This is a major distortion of the carbon price signal and leads to less cost-effective emission abatement from production and investment decisions. It is likely to be addressed only if it is signaled at an early stage that subsequent allocations will not be based on grandparenting, as indeed has been the case in several systems.
- **Weak impact on leakage risk.** Since grandparenting does not affect the marginal incentives that firms face under a carbon price, it does not protect against production leakage. The risk of capital leakage is only partially protected against. Existing productive capacity is maintained by grandparenting when there is a minimum production requirement; however, investments into new capital or maintenance of existing capital may be lower. The higher costs brought about by the introduction of a carbon price presents a risk that a firm may reduce investment and/or output (and transfer this output to competitors outside of the jurisdiction).
- **Windfall profits.** Grandparenting can create windfall profits via different channels:
  - With grandparenting, firms are incentivized to reduce emissions to minimize their carbon-cost liability. Firms may be able to invest in low-cost abatement that reduces liabilities by much more than the cost of the investment, therefore reducing the carbon-cost liability. Any investment has no impact on the number of free allowances it receives. In this case, having a high quantity of freely allocated allowances results in a large rise in assets without a comparative increase in costs. These windfall profits under grandparenting may be highest for the historically high emitters within a sector that have not taken early action; they receive a high rate of free allocations and may still have significant low-cost abatement opportunities available.
  - The additional carbon-cost liability changes optimal output decisions; firms may decrease output, leading to an increase in prices. Combined, firms may benefit

from both higher prices and free allowances,[181] thus prolonging the lifetime of high-carbon assets and leading to higher costs of emission reduction. This was seen, for instance, for some electricity generators in Phases 1 and 2 of the EU ETS.[182] Windfall profits could be a wider issue for the longevity of the ETS, potentially undermining public confidence in the system, particularly if they persist.

- Without additional provisions, once firms have received their free allocation they could close and sell their allowances, creating windfall profits. However, some of the revenue generated may cover any stranded assets. Because of this risk, when grandparenting is implemented it often requires facilities to maintain operations to some extent to receive free allocations.

- **Penalizing early action.** Early actions and early movers would face disadvantages if they implemented abatement measures before the period that was selected as the base period for grandparenting.
- **New entrants and closures.** Firms that wish to enter a sector may be at a disadvantage because they have no historic emissions on which to base allocation through grandparenting. In this way, grandparenting can act as a barrier to entry, which reduces the ability of the ETS to drive emissions reductions. The reduced competition from this barrier to entry will delay decisions on emissions reductions for existing firms, which may choose to instead increase emissions since they are able to absorb the additional increase in costs. The barrier to entry may also prevent new firms with new, low-emission technologies from entering the market. Any provisions to adjust for this may be inaccurate or may leave the firm with a lower allocation than other firms.

5.3.2 FREE ALLOCATION USING FIXED HISTORICAL BENCHMARKED ALLOCATION

Fixed historical benchmarked allocation combines two features. First, in contrast to grandparenting, the degree of free allocation is determined by applying a sector-wide process or product-level benchmark emissions intensity to historical output levels. All firms undertaking the same process or producing the same product receive the same benchmark. The size of a firm's allocation depends on the firm's historical output level but not its emissions. Any adjustment factors are applied to scale the free allocation.

This is the approach adopted in the EU ETS for those deemed to be EITE (see Box 5-6). A series of benchmarks were created for different products under the cap. Where product-based benchmarks were challenging given data limitations or heterogeneity in the production process of a single product, fallback benchmarks such as fuel inputs were used. Free allowances received by firms/installations in the sector are in principle calculated by multiplying the installation's historic output level by the benchmark. Once the level of free allowance is set, future changes in installation output have limited impact on the allowances received by each installation (only if capacity is added). In this way, fixed historical benchmarked allocation does not have an impact on marginal incentives for abatement, similar to grandparenting and in contrast to OBA, which does impact marginal incentives.

Advantages

The main advantage of this approach is that it provides incentives for substitution within sectors by advantaging more efficient firms:

- **Severing the link between firms' emissions intensity and allowances received.** Firms that have taken action before the ETS to reduce their emissions intensity will benefit relative to those with high emissions intensity; early actions are rewarded. In addition, as explained above, under a grandparenting approach with periodic updating, firms may be reluctant to reduce their emissions intensity, as it will reduce the free allowances the firm is entitled to receive in the future. This challenge is largely eliminated by this approach; it is the industry-wide benchmark, rather than firm-specific emissions, that determines the amount of free allowances received in the future. Firms will therefore profit even in the medium to long run from production efficiency improvements that reduce their emissions intensity.

Disadvantages

The disadvantages of this method are:

- **Calculation of product benchmarks.** This is data-intensive and creates potential for lobbying around the allocation methodology. Complications arise through issues such as the existence of similar products with different production processes and through multioutput production processes. However, the successful development of benchmarking approaches in many jurisdictions indicates that these technical challenges can be overcome. Existing principles and methodologies to set benchmarks, for example, from the EU or from California, could also be used by other systems as a basis for developing their own.
- **Risk of windfall profits.** As the level of allocation is not dependent on current output levels, firms that are not exposed to international competition may raise prices in response to a significant emission cost. While, as

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181 CE Delft and Oeko-Institut 2015 present empirical evidence suggesting cost pass-through despite the provision of free allowances in both Phase 2 (grandparenting) and Phase 3 (fixed-sector benchmarking) of the EU ETS, for certain industrial sectors.

182 See Sijm, Neuhoff, and Chen 2006.

discussed above, this increase in prices might stimulate some demand-side abatement, it can also lead to firms earning windfall profits from free allowance allocations,[183] thus prolonging the lifetime of high-carbon assets and leading to higher costs of emission reduction.

- **Mixed results in mitigating leakage risk.** Fixed historical benchmarked allocation has a similar dynamic to grandparenting: sectors exposed to international competition could experience production leakage, cutting back on production and losing market share to those not facing carbon prices. In other words, it may not be particularly effective at reducing carbon leakage risk. However, as the historical level of output used to calculate these benchmarks is often updated on a semi-regular basis, this provides some incentive to maintain a certain level of production and productive capacity. This would provide some degree of protection for carbon leakage.
- **Potential for distortions of the price signal.** If benchmarks are not strictly based on product outputs but instead reflect process, fuel, or other input specifics, price signal distortions may arise that are comparable with those observed with grandparenting in combination with updating provisions.
- **New entrants and closures.** This requires a policy approach to ensure new entrants are not disadvantaged compared to incumbents. With free allocation determined by previous output, the new entrant would have to purchase allowances to enter the market and thus would experience higher costs than incumbents who received the free allocation. Closures may introduce scenarios where firms have large free allocations to sell, creating windfall profits.

Box 5-6 Case study: Fixed historical benchmarked allocation in Phases 3 and 4 of the EU ETS

Under fixed historical benchmarked allocation, the number of allowances an entity receives is a function of a product-based benchmark combined with installation-specific historic activity levels for a fixed baseline period. Although allocation in Phase 3 is not adjusted frequently to changes in output, the levels are tied to each installation's historical production and not historical emissions. For Phase 4, the allocation is adjusted based on a 15 percent change of the production level.

The approach to fixed historical benchmarked allocation under the EU ETS Phase 3 did not regularly update the output basis for allocation of free allowances. However, provisions were in place to reflect large decreases in plant activity or changes in capacity. Allocation rules required firms to report activity level changes of at least 50 percent from the period when free allocation rules were set. In the face of declining output associated with the financial and economic crisis, this is considered to have resulted in (1) overallocation to some installations that had reduced their activity levels by less than 50 percent; and (2) creating incentives for companies to spread production over several installations to maintain full issuance of free allowances, leading to inefficient levels of production in some sectors.[184]

In addition to the above-outlined problems, industry remained concerned that as fixed historical benchmarking would not adjust free allocation provisions for increased levels of production, it would not provide sufficient protection against carbon leakage.

Against this background, the free allocation provisions under the EU ETS were adjusted for Phase 4. Specifically, rules that are more flexible have been introduced to better align free allocation with actual production levels. The relevant changes to the ETS Directive are specified in the implementing regulation on adjustments to free allocation of emission allowances due to activity-level changes.[185] The main aspects of free allocation provisions for Phase 4 of the EU ETS specify the following:

- Free allocation may be updated annually to mirror sustained changes in production (if this change is higher than 15 percent compared to the initial level, on the basis of a two-year rolling average).
- Carbon leakage will be assessed against a composite indicator of trade intensity and emissions intensity, with industries considered at risk listed in the Carbon Leakage List. The updated Carbon Leakage List for Phase 4 was adopted in 2019.
- Historical activity levels are adjusted twice throughout the phase to ensure free allocation is targeted to production levels. Furthermore, benchmark values account for technological progress, declining at an annual rate between 0.2 and 1.6 percent compared to the Phase 3 benchmark reference. For the steel sector, the lower end of the 0.2 percent annual benchmark update rate applies for the period 2021–2025. →

183 CE Delft and Oeko-Institut 2015 present empirical evidence suggesting cost pass-through despite the provision of free allowances in both Phase 2 (grandparenting) and Phase 3 (fixed-sector benchmarking) of the EU ETS, for certain industrial sectors.

184 For example, cement (see Branger et al. 2014).

185 Commission Implementing Regulation, 2019/1842, European Commission 2019a.

- Free allocation for sectors deemed not to be exposed to risk of carbon leakage will be 30 percent from 2021 to 2026, reducing to 0 percent by 2030 (except district heating, which will be at 30 percent).
- As an additional safeguard for industry, a free allocation buffer of over 3 percent of the cap, initially earmarked for auctioning, will be made available if the initial free allocation is fully absorbed (thereby reducing the likelihood of a correction factor being applied).

The revised EU ETS Directive also provided an enhanced data collection framework, which is considered important for attaining robust data. To be eligible for free allocation, installations are obliged to perform a data collection exercise and submit production, emissions, and energy data to their competent authority prior to Phase 4. To facilitate this exercise, the European Commission held technical workshops in eight Member States. These one-day events covered all the details of the free allocation rules, including the National Implementation Measures process; benchmark updates; and monitoring, reporting, verification, and accreditation requirements. In addition, they provided data templates, case studies, and the opportunity for installations to ask specific questions.

5.3.3 FREE ALLOCATION USING OUTPUT-BASED BENCHMARKED ALLOCATION

OBA is also a benchmarked approach in that it uses predefined benchmark emissions intensities fixed by process or product type to calculate allocations. However, unlike fixed historical benchmark allocations, OBA adjusts allocations to reflect the *actual* level of production in each compliance period (rather than a fixed, historical level of production). Because OBA adjusts allocations for changes in a firm's output, it also changes the marginal incentive that a firm faces. That is, the decision to produce an additional unit of production will lead to both a higher cost from increased carbon liabilities and an increase in free allocation. Like other forms of free allocation, adjustments are sometimes made to better target free allocation or to make total allocation consistent with the overall cap.

Variants of OBA are used in California, Québec, New Zealand, the former ETS in Australia, and some sectors in most of the Chinese pilots. A simple example of OBA is provided in Box 5-7.

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Box 5-7 Technical note: Impacts of output-based allocation

	Unit	Firm	Output	
			1 unit	2 units
Firm emissions intensity	tCO_2e/unit of output	A — High	1	
		B — Low	0.5	
Benchmark	Allowances/ unit of output		0.7	
Allocation	tCO_2e	Both	0.7	1.4
Emissions	tCO_2e	A — High	1	2
		B — Low	0.5	1
Net liability (emissions less allocation) and cost (price = USD 100)	tCO_2e USD	A — High	0.3 USD 30	0.6 USD 60
	tCO_2e USD	B — Low	-0.2 USD -20	-0.4 USD -40

This example illustrates the leakage protection and incentive for increasing GHG efficiency of EITE industrial production under OBA. Consider an emissions price of USD 100 per ton of carbon dioxide equivalent (tCO_2e). As high-emissions intensity Firm A increases output from 1 to 2 units, its emissions also rise by 1 tCO_2e. With no free allocation, this increase in production would cost USD 100 in terms of allowance costs in addition to the direct cost of production. That could leave Firm A vulnerable to international competition and risks carbon leakage. By providing free allowances based on a benchmark and the firm's output, OBA reduces the allowance costs for a firm. In this example, assume the benchmark is set at 0.7 tCO_2e per unit of output, and Firm A continues to emit 1 tCO_2e per unit. This means that as production increases from 1 to 2 units, Firm A's emissions increase from 1 to 2 tCO_2e, while its free allowance allocation increases from 0.7 to 1.4. Therefore, the allowance cost for the firm is only USD 60, rather than USD 200 in the absence of OBA.

In contrast, when low emissions intensity Firm B (with an emissions intensity of 0.5 tCO_2e per ton) increases output, the extra free allocation it receives (also based on the benchmark of 0.7 tCO_2e per ton) is greater than its extra emissions (0.5 tCO_2e) and it receives a production subsidy of USD 20 per unit. This illustrates the way benchmarks give low-emissions-intensity firms a competitive advantage but also illustrates the risks of setting sectoral benchmarks that are too high. If the emissions rate is set above the level of actual emissions per unit of output, perverse incentives to increase output can be created. This is a particular issue in a heterogeneous sector where one rate may be applied to a set of different activities and outputs.

Advantages

The advantages of OBA are:

- **Strongly targets leakage risks.** Under OBA an extra unit of output (or production by a new entrant) will directly result in additional allocations, as opposed to grandparenting and fixed historical benchmarked allocation schemes, where extra output does not usually lead to additional assistance. This means that the short-run risks of production leakage both domestically and externally are reduced, as increased production leads to increased allocations that may partially or fully offset additional carbon costs. Further, as benchmarks are used, firms still maintain incentives to invest in reducing the emissions intensity of production, including for capacity expansions. For instance, a glass manufacturer may choose to invest in a new low-emission furnace that enables it to increase production as any additional carbon costs are offset through additional allocations received via OBA.
- **Maintains incentives to reduce emission intensity.** Output-based allocation preserves incentives to reduce emissions intensity. A reduction in emissions intensity reduces emissions liability but has no effect on free allocation. This incentive will be strongest when OBA is used with a stringent product benchmark calculated across the sector. Product benchmarks encourage early mitigation action and allow less carbon-intensive firms to gain a competitive advantage through changing technologies and processes to lower carbon costs. Process benchmarks also encourage efficiency improvements but do not encourage adoption of new technologies or processes.
- **New entrants.** OBA is the only free allocation method discussed that adequately addresses the issue of new entrants. New entrants under OBA would be allowed the same allocation as an identical incumbent firm; hence, new entrants are not disadvantaged compared to incumbents in this respect.

Disadvantages

The disadvantages of this method are:

- **Demand-side abatement incentives are reduced.** OBA provides firms with additional allocations for each additional unit of production. Tying allocation to current production reduces the marginal costs of production relative to other allocation mechanisms; at the margin, a firm does not face the full carbon price. The lower increase in costs means a lower increase in prices. A lower pass-through of costs in turn undermines incentives for consumers to change behavior to reduce consumption of emissions-intensive products or substitute for less emissions-intensive alternatives. There are a growing number of studies that show how important demand-side abatement and the circular economy will be for achieving net-zero emissions.[186] The demand-side abatement can often be relatively low cost (for example, using steel, aluminum, and cement more efficiently in construction). If these low-cost actions are not incentivized to occur, the cost of meeting a given emission reduction target may increase. In trade-exposed sectors the reduced cost increase may not have material effects on demand-side abatement, as international competition would serve to limit price increases in any case. However, there are policies that could be combined with OBA such that leakage protections are maintained, but demand-side abatement is better incentivized. For example, jurisdictions could apply charges downstream on the consumption of emissions-intensive goods while maintaining OBA for producers, which would effectively pass on carbon costs that are blunted through free allocation and incentivize more efficient use of industrial products.[187]
- **Calculation of benchmarks and measurement of output.** OBA, as with fixed historical benchmarked allocation, uses historical emissions intensity and output to calculate benchmarks. Benchmarks based on firms' historical emissions intensity require the collection of data on emissions and output. Establishing sectoral benchmarks is data-intensive and creates potential for lobbying around the methodology. In applying a benchmark across a sector, it is often difficult to determine the common output and ensure it fits the sector in question. These issues may be lessened by utilizing international benchmarks.
- **Possible interaction challenges with the overall cap.** Keeping the number of allowances allocated for free within the cap may be more difficult to manage under OBA if overall levels of free allocation are high. As allocation adjusts with changes in recent output, the overall level of assistance that firms are entitled to receive may not be known when a particular phase of an ETS starts. If increases in OBA cannot be absorbed by the pool of allowances that would otherwise be auctioned, there is a risk of exceeding the cap, rendering the domestic environmental outcome of the ETS less certain. This potential challenge raises the need for adjustment factors that align allocation with the cap trajectory.

5.3.4 TARGETING FREE ALLOCATION

Excessive free allocation can reduce the efficiency of carbon markets and the amount of revenue flowing to government for use toward other objectives. These trade-offs have led jurisdictions to try to closely target free allocation to the sectors and firms that need it most. Free allocation often reduces the incentives for abatement but

186 For example, Material Economics 2018; Rissman et al. 2020.
187 See Acworth et al. 2020 for an overview of consumption charges and demand-side abatement measures.

often helps with managing the transition to the ETS and can reduce the risk of carbon leakage. Jurisdictions with existing ETSs often deem those in most need as the firms that face the highest carbon leakage risk, as this is often the largest concern of participants.

The risks of leakage are usually highest for industries that produce outputs that are both emissions-intensive and trade exposed:

- **Emissions intensity** captures the impact that carbon pricing has on a particular firm or sector. An emissions-intensive product is one for which the additional costs from a carbon price are large enough to substantially affect the overall cost of production.
- **Trade exposure** is used as a proxy for the ability of a firm or sector to pass on costs without significant loss of market share and hence their exposure to carbon prices. Trade, or the potential to trade, is what allows competition between producers in different jurisdictions. Products are trade-exposed if the companies that produce them compete with foreign producers in either export or import markets. For trade-exposed products, higher production costs because of the ETS cannot be fully passed on to consumers and production may no longer be profitable. Where factors such as trade barriers or transport costs make trade unlikely to occur, covered firms are insulated from competition from uncovered competitors and the risk of leakage should be small. Trade exposure is often quantified with trade-intensity indices.

In addressing leakage risk concerns, most jurisdictions combine the two indicators of emissions intensive and trade exposed. They are often used to create separate EITE sectors into tiers of leakage risk, with the tier level dictating the level of assistance provided. Table 5-2 shows the different factors that ETSs have used to identify which sectors might be exposed to the risk of leakage.

Table 5-2 Trade exposure and emissions intensity in different ETSs

	Emission Intensity (EI)	Trade Exposure (TE)	Carbon leakage risk criteria
California (WCI)	EI = tCO_2e/million dollars of value added	(imports + exports)/ (shipments + imports)	Emission intensity tiers: 1. High: >5,000 tCO_2e per million dollars of value added 2. Medium: 1,000–4,999 tCO_2e per million dollars of value added 3. Low: 100–999 tCO_2e per million dollars of value added 4. Very low: <100 tCO_2e per million dollars of value added Trade intensity tiers: High: >19 percent Medium: 10–19 percent Low: <10 percent Both measures combined to determine final leakage risk category of low, medium, or high.
EU ETS (Phase 3)	Cost intensity used: [Carbon price[188] × (direct emissions × auctioning factor[189] + electricity consumption × electricity emission factor) / Gross value add (GVA)]	(imports + exports)/ (imports + turnover)	Direct and indirect cost increase >30 percent; or non-EU trade intensity >30 percent; or Direct and indirect cost increase >5 percent and trade intensity with non-EU countries >10 percent.
EU ETS (Phase 4)	{[direct emissions + (electricity consumption × electricity emission factor)] / GVA}	(imports + exports)/ (imports + turnover)	Trade intensity * Emissions intensity > 0.2 then considered to be at risk of carbon leakage. Trade intensity * Emissions intensity between 0.15 and 0.2, qualitatively assessed and may be considered at risk of carbon leakage. Criteria include abatement potential, market characteristics, and profit margins.
New Zealand	EI = tCO_2e / million dollars of revenue	Trade exposure is qualitative and based on the existence of trans-oceanic trade in the good in question.	Two tiers: 1. Highly exposed: carbon intensity >1,600 tCO_2e per million New Zealand dollars of revenue and trade exposed. 2. Moderately exposed: carbon intensity >800 tCO_2e per million New Zealand dollars of revenue and trade exposed.
Québec (WCI)	tCO_2e / million dollars of value added	(imports + exports)/ (imports + domestic production)	Three tiers for both emissions intensive and trade intensity: low, medium, high.

Source: Acworth et al. 2020.

188 Assumed carbon price of EUR 30.
189 Auctioning factor represents the share of allowances the sectors would need to purchase if not on the carbon leakage list in order to cover their emissions stemming from activities eligible for free allocation.

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While these criteria have typically been used in determining sectors exposed to carbon leakage, there are a number of important considerations.

First, when considering emissions intensity, it is important to take into account the carbon emission costs passed through from the supplying sectors, particularly electricity, as well as the direct carbon emission costs incurred in production. This may be important for industries such as aluminum smelting, where most of the impact of a carbon price is indirect cost impacts from electricity prices.

Second, in the academic literature several authors have argued that trade intensity, while relevant, is not a stand-alone driver of carbon leakage and only has an effect when a sector or firm is also emissions intensive. The same can also be true of emissions intensity in cases where trade intensity is not high. An important caveat is that trade exposure will be a useful metric only if a jurisdiction's trading partners do not have a sufficiently high carbon price in place. If trading partners have a carbon price at a similar level, then leakage is unlikely to occur. Therefore, as carbon pricing expands, risks of leakage are likely to reduce. An additional important consideration is the nature of competition between trading partners. If firms facing a carbon price are able to pass through costs to consumers because of the market structure, then the risk of leakage is lower.

This means that the current approach to targeting free allocation may not measure leakage risk well, particularly when carbon pricing diffuses to key trading partners. However, currently there are no clear alternatives that can be applied in broad leakage risk assessment.[190] Discussion on the potential alternative methods to provide leakage protection that aim to address the limits of free allocation can be found in Box 5-8.

Overall, free allocation to at-risk industries is important. However, providing free allocation comes at a large cost in terms of both forgone revenue and reduced abatement. The caps of ETSs are set to decline in the decades ahead as jurisdictions scale up their mitigation efforts, which means the amount of allowances available for free will decline as well. Therefore, free allocation faces increasing constraints as an instrument to compensate leakage-exposed industries for increased production costs of ETS compliance. This is particularly true for systems where EITE industries reflect a large proportion of the allowance cap. To achieve the ETS's objective of reducing carbon emissions, steps should be taken to reduce free allocation over time. This can be done via reducing the assistance rates or by recalculating the benchmarks.

Box 5-8 Technical note: Alternative approaches to carbon-leakage protection

Concerns about the limits of free allocation as protection against carbon leakage have prompted discussion in academic and policy circles about alternative approaches. Some of the most commonly discussed ideas are summarized below.

- **Tiered approaches to free allocation.** ETSs have often award sectors deemed at risk of carbon leakage an equivalent or very similar level of assistance, despite varying levels of vulnerability to carbon leakage across sectors. One way to ensure declining budgets for free allowances target sectors that are most vulnerable is to create a tiered approach that categorizes sectors according to their risk and gives different levels of free allocation based on those classifications. Such an approach is planned for Québec post-2020, is done in New Zealand, and was suggested by some EU Member States during deliberations on Phase 4 of the EU ETS.[191]
- **Border carbon adjustment (BCA).** BCAs would apply tariffs or other fiscal measures to imported goods based on their GHG content, with or without rebates to domestic exporters to recover their costs of ETS compliance. By leveling differences in carbon costs between domestic and foreign producers, BCAs could offer strong protections against carbon leakage. They could also strengthen incentives to reduce emissions by allowing the jurisdiction to end or limit free allocation to sectors included in the BCA scheme. However, BCAs present challenges in terms of administrative complexity (for example, data availability on the carbon content of imported goods) and the potential for legal disputes under the World Trade Organization. These challenges may also limit the effectiveness of a BCA as a policy response to carbon leakage.[192]
- **Charges on consumption.** A charge could be applied at the point of consumption based on carbon content and the price of an ETS allowance in the implementing jurisdiction. Producers would continue to receive free allocation but would be held liable for consumption charges, which they could directly pay themselves or pass to the next purchaser down the value chain. Imported goods would be treated equivalently. Consumption charges paired with free allocation therefore have the potential to protect against carbon leakage while →

190 Acworth et al. 2020.
191 California Air Resources Board 2013.
192 Mehling et al. 2019; Cosbey et al. 2019; and Acworth et al. 2020.

improving incentives for low-carbon intermediate and final consumption, which is a key lever to push for deep decarbonization.[193] Given their resemblance to a value-added tax, consumption charges may be simpler to implement. However, extending the charge further downstream to address domestic leakage concerns would also require default values for carbon-intensive imported goods.

- **Supporting investments in transformative technologies:** Especially for production processes with very high capital and low operational costs (including allowance costs), the capital leakage channel is the most significant mechanism for carbon leakage. Targeted low-carbon investment support could be accompanied by a ratcheting down of free allocation such that allowance costs are reduced in line with a reduction in emissions. Policies supporting low-carbon investment include carbon contracts for difference, which offer price guarantees for technologies that yield emissions reductions below a certain benchmark.[194]

5.4 COMPARISON OF ALLOCATION METHODS

This section compares the different allocation methods. Section 5.4.1 assesses the performance of each allocation method against the objectives identified; Section 5.4.2 discusses the topic of new entrants and closures; and Section 5.4.3 discusses the data requirements for implementing each allocation method.

5.4.1 PERFORMANCE AGAINST OBJECTIVES

No method of allocation performs best across all the objectives that policymakers may pursue. The different objectives and allocation approaches need to reflect the market environment as well as regulatory arrangements.

The rest of this subsection discusses how each method of allocation performs against the objectives in more detail. Table 5-3 provides a summary of the performance of each method.

Table 5-3 Summary of methods of allocation against objectives

Method of allocation	Objective				
	Preserving incentives for cost-effective abatement	Managing the transition to the ETS	Reducing the risk of carbon leakage	Raising revenue	Price discovery
Auctioning	High	Low	Low	High	High
Grandparenting	Medium	Medium	Medium (capital leakage)		
Fixed historical benchmarked allocation	Medium	Medium	Medium (capital leakage)		
Output-based benchmarked allocation	Medium	Medium	High		

● High ● Medium ● Low

Preserving incentives for cost-effective abatement

The ultimate aim of the ETS is to reduce emissions. Table 5-3 shows that auctioning provides full incentives for abatement while none of the free allowance allocation approaches score a "high" against preserving the incentives for cost-effective abatement. This partly relates to the approach that they take to updating allowance allocation over time. Updating allowance allocation is discussed further in Sections 5.3.1 and 5.3.2, as well as Box 5-9 below. Because free allocation reduces the

193 Munnings et al. 2019; Ismer et al. 2016; and Acworth et al. 2020.
194 See Acworth et al. 2020; Richstein 2017; and Sartor and Bataille 2019.

compliance burden for firms, the full cost of allowances is not internalized. Ultimately this disadvantages cleaner alternatives to carbon-intensive goods because emissions from those goods are not fully priced. This muted price signal reverberates across the industrial value chain, disincentivizing more efficient intermediate and final consumption.[195] This means that the aim of encouraging substitution from high-carbon to low-carbon producers may not be fully realized, and any related demand-side abatement driven by price pass-through on emission-intensive goods and services is only partially achieved. As discussed in Box 5-9, incentives for emissions-intensity reductions, but not necessarily absolute emissions reductions, are preserved in OBA.

Box 5-9 Technical note: Updating free allocation provisions

If allowances are allocated for free, the price signal of the ETS can be distorted and the incentives for cost-effective abatement may not be preserved.

A key determinant of the degree of these distortions is the interaction between allocation and different updating provisions, that is, whether and how the allocation of allowances responds to changes in circumstances after the initial allocation is made. If entities know or can predict that a change in circumstances will lead to a change in the allocation approach, then this may distort their behavior.

Most existing ETSs update free allocations — for example, in response to plant closures or alternatively large changes in production or capacity levels. This may be done between trading phases (the fixed baseline period benchmark approaches described in Section 5.3.2) or within a trading phase (the OBA approach described in Section 5.3.3). This updating can reduce leakage, but it can also create significant price distortions. Many ETSs also have updating provisions for new entrants and plant closures. These likewise require carefully and consistently designed allocation (benchmarking) features.

Due to the possible distortions of price signals, the allowance allocation needs to be not only reflected as a pure distributional issue but also considered an important design feature with regard to the cost-effectiveness of emissions abatement.

Managing the transition to an ETS

Each allocation method manages the transition to an ETS to some extent, with no method providing full assistance. At face value, auctioning provides the lowest assistance in managing the transition because it provides no support on stranded assets and no protection against potential distributional impacts on households. However, the revenues from auctions can be used to protect against these disadvantages, and auctioning does reward early investments in emissions reductions and facilitates price discovery, which can be important in activating trade in the nascent stages of an ETS.

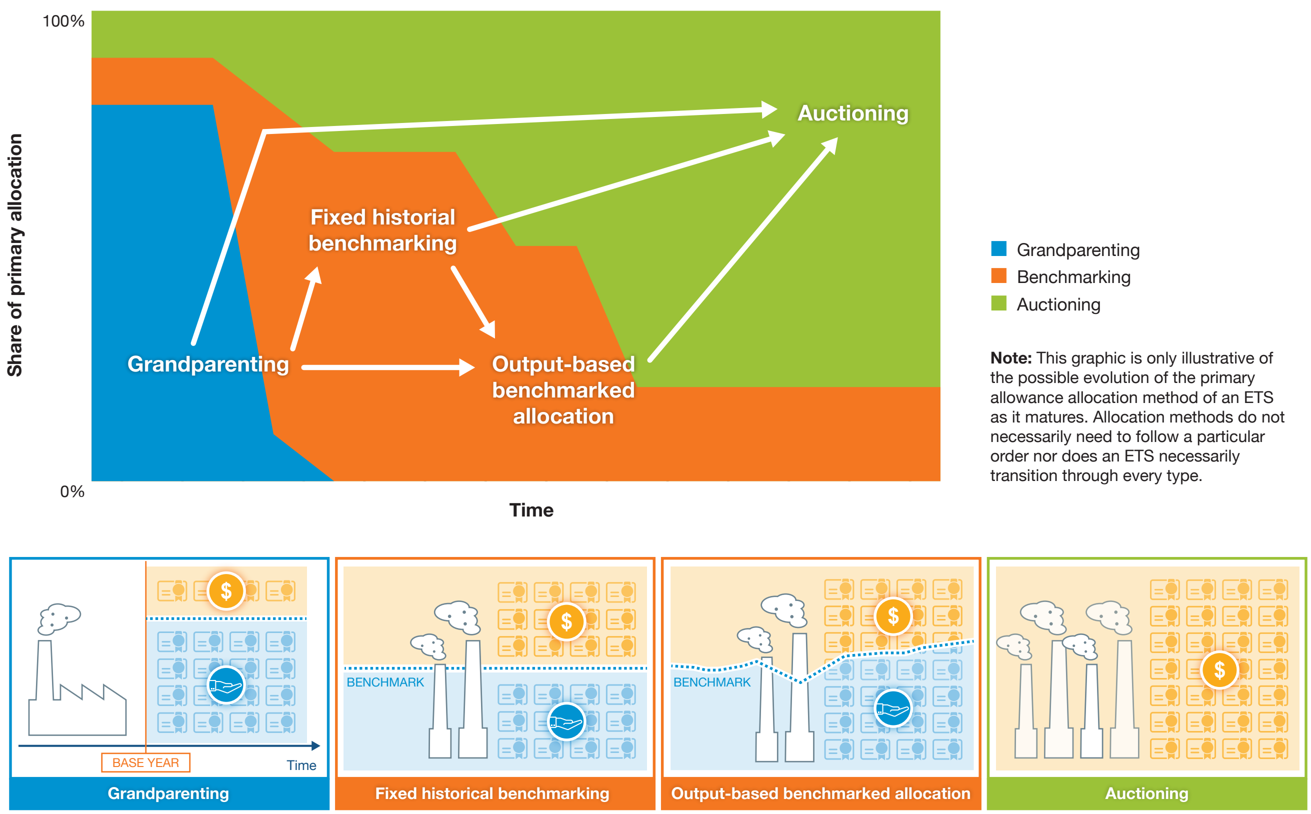
Grandparenting performs strongly where auctioning does not, compensating for stranded assets and helping avoid negative impacts from cost pass-through. Providing a high percentage of allowances in the early stages of an ETS will reduce the need for trading, thereby allowing time for firms to build up the capacity to trade. In addition, this may reduce opposition to the initial implementation of the ETS. However, grandparenting does not recognize early investments well, and, as discussed in Section 5.3.1, may provide incentives for an increase in emissions.

Benchmarking methods look to provide partial compensation for stranded assets by rewarding those that have lower emissions intensity with a higher percentage of free allocation relative to their emissions level. This means that early investments are not disadvantaged or disincentivized. With benchmarking providing some percentage of the current allowance burden for free, the average cost of compliance is reduced, meaning that cost pass-through is partially reduced.

The introduction of carbon pricing carries an important political dimension and is usually a politically contentious process, with significant vested interests often opposed to policy reform. However, this is increasingly balanced by a constituency of business interests and other stakeholder groups calling for carbon pricing. In a context of strong opposition to policy reform, free distribution of allowances provides a visible reduction in the distributional impacts of carbon pricing on some of those who might be most opposed to its introduction, while still providing policymakers with an assurance that a particular emissions reduction target, as reflected in the cap, will be met. In cases where demand for strong carbon pricing is high, auctioning is an attractive method because of its preservation of abatement incentives.

195 Branger and Sato 2017; Fisher and Fox 2007; and Acworth et al. 2019.

Figure 5-1 Possible evaluation of primary allocation method as an ETS matures



Note: This graphic is only illustrative of the possible evolution of the primary allowance allocation method of an ETS as it matures. Allocation methods do not necessarily need to follow a particular order nor does an ETS necessarily transition through every type.

Many ETSs have initially started with a large majority of allowances allocated for free using different approaches, then often looked to gradually increase the proportion of auctioning over time.

Reducing the risk of carbon leakage or loss of competitiveness

Grandparenting and fixed historical benchmarked allocation provide some protection against capital leakage in the form of avoiding closure of existing production capacity, while output-based benchmarked allocation provides more complete protection against both capital leakage and production leakage. Comprehensive protection may be more important for growing developing economies, since new capital will be more important than existing capital. In addition, new investments are also the most responsive to leakage pressure.

Grandparenting provides the facility with free allocation to cover some percentage of its emissions, for example, 90 percent or 100 percent of historical emissions. Facilities experience the full opportunity cost of the allocation immediately. In the short term, if the facility wants to produce more, it experiences the full cost of the carbon price and therefore may decide to limit production, which could be taken up by firms uncovered by carbon pricing. This means the capital is preserved but production leakage may occur.[196]

Fixed historical benchmarked allocation provides allocation in line with previous production and thus provides a degree of certainty on allocation to firms. Due to its providing allocation based on previous production, its protection against carbon leakage is similar to grandparenting. Fixed historical benchmarked allocation protects against existing capital leakage, but production leakage could occur.

In comparison, OBA always adjusts in line with levels of production. If a facility wants to increase production, this will be matched by a proportional increase in free allocation. The full cost of the carbon price is not faced, and the production leakage that occurs in grandparenting and fixed historical benchmarked allocation does not occur to the same extent or at all. OBA also protects against capital leakage, unlike grandparenting and fixed historical benchmarked allocation. OBA protects against leakage of investment in existing capital and new capital because

196 Production leakage through both domestic and external channels (see Box 5-2).

increases in production are reflected with the proportional increase in allowances. With OBA, firms receive the full benefits from reductions in emissions intensities. Since the allocation uses a benchmark for emissions intensity, the benefits of reductions (either increased selling or decreased purchasing of allowances) against this benchmark are experienced for every unit of production.

Table 5-4 provides a summary of the performance of each method allocation in protecting against the risk of production and capital leakage.

Table 5-4 Summary of performance in reducing the risk of carbon leakage for different methods of allocation

Method of allocation	Production leakage risk protection	Capital leakage risk protection
Auctioning	No	No
Grandparenting	No/limited[197]	Yes
Fixed historical benchmarking	No/limited	Yes
Output-based benchmarking	Yes	Yes

● Yes ● No

Raising revenue

Auctions are a source of revenue (see Section 5.2), while free allocation forgoes this revenue to achieve other objectives. Policymakers should consider the extent to which auctioning, in conjunction with targeted revenue use, can achieve the desired objectives relative to free allocation methods.

A more detailed discussion on the use of revenues from ETS auctioning can be found in the PMR's *Using Carbon Revenues* report.

Supporting price discovery

Auctions can support price discovery in the market (see Section 5.2). High levels of free allocation inhibit price discovery because of the lack of trading that occurs (see Section 5.3). If free allocation is pursued as the allocation method, a small amount of auctioning can aid in price discovery. Alternatively, consignment auctions can facilitate price discovery where conventional auctioning is not applied.

5.4.2 NEW ENTRANTS AND CLOSURES

When deciding on allocation methods, it will be important to consider how the system will deal with both new entrants to, and exits from, the market.

Under an auction system and OBA, both entry and exit may be accommodated in a relatively straightforward manner. An auction system automatically accommodates new entrants and exits — allowances are readily available for purchase. In OBA systems, new entrants are treated in broadly the same way as an existing source that expands production. When a new entrant reports output, it will receive allowances just like existing firms. Similarly, if any firm closes, it produces no output and receives no allowances.

In comparison, grandparenting and fixed historical benchmarked allocation are less accommodating in allowing entry and exit. In terms of closure, to avoid windfall profits from selling allowances, a facility should no longer receive free allowances after closing. However, this may not be consistent with an intention to provide allowances as compensation for the loss of stranded assets. It may also create an artificial incentive to preserve production.[198] Nonetheless, in most ETSs with grandparenting, closure is normally associated with the loss of rights to free allowances.

In terms of new entrants, the typical approach in systems with grandparenting involves a new entrant's reserve, which is set aside within the cap to provide free allocation to eligible new entrants to the market. In the EU, new entry provisions are used primarily to avoid leakage of new entrants.

5.4.3 DATA REQUIREMENTS FOR ALLOCATIONS

The different types of allocation also have different levels of complexity that may play into decision-making. Auctioning is the lightest on data requirements since allocation is done via a centralized manner. However, that is not to say that auctions are without the need for data capacity. Of the free allocation mechanisms, grandparenting is the least demanding since it requires only data on historical emissions. Fixed historical benchmarked allocation has the added requirement of emission benchmarks, which may be harder for policymakers to initially define. OBA requires, in addition to emission benchmarks, current firm output data. OBA is not necessarily more complicated to implement than fixed historical benchmarked allocation; for example, firms may not have accurate records of previous emissions/output, so implementation of OBA using current output would be more feasible than fixed historical benchmarked allocation (which uses historical data), especially in the

197 Grandparented allocations that are updated with more recent historical emissions will provide limited leakage support. "Pure" grandparenting with no updating provides no leakage support.

198 Ellerman 2008 discusses these issues in the context of Phase 1 of the EU ETS.

initial phases of an ETS. If OBA is to be implemented under a firm cap, additional data and procedures will be needed to align the allocation to the cap in case the aggregate allocation exceeds the cap (or a predefined share of the total cap). Regardless of the approach, collecting the required data can be difficult, with companies having incentives to try to distort the data to reduce their liabilities or increase their allocation.

Table 5-5 provides an overview of the data requirements for the different allocation methods.

Table 5-5 Summary of data requirements for different methods of allocation

	Historical emissions	Historical output	Emission benchmark	Actual output
Auctioning	Low	Low	Low	Low
Grandparenting	High	Low	Low	Low
Fixed historical benchmarking	Medium	High	High	Low
Output-based benchmarking	Medium	Medium	High	High

● High ● Medium ● Low

5.5 QUICK QUIZ

Conceptual Questions

1. What are the key options for distributing allowances?
2. What objectives can each distribution option help achieve?

Application Questions

1. In your jurisdiction, what activities are both strongly trade exposed (to jurisdictions with no or weak carbon pricing) and emissions intensive?
2. In your jurisdiction, what regulatory arrangements need to be reflected to assess the advantages and disadvantages of different allocation approaches?
3. Would your jurisdiction want an ETS to generate additional government revenue that could be used strategically?
4. Given the local confidence in markets, how willing would firms and regulators be to rely on auctions versus free allocation for distributing allowances?

5.6 RESOURCES

The following resources may be useful:

- Carbon Leakage: Theory, Evidence and Policy Design
- Using Carbon Revenues
- The Use of Auction Revenue from Emissions Trading Systems: Delivering Environmental, Economic, and Social Benefits
- A Guide to Greenhouse Gas Benchmarking for Climate Policy Instruments
- Carbon Leakage and Deep Decarbonisation

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STEP 6
Promote a well-functioning market

BOXES

FIGURES

TABLES

AT A GLANCE

Checklist for Step 6: Promote a well-functioning market

- ✔ Establish the rationale for, and risks associated with, market intervention
- ✔ Establish rules for banking and borrowing
- ✔ Establish rules for market participation
- ✔ Identify the role played by a robust secondary market
- ✔ Choose whether to intervene to address low prices, high prices, or both
- ✔ Choose the appropriate price or supply adjustment measure

Allowance prices can vary as they balance policymaker-controlled supply with demand, which is driven by a complex interaction of economic and firm-level factors. Delivering a well-functioning market is crucial for an emissions trading system (ETS) to operate as intended, to deliver emissions reductions efficiently and provide appropriate price signals for long-run decarbonization. A well-functioning market will see predictable price adjustments to external events and changes in information available to market participants, and feature liquid allowance markets governed by transparent rules that facilitate price discovery. These markets in turn will deliver emissions reductions that occur at the right time and use the least-cost mitigation options available to market participants.

Fluctuations in prices are often desirable as they represent the adjustment of the market to new information about the cost of abatement. However, large changes in price can occur because of exogenous shocks, regulatory uncertainty, or market imperfections. Whether large fluctuations in price warrant market intervention by policymakers depends on the objectives of the ETS and whether the benefits of intervention are judged to exceed its risks. If the sole objective of an ETS is the reduction of emissions cost, at least in the short term, price variability may not be of concern. If, however, the objective is to realize an efficient abatement pathway over the long term with high levels of innovation, persistently low prices may be considered undesirable as they may deter investment. Policymakers may also wish to contain costs for market participants to ensure political support.

A well-functioning market will deliver emissions reductions to support the achievement and strengthening of emission-reduction targets. It will also support economic efficiency through ensuring emissions are reduced at the right time (intertemporal efficiency) and ensuring that the right mitigation projects are occurring (allocative efficiency).

Economic shocks and market or regulatory failures can undermine the pursuit of these outcomes. To ensure the market is performing well and prices are predictable, it is essential to support the market through rules for intemporal flexibility that allow current prices to reflect future expectations. Similarly, appropriate rules for participation in and governance of secondary markets can improve market efficiency.

There are three tools available to policymakers to provide intemporal flexibility:

1. **Banking:** This allows regulated entities to bank allowances from the current compliance period for use in future periods. Banking can help boost low prices as well as create a buffer against future high prices. Crucially, banking brings forward emission reductions, making it more likely that short-term targets will be met.
2. **Borrowing:** This allows regulated entities to borrow allowances from future compliance periods for use in the current period. This provides entities with flexibility in determining their compliance strategy. However, by reducing mitigation action in the near term, borrowing can delay emissions reductions needed to achieve ETS caps. As such, most ETSs have either prevented borrowing or allowed it only to a limited extent.
3. **Length of compliance periods:** Within a compliance period, firms can reduce emissions whenever it is most efficient, akin to having unlimited banking and borrowing within the period. This makes the length of the compliance period an important determinant of intertemporal flexibility.

Policymakers must decide on who can participate in primary markets (auctions) and secondary markets, as well as the institutions that will support market development. Firms that have liabilities under an ETS are a given for participation in the market but noncompliance entities, particularly from the financial sector, can also play an important role in adding liquidity and providing access to risk-management products. Including financial-market players in the operation of an ETS must be carefully regulated. The degree to which government itself participates in the market must also be decided. Governments can directly intervene to provide liquidity in exceptional circumstances; however, repeated interventions should be avoided and may suggest more fundamental problems with market design.

Even if an ETS has a relatively well-functioning secondary market, there remain risks of prices being consistently much higher or lower than intended. As such, it is now common practice for ETSs to adopt some form of price or supply adjustment measure (PSAM). PSAMs help jurisdictions achieve a predictable and effective market, meaning prices that are not too high, with their associated costs, or too low, which may be inconsistent with longer-term decarbonization.

PSAMs work by adjusting allowance supply available for use in response to certain criteria. These measures will differ based on whether they are targeting high or low prices, the way in which rules to trigger interventions are defined using price or quantity criteria, and whether they impact the supply of allowances in a temporary or permanent way. The design of a PSAM seeks to balance a jurisdiction's preferences over the certainty of achieving a given emissions level with the costs of achieving emissions reductions. The operation of these measures, and the decision to make a temporary or permanent supply adjustment, has clear links with cap setting (see Step 4) and the allocation of allowances (see Step 5). PSAMs are typically based on clearly defined intervention rules that are announced well in advance. However, in some cases jurisdictions have adopted PSAMs that give regulators some discretion regarding when and how to intervene in the market.

Most PSAMs focus on avoiding prices that are too high or too low. Options used to respond to low prices include the use of auction reserve prices, hard price floors, or the levying of additional fees and charges. Options used to respond to high prices include the use of cost-containment reserves or hard price ceilings. While less common, PSAMs can also seek to manage supply by responding to quantity criteria, like the number of banked allowances. Each approach has advantages and disadvantages, but recent trends globally have seen an increasing use of PSAMs to address the risks of both high and low prices by adjusting supply at auction.

Section 6.1 discusses the mechanism of price formation in an ETS and outlines what is required for a predictable and effective market. Section 6.2 sets out the options for providing intertemporal flexibility in a market. Section 6.3 outlines options to support a functioning secondary market. Section 6.4 discusses options for addressing price variability.

6.1 PRICE FORMATION IN AN ETS

This section explains the ways in which prices are formed in an ETS. Section 6.1.1 explains the dynamics of supply–demand balancing in the market, and how this may lead to excessive medium-term price variability that might run counter to some ETS policy objectives. Section 6.1.2 introduces the concept of price volatility (short-run variations in allowance prices) and distinguishes it from having prices that are persistently too high or low. Section 6.1.3 highlights the importance of a predictable and effective market to reduce emissions and promote efficiency.

6.1.1 SUPPLY AND DEMAND

Various factors will affect the demand and supply of emissions allowances in an ETS (see Figure 6-1), and hence determine allowance prices and how they evolve over time.

Supply

The total supply of emission units at a given point in time depends on:

1. the level of the cap and the associated amount of allowances (allocated freely, through auctions, or through unit reserves) (see Step 4);
2. any supply of allowances carried over ("banked") from previous periods or drawn from future periods ("borrowed") (see Section 6.2);
3. the availability of offset units (see Step 8); and
4. the availability of allowances from linked systems (see Step 9).

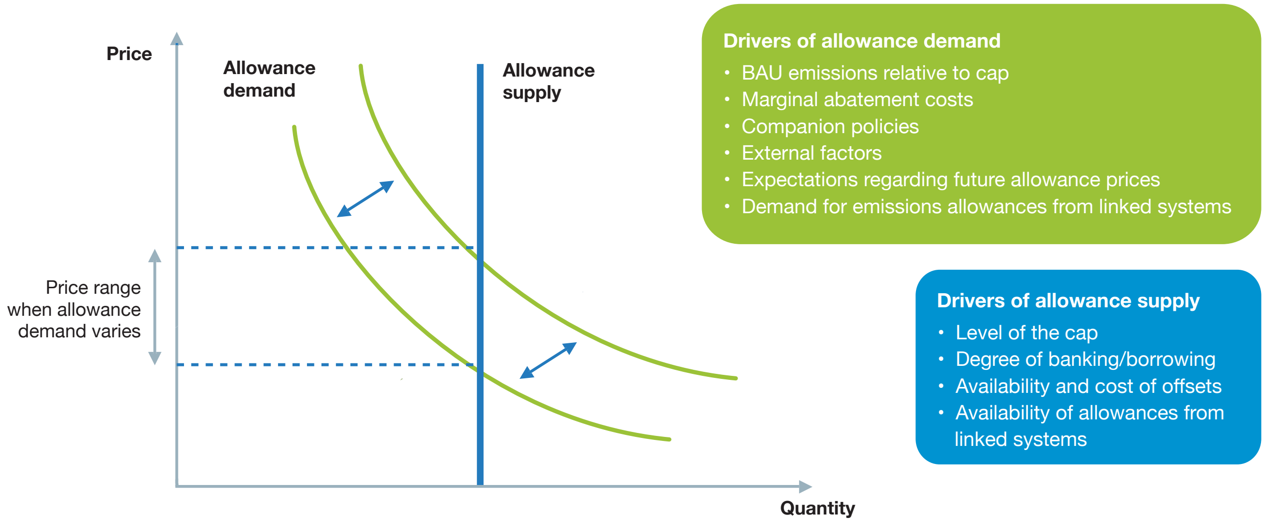
To a large extent, therefore, supply depends on parameters set by policymakers, be it directly by the level at which the cap is set, or through the rules for offsets, banking and borrowing, or linking.

Demand

By contrast, the total demand for emissions allowances in an ETS depends largely on technology, expectations, exogenous shocks, and profit maximization by market participants. The following are important for determining allowance demand:

- the level of emissions under business as usual (BAU) (i.e., no carbon price) relative to the cap;
- the costs of abating emissions within the covered sectors (which are driven by factors including weather, economic conditions, capital stock, and availability of existing technologies);
- the outcomes of companion policies (such as renewable energy mandates or fuel economy standards) that reduce emissions within covered sectors;
- expectations (and uncertainty) regarding future allowance prices, which determine the demand for banking emissions allowances for use in future compliance and for hedging price risks;

Figure 6-1 ETS allowance price formation



- technological change, including that driven by the expectation of future stringency of the program and future demand for allowances; and
- any external demand for emissions allowances from linked systems.

6.1.2 PRICE LEVELS AND VOLATILITY

The market will set the price that balances supply and demand at any one point in time. When the economy is strong and businesses are expanding operations, there will be higher demand for products and thus higher associated emissions. This will put upward pressure on emissions and increase the total amount of abatement necessary to meet a given cap. In an ETS, underlying economic and technological conditions interact with the cap to determine the price. For instance, a faster rate of economic growth will result in higher carbon prices when the set of abatement technologies and other factors are held equal. Conversely, a lower rate of economic growth under the same conditions will lead to a lower price (as discussed in Section 6.2.1) and could even reach zero, particularly if banking is not permitted.

Expectations about the allowance market also drive price formation. For example, a low-interest-rate environment will reduce the cost of purchasing allowances today for future use and increase banking demand; by contrast, regulatory uncertainty over the future of the ETS will temper such demand. Expectations can mean that even if, in the short run, the total demand for emission allowances associated with current production falls below the number of allowances available in the marketplace (supply), emission unit prices may still be nonzero if there is demand for banking allowances. Expectations of economic and policy conditions also affect the expected profitability of investments in mitigation projects and research and development in new technologies and processes.

Various system design features enable regulated entities to respond to short-lived price volatility. Broad scope, intertemporal flexibility provisions, regularly held auctions, availability of offsets and allowances from linked systems, and access to derivatives and other hedging products can help reduce the degree of price fluctuations and their impact. In general, moderate price volatility is not a serious concern for regulated entities and policymakers and can be managed if financial market instruments, such as options, futures, and other hedging products, are available, as they are for other commodity markets.

Promoting financial-sector participation in secondary markets is important for managing volatility, as it supports the development of the financial instruments needed for entities to manage price volatility. The financial sector can assist with creating products that regulated entities can use to hedge the risk of prices changing, such as options and futures contracts. This is discussed further in Section 6.3.3.

In addition to short-term volatility in prices, markets may experience price changes that are persistent and systemic. This is captured by the concept of price variability: a divergence between expected and actual prices that persists over the medium to long term. In other words, it means prices being consistently much higher or much lower than intended.

For example, a rapid expansion of economic growth and emissions could cause prices to remain unexpectedly high for an extended period. This could create challenges for business competitiveness and may have unwelcome distributional impacts if the effects of high prices are borne disproportionately by vulnerable communities. On the other hand, a recession, or a faster-than-expected deployment of renewable energy, could lead to relatively low prices for a prolonged period. It is unlikely that market actors would be able to completely buffer such medium- or long-term price changes with derivative instruments, which may not be available, or available only for relatively short time periods (rarely more than three years). Similarly, banking allowances or purchasing future allowance vintages may not be enough to buffer large, persistent, and unanticipated increases or decreases in prices.

6.1.3 A PREDICTABLE AND EFFECTIVE MARKET

An ETS should be designed so that it achieves its underlying economic and environmental objectives. Good market design and the use of measures to promote market predictability can help achieve this. A well-designed, well-functioning market will deliver three main objectives:

- **Reduced emissions:** Delivering emissions reductions to support jurisdictions to achieve, and strengthen, emissions reduction targets consistent with the Paris Agreement.
- **Intertemporal efficiency:** Ensuring emissions are reduced at the right time.
- **Allocative efficiency:** Ensuring that the least-cost mitigation options are being used.

Delivering these objectives requires that policymakers take account of the quantity of emissions reductions required, as well as provide predictability about the level and volatility of the carbon price that will generate mitigation incentives. These objectives can inform the design of and operating rules for an ETS.

Reduced emissions

An ETS is created to promote numerous objectives but ultimately its aim is to deliver reductions in emissions to mitigate climate change (as discussed in Step 1).

The Paris Agreement codifies the aim to limit warming to well below 2 degrees above preindustrial levels, which is to be delivered through a set of bottom-up targets with ambition ratcheting up over time. An implication of this goal is that global greenhouse gas (GHG) emissions should reach "net zero" by the middle of the century.[199] Reaching net zero requires that carbon markets provide sufficient price incentives to mobilize investment in new emissions-reduction technologies and processes.

A robust and rising price level over time can encourage early investment in low-cost mitigation, with a gradual movement to more costly abatement as lower-cost options are exhausted. Designing a market that delivers a robust price signal reduces the price risk faced by investors and encourages investments that may pay off only if a robust carbon price is maintained in the longer term.

Similarly, measures that increase governments' ability to ratchet up targets can also play a role. Evidence from the ETS to date suggests that emissions are often reduced for a lower cost than first anticipated.[200] Given this, policies that maintain prices at a certain level can bring forward cost-effective emissions reductions and make it easier to ratchet up ambition over time.

Promote intertemporal efficiency

Intertemporal efficiency requires that mitigation happens when it is most efficient. If it costs less to reduce emissions now rather than in the future, then the ETS should support this substitution. This means the quantity of mitigation must have some flexibility over time.

Intertemporal efficiency is driven by forward-looking firms anticipating and responding to potential future costs. If firms expect prices to be higher in the future, then they will be willing to pay more for an allowance today. However, due to uncertainty about the future, how much firms are willing to pay is "discounted" downward to reflect evaluation of this uncertainty alongside any borrowing costs. Through this mechanism, current prices reflect expected future prices in carbon markets.

As discussed further in Section 6.2, allowing entities flexibility over the point in time when they reduce emissions can facilitate cost-effective action on climate change. It does so in two ways:

1. **By allowing individual entities to abate in the most cost-effective way.** The regulator's timing of emissions limits and associated allowance allocations over time may not match the most cost-effective path for individual regulated entities. Intertemporal flexibility allows heterogeneous firms to determine the most cost-effective trajectory for new investments and to balance these with the optimal management of existing assets and infrastructure.[201]
2. **By facilitating investment in new technology.** Fully addressing the challenge of climate change over the long term will also require technologies that may not yet exist, so time is needed for new investments in research, development, and demonstration to pay off. Intertemporal flexibility can provide sectors and

199 Dietz et al. 2018.
200 Burtraw and Keyes 2018.
201 Kling and Rubin 1997 state that banking will lead to cost reduction and banking while discounting the value of banked units will lead to a convergence of socially optimal and firm optimal costs. Fell, MacKenzie, and Pizer 2012 compare ETSs with and without banking. Their analysis shows that allowing participants to bank allowances significantly lowers expected costs.

individual firms with the necessary time to invest in new technology and R&D.

Ensuring predictable prices by avoiding extreme high- or low-price outcomes is important to support intertemporal efficiency, as predictable prices provide markets with confidence and reduce the cost of investment in abatement technology. Under a predictable allowance price path, investment can be planned according to whether the costs of the project outweigh that of the cost of future avoided allowance purchases, in addition to other savings. This consideration becomes much more difficult if prices follow an unpredictable price path, and with enough uncertainty investments will be delayed or potentially not be made at all.

Promote allocative efficiency

Allocative efficiency refers to whether the mitigation effort is appropriately split between regulated entities. That is, allocative efficiency ensures that the lowest-cost mitigation options are used to reduce emissions in a given time period. Ensuring broad coverage can support allocative efficiency across the economy, as discussed in Step 3. Market design can also support allocative efficiency in two main ways: by ensuring liquidity and by reducing transaction costs.

Liquidity means that firms that wish to buy or sell allowances can do so at any point, enabling trade-in allowances, which helps ensure the right entity cuts emissions. In a liquid market, firms that can reduce their emissions at a low cost will do so and can choose to sell their allowances to those that cannot reduce their emissions. Liquid markets also transmit a clear price signal to participants such that they can make informed choices regarding their trading strategies.

The secondary market for allowances can support allocative efficiency through reducing transaction costs. Both financial and administrative transaction costs can create barriers to trade-in allowances, which can lead to inefficient mitigation outcomes. If transaction costs are high (for instance, if brokers charge a large amount to facilitate a trade), the firms that are initially allocated allowances may decide to keep them, regardless of whether they need them or not. This could mean that firms with higher mitigation costs, which would otherwise purchase these firms' allowances, are not able to do so. This results in mitigation efforts being split inappropriately across entities.

A liquid market with low transaction costs will support trade-in allowances and help ensure that prices reflect the latest information available to market participants.[202] In general, greater participation in the secondary market will increase liquidity and spur competition that reduces transaction costs. Further information on how to promote a well-functioning secondary market is provided in Section 6.3.

6.1.4 MARKET INTERVENTION: RATIONALE AND RISKS

In carbon markets operating to date, market dynamics have sometimes resulted in prices being consistently much lower (or higher)[203] than policymakers think is consistent with their long-term economic or environmental objectives, creating the need for market intervention. These high or low prices have two main drivers: first, the potential for shocks, given underlying uncertainty in carbon and other markets, and second, examples of market or government failure.

6.1.5 SHOCKS AND UNCERTAINTY

The world is uncertain, and unexpected shocks can and do influence the operation of carbon markets. Shocks to demand or shocks to supply can lead to large and lasting changes in prices, and it is increasingly recognized that carbon markets need to be robust to these shocks.

Demand shocks are unexpected events that change the emissions profile or mitigation costs of entities covered in a carbon market that alter demand for emissions allowances. Demand shocks are generally driven by economic factors or unexpected technological developments. For instance, the 2007–2008 financial crisis and subsequent recession saw industrial activity and emissions fall rapidly, which precipitated the fall in allowance prices in the European Union (EU) ETS from more than EUR 20 in 2008 to less than EUR 10 in 2009. On the other hand, the US unconventional gas boom played a key role in driving the restructuring of the electricity sector in the Northeastern states and led to a rapid fall in emissions and demand in the Regional Greenhouse Gas Initiative (RGGI). At present, the impacts of COVID-19 and jurisdictions' policy responses have led to a significant fall in economic activity, emissions, and therefore demand for emissions allowances.

Shocks can affect sectors differently, which should be considered when deciding the scope of an ETS (see Step 3). For instance, the 2007–2008 financial crisis had a larger relative effect on emissions from the electricity and industry sectors in Europe, whereas other sectors like transport saw far smaller changes in demand and emissions.[204] Similarly, the US unconventional gas boom primarily drove reduced emissions in the electricity sector, the only sector covered by RGGI. A broader scope generally reduces the risk of a market being disproportionately affected by sector-specific shocks.

202 The process of the market integrating new information is known as price discovery. Reflecting information from all market participants — from manufacturers to generators and traders — can ensure that the carbon price acts as a real-time reflection of the expectations for the future and delivers emissions reductions from the least-cost mitigation options.

203 To date, persistent high prices have not been an issue, but these could prove a risk in the future and are a concern of many policymakers.

204 European Environment Agency 2020.

A rapid expansion in the supply of emissions allowances can also be a type of shock. For instance, this occurred in the New Zealand ETS and the EU ETS with the rapid expansion in supply and use of low-cost offsets from the Clean Development Mechanism in 2009–2012. In this case the rapid expansion in supply led to a flood of allowances in the market, greatly reducing the price before further strict limits on offset use were introduced to steady the price. This is discussed further in Step 8, Box 8-3.

6.1.6 GOVERNMENT AND MARKET FAILURES

The potential need for intervention to constrain excessive price variability needs to be balanced against the possibility that intervention in the market may itself create distortions. Allocation through a market-based approach like an ETS facilitates the cost-effective allocation of emissions-reduction efforts across the regulated entities. This can be jeopardized by market distortions or unintended effects of policy intervention.

In particular, there is a risk that policy intervention can create uncertainty regarding future policy developments that can exacerbate excessive price volatility or variability.[205] Governments will always retain the legitimate ability to change certain key parameters of an ETS or adjust the policy mix of which the ETS is a part. These changes, or anticipation of these changes, can also lead to considerable price changes, as well as uncertainty that increases risks to abatement investments. For example, policy deliberations over postponing ("backloading") the auction of allowances to balance the EU ETS's cap supply and demand accompanied considerable price movements during the third phase of the program.[206]

The extent to which PSAMs compound regulatory uncertainty will be limited if the measures are well designed and operate in a predictable manner. At a minimum, they should be transparent, have a long-term horizon, and have a clear and targeted remit. If effectively implemented, PSAMs can reduce regulatory uncertainty and improve the functioning of an ETS, which may reduce the need for future regulatory changes. A well-planned, predictable approach to the operation of PSAMs can help guide price expectations rather than add to price variability.

Market imperfections may persist despite the best efforts of policymakers,[207] which may lead to prices being "too high" or "too low," or otherwise not reflecting all relevant considerations. For instance, ordinarily it would be expected that a low allowance price would lead to an increase in demand as participants sought to bank allowances now, which they could use for compliance purposes later. This would lead to prices partly self-correcting after a short-term shock. However, if market participants have systematically higher, less than "ideal" discount rates, or lack the strategic insight or information to value allowances properly beyond the short term, this self-correction may not take place and prices will remain low. This can be aggravated by regulatory uncertainty, which creates further uncertainty about the long-term value of allowances.

Careful consideration of local context and policy design is needed to support the development of well-functioning secondary markets. For instance, sometimes a hedging product may not be available to purchase at a competitive price, despite the existence of demand; this is known as a "missing market." Missing markets can be caused by policy choices, a lack of financial market development within a jurisdiction, or characteristics specific to a given carbon market such as its small size.

There are several factors that affect the development of a secondary market. For instance, the lack of liquidity in exchange-based trade in Korea has created concerns for liable firms seeking to access allowances to meet liabilities. Other jurisdictions, like New Zealand, have active over-the-counter trade offered but lack an exchange with standardized contracts. Only the EU ETS has deep and liquid exchange-based trade of derivative products that provide longer-term hedging options for firms, and even these markets only trade contracts a few years in advance. While this lack of access to long-term hedging is also typical for other commodity markets, this means that firms looking to make investments in projects with long payback periods still bear a large degree of risk.

A lack of market information can also lead to imperfect outcomes in secondary markets as participants seek to make decisions without the information they need. For instance, in the Korean ETS prices spiked close to compliance deadlines because firms were unsure of underlying demand in the market and became concerned that they would not be able to access the allowances they need. This is a particular risk in ETSs with high levels of free allocation, which can reduce incentives for trading. A lack of liquidity can lead to poor price discovery in the secondary market, which can be compounded by a lack of clarity on the future stringency of the ETS. This can be alleviated by the government providing transparent information on how the ETS operates and its future direction, but also through financial market intermediation. Intermediaries help match buyers and sellers, provide markets with risk-management products, and have an incentive to provide market information to increase confidence and facilitate trade. Some jurisdictions, such as California, have managed to support well-functioning secondary markets with only limited exchange-based trading,

205 For a discussion of this issue with regard to experience in the EU, see Koch et al. 2015.
206 Koch et al. 2015.
207 Based on a discussion in Neuhoff et al. 2015.

in part as restricted free allocation has facilitated the growth of liquid markets for over-the-counter trade.

6.2 DECIDE ON INTERTEMPORAL FLEXIBILITY

The key decisions that a policymaker needs to make in the design of intertemporal flexibility are how to approach banking and borrowing, and, in addition, the length of the compliance period. A decision must be made as to whether allowances in the current compliance period are allowed for compliance in future compliance periods (banking), and if allowances from future compliance periods can be used in the current period (borrowing). Generally banking is considered a valuable, necessary addition to an ETS, while borrowing is deemed too risky to allow apart from in limited cases. The length of the compliance period differs between existing ETSs, with the longer time frames potentially allowing for more intertemporal efficiencies in abatement while reducing the administrative burden. However, long compliance periods expose the ETS to the risks associated with borrowing, which makes it unattractive.

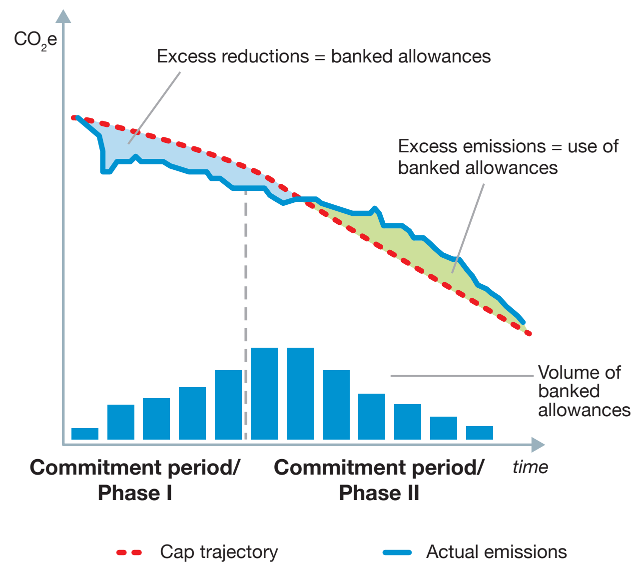
Intertemporal flexibility is a prerequisite for intertemporal efficiency, as discussed in the section above, “Promote intertemporal efficiency”.

By reducing price volatility, intertemporal flexibility can also potentially encourage low-carbon investment.[208] If allowance prices are low, entities may choose to buy or hold allowances and save them for later when prices might be higher. This will increase demand for allowances and hence increase prices. Similarly, when prices are high, entities that have excess allowances may choose to profit by selling these allowances or may bank these allowances for use against compliance shortfalls at a later point in time. This will reduce allowance demand, causing allowance prices to fall.

The net result of these dynamics is that the trajectory of carbon prices over time is smoother than it otherwise would be (see Figure 6-2).

Under certain circumstances, however, allowing intertemporal flexibility will be insufficient to address volatility and may even exacerbate it. Other market management interventions may be needed to ensure price predictability and provide cost containment in the context of longer-term, system-wide market conditions. These are discussed in Section 6.4 below.

Figure 6-2 Stylized model of banking in an ETS over time



6.2.1 BANKING

Banking allows regulated entities to save unused allowances for use in future compliance periods. It enables reductions in emissions today in exchange for increased emissions later and is a vital component of all existing ETSs.

Banking can facilitate cost-effective abatement by allowing those that wish to abate early the flexibility to do so to prepare for stricter caps later. Moreover, it can reduce price volatility by creating additional demand for allowances when prices are low and, once a bank is established, providing an additional supply of allowances when prices are high.

Moreover, in contrast to borrowing, banking also can create a private-sector group with a vested interest in the success of the system, including an incentive to ensure rigorous monitoring and enforcement, as well as tight future targets, to protect and maximize the value of their carbon assets.

In general, banking is central to the efficient functioning of most carbon markets. Given this, policymakers have

208 Fell, MacKenzie, and Pizer 2012. Conversely, intertemporal flexibility in the form of banking helps smooth the transition to stricter caps. When long-term targets are credible and anticipated, regulated entities may find it in their best interest to over-comply and save allowances for use later when caps will be stricter and prices can be expected to be higher (Dinan and Orszag 2010; Murray et al. 2009). Fell et al. 2012 also find that allowing temporal flexibility in the form of banking could save significant costs by incorporating some of the benefits of tax policy, allowing quantity to adjust on a short-term basis.

usually allowed full flexibility on banking across compliance periods within the same phase (see Box 6-5 of this step for a recap on the differences between compliance periods and phases). Across phases, banking has been unlimited in the EU ETS since 2008, and is also unlimited in the ETS in New Zealand and RGGI, while in Korea banking limits apply at the installation level, and in California and Québec banking is allowed subject to purchase and holding limits at the entity level.

Banking can however create some challenges. For one, unlimited banking can enable an excess supply of allowances in one compliance period to be carried over into future compliance periods, potentially prolonging an underlying "imbalance" between demand and supply, leading to excessively low prices. Without banking, such an imbalance would be contained within the current compliance period. Also, while allowing banking can often reduce volatility, there are cases where it can lead to adverse outcomes. In particular, banking means that changes in expectations of future market conditions can feed back to today's prices, through altering the value of banked allowances. This is desirable if future caps are credible and policy signals are clear but can generate volatility in cases where there is a lack of certainty over future policies. This is most likely to emerge in cases where there is an oversupply of allowances in the present and so the primary driver of allowance demand is for future compliance. Box 6-1 describes how this problem arose in the EU ETS.

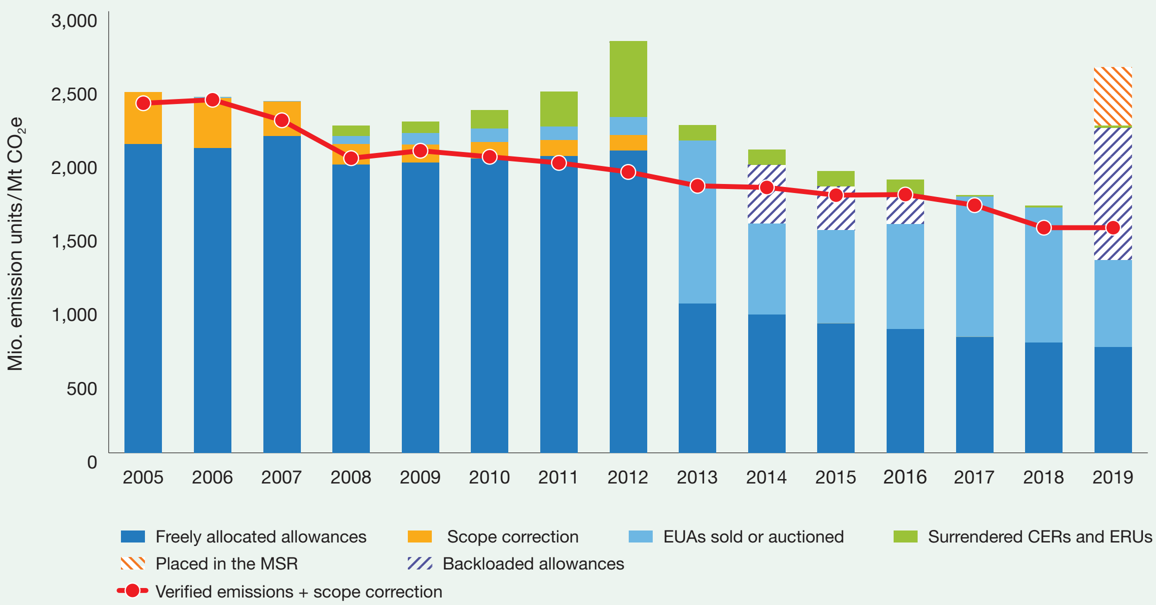
Box 6-1 Case study: Banking in Phase 3 of the EU ETS

During Phase 2 and the early years of Phase 3 of the EU ETS, a "surplus" of allowances relative to emissions projections developed (see the figure below). Prices reflected continued market demand for allowances that could be banked, in the expectation that they would be valuable in the future.

However, this resulted in speculation over future policies becoming the principal driver of changes in the ETS price during Phase 3.[209]

This experience emphasized the importance of ensuring that long-term market signals are maintained. To that effect, the Market Stability Reserve (MSR) was introduced. By adjusting the volume of allowances to be auctioned, it aims to maintain a demand–supply balance within the EU ETS (as discussed in further detail in Box 6-7).

Figure 6-3 Case study: Banking in Phase 3 of the EU ETS



Source: European Environment Agency 2019. EU ETS data viewer.

Note: EUA = EU Allowance; ERU = Emission Reduction Unit; CER = Certified Emission Reduction
Backloading refers to a short-term measure the European Commission implemented where 900 million allowances were not auctioned over the years 2014–2016. Initially they were to be auctioned in 2019–2020 but ultimately were added to the MSR in 2019, along with 397.124722 allowances that were withheld from the auction volumes by the MSR. The sum of allowances depicted in the chart for a given year does not equal the cap as allowances from the NER300 program, deviations from the cross sectoral correction factor, and unallocated allowances are not included.

209 Koch et al. 2014; Koch et al. 2015.

In practical terms, there are several cases where policymakers have chosen to impose limits on the banking or holding of allowances:

- **Banking from trial phases.** Prohibiting or limiting banking is a way to isolate a pilot phase from the subsequent phase. This creates potential for greater experimentation in the pilot phase without necessarily requiring that the allowances from the first phase be recognized as valid in the subsequent phases (see Step 10). This approach was adopted in relation to Phase 1 of the EU ETS. However, as the EU ETS Phase 1 experience shows, if there is excess allocation of allowances in the pilot phase, prices can fall to zero, as there will be no demand to buy and bank allowances for later use.
- **To control the ability of individual entities to acquire market power.** If individual institutions can acquire large numbers of allowances, there may be a concern that this could be used to distort the market. This may provide a rationale for limiting the amount of allowances that entities can hold, including for banking, as the case of California illustrates (see Box 6-2).

Box 6-2 Case study: Holding and purchase limits in California and Québec

The respective regulations in California's and Québec's cap and trade systems impose holding and auction purchase limits to prevent participants from acquiring market power. These regulations affect the number of allowances that can be purchased from auction or held in an entity's account at any one time, and thereby also limit banking.

With regard to purchase limits, all regulated entities are subject to a purchase limit of 25 percent of allowances sold at auction, while nonregulated entities are limited to 4 percent.

The California regulator, the California Air Resources Board (CARB), treats a group of associated entities as a single entity for determining compliance with the holding and purchase limits. This is also the case in Québec, where related entities are considered a single entity, which has an overall holding amount that can be distributed among its individual entities. The resulting distribution must be communicated to the regulator. Each regulated entity can make use of a limited exemption in order to be able to acquire sufficient allowances to meet its respective compliance obligation. Allowances acquired through the exemption must be transferred to an entity's compliance account and can only be used to cover emissions.

Holding limits are vintage specific. The current vintage holding limit applies to all current vintage allowances (for example, allowances from the current and previous vintage years) as one group. Thus, in 2020, the current vintage holding limit covers an entity's holdings of 2013 through 2020 vintage allowances. The holding limit is set with reference to a "base" 25 megatons of carbon dioxide equivalent (25 $MtCO_2e$) and an "annual allowance budget," which is equal to the number of allowances issued for the current budget year, as shown in the following formula:

$$HLy = 0.1 \times Base + 0.025 \times (Cy - Base)$$

Where:

HL = holding limit C = annual allowance budget y = current year

6.2.2 BORROWING

Borrowing allows entities to use allowances they will receive in future compliance periods within the current compliance period. This means regulated entities can emit more today and make up for this with larger emissions reductions in the future.

Borrowing provides firms with flexibility to meet targets. For instance, it allows those that cannot easily abate immediately the opportunity to make investments that will provide greater abatement in the future. It can also reduce short-term price volatility; in particular, it helps to provide market liquidity in times when allowances might be scarce and prices high.

However, some of the challenges associated with providing intertemporal flexibility can be illustrated in the context of borrowing. Private actors are likely to face incentives to delay costs and behave in a short-sighted manner. In addition, challenges associated with allowing entities to borrow allowances include:[210]

- **Delay and uncertainty over future targets.** Depending on the length of the borrowing period, there will be less certainty over whether domestic or international emission-reduction targets will be reached. With Nationally Determined Contribution (NDC) goals for emissions reductions, delayed mitigation may be inconsistent with these obligations.

210 Fankhauser and Hepburn 2010; Vivid Economics 2010.

- **Governments may not be able to assess creditworthiness.** The government may not be well-equipped to assess the creditworthiness and solvency of firms that borrow allowances. Further, there is likely to be adverse selection, with the firms that are least solvent likely to want to borrow more than the firms that are most solvent. Requiring firms to report net compliance assets and liabilities on their balance sheets is one possible way to promote transparency and oversight by shareholders. Provision of collateral may be deployed to mitigate this risk, but this adds transaction costs and complexity.
- **Increases political pressure to delay action.** Borrowing allows firms to delay abatement, thus potentially creating an active interest to lobby for weaker targets, or even for scrapping emissions trading altogether, so that their debts are reduced or cancelled.[211]

As a result of these disadvantages, ETSs have either prevented explicit borrowing or limited it quantitatively (for instance, Korea calculates an entity-specific limit on borrowing). As prices in ETSs are expected to rise over time as ambition increases, banking alone is likely to provide sufficient intertemporal flexibility. An example of the risks of borrowing is provided in Box 6-3 below.

In some ETSs, a degree of short-term implicit borrowing is facilitated by offering early access to future allowance allocations, prior to the deadline for compliance in the current period. For example, in the EU, entities receive allowances for the current compliance year by February 28, two months ahead of the end of the previous compliance period (April 30). Because there is no vintage associated with the allocation (in other words, there is no "activation" date at which an allowance becomes valid for compliance — see Box 6-3) these allowances can be used for current compliance and implicitly "borrowed" without any limitation or penalty from the next year's allocation, except in the last year of the phase.

Box 6-3 Case study: Allowance borrowing and financial distress

During a phase, companies operating under the EU ETS can use free allowances to meet the present or the previous year's emissions liabilities, a strategy equivalent to restricted borrowing as previously discussed in this chapter. While borrowing allowances from future allocations has some appeal, as it provides increased flexibility for operators to reduce emissions when it is most cost-effective for them to do so, it also faces some challenges as illustrated by two high-profile cases of regulated firms in the United Kingdom (UK) in 2019.[212]

Flybmi, a regional airline company based in the UK, collapsed in February 2019, citing several difficulties, including recent spikes in fuel and carbon costs. The company relied on borrowing to meet its surrender obligations but ran into constraints when free allocation to UK participants for the 2019 trading year was delayed following the then-ongoing Brexit negotiations and safeguarding measures implemented by the European Commission.

While aircraft operators' total allowance costs are estimated to have represented only about 0.3 percent of their total operating costs on flights within the scope of the EU ETS in 2017,[213] the inability to borrow allowances from the next year's allocation was cited as one aspect that resulted in the airline's collapse.[214]

Shortly after, similar concerns were raised by another UK company, British Steel.[215] Its obligations under the EU ETS, combined with the company's reliance on borrowing from its future year's allocation, resulted in UK government support on commercial terms. The EU ETS was reported to be a contributing factor to debts accrued by the company before it collapsed in May 2019.[216]

It is generally considered that specific borrowing mechanisms provide companies helpful flexibility to meet compliance obligations. However, while these two cases may be specific to the uncertainty surrounding Brexit at the time, they highlight the financial risks to firms that rely on borrowing future allocations for present-year compliance.

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211 Kling and Rubin 1997 found that when firms are given complete freedom to bank and borrow, they produce (and emit) more than socially optimal in early periods.
212 See Tietenberg 2010 for a nontechnical treatment on borrowing for which Rubin 1996 and Kling and Rubin 1997 provide the rigorous foundation.
213 *European Aviation Environmental Report* 2019.
214 Carbon Pulse 2020.
215 Shankleman and Morales 2019.
216 Clark 2019.

Box 6-4 Technical note: Vintage allowances and advance auctions

In some systems, issued allowances are tagged with vintages (dates), before which they cannot be used for compliance. They can only be banked or traded. For example, California and Québec sell a limited number of allowances from vintages up to three years ahead during the quarterly joint "advance auctions."

While putting a vintage on allowances prevents some of the implicit forms of borrowing discussed above, the trading of these allowances provides a forward price signal, revealing market expectations of future prices. This can make it easier for participants in financial markets to design derivatives such as futures and options, which can make it easier for market participants to hedge price risk (as discussed in Section 6.3).

6.2.3 LENGTH OF COMPLIANCE PERIODS

A further way to provide intertemporal flexibility is through the choice of length of the compliance period; in other words, over what period of time emissions are calculated and the surrender obligation is established. Rules for banking and borrowing establish the flexibility to trade allowances between compliance periods and often across phases. However, within a given compliance period, firms can effectively bank or borrow freely, since they have intertemporal flexibility for managing emissions and compliance efforts. Box 6-5 explains the terms referenced in this section.

Box 6-5 Technical note: Compliance, reporting, and phasing

The length of the *compliance period* establishes the basic time limit for compliance, with longer periods providing greater intertemporal flexibility for managing emissions and compliance efforts. At the end of each compliance period, regulated entities need to surrender the allowances necessary to cover their emissions in that time frame.

The length of the *reporting period* determines the point at which entities need to provide information on emissions over a given time frame. The reporting period may be shorter than the compliance period. For more information on compliance and reporting, refer to Step 7.

The compliance period may fall within a longer *commitment period* (called a "phase" or a "trading period" in the EU ETS), whereby a time frame is linked to a specific emissions reductions target, potentially tied to an international commitment or a contribution under relevant climate policy, and during which allowance allocations and other program features are comparatively fixed.

Separate rules may exist for banking and borrowing across compliance versus commitment periods.

Longer compliance periods reduce administrative burdens on regulated entities and provide greater opportunities for cost-effective timing of abatement and greater flexibility to respond to unplanned events. For example, in California the regulator notes that the three-year compliance period helps firms respond to low-water years that might affect the generation of hydroelectric power. Longer compliance periods may be particularly valuable when it is known that abatement investments requiring long lead times may be required for some emitters.

At the same time, longer compliance periods — and the associated implicit banking and borrowing that they allow — raise the same challenges as banking and borrowing more generally.

Systems with longer compliance periods may also require reporting and some "partial" compliance on a more frequent basis, while still maintaining some of the flexibility from a longer period. This helps to ensure regulated entities are making progress toward meeting their obligations. Partial or full compliance on an annual basis could also help align ETS compliance requirements with other normal financial disclosure, tax, and regulatory compliance requirements. In most existing and proposed ETSs, there are some annual compliance requirements. However, except for Kazakhstan, New Zealand, and Korea, systems provide flexibility to partially comply each year. ETSs with longer compliance periods include RGGI, California, and Québec, at three years, and Tokyo, at five years. In addition, in California there is a requirement of partial yearly compliance of 30 percent of annual covered emissions.[217] The EU effectively has a rolling compliance deadline as allowances from the next compliance period can be used to cover emissions during the current period, up to the end of each phase, which provides a form of implicit borrowing.

6.3 PROMOTE A FUNCTIONING SECONDARY MARKET

The secondary market is where allowances are traded between firms after they have been auctioned or freely allocated. While the trading is done by private actors, policymakers have a large role to play in defining the rules and structures under which the market must operate. All aspects of ETS design will affect secondary market function in some way, but decisions regarding who can participate in these markets are particularly important. Firms with liabilities under an ETS need to participate in the market, but other actors, such as financial market participants, can play an important role in adding liquidity and providing access to risk-management products.

This section focuses on the rules, participants, and infrastructure that can contribute to a well-functioning secondary market. Sections 6.3.1 and 6.3.2 outline how existing financial markets and financial service providers can support a robust carbon market, including promoting market liquidity and trade. Section 6.3.3 discusses the role of risk-management instruments, and Section 6.3.4 outlines approaches to direct intervention by regulators to address volatility or provide liquidity.

6.3.1 SUPPORTING MARKETS

Financial markets play a key role in shaping production and investment patterns across a range of industrial and product markets and can play a similarly important role in carbon markets. Financial markets' participants provide liquidity and support information flows, arbitrage price differentials across markets, facilitate trade of liable firms, create products to manage price and volume risks, and in some cases take positions regarding future market prices.

Traders from banks, investment firms, and related entities often engage in arbitrage, which means they take advantage of price differences between carbon markets and other markets by buying under-priced instruments and selling them at a profit. Traders can take advantage of arbitrage opportunities at scale to profit from even minor price differentials, providing a source of allowance demand or supply for entities seeking to trade for compliance purposes. The process of arbitrage can reduce price volatility and better align carbon pricing outcomes with fundamental price drivers across multiple markets, for instance, by ensuring changing prices of energy commodities are reflected in carbon prices.

Financial market participants and other investors may take longer-term positions in carbon markets if they consider the longer-term price outlook to be too high or too low relative to current levels. This reduces volatility by narrowing the trading price band, with financial market participants buying when prices drop below their long-term price expectation and selling when they rise above it. This helps to provide a source of secondary market demand or supply to the market, pushing prices up or down and driving intertemporal substitution as liable entities increase or reduce emissions in response to the changing level of the carbon price.

Broader market design decisions will affect how a secondary market develops. This requires a coordinated approach to avoid unnecessary barriers to trade, for instance by allowing the banking of allowances that enables mitigation to shift over time. Other design decisions can also be made with an eye toward secondary market development; for instance, registries for emissions allowances and auction platforms can be designed to integrate with secondary market exchanges, enabling trade to occur with lower costs and higher participation than would otherwise be available. Exchange-based trading in carbon markets plays an important role in providing risk-management services and information flows, as discussed in Section 6.3.2 below.

By creating the conditions for secondary markets to expand and ensuring transparent flows of information, policymakers can help covered firms understand supply and demand dynamics and better manage the risks associated with fluctuating allowance prices.

Policymakers can provide market-relevant information regarding several aspects of market functioning, including:

217 From CARB's *Initial Statement of Reasons*, justifying the three-year compliance period: "A three-year compliance period provides some intertemporal flexibility by allowing regulated entities to manage planned or emergency changes in operations over the short term, as well as to deal with low water years that might affect the generation of hydroelectric power." And ARB's justification for partial annual compliance, to address potential adverse selection: "Staff also recognizes that there is a need to require regulated entities to submit a portion of its compliance obligation more frequently to ensure they are making progress toward their obligations. Regulated entities could emit GHGs and then declare bankruptcy or otherwise cease operation before fulfilling their compliance obligations at the end of the three-year compliance period."

- the level of emissions and provision of free allowances at a sector, firm, or facility level;
- the outcomes of auctions and underlying supply and demand;
- information on the type, number, and timing of transactions made in the registry;
- the operation of a PSAM and its impacts;
- any evidence of misconduct, for instance, market manipulation or noncompliance; and
- the overall functioning of the market, as discussed further in Step 10.

Opening carbon market participation to the financial sector and other participants results in carbon markets operating more like financial markets and creates the need to expand oversight to this new segment of trading. This brings its own set of risks, which has led some jurisdictions, like the EU, to regulate carbon markets using existing financial market regulatory powers.[218] Allowing financial market participants to trade in emissions allowances or participate in auctions can introduce additional complexity into the operation of the ETS, requiring greater oversight and management of a larger number of participants. However, existing laws and oversight arrangements for trading goods and financial products can be used so new rules do not need to be developed. Nonetheless, financial market participants are sometimes prevented from trading during pilot phases or the initial operation of an ETS. These issues will be discussed further in International Carbon Action Partnerships (ICAP) and the Partnership for Market Readiness's (PMR) forthcoming paper on *ETS Governance*.

6.3.2 FACILITATING TRADE

Trade in carbon markets often occurs through financial service providers, which will often act as brokers for trade for liable entities or provide information on market trends and outlook. There are three ways in which allowances can be traded:

1. direct trade between liable entities,
2. trade facilitated by a broker ("over-the-counter" trade), and
3. exchange-based trade on a given platform.

These options differ in terms of their transaction costs, flexibility, and provision of market information.

Direct trade between liable entities is rare, as the transactions costs involved in identifying potential trading partners and agreeing to the terms of a trade can be high. Such trades are flexible, because trading terms can be agreed upon between firms; however, "counterparty risk" is higher, as there is a risk that one party will not comply with the agreed terms of the trade. Similarly, without a central entity to identify and report on terms of trade, this approach provides very little information on demand and supply to the broader market.

Over-the-counter trade is generally facilitated by specialist firms acting as brokers and dealers. These brokers will buy and sell allowances, engage in direct (proprietary) trade, or more commonly act as an intermediary for trades between other firms. Over-the-counter trading cuts transaction costs relative to direct trade because brokers can more efficiently connect buyers and sellers compared to direct trading. It has the advantage of flexibility, offering customized provisions for trade based on the needs of the buying or selling party. It can also protect against nonpayment by holding allowances or money paid in a separate account (in "escrow") until obligations have been met on both sides of the trade. However, because of the need to match a seller to a buyer for a customized trade, it can be difficult to efficiently respond to a rapidly changing market environment. The firm acting as the broker for an over-the-counter trade largely determines the degree of information it releases on trades, meaning that the information available to the broader market is often sparse. This has implications for oversight of the market, as there is limited information to assess how the market is functioning.

Exchange-based trade occurs on platforms, like stock exchanges or commodity exchanges. These platforms facilitate trade in standardized contracts, which enables the participation of a wide range of buyers and sellers trading identical products in markets that may see thousands of trades an hour. By aggregating buyers and sellers these exchanges provide an important source of price discovery, as differences in information are reflected in demand and supply as willingness to buy or sell at certain values. As such, the market price aggregates the pools of information and communicates the weighted view of the market on the value of these allowances, in a transparent carbon price. In addition to facilitating trade, such readily available information about allowances prices and volumes supports oversight by government on the operation of the market. Exchanges also reduce counterparty risk by requiring guarantees of payment prior to allowing trades and by using clearinghouses to facilitate settlement of trades. Finally, exchange-based trading supports the development of liquid derivatives markets that can be used for risk management by hedging carbon pricing risks. These markets are discussed further in Section 6.3.3. These risk-management products provide entities with the confidence to invest in mitigation by locking in carbon prices beyond the current compliance period and reducing uncertainty, despite uncertain market conditions.

218 The Markets in Financial Instruments Directive is the framework of EU legislation for the financial sector.

6.3.3 RISK-MANAGEMENT INSTRUMENTS

The financial services sector can help liable firms manage risks associated with both trading and changes in emissions over time associated with their production processes — in particular, the development of derivatives products traded over the counter or through exchanges, which enables firms to manage risks by hedging against future carbon price movements.

Financial market participants create risk-management products that otherwise would not exist. Risk-management instruments called derivatives allow firms to reduce price uncertainty using products like futures, forwards, options, and swaps, as outlined in Box 6-6.[219] Futures contracts are commonly used by firms to buy or sell allowances at a set price at a contractual point in the future, and normally trade on derivatives exchanges, like the Intercontinental Exchange, or energy exchanges, like the European Energy Exchange. This allows firms to lock in a price for allowances they will buy in the future.

Futures markets and other derivative products provide a valuable service to firms, which may want to be certain of their future carbon liabilities. In many sectors, production decisions are made in advance, and firms may wish to have certainty on their costs when they are setting the price for their product. An example of this is the electricity sector, where a large proportion of electricity generation is sold several years in advance, either through long-term power purchase agreements, or through forward contracts that are typically two to three years in the future. This locks in a large proportion of generators' revenues, which means that to ensure a certain level of profit they may also seek to lock in their costs. As carbon liabilities can form a large proportion of total costs, generators often use derivative products to reduce risks of changes in the carbon price.

These futures markets also provide a channel through which future price expectations can affect current carbon prices. Liquid futures markets encourage arbitrage given the clear link between prices for derivatives contracts and spot markets. The existence of derivatives can therefore improve price discovery and lead to a more efficient spot market through arbitrage trading. This can help drive intertemporal substitution as described above, as it provides for the guaranteed sale or purchase of allowances in the future.

Box 6-6 Technical note: Financial products in secondary carbon markets

Derivatives are financial products that derive their value from changes in the price of an underlying asset or commodity. There are four main types of derivatives. These are described below, along with their application to carbon markets.

- **Futures contracts** are standardized exchange-traded agreements to buy or sell allowances or offsets at a certain maturity date in the future for a certain price. A futures contract can be settled by a payment based on the current market price at the contractual maturity, which is commonly used for hedging. Futures contracts are the most traded form of derivatives product.
- **Forward contracts** are like futures but are nonstandardized agreements to buy allowances or offsets in the future for a certain amount, usually through a specialized over-the-counter broker. A forward contract is usually settled through the physical delivery of the underlying asset. There may be details in the forward contract that fit the exact needs of the buyer or seller that are not going to be common in the market and are therefore comparatively less commonly traded.
- **Options** entail the right, but not the obligation, to buy ("call option") or sell ("put option") a certain quantity of allowances at a future date for an agreed price.
- **Swaps** are a nonstandardized exchange or series of exchanges (allowances, offsets, cash flows) at a given time or for a set period at an agreed price. For example, in some trading systems there is a limit placed upon the amount of offsets installations can use for compliance, which can result in a price differential between offset and allowance units. Swaps can be used to exploit this differential.

219 Aki and Michel 2013; Monast et al. 2009; Pew Center on Global Climate Change 2010.

6.3.4 DIRECT VOLATILITY AND LIQUIDITY MEASURES

Aside from allowing financial market participation in the ETS secondary market, the government can play a direct role in managing volatility and supporting liquidity. Measures introduced in the Chinese pilot ETSs focus on managing market volatility, while the Korean ETS has introduced a market-maker function to support liquidity.

Several additional measures have been introduced in the Chinese pilot ETSs to limit price volatility. This includes the use of "circuit breakers," which stop trade on secondary markets when a limit is hit regarding the daily increase and decrease of price (typically 10 percent to 30 percent). The specific design of these measures varies in each pilot. In Hubei, price fluctuations are directly controlled by the exchange, which limits day-to-day price fluctuations to 10 percent of the opening price, and intervention is also allowed in the event of supply and demand imbalances or liquidity issues. Similarly, in the Fujian ETS the regulator can intervene in the market when it judges there are demand and supply imbalances, or when liquidity issues arise.

The Korean ETS introduced a market-maker facility in 2019 to improve market stability and enhance liquidity. This followed several years of illiquid trading, in part due to the large proportion of freely allocated allowances. Its main purpose is to provide selling offers to entities that are unable to purchase allowances in the event of shortages in the market. The Korea Development Bank and the Industrial Bank of Korea were designated as market makers and can draw on a government-held reserve of five million allowances to increase liquidity in the market if needed.[220] These interventions can help reduce price volatility and therefore short-term price risk, which may increase confidence in the market. Similarly, the market-maker mechanism in the Korean ETS can help provide liquidity for liable entities seeking to buy or sell allowances. However, these direct interventions also risk introducing distortions, driving prices to deviate from those that are implied by economic fundamentals, generating inefficiencies, and decreasing confidence in the market.

As a rule, direct intervention to reduce short-term volatility or provide liquidity should be an exception rather than a regular occurrence in an ETS. Effective market functioning and price discovery can be ensured by good design, including an ambitious cap, regular auctions for a large proportion of allowances allocated, and allowing participation of a wide range of financial market intermediaries in secondary markets. Intervention by government should be considered only if other aspects of market design have been shown to be ineffective.

In contrast, PSAM's aim to provide greater certainty about long-term prices can play an important role, as discussed in Section 6.4.

STEP 6
MARKETS

6.4 TOOLS TO ADDRESS PRICE VARIABILITY

Given the risk of excessive price variability in carbon markets, it is now common practice for ETSs to adopt some form of PSAM.[221] PSAMs help jurisdictions to achieve a predictable and effective market (as discussed in Section 6.1.3) that can ensure prices are sufficiently high to support longer-term decarbonization, but not so high as to result in excessive costs.

PSAMs work by adjusting the supply of allowances into the market in response to certain criteria. Other measures may work to ensure a minimum cost of emissions by "topping up" the costs faced by regulated entities. The manner through which PSAMs can be targeted to achieve specific outcomes is discussed in Section 6.4.1.

The implementation of a PSAM will depend largely on its design, but several options are available to enact these measures, which can differ depending on whether they target low prices (see Section 6.4.2), high prices (see Section 6.4.3), or quantity measures to manage supply (see Section 6.4.4).

6.4.1 TARGETING MARKET INTERVENTIONS

Targeting high or low prices

PSAMs can operate by targeting low or high prices in the market, or both. This is generally done by either reducing supply if prices are too low, or increasing supply if prices are too high. By increasing price certainty, PSAMs can help provide bounds on future price expectations. This can support investment in low-carbon technologies and assets. By reducing the bounds of future price expectations, PSAMs can reduce price risk, which may reduce the required rate of return for this investment and thus increase abatement investment.

220 ICAP 2020c.
221 In this publication we use price and supply adjustment measure as a generic term for the universe of interventions that alter supply based on market price or balance. This is distinct from the Supply Adjustment Mechanism, which may be introduced under the UK ETS.

Increasingly, jurisdictions are seeking to manage potential risks from both high and low prices. The EU ETS, California Cap and Trade Program, Québec Cap and Trade Program, and RGGI all have PSAMs that seek to increase or decrease supply if prices are too high or too low, respectively. The New Zealand ETS is moving from a system that addresses only high prices to one that seeks to avoid both low and high prices. China's ETS pilots employ a mixture of approaches, with Beijing targeting only high prices while Hubei and Shenzhen target both high and low prices.

Determining triggers for price or supply adjustments

Most jurisdictions set out clear rules for the implementation of PSAMs by deciding whether to adopt a price or quantity trigger. Most systems use a price-based trigger, which allows them to directly target the trade-offs between prices and quantities for the operation of the ETS. However, the EU ETS adopted an approach using a quantity-based trigger.

A price-triggered approach helps to keep the market price for allowances within a certain range. This has the advantage of providing businesses greater certainty regarding the level and future trajectory of carbon prices. The level of the carbon price is important for determining whether an investment is financially viable and for planning future changes in processes that may impact emissions levels. By signaling a lower price range, businesses can better plan investments, and the risk associated with these investments will be reduced if extreme price realizations in the future can be ruled out. Disadvantages of a price-based approach include that it can be politically difficult to identify the right range, as different industries and interest groups may disagree on the appropriate trajectory. Further, abatement costs can significantly change, for instance, following changes in fuel prices, which could hold implications for the appropriate choice of price-based triggers.

Quantity-triggered approaches manage the number of allowances that are in circulation. Given a fixed cap, a quantity-triggered reserve can respond to external shocks by adding or subtracting allowances from a reserve and releasing them into the market based on predefined triggers, including the quantity of surplus or banked allowances.[222] The advantage of a quantity-based approach is that it retains flexible supply while avoiding an approach that directly targets the price, which can be difficult politically. This also makes the impact on prices more uncertain and makes calibrating a quantity-based approach more difficult in achieving a preferred price outcome. This characteristic may make it easier to implement in certain policy environments, especially given political challenges around agreeing on specific price trigger levels, but makes it less appropriate for directly targeting specific prices.

Price and quantity triggers can be designed to be "soft" or "hard." Soft interventions will increase or reduce supply up to a predefined limit, whereas hard interventions may increase or reduce supply without bounds. For instance, a cost containment reserve will release allowances at a given price until the reserve is depleted, whereas a hard price ceiling will provide an unlimited additional supply of allowances, or compliance units, at that price. A hard intervention provides greater certainty in keeping the market within predetermined bounds, usually based on price levels. This means that it is more effective in reducing price variability. However, hard interventions can create a barrier to linking and have potentially large fiscal consequences; for example, if prices are at the hard floor for a long time then governments could face large costs from buying allowances.

The way in which hard and soft interventions affect supply is explained in Box 6-7.

222 Analysts have suggested a variety of potential triggers for regulating allowance volumes offered at auction, including allowance volumes in circulation as well as changes in production and other economic conditions. These approaches vary in their ability to provide price predictability, respond to shocks, provide certainty of adjustment, reduce oversupply, and prevent potential manipulation. See Gilbert et al. 2014 for a review.

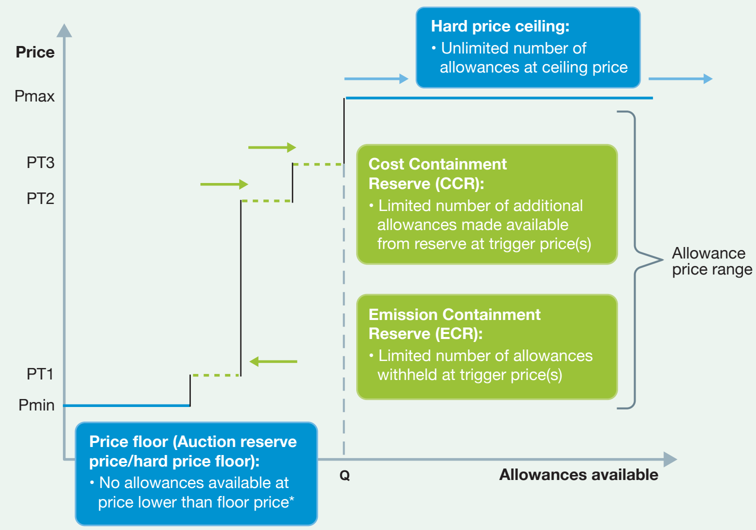
Box 6-7 Technical note: The impact of PSAMs

The figure below illustrates the effect of PSAMs on the allowance supply curve, with arrows indicating whether supply is added or withheld from the market. It serves as a general illustration of these measures and thus does not depict their use under specific jurisdictions. Without price controls, allowance supply is perfectly inelastic and does not react to price differences. This is illustrated by the vertical line Qo.

An auction reserve price sets a minimum price at which allowances enter the market through auction. Since bids are not accepted below the reserve price, a reserve price at auction sets a soft minimum bound on allowance prices (Pmin). As prices could fall below the auction reserve price in the secondary market, a hard price floor would require government purchases of allowances to defend a minimum price.

At the other end of the spectrum, a price ceiling can be introduced into an allowance market through the regulator committing to make available allowances at a fixed upper price (Pmax). Implementing a price ceiling implies surrendering control of the allowance budget (cap) once the ceiling price is reached.

Figure 6-4 Technical note: The impact of supply adjustment measures



Source: Acworth, Schambil, and Bernstein 2020.

* An auction reserve price only poses a price floor at allowance auctions; therefore, the share of allowances auctioned is important for the overall effect on the supply of allowances and the resulting price effects for this tool. In secondary markets, prices could still fall below the auction reserve price.

Within these upper and lower bounds, different allowance reserves can be employed to adjust the supply curve. By design, a reserve has only a limited number of allowances and as such does not guarantee a certain price outcome. An Emission Containment Reserve (ECR) withholds a fixed quantity of supply from the market when declining allowance prices trigger the reserve price (PT1). However, once this adjustment has been made, prices are free to continue to decline. In the face of increasing prices, a Cost Containment Reserve (CCR) makes a limited number of additional allowances available when certain trigger prices are reached (PT2, PT3). However, as the reserve is finite, prices are free to increase once allowances have been released to the market. Multiple reserves at increasing tier prices can also be employed to act as “speed humps” to slow price increases during periods of increasing demand. But ultimately, these reserves can only act as a “soft price ceiling” to the point where demand surpasses the capacity of the reserve to inject additional allowances and prices are again free to rise to the Pmax.

Temporary and permanent supply adjustments

PSAMs alter the allowance supply in the short term through increasing or reducing supply; however, there is a question as to what to do with the supply that is injected or removed.

The decision to make a temporary or permanent supply adjustment has clear links with cap setting (see Step 4) and the allocation of allowances through auctions (see Step 5). PSAMs that offset changes in supply today with changes of allowances in future auctions or caps are known as temporary alterations of supply. Permanent alteration of supply is where some or all the supply change is not offset by future auctions or under future caps.

PSAMs that have a temporary effect on market supply simply smooth the market over time. PSAMs with a permanent supply response can affect levels of realized ambition. Currently, there is a mix of both in use.

The California Cap and Trade Program, Québec Cap and Trade Program, and Korean ETS use PSAMs that provide a temporary supply response as allowances that are unsold at auction are returned to the market in subsequent auctions, while allowances in the CCR are sourced from the caps in other years. Since 2021, the California Cap and Trade Program will allow for increases in supply for price ceiling allowances that are sold, although revenues from the sale of additional compliance allowances at the price ceiling (should it be triggered) are required to be used to purchase additional ton-for-ton reductions from low-carbon projects to ensure the environmental integrity of the ETS.

The EU's and RGGI's ECR include a permanent supply change through the invalidation of excess allowances. This effectively increases the ambition of the ETS, which may feed through to the jurisdiction-wide emissions target. Conversely, RGGI's CCR is sourced from allowances outside the ETS cap, and when a release is triggered in response to high demand and prices, overall emissions increase. While temporary supply responses may be easier to introduce, permanent supply responses may elicit greater changes in behavior.

Permanent supply adjustment has implications for the effective ambition of an ETS. For instance, a PSAM that features a permanent reduction in supply effectively reduces cumulative emissions and can act as a ratchet for ambition. However, a PSAM that allows for a permanent increase in supply could lead to cumulative increases in emissions that could undermine the jurisdiction's ability to achieve its emissions reductions targets.[223] Therefore, it may be prudent to avoid permanent increases in supply, but permanent reductions of supply could play a useful role in helping countries ratchet up their target ambitions.

Discretionary PSAMs

Most PSAMs are rule based, with the requirements for intervention predefined. Some jurisdictions, however, including the Korean ETS and some Chinese pilots, have retained discretionary interventions that provide flexibility regarding when and how they intervene in a market. Box 6-8 outlines the conditions under which Korea's Allocation Committee may intervene in its carbon market.

A discretionary PSAM may identify circumstances under which intervention could occur and potential methods of intervention, while not specifying the precise measure of intervention. While providing flexibility, this approach can be counterproductive if the lack of clear criteria for intervention creates unpredictability. In recent years there has been a movement toward greater reliance on rule-based PSAMs with the EU and New Zealand adopting rule-based measures and Korea investigating moving to a rule-based approach. In general, rule-based PSAMs provide more certainty regarding a regulator's response to shocks and unforeseen events, and are therefore considered better at managing excessive price variability.

There have been proposals for delegating management of the allowance market to an independent carbon authority or a carbon central bank. Researchers have proposed various models for delegation to independent bodies that would aim to adjust auctions to ensure proper market functioning and liquidity in the short term and, over the medium to long term, potentially change the ETS cap. However, these have not been used to date.

Box 6-8 Case study: The Allocation Committee in the Korean ETS

The Korean ETS currently operates with an Allocation Committee that is guided by rules on when to intervene in the market, but also operates with a degree of discretion. There are predetermined situations in which the Allocation Committee is authorized, but not required, to intervene in the market.

The conditions under which the committee may intervene in the market include the following:

- the market price for allowances has been at least three times the two-year average for at least six consecutive months; or
- the market price for allowances has been at least two times the two-year average for at least one month, and the average trading volume for the current month is at least twice that of the same calendar month in the two previous years; or
- the average market price for allowances for the last month is less than 40 percent of the two-year average; or
- it is difficult to trade allowances due to the imbalance of supply or demand.

There are several actions the Allocation Committee may take in any of these situations, including but not limited to releasing allowances from a reserve. The Allocation Committee may also change rules regarding borrowing and use of offsets in this situation as well as establishing a price ceiling or floor.

223 California's price ceiling includes a requirement to purchase at least a ton-for-ton corresponding emissions reduction to mitigate this risk.

6.4.2 MEASURES TO RESPOND TO LOW PRICES

Auction reserve prices

Auction reserve prices place limits on auctions to ensure that they cannot settle below a predetermined price. Controls on auction prices flow through to the secondary market as compliance entities and other market participants seek to source allowances at least cost. This means that if the supply at auction is reduced to ensure the auction settles at the reserve price, this is likely to be matched in the secondary market, making an auction reserve price an effective means of intervention in the broader market. At present, jurisdictions including Korea, California, Québec, RGGI, and the UK have auction reserves in place, and they are also planned to be introduced in the New Zealand ETS. The operation of RGGI's auction reserve price and other PSAMs are discussed in Box 6-9.

Reserve prices are popular in part due to the ease of implementing a PSAM via auction. Because the regulator already operates the auction and defines auction supply and rules (see Step 5), implementing PSAMs through these auctions is relatively straightforward. However, if a large majority of allowances are not allocated by auction, then the effectiveness of a reserve price may be limited. In this case policymakers can only make relatively small adjustments to the overall market.

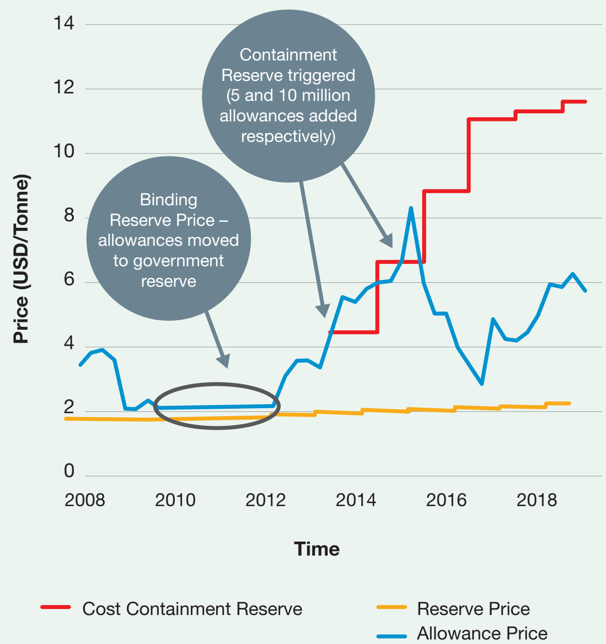
Box 6-9 Case study: RGGI's PSAMs

RGGI has evolved to include various price or supply adjustment measures. Since inception, RGGI has operated with a minimum reserve price at auction, which precludes bids below the predefined reserve price. The reserve price was set at USD 1.86 in 2008 and increased at a rate of 2.5 percent from 2014 onward. The minimum price was binding between June 2010 and December 2012 when a surplus of banked allowances accumulated in the RGGI market. This was addressed as part of the scheduled 2012 review, where the RGGI cap was revised downward for the years 2014–2020, effectively cancelling the surplus (banked) allowances. Starting in 2021, the minimum reserve price will be set at USD 2.30 per short ton and continue to increase at 2.5 percent per year.

As of 2014, RGGI states created a CCR, where allowances are released to the market when a certain trigger price is reached. The trigger price was set at USD 4 in 2014, USD 6 (EUR 5.40) in 2015, USD 8 in 2016, and USD 10 in 2017. Since 2017 it has increased annually by 2.5 percent. In 2021, as per the 2017 model rule updates, the trigger price will be set at USD 13 and will increase by 7 percent compared to the previous year thereafter.

The CCR was triggered in 2014 and 2015, collectively releasing 15 million additional allowances to the market. As these allowances are not sourced from within the cap, triggering the CCR effectively increases the allowance cap. It is difficult to assess the impact the CCR has had in terms of price control. While the first intervention likely placed downward pressure on allowance prices, allowance prices continued to rise, albeit at a slower rate than before the CCR was triggered. The CCR was again triggered in 2015, as prices rose marginally above the CCR in the third quarterly auction. The last auction of 2015 saw prices rise 25 percent to an all-time high despite the injection of 10 million allowances from the CCR at the previous auction. Prices declined soon after. The decline in prices has also been attributed to the legal challenge to the Clean Power Plan, a proposed federal program that would have required states to reduce CO_2 emissions, which in February of 2016 was stayed following a Supreme Court ruling.[224]

Figure 6-5 Case study: The impact of supply adjustment measures in RGGI



Source: ICAP Allowance Price Explorer

* RGGI uses short tons; for the purpose of comparability, prices have been converted into metric tons.

224 Energy Information Administration 2016.

The results of the 2017 scheduled review added another element to RGGI's toolbox of instruments, the ECR. The ECR is an automatic adjustment mechanism that will operate within RGGI starting in 2021. The mechanism automatically adjusts the cap downward in the face of lower-than-expected costs. Should prices drop below USD 6 in 2021 (rising 7 percent per year), participating states will be able to withhold up to 10 percent of their allocation from the auctions. Allowances withheld will not be reoffered for sale, thereby adjusting the cap downward.[225, 226, 227, 228]

Hard price floors

A hard price floor can be implemented through direct intervention, in which a jurisdiction buys back an unlimited number of allowances at a predetermined price. This could include providing an open option for firms to sell allowances at a fixed price or the regulator purchasing allowances on the secondary market to maintain that price. These interventions have generally been avoided in ETS to date as they introduce unnecessary complexity. This is particularly the case given the relative ease of implementing PSAMs through auctions and preferences for lower-risk, softer forms of intervention.

Additional fees or charges

Additional fees and charges have sometimes been used when policymakers wish to ensure that firms face a certain total cost, rather than exclusively the allowance price. A top-up fee or surrender charge on allowances is one way of increasing the cost of emissions in an ETS domestically within a linked or multijurisdictional system and could also be used to ensure a minimum cost for emissions in a stand-alone system. It could also be used to raise the cost of using offsets when these trade at a lower price than allowances.

Under a surrender charge, emitters are required to pay a top-up fee to the government that reflects (either exactly or approximately) the difference between the market price and a given set price. This approach does not affect the quantity of allowances in the ETS, but rather combines a fee with an ETS such that a minimum combined cost per ton of emissions is maintained for ETS participants. In this way, it can deliver a high degree of price certainty. However, the exact degree of price certainty depends on how frequently the top-up fee changes in response to changes in the market prices of allowances. Frequent updating increases price certainty but can be technically challenging to implement (as discussed in the box below).

An additional fee has been implemented in the UK power sector (see Box 6-10), a subset of the entities covered in the EU ETS. The policy is designed to increase certainty to generators and encourage investment in low-carbon power generation. A bill to introduce a similar levy has been introduced in the Netherlands.[229]

Australia's ETS was initially designed to include a price floor implemented through a minimum auction price domestically and a surrender charge on imports of foreign offset credits. The implementation of this surrender charge raised a number of important technical challenges given the expectation that it would respond quickly to changes in the CER price and the difficulty for the government to know what price was being paid for an offset.[230] When Australia entered into linking negotiations with the EU ETS, Australia agreed to abandon its price floor (see Step 9).

Box 6-10 Case study: Carbon price floor to foster investment in the UK

On April 1, 2013, the UK unilaterally introduced a carbon price floor (CPF) within the electricity sector.[231] The goal of the CPF was to "reduce revenue uncertainty and improve the economics for investment in low-carbon generation."[232] The price floor was achieved by implementing a carbon price support (CPS), an additional carbon tax levied on all entities that generate electricity using gas (supplied by a gas utility), liquid petroleum gas, or coal and other solid fossil fuels. Rather than operating as a reserve price at auction, the CPS is charged on top of EU ETS allowance prices to ensure that the price of carbon meets a minimum national target. The CPS is paid by entities for each unit of emissions and is additional to any cost of allowances. The obligation to pay the CPS applies when allowances are surrendered. Entities are regulated at the point where gas passes through the meter or, in the case of liquid petroleum gas, coal, and other solid fossil fuels, at the point of delivery at generating stations. →

225 As of 2019, Maine and New Hampshire did not intend to implement the ECR.
226 Regional Greenhouse Gas Initiative 2019a.
227 Regional Greenhouse Gas Initiative 2017a.
228 Regional Greenhouse Gas Initiative 2017b.
229 See Rijksoverheid 2019, 2020.
230 See Hepburn et al. 2012.
231 Brauneis et al. 2013; HM Revenue and Customs 2015; HM Revenue and Customs 2014a; HM Treasury and Customs 2011.
232 HM Treasury and HM Customs 2011.

The CPS was designed to start at £4.94 per ton and to increase stepwise. The value of the CPS is based on the projected gap between the target price in each year and the price of allowances in the EU ETS in the recent past, with a target price in 2020 of £30 per ton, in 2009 prices. Once the CPS is set for a given year, it is not adjusted to actual fluctuations in the EU allowance unit price such that the final price paid by generators may differ from the target price. HM Revenue and Customs expected that this would support £30–40 billion of new investment in low-carbon technology. However, in March 2014 it was announced that the CPS (the UK-only element of the CPF) rate would not exceed £18 per ton of carbon dioxide from 2016–2017 to 2019–2021, due to lower than expected EU ETS allowance prices in the time after the price floor was introduced, resulting in a wider gap between the prices for emissions allowances for other states in the EU ETS and those in the UK. At the time of writing, the CPF is approximately £40 against a stated target of £30 for 2020. This has created concern that the CPS might be damaging the competitiveness of UK industry and leading to undue increases in household energy bills.

The UK government analysis of the increased cost burden concluded that the contribution of the CPF to household energy bills was expected to remain small. For energy-intensive industry in the UK, however, the burden could be quite significant. In response, the UK government announced targeted compensation packages for the increase in energy costs of the energy-intensive industry, which were approved by the European Commission under the state aid rules. The higher costs and compensation notwithstanding, the CPF was identified as the main driver for the shift in generation away from coal, reducing its share in UK electricity generation to about 5 percent in 2018 from about 35 percent in 2013.[233]

6.4.3 MEASURES TO RESPOND TO HIGH PRICES

Cost containment reserves

A CCR operates like a price ceiling except that the amount by which auction supply is increased is limited. When these reserve allowances are exhausted, the price can therefore still increase.

To provide a source of allowances for injections, an allowance reserve is created from allowances that are initially withheld from distribution and/or put up for auction but remain unsold (for example, because the auction reserve price is not met). These allowances are part of the overall cap but are offered for sale only at prices above a certain level, as a means of helping to contain costs. In order to keep the level constant in real terms over time and to avoid creating unintended speculative opportunities to profit from simply holding allowances, the threshold price level is usually set to rise over time at a rate comparable with the market rate of return for other investments with similar risk profiles (for example a 5 percent interest rate plus inflation).

An allowance reserve provides a soft ceiling since there is only a fixed amount of allowances the government is prepared to sell at a given price. This provides some assurance to the market, but not a guarantee, that the price will not rise above that level. In this way it provides more certainty over the quantity of allowances auctioned and resulting emissions levels than it does over the maximum price. Probabilistic modeling can help conduct stress tests and estimate the required size of a reserve to keep prices within certain bounds, given best available information.[234]

In the case of California, a percentage of allowances from the cap is set aside each year into an Allowance Price Containment Reserve (APCR) (see Box 6-11). So far, market prices in California's ETS have remained below the level at which an allowance release from the APCR is triggered. In Québec, a similar system is in place, and the auction reserve price and allowance reserve prices are harmonized with California. In both jurisdictions, a staggered approach is used, with different quantities of allowances available for sale at different prices. The RGGI system also implemented a CCR in 2014. In contrast to California and Québec, this has a single price at which intervention is triggered, and allowances from the CCR are automatically offered as part of regular auctions if the trigger level is reached.

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233 DUKES 2019.
234 Golub and Keohane 2012.

Box 6-11 Case study: California's PSAMs

California uses a comprehensive set of tools to manage the risks of high and low prices in its carbon market.

Over the period 2013–2020, California has implemented a three-tiered APCR as well as a reserve price at auction within its ETS. The latter precludes bids below the reserve price being accepted at auction and therefore sets a minimum price bound. The APCR was designed to provide flexibility in responding to increasing prices. When a quarterly auction results in a settlement price greater than or equal to 60 percent of the lowest reserve tier price, CARB will offer allowances through an APCR reserve sale. CARB will also offer the reserve sale immediately preceding the compliance deadline if there is demand from any regulated entity.[235] To date, CARB has not held a reserve sale. The APCR tiers were set at USD 40, USD 45, and USD 50 in 2013, increasing by 5 percent plus inflation annually to 2020.

Reforms to the cap and trade program approved in December 2018 provided amendments to the price stability mechanisms of 2021–2030. Going forward, California will operate the reserve sale mechanism with a hard price limit (ceiling) set at USD 65 per allowance. The program will maintain its auction reserve price as a price floor. In between the upper and lower price limits will be two "reserve tiers" that, if reached, would result in additional allowances being offered for sale, like the previous APCR. Those levels will be set at USD 41.40 and USD 53.20 in 2021. All reserve prices, including the price ceiling, increase by 5 percent plus inflation each year. Filling the APCR requires removing allowances from the overall allocated budget.

If allowances from the APCR are exhausted or a regulated entity does not hold enough compliance instruments, CARB will offer additional allowances at the price ceiling. The sale of "price ceiling units" is limited to entities' allowance shortage with respect to their compliance obligation due for the next surrender deadline. CARB uses the revenue generated from the price ceiling sales to achieve emissions reductions on at least a one-to-one basis from projects in sectors or regions outside of the cap and trade program. This provision is meant to ensure that the implied increase in the cap from the price ceiling sales would not lead to an increase in emissions.

Hard price ceilings

A hard price ceiling is implemented through direct intervention, in which a jurisdiction supplies an unlimited number of allowances at a predetermined price. This could include providing an open option for firms to buy allowances at a fixed price or the regulator selling allowances on the secondary market to maintain that price. This sets an absolute ceiling on the price that entities must pay to buy allowances.[236] As an unlimited number of allowances will be released to defend the price ceiling, implementing a price ceiling surrenders some certainty surrounding the overall allowance cap.

New Zealand's Fixed Price Option acted as an effective price ceiling, as it allows ETS participants to pay NZD 25 per allowance to the government as an alternative to purchasing allowances from the NZ ETS market. Alberta's Specified Gas Emitters Regulation (although this is not a formal ETS) uses a similar approach; entities can pay a penalty or other fee to the government in lieu of submitting allowances. These are effective price ceilings, which directly substitute a set tax for an ETS when prices hit certain levels. Similarly, if the ETS enforcement arrangements do not include a penalty set with reference to the price or make good provision (see Step 7), the penalty will also act as a price ceiling.

As outlined in Box 6-11 California is introducing a hard price ceiling, with "price ceiling units" being made available at the ceiling level for regulated entities that need them to meet compliance obligations. The revenue generated from the price ceiling sales will be used by CARB to achieve emissions reductions on at least a one-to-one basis from projects in sectors or regions outside of the cap and trade program. This provision is meant to ensure that the implied increase in the cap from the price ceiling sales would not lead to an increase in emissions.

6.4.4 QUANTITY-BASED MEASURES

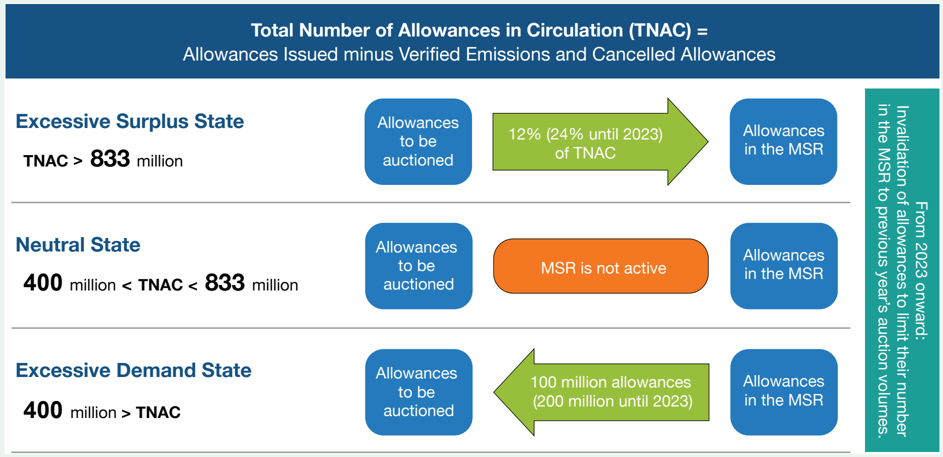
The MSR in the EU ETS is a rule-based, quantity-triggered intervention. The MSR is designed to adjust the annual number of allowances auctioned in the market in certain years, based on predefined rules surrounding the level of the allowance surplus. The MSR aims to maintain a certain supply–demand balance to address the current surplus of allowances in the EU ETS and improve the system's resilience to major shocks.[237] By targeting both oversupply and undersupply in secondary markets, the MSR seeks to avoid excessively low or high prices. Further details on the operation of the MSR are provided in Box 6-12.

235 CARB 2019:250.
236 The idea of a price ceiling was originally developed by Roberts and Spence 1974 and applied to the case of climate policy by Pizer 2002.
237 European Commission (EC) 2015d.

Box 6-12 Case study: The EU ETS Market Stability Reserve

In 2015, EU policymakers adopted the MSR to address the structural surplus of allowances built up in the system and improve the system's resilience to future shocks. To that effect, the MSR adjusts the supply of allowances to be auctioned when the Total Number of Allowances in Circulation (TNAC) — a measure of allowances surplus — is above or below predefined thresholds.[238] The MSR was established in 2018 and began operating on January 1, 2019.

Figure 6-6 Case study: The EU ETS Market Stability Reserve



Note: The TNAC is the cumulative number of allowances issued in the period since January 1, 2008, and entitlements to use international credits exercised by installations under the EU ETS in respect of emissions up to December 31 of a current year, minus the cumulative tons of verified emissions from installations under the EU ETS since January 1, 2008, any allowances cancelled in accordance with Article 12(4) of Directive 2003/87/EC, and the number of allowances in the MSR.[242]

The MSR functions as follows: when the TNAC is above 833 million, 12 percent (24 percent up to 2023) of the surplus is withheld from auctions. Actual adjustments to auction volumes take place over the subsequent calendar year. When the TNAC is less than 400 million allowances, 100 million allowances (200 up to 2023) are taken from the reserve and added to auction volumes in the subsequent calendar year. The parameters of the MSR are subject to periodic review, with the first review foreseen for 2021 and every five years thereafter.[239] As part of the last reform of the EU ETS for Phase 4, it was also agreed that the number of allowances held in the MSR will be limited to the previous year's auction volume from 2023 onward — allowances in the MSR exceeding this volume will become invalid.[240]

The European Commission publishes the TNAC before May 15 each year so that market participants understand whether allowances will be placed into or taken out of the MSR.[241]

Excessive Surplus State: TNAC is above the threshold (833 million). Allowances are withheld from auction volumes and placed in the MSR.

Neutral State: TNAC is within the upper and lower thresholds. Allowances are not placed in the MSR nor does the MSR issue allowances.

Invalidation State: Allowances in the MSR exceed previous year's auction volume and are therefore invalidated (lightly shaded area above the dotted threshold represents total amount cancelled). This occurs only after 2023.

Excessive Demand State: The number of allowances in circulation is below the lower threshold (400 million). Allowances move from the MSR back to the market.

238 EC 2015d.
239 EU 2015.
240 Depending on the emissions forecast assumed, this could result in roughly 2 billion allowances — roughly the allowance cap of one year — being cancelled in 2023. See Weinreich et al. *A Resilient System to Support Long-Term Decarbonization*, in ICAP 2018b.
241 EC 2019c.
242 EC 2015b.

6.4.5 SUMMARY OF OPTIONS FOR IMPLEMENTING A PSAM

A summary of the advantages and disadvantages of different designs of PSAM is provided in Table 6-1. PSAMs can make carbon markets function better, but they also increase their complexity in a manner that makes ETS linking challenging. The implications of PSAM design for ETS linking are discussed further in Step 9.

Table 6-1 Advantages and disadvantages of different approaches to PSAMs

Approach to manage market	Advantages	Limitations
Managing low prices		
Additional fees and charges	Simple to implement if fee does not fluctuate with price. Provides hard floor on emissions price faced by entities subject to fee.	Difficult to implement if fee adjusts with price. Inhibits efficiency of system if implemented only partially.
Auction reserve price	Relatively simple to implement; increases price certainty to underpin investment; can result in higher government revenue even if emissions demand is lower than anticipated.	Does not guarantee minimum price in the secondary market, particularly if there is only limited use of auctions.
Hard price floors	Relatively simple to implement; can tighten cap if volumes not reintroduced.	Financial burden to regulator for guaranteeing price ceiling.
Managing higher prices		
Cost containment reserve	Provides greater certainty on prices while limiting uncertainty on emissions (since emissions cannot increase by more than the number of allowances released from reserve).	Price ceiling can only be partially guaranteed.
Hard price ceiling through unlimited supply at fixed price	Guarantees price ceiling for market participants.	Environmental target will be compromised if rectifying actions are not in place.
Other approaches		
Discretionary approaches	Could enhance compatibility of ETS with other energy and climate policies, monitor the interactions with international markets, and add flexibility to balance ensuring target quantities with allowance prices.	May be politically challenging to implement. Provides less certainty on response to shocks.
Quantity-based measures	Avoids political debates on where the price should be set.	May increase policy complexity and uncertainty.

6.5 QUICK QUIZ

Conceptual Questions

1. What factors determine the supply of, and demand for, emissions allowances and corresponding prices?
2. What are the key policy tools for providing intertemporal flexibility over short, medium, and longer terms?
3. What are the rationales for managing low or high prices?
4. What different design options are there for price or supply adjustment measures?

Application Questions

1. What are your priorities for ensuring price predictability on the low and/or high end, and for other goals of market management?
2. What approaches might provide sufficient certainty over prices, emissions, and other market indicators?
3. Are you considering linking your system in the future, and how might this affect your preferred approaches?
4. How confident are market actors likely to be in the future of an ETS in your jurisdiction and how can policy design help provide predictable signals for investment?

6.6 RESOURCES

The following resources may be useful:

- Market Stability Mechanisms in Emissions Trading Systems
- Emissions Trading and the Role of a Long-run Carbon Price Signal

STEP 7
Ensure compliance and oversight

BOXES

FIGURES

TABLES

AT A GLANCE

Checklist for Step 7: Ensure compliance and oversight

- ✔ Identify the regulated entities
- ✔ Manage emissions reporting by regulated entities
- ✔ Approve and manage the performance of verifiers
- ✔ Establish and oversee the ETS registry
- ✔ Design and implement the penalty and enforcement approach
- ✔ Regulate and oversee the market for ETS emissions allowances

An emissions trading system (ETS) must be governed by a rigorous system for market oversight and enforcement. A lack of compliance and oversight may threaten the environmental integrity of the system and the basic functionality of the market, with high economic stakes for all participants. The compliance and oversight systems ensure emissions covered by the ETS are measured accurately and reported consistently. Effective market oversight can enable the market to run efficiently and promote trust among market participants.

A prerequisite for effective compliance is developing a legal framework and identifying all entities regulated by the system. The legal framework consists of the legal basis for the ETS, which will usually be adopted by formal legislation, as well as additional rules and guidelines to enact the ETS. Additionally, interactions with other areas of law, such as financial market regulation, play an important role. The list of entities to be covered by an ETS can be compiled centrally or based on firms' self-nominations. This can be made easier by leveraging existing regulatory relationships, but it is likely that governments will also need to develop a specific process to identify new regulated entities as the number of firms changes over time.

Effective systems for monitoring, reporting, and verification (MRV)[243] of emissions and other necessary data (for example, for benchmarking or output-based allocation) are at the heart of ensuring the environmental integrity of an ETS. Different methodologies for monitoring emissions have been used in different systems, but default emissions factors are often used in cases where monitored data is not available or to keep costs low. Reporting arrangements need to be transparent and can build on existing data collected on energy production, fuel characteristics, energy usage patterns, industrial output, and transport.

Robust verification of reported data is important for the credibility of an ETS. Further collection, monitoring, reporting, and verification of activity data (for example, the tons of clinker or steel produced) allows for cross-checks and provides flexibility to adopt different approaches to allowance allocation. If independent verifiers are used, the accreditation process must be robust. Alternatively, auditing and self-regulation backed with credible enforcement and punishment can also provide credibility. While international standards for accrediting verifiers can be leveraged, governments may sometimes need to supplement these with additional checks on verifier capacity, especially in the early stage of an ETS.

Full compliance must be assured through a credible enforcement regime with appropriate penalties. Systems typically rely on a combination of naming and shaming, fines, and make-good requirements to provide this enforcement. While the reputational implications of noncompliance have proven to be a strong deterrent, which can be reinforced by public disclosure of ETS performance, a binding system of penalties is still needed.

Registries — systems that record, monitor, and facilitate the creation, trading, and surrender of all allowances within an ETS system — need to be developed. This requires an assessment of the legal and institutional framework in which the registry will be situated, as well as the identification of its functional and technical requirements. Registry data can be made available to market participants and the public to allow interested parties to form views on the balance of demand and supply. This is a precondition for the emergence of liquid primary and secondary markets for emission allowances with robust price information. The registry should provide sufficiently granular data on emissions, allowance allocation and surrender, and compliance while ensuring that appropriate standards of confidentiality and security are maintained.

Finally, regulators also need to oversee both the primary and secondary allowance markets. Market regulation determines who can participate, what is traded, and where transactions take place, as well as other rules on market integrity, volatility, and preventing fraud or manipulation. Instruments for market regulation include clearing and margin requirements, requirements for reporting and disclosure of trading positions, position limits, and participation, registry accounts, and licensing requirements.

243 Detailed guidance on reporting can be found in the *Guide for Designing Mandatory Greenhouse Gas Reporting Programs*. Guidance on verification can be found in the Partnership for Market Readiness (PMR) publication *Designing Accreditation and Verification Systems: A Guide to Ensuring Credibility for Carbon Pricing Instruments*.

This step considers the requirements and options for regulators to oversee and enforce compliance of regulated entities with the ETS requirements. While there are different options that will depend on the design of the ETS and the specific jurisdictional context, compliance — and sufficient trust that there is compliance — is essential for the integrity and functioning of the entire ETS. Stakeholders and technical experts in areas such as law, IT, and MRV can provide valuable input in designing an effective compliance system.

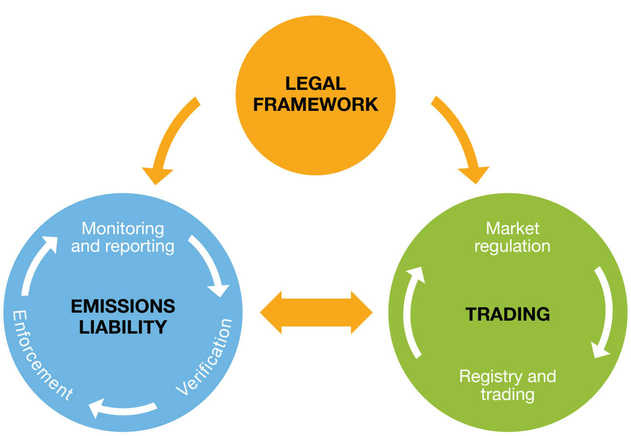
The chapter is structured around six elements. Section 7.1 discusses how to develop a legal framework for the ETS. Section 7.2 outlines key elements of the reporting cycle, and Section 7.3 how to manage the performance of verifiers. Section 7.4 discusses how to design an enforcement approach. Section 7.5 discusses how to develop an ETS registry to facilitate trade, while Section 7.6 discusses oversight of the carbon market.

7.1 DEVELOPING A LEGAL FRAMEWORK

7.1.1 ROLE OF LAW IN ETS DESIGN AND IMPLEMENTATION

Legal considerations play an important role in all stages of an ETS. Clearly defined and enforceable rules are vital for the ETS to function properly because the allowances are constructed by policymakers and artificially constrained in supply. A flawed legal framework can undermine the environmental objectives of the ETS and weaken confidence among market participants. This will affect trading behavior and interfere with the integrity and efficiency of the market. A robust legal framework includes an initial mandate authorizing its establishment, the legal operationalization of key design parameters, and the enforcement of compliance obligations. Figure 7-1 provides an overview of how the legal framework relates to the overarching compliance and monitoring structure that is discussed in more detail in the rest of this chapter.

Figure 7-1 Overarching compliance and monitoring structure

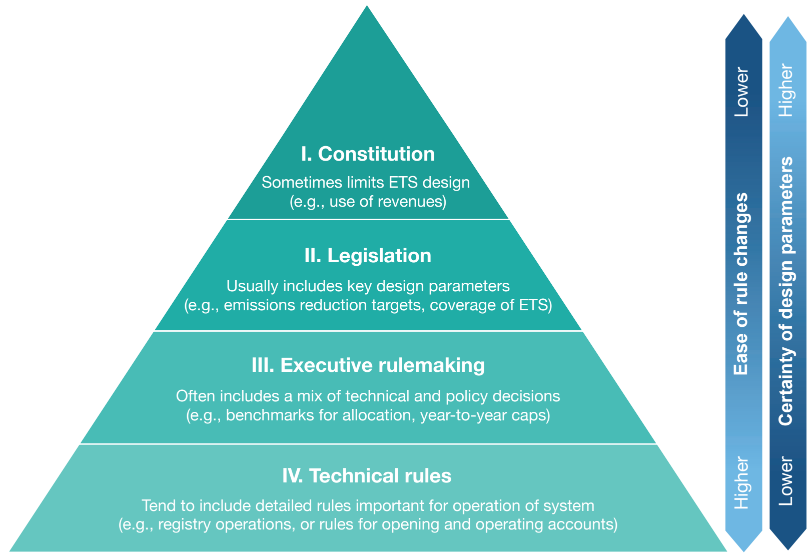


Each jurisdiction's constitutional and broader legal framework will determine how the ETS is legislated, who must be involved, and the timeline for implementation. An ETS imposes constraints on the economic freedom of regulated entities, which is why its introduction generally requires a formal mandate by a legislature or comparable body. A firm basis in statutory law is core to the rule of law and vital for the exercise of public authority by the government's executive branch. ETS design features, such as the rights and obligations of entities covered by the ETS and its core institutional functions, are also often set out in formal legislation.

The type of legislation to establish an ETS will differ across jurisdictions in line with differences in standard legal practices. In California, the AB 32 Global Warming Solutions Act of 2006 required California to reduce its emissions by around 15 percent by 2020 in the most cost-effective way. The AB 32 authorized the adoption of a market-based instrument and required the development of a scoping plan to lay out the strategy for meeting the emissions reduction goal. The law left the design of the future instrument to the California Air Resources Board (CARB) but put in place some guiding principles, such as ensuring the approach minimized carbon leakage, and did not disproportionately impact low-income communities. The first scoping plan was approved later in 2008, which recommended the implementation of a California Cap and Trade Program. Thus, the legal basis and objective of the ETS was established in legislation while much of the details on design and implementation were developed through regulations.

The design features of an ETS that are set out in formal statutory law may be more resilient to judicial or political change but are also more cumbersome to amend. Therefore, legislators need to make a choice about the design elements that should be in legislation and the elements that can go in subordinate instruments like regulations or technical guidelines.

Figure 7-2 Hierarchy of norms: The normative pyramid



Generally, those details that are more important to the operation of the system, or that are more politically sensitive, will be defined in legislation, while more technical issues may be set out in subordinate instruments. Figure 7-2 presents a hierarchy of legal norms that can be used to help identify which elements should be included in legislation. Where a norm is situated in this hierarchy will entail different procedural requirements, with ramifications for the regulatory timeline and extent of stakeholder involvement. This will impact its flexibility to adjust to changing circumstances and has implications for the perceived legitimacy and legal certainty it affords. The higher the rank of the norm, the greater the resilience against judicial reviews, as well as amendment or annulment following political changes. However, the higher-ranked norms are more cumbersome to adopt or adjust. Therefore, opting for ETS rules situated higher up in the normative pyramid, such as formal legislation, can strengthen the legitimacy and political durability of the ETS, but also tends to result in a slower and more cumbersome adoption or amendment process.

Since the political context of an ETS and market fundamentals are in states of constant change, jurisdictions will seek to retain differential degrees of flexibility regarding certain elements. The legal basis, which consists of the central parameters of the ETS (such as its overarching objectives, general principles, and the main rights and duties of regulated entities), are usually regulated at a higher, more formal level. Technical guidance or operational details that require frequent updating (such as benchmarks or detailed MRV rules) are commonly adopted by way of more flexible regulations and decrees. California's legislation specifies the overall emissions reduction target from the ETS and a high-level overview of the features of the ETS — for example, the start date and duration, the existence of an auction system, and the development of offsets. AB 32 specified that regulation must be published with regard to regulated entity subjects and reporting requirements. This provides California's Air Resources Board more flexibility to adjust the precise features of the ETS.

Similarly, in federally organized or supranational jurisdictions, regulators must decide what to regulate at the central level and what to delegate to regional or local authorities. Greater centralization has the benefit of allowing for better coordination and helping avoid uneven implementation across jurisdictions. However, many tasks require knowledge of local circumstances and direct contact with compliance entities and may therefore benefit from delegation to local authorities. Box 7-1 illustrates the European Union's (EU) choices on legal pedigree and degree of centralization, as well as the timeline for adopting the EU ETS legal framework.

Box 7-1 Technical note: Legal pedigree and legislative timeline in the EU ETS

For the EU ETS, the regulator opted to set out the main elements of the legal framework in a directive including central features such as scope and coverage, issuance of allowances, and compliance and enforcement.[244] Since the initial directive, there have been over a dozen subsequent directives, regulations, and decisions that have made numerous changes to the ETS, including updating the legal framework to reflect new mitigation targets and a link to international offsets, extending the market to new sectors and gases, establishing common infrastructure systems such as the Union Registry, and providing technical guidance and procedural details on design features such as auctioning and MRV. As a result, the legal framework of the EU ETS has evolved significantly over consecutive trading periods. Competences have been centralized in several areas (such as the allocation of allowances and operation of the registry) where implementation at Member State–level proved inadequate. The revisions also added design aspects →

244 A directive is a formal legal act comparable to parliamentary legislation in a national jurisdiction.

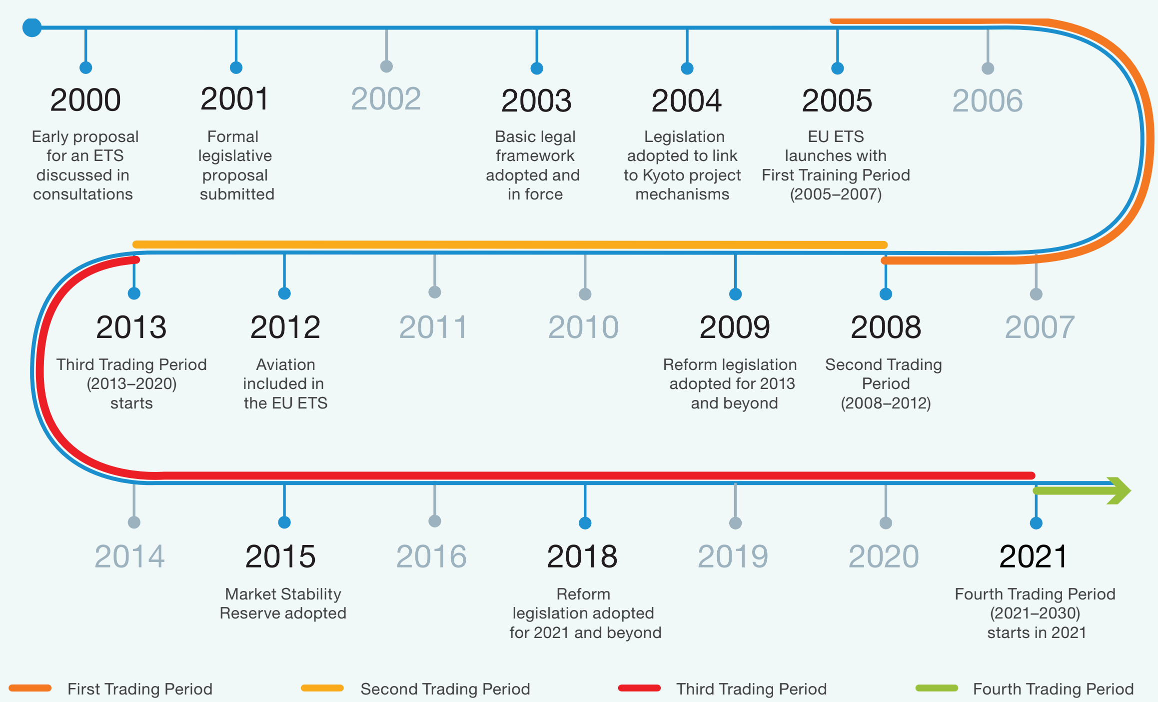
not envisioned in the original directive in response to observed regulatory gaps or design shortfalls (see Table 7-1).

The EU ETS legal framework has a relatively high degree of formality. This is at least partly due to the division of competences between the EU and its Member States. Table 7-1 lists legal acts that put key design elements of the EU ETS into action. The table indicates the level at which these acts would be situated in the normative pyramid described in Figure 7-2. Reforms and interventions have generally necessitated lengthy and complex amendment procedures due to the high degree of formality. This is illustrated in the legislative timeline of the EU ETS (see Figure 7-3), with almost five years passing between the first conceptual proposal and the actual start of trading. At the same time, the EU ETS has proven remarkably durable, withstanding, inter alia, several lawsuits aimed against it.

Table 7-1 Legal acts resulting in EU ETS design changes

Function	Norm	Level
Legal Mandate	Directive 2003/87/EC (as amended) Article 192 TFEU (legislative competence)	II I
Scope and Coverage	Directive 2003/87/EC (Annexes) Directive 2008/101/EC EEA Joint Committee Decision No 146/2007	II II II
Data Collection and Inventory Generation	Directive 2003/87/EC (as amended) Regulation (EU) No 525/2013	II II
Nature and Stringency of Target	Directive 2003/87/EC (as amended)	II
Issuance of Units and Definition of Benchmarks	Directive 2003/87/EC (as amended) Commission Regulation (EU) No 1031/2010	II III
Price Management and Compliance Flexibility	Directive 2003/87/EC (as amended) Decision (EU) 2015/1814 Decision No 1359/2013/EU Directive 2004/101/EC	II II II II
Registry	Commission Regulation (EU) No 389/2013	III
Monitoring, Reporting, Verification	Directive 2003/87/EC (as amended) Commission Regulation (EU) No 601/2012 Commission Regulation (EU) No 600/2012 Guidance documents and compliance tools	II III III IV
Compliance and Enforcement	Directive 2003/87/EC (as amended) Directive 2014/57/EU	II II
Market Oversight and Regulation	Directive 2014/65/EU Regulation (EU) No 596/2014 Commission guidance on the application of VAT to emission allowances	II II IV

Figure 7-3 Legislative timeline of the EU ETS



Once the appropriate degree of formality and centralization has been determined, a formal notification and stakeholder consultation is typically the next step. Inputs obtained during this process can also inform subsequent legislative or regulatory proposals. The regulatory proposal is often accompanied by an impact assessment that evaluates the relative costs and benefits of the proposed measure. The exact procedural and material requirements vary between jurisdictions, often reflecting different regulatory traditions, as well as constitutional and administrative structures.

The legal framework also serves to put various elements of the ETS design steps outlined in this handbook into action, including the determination of the cap; allowance allocation; establishment of the registry, including its operating terms and the conditions and fees for account creation; maintenance and closure; rules and procedures on transparency and MRV, including accreditation of verifiers; the nature and level of sanctions for noncompliance; and — where the ETS design includes such features — a system for offset project approval and credit issuance, and rules governing price or supply adjustment measures (PSAMs).

An ETS will exist within a densely populated context of existing rules and principles across countless issue areas. As an instrument of climate policy, the ETS will often be rooted in the administrative and regulatory system dedicated to environmental protection. Therefore, the ETS can build on that existing body of rules and institutions for its implementation, helping lower administrative costs. However, it may need to be established through entirely new structures if existing rules do not suffice. Regulators need to be aware of overlaps with other issue areas, such as the regulation of economic activity or the regulation of energy markets, to ensure the best possible legal alignment of the ETS with the broader legal system and minimize the risk of conflicts or judicial disputes.

Financial market regulation is often highly relevant for emissions trading, influencing the oversight of the allowance market (see Section 7.6 of this chapter). It is advisable to consider from the outset the treatment of allowances and ETS transactions under other relevant regimes, for example, taxation and financial accounting rules, the law of property, contract, obligations, tort, and insolvency. Clarity on the legal nature and treatment of allowances and their transaction can help avoid legal uncertainty, reduce transaction costs, and preempt loopholes that might undermine the integrity of the ETS and the market it engenders (see Box 7-2).

Box 7-2 Technical note: Legal nature of allowances

How allowances are legally defined and treated has a number of important economic consequences for market participants. Such consequences include

- whether allowance holders can acquire genuine ownership of allowances, along with the rights that convey with property, or only enjoy possession;
- whether allowances are classified as financial instruments and thus fall within the remit of financial market rules;
- whether and when allowances are taxed, and on what basis;
- whether allowances can serve as collateral or security for a loan; and
- how allowances are treated in the case of insolvency of their holder.

Regulators have not always anticipated these questions and possible outcomes, nor in every case chosen to adopt clear and consistent legal guidance. Hence, the definition and treatment of allowances has displayed significant heterogeneity across systems, often evolving over time and on a case-by-case basis through judicial or administrative decisions, consistent practice of relevant actors (such as tax accountants), and the recommendations of professional bodies such as the International Accounting Standards Board.

In California, for instance, allowances are explicitly precluded from conveying property rights, given concerns that regulators might otherwise be unable to specify how much allowance holders may emit. In the EU ETS, meanwhile, some Member States treat allowances like property, while others consider them administrative or "sui generis" rights that afford their holders fewer privileges than full property.[245] Likewise, different jurisdictions apply different rules on how allowances are valued in the financial accounts of holders, with some requiring that they be valued at their purchase price and others at fair market value, substantially affecting the taxable basis when allowances are sold. Rules on capitalization and allowance depreciation also vary considerably between jurisdictions. Such differences can result in legal uncertainty and higher costs for market participants and may also increase the risk of abusive practices. For that reason, for instance, value-added taxation of allowances traded in the EU ETS was eventually harmonized to prevent tax fraud, and since 2018 EU allowances are classified as financial instruments under financial market rules.

245 See, for instance, European Commission 2019c.

Once the ETS has been set up, a new phase in the governance of the system begins: routine operation. This phase is focused on exercising institutional functions and applying and enforcing rules. These operational aspects are considered in the remainder of this chapter.

7.1.2 IDENTIFYING AND MANAGING LEGAL ENTITIES

As discussed in Step 3 of the handbook, there is a wide range of options available for determining the ETS scope and points of obligation. These decisions will need to be formalized in a set of rules determining which installations, facilities, or operations are covered by the ETS and the nature of the interactions that are expected between these entities and the ETS regulator. A regulator will need to keep track of these arrangements by identifying legal entities, assessing the nature of existing or new regulatory relationships with regulated entities, and updating the list of regulated entities over time, as described in the subsections below.

Identifying the regulated legal entities

Legal entities in an ETS are those that are responsible for emissions and ensuring compliance with ETS legislation. The point of regulation might be at the facility level, but those that are responsible for the MRV are the legal entities, most commonly a corporation but also potentially an individual or government entity. There are two main approaches to identifying the regulated entities within an ETS. They may be identified through self-nomination — consistent with the self-reporting of tax liabilities by liable entities in many jurisdictions — or identification may be based on a regulator's own research. Often a combination of these approaches is used. Once an approach is decided upon, an appropriate list of entities regulated by the ETS will need to be drawn up and published to provide clarity and transparency to businesses.

Leveraging existing reporting frameworks with regulated entities

Regulators often have existing relationships with, and frameworks for, entities newly regulated under an ETS, which they can build upon when setting up the ETS compliance cycle. For example, fossil fuel power stations may have reporting obligations on production, energy use, or emissions from sulfur dioxide, nitrous oxide, and other pollutants. These (legal) arrangements provide clarity on which legal entity is regulated and support the establishment of regular reporting cycles and penalty systems. Similarly, large industrial installations may already be subject to a compliance cycle associated with maintaining and enforcing licenses to operate. Other helpful relationships may exist between government statistical agencies and regulated entities and/or between government departments and industry associations. New or expanded rules will become necessary if existing frameworks are insufficient to ensure compliance with the ETS. Depending on the jurisdictional context, such rules may be based on existing powers granted to the ETS regulator or may necessitate new legislation.

Managing regulated entities over time

The list of regulated entities changes over time and must be continuously managed and updated. Businesses may open or close, expand, dispose of, or merge their operations, with implications for the specific legal entities involved and their compliance requirements under an ETS. These changes will not align with the compliance cycle of the ETS, requiring the regulator to determine rules and processes for managing part-year emissions liabilities and compliance requirements. Most ETS regulators have a regular cycle for updating the list of regulated entities and oblige entities to report material changes in their eligibility or the legal ownership of assets.

7.2 MANAGING THE REPORTING CYCLE

An ETS requires effective MRV.[246] Monitoring involves emissions quantification through calculation or direct measurement, which must then be consolidated in an emissions report. Typically, these reports are then verified by independent service providers (verifiers) or through similar audit processes. As an illustrative example, Figure 7-4 details the EU ETS MRV cycle. As such, a regulator must provide the following key elements of an MRV system, in line with the relevant legislative regimes in the jurisdiction:

- methodologies for accounting and quantification of emissions and other necessary data (for example, in the context of allocation approaches such as benchmarking or output-based allocation);
- guidance on monitoring methodologies;
- templates for reports;

246 For more information on creating programs for the monitoring, reporting, and verification of greenhouse gas (GHG) emissions, please refer to the PMR's *Designing Accreditation and Verification Systems: A Guide to Ensuring Credibility for Carbon Pricing Instruments*.

- rules for the accreditation and use of verifiers; and
- details on the exchange and management of data.

It is important for MRV requirements to be established early given the number of components that must be communicated to stakeholders and the importance of MRV for implementing other aspects of policy such as allocations. The provision of detailed methodologies and guidance for regulated entities is key to enhancing compliance with the MRV system. Compliance can be further enhanced if the regulator minimizes the administrative costs for regulated entities, for example, through establishing information technology platforms that allow for efficient transfer of data and compliance reports. Regulators may design monitoring guidance in such a way that preexisting monitoring systems, such as process control systems, energy statistics reporting, and financial accounting systems,[247] can also be used for the MRV requirements under the ETS, lowering compliance costs.

Detailed guidance on MRV is provided in PMR publications, including the *Guide for Designing Mandatory Greenhouse Gas Reporting Programs, Developing Emissions Quantification Protocols for Carbon Pricing: A Guide to Options and Choices for Policymakers,* and *Designing Accreditation and Verification Systems: A Guide to Ensuring Credibility for Carbon Pricing Instruments*.

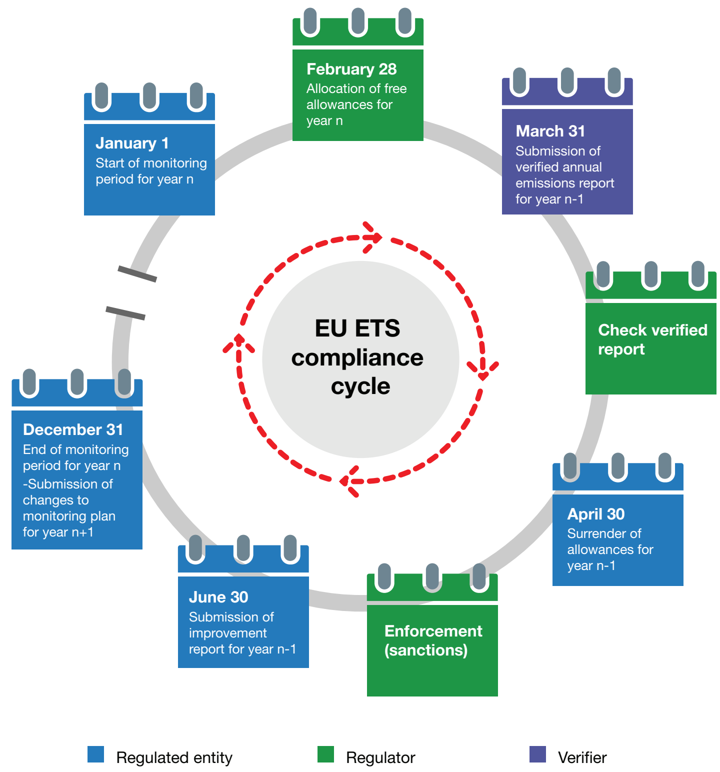
Key points on establishing monitoring requirements are provided in Section 7.2.1; on establishing reporting requirements in Section 7.2.2; and on establishing verification requirements in Section 7.2.3. Additional procedural considerations are discussed in Section 7.2.4.

7.2.1 ESTABLISHING MONITORING REQUIREMENTS

Monitoring refers to the process of collecting the data necessary to quantify emissions. The ETS regulator should define the specific monitoring requirements for all emission sources included in the scope of the system.

Monitoring guidelines must be available for each sector covered by the ETS. These can draw upon a wide library of detailed methodologies, product and activity descriptions, emissions factors, calculation models, and relevant assumptions,[248] although in some cases they will need to be tailored to the specific context of the ETS. Table 7-2 gives a brief overview of the approach to monitoring (and reporting and verification) in some of the jurisdictions with established ETSs. As also observed in Table 7-2, some jurisdictions require installations to have a monitoring plan. This plan outlines the steps the installation will take to monitor its emissions, including the site- or company-specific methodologies for measuring, calculating, and reporting data, and are subject to approval by the regulatory authority. Other approaches used by jurisdictions specify the monitoring requirements more explicitly in legislation, rules, or guidelines. Regardless of the approach to monitoring, the majority of ETSs require annual reporting through an online system.

Figure 7-4 MRV in the EU ETS



Source: ECRAN, 2014.

247 Such as SAP (Systems, Applications, and Products in Data Processing).
248 ICAP 2016g provides links to monitoring approaches used around the world on its website.

Table 7-2 MRV approaches by ETS

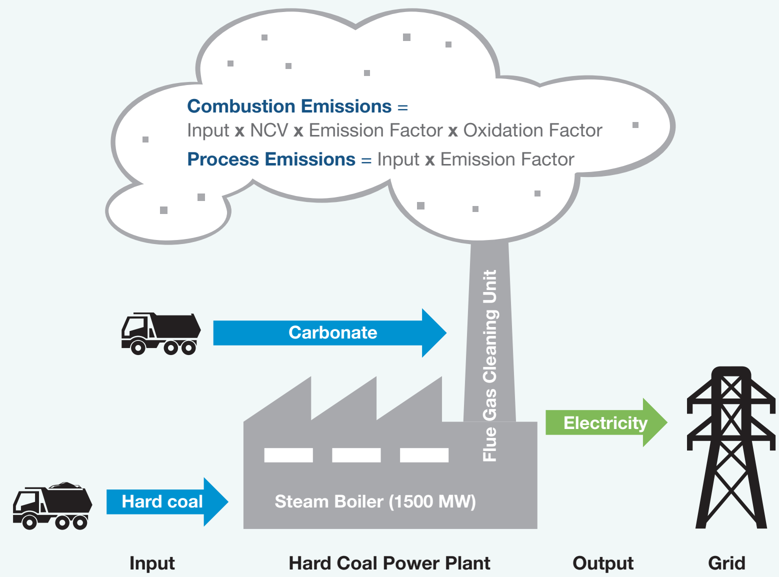
Jurisdiction	Monitoring methodologies	Verification required for	Reporting software/platform
California	Both calculation and measurement may be used with specific tier requirements. Continuous emissions monitoring (CEM) is required for certain activities.	Monitoring Plan and annual Emissions Report	California Electronic Greenhouse Gas Reporting Tool (Cal e-GGRT)
EU ETS	For CO_2 calculation (standard methodology, mass balance), direct measurement, fallback approaches, or combinations of approaches can be used. For N_2O, direct measurement is required. A tier system sets requirements for data quality and accuracy.	Annual Emissions Report	Electronic templates (available from European Commission website)
Korea	Calculation with different uncertainty and data requirements. For some installations CEM, is required.	Annual Monitoring Plan and Emissions Report	National Greenhouse Gas Management System
New Zealand	Methodologies for each sector are provided. Generally, the accounting uses activity data on inputs. Emissions factors are specified by the ministry, but entities can apply for unique emissions factor. Majority of activities have to use calculation as standard methodology. However, use of continuous emissions monitoring is an explicit possibility in the context of the combustion of used/waste oil, used tires, or municipal waste.	Annual Emissions Report	Emissions reporting via the New Zealand Emissions Trading Register
Québec	Entities can choose their calculation methods among those provided by the ministry for each sector. If entities have measurement instruments, they must use the method associated with the instrument.	Annual Monitoring Plan and Emissions Report	IQÉA (Inventaire Québécois des Émissions Atmosphériques)
Regional Greenhouse Gas Initiative (RGGI)	Operators of unit combusting any type of solid fuel have to use continuous emissions monitoring. Operators of gas- and oil-fired units may use other methods, calculating emissions via daily fuel records with periodic fuel sampling to identify carbon content.	Annual Emissions Report	RGGI uses data from the US Environmental Protection Agency Clean Air Markets Division database in accordance with state CO_2 Budget Trading Program regulations. RGGI COATS
Tokyo	All major GHGs must be monitored and reported: CO_2, CH_4, N_2O, PFCs, HFCs, SF_6, and NF_3. Large tenants, that is, those with a floor space above 5,000 m^2 or over 6 million kilowatt-hours electricity use per year, are required to submit their own emissions reduction plan to the Tokyo Metropolitan government in collaboration with building owners.	Annual emissions report, including emission reduction plans	Electronic templates (available from Tokyo Metropolitan government website)

The variety of approaches to monitoring across jurisdictions shown in Table 7-2 illustrates that different monitoring requirements will work best for different sectors and different GHGs. One approach to monitoring is to prescribe different calculation methods depending on the size of the installation. For example, there could be a conservative default calculation method, which is relatively easy to apply (and verify) for small emitters, along with a requirement for larger emitters to monitor emissions more accurately (see Box 7-3).

Box 7-3 Technical note: Annual emissions monitoring (calculation) in a hard coal power plant

Power plants are a typical example for calculating emissions. This illustration shows a simplified example of the standard methodology to monitor and calculate combustion emissions from a hard coal–fired power plant. In a hard coal power plant there are two inputs: hard coal and carbonate. The hard coal is burned to generate electricity, which creates a large amount of carbon dioxide and other pollutants, including sulfur dioxide. Carbonate is used to react with the sulfur, thus preventing it from entering the atmosphere. Both the coal's and the carbonate's emissions will need to be calculated under an ETS. Here, emissions are calculated by means of activity data for the two inputs, coal and carbonate, multiplied by emissions and oxidization factors. The amount of hard coal and carbonate is measured via a truck weigh station; for the major emissions source, the steam boiler, the net calorific value (NCV), and the emissions factor are determined by sample analysis, while for the minor emissions from the flue gas cleaning unit a standard emissions factor can be applied. As the currently valid 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines work from a basis of complete fuel oxidation, the default value for the oxidation factor, calculated from the carbon content remaining in ash, is set at 1.

Figure 7-5 Simplified example of annual emissions monitoring (calculation) in a hard coal power plant



	Inputs	Heating Value (NCV)	Emissions Factor	Oxidation Factor	Emissions
	tons	Energy GJ/t	tCO_2/GJ		tCO_2
Hard Coal	1,087,387 (truck scale)	25.5 (sample analysis)	0.095 (sample analysis)	1	2,634,195
Carbonate	10,321 (truck scale)	—	0.44 (standard factor)	1	4,541
Total					**2,638,736**

Source: German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB/Futurecamp)

Determining which installations follow stricter monitoring can be defined using tiers of approaches. The IPCC[249] uses three tiers, each representing a level of methodological complexity. The first tier is the simplest, tending to use global standard emissions factors from IPCC. The second and third are generally considered to be more accurate. Tier 2 tends to be emissions factors at a jurisdiction or more disaggregated level. Tier 3 tends to be direct measurement or equivalently complex methodologies.

The differentials in monitoring requirements tries to seek a balance between a desire to minimize over-rewarding those who monitor poorly with a desire not to unnecessarily penalize small sources that may not be able to afford or have the capability for more accurate methods. An ETS may also require that facilities move up the tiers to more accurate methods over time as capacity improves. Box 7-4 presents an illustrative example on emissions monitoring requirements for a lime kiln included in the EU ETS.

249 Further details can be found in the *IPCC 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories*.

Box 7-4 Technical note: Monitoring emissions from a lime kiln

Background and context:

When Croatia joined the EU in 2013, installations in the power sector and industry had to ascertain whether it would be covered by the EU ETS. A manufacturing plant for dolomitic lime determined that it would be covered because its daily production capacity exceeded 50 tons of lime. The operator of the lime kiln, who had never been required to monitor and report on GHG emissions, was tasked with designing a monitoring plan. The plan, which is required in the EU ETS but not necessarily in other systems, had to be approved by the competent authority.

Methods for determining process and combustion emissions:

The relevant EU ETS instructions for meeting monitoring and reporting GHG emissions are laid out in the Monitoring and Reporting Regulation (MRR) and associated guidance documents. They specify that monitoring parameters such as activity data and calculation factors have to meet certain quality requirements, so-called "tiers." To minimize cost burden, minimum tiers are based on the amount of GHG emitted and less rigorous requirements are imposed on smaller emitters. As the plant's average annual emissions were between 50,000 and 500,000 tCO_2, it was considered a mid-size emitter (a "Category B installation"), which determined its options for monitoring methods.

When producing dolomitic lime, CO_2 is emitted during the chemical reaction that converts the raw material, that is, dolomitic limestone, into the final product (*process emissions*), as well as during the combustion of fuel to heat the kilns in which the conversion takes place (*combustion emissions*). Under the MRR, both the process and the combustion emissions have to be monitored and included in an annual emissions report.

To determine emissions the regulation provides a "standard calculation method" that builds, to the greatest extent possible, on data already available to the operator for other purposes, such as process control and financial bookkeeping. Another valid, albeit costlier, option is continuous emission monitoring based on sensor probes that measure CO_2 concentrations and volumetric flows in the flue gas stream. Here, the operator chose the standard calculation method as it was deemed that the required investment for installing probes was too costly in 2013.

To determine process emissions, the operator had a choice of focusing on either on the quantity of limestone input or the amount of lime output, multiplied by their respective emission factors and a conversion factor reflecting the proportion of unconverted limestone in the final product. The operator chose the second method as appropriate metering equipment was already installed for product quality control purposes. Lime production was determined using a regularly calibrated weighing belt, while various accessible data sources, including sales invoices, inventory data, and financial statements, were then used to corroborate the results and reduce the risk of errors.

The vertical annular shaft kiln used in the plant was fueled with natural gas. The operator had to determine whether the existing gas meter complied with the relevant quality requirements, especially regarding measurement uncertainty. The operator successfully demonstrated that the requirement for Tier 3 (± 2.5 percent over the reporting period) could be met. Therefore, use of the existing meter was allowed. For the combustion emissions, the calculation required establishing the calorific value of the fuel used to fire the kiln and multiplying it by the emissions factor of the fuel type and the oxidation factor indicating the amount of unburnt carbon. Given that the installation was midsize, the use of standard factors as established by the national inventory was allowed, thereby avoiding the costs for sampling and laboratory analyses.

Calculating emissions: An example

Under the MRR, process emissions are calculated using the following formula:

$$Em = AD * EF * CFF$$

where ***Em*** stands for emissions (in tCO_2); ***AD*** for activity data; ***EF*** and ***CF*** for emissions and conversion factors, respectively.

The plant's production data determined ***AD*** to be 63,875.25 tons of lime in 2013. On average, the ***EF*** was determined to be 0.91 tCO_2/t and the ***CF*** of limestone to lime in the plant's kiln was 0.96. Applying the above formula yielded total process emissions of 55,801 tCO_2 in 2013.

For the natural gas used to fire the kiln, the operator was allowed to use the reference values set out in the national inventory, namely an emission factor of 56.1 tCO_2/TJ and a net calorific value of 34 $TJ/10^6m^3$. Likewise, the rules allowed applying a fixed oxidation factor of 1.

→

For combustion emissions, the MRR sets out the following formula:

$$Em = AD * EF * OF$$

where ***EM***, ***AD***, and ***EF*** are as defined above and ***OF*** is for oxidation factor. Furthermore, activity data of fuels is calculated using the formula

$$AD = FQ * NCV$$

where ***FQ*** stands for fuel quantity and ***NCV*** for the net calorific value.

In 2013 the plant had combusted 7,095,379 m^3 of natural gas. Thus, the combustion emissions of the plant in 2013 amounted to 13,534 tCO_2. Adding these combustion emissions to the process emissions calculated earlier showed that the plant's emissions in 2013 were 69,335 tCO_2.

The regulator needs to balance a desire for accurate and robust data while limiting the potential for gaming. This is especially true in the early phases of an ETS when a long time series of consistently monitored and reported data is lacking. This creates uncertainties about site-specific factors that can give rise to significant potential for gaming. A stepwise phase-in of more precise monitoring and reporting approaches, starting with default factors followed by a carefully supervised transition to site-specific sampling and emission factor calculation, may reduce these risks (see Box 7-5).

Box 7-5 Technical note: Default emission factors for balancing cost with accuracy

Default emissions factors can be used to provide an estimate for emissions without having to directly measure emissions factors from a particular source. They allow entities to save costs on detailed monitoring procedures and are feasible where emissions sources are similar. In New Zealand, default emissions factors are available for most emission sources unless a participant prefers to obtain a "Unique Emissions Factor" through direct measurement.

A default emissions factor should be set to ensure that it provides reasonable accuracy without penalizing sources that may not be able to use more accurate methods (based on costs or capabilities). The use of defaults may also be restricted to smaller emitters and avoid the use of uncertainties related to site-specific emission factors to game the system, especially in the initial and early phases of an ETS.

If there is no flexibility to measure emissions other than the default factor, entities will not be incentivized to introduce new and cleaner inputs. Overall accuracy can be improved if flexibility is provided for entities to adopt more accurate approaches than the default, as the information provided by those entities can also be used to improve default factors.

7.2.2 ESTABLISHING REPORTING REQUIREMENTS

Regulated entities need to report their monitoring data to the regulator in a standardized and transparent form. Emissions report timing should be aligned with compliance time frames (see Step 6 for more details about the frequency of compliance requirements), typically providing sufficient time after the end of the monitoring period for reports to be prepared. The regulator can design an efficient reporting process by[250]

- providing regulated entities with clear guidance about reporting requirements, including:
  - the type of information to report,
  - the frequency of reporting, and
  - how long records should be kept (typically between 3 and 10 years);[251]
- standardizing emissions reports to ensure consistency over time and across reporters;
- aligning timing of emissions reports with existing financial reporting cycles and compliance time frames; and
- creating electronic reporting formats to cut down on processing time and transcription errors, for example, through web-based reporting platforms that can reduce time demands, easily manage large volumes of data, automatically check for errors, and bolster security.

When establishing reporting requirements, it is important to consider the ETS context. Many jurisdictions already collect

250 Prada 2010.

251 The PMR's *Designing Accreditation and Verification Systems: A Guide to Ensuring Credibility for Carbon Pricing Instruments*.

inputs to the calculations used for emissions reporting, such as energy production and consumption, transport and distribution statistics, fuel characteristics, industrial output, and transport statistics. Synergies with company process control systems and financial accounting systems can help avoid duplication of information flows and ensure that reporting requirements are practical and effective.

Some types of allowance allocation may require additional data (see Step 5). Many ETSs require the monitoring, reporting, and verification of activity data (for example, tons of clinker or steel produced). Even if these are not needed for allocation initially (for instance, if allocation is done through grandparenting), collecting this data from the outset can help understand emissions intensities across sectors and help build the capacity and infrastructure that facilitates a shift to alternative allocation approaches such as benchmarking or output-based allocation in the future. Regulators should map out their data needs in advance, identifying what data they currently have access to, and make information requests from regulated entities as efficient as possible.

7.2.3 ESTABLISHING VERIFICATION REQUIREMENTS

Regulated entities have an incentive to under-report total emissions to pay less for compliance, and in some situations also to over-report emissions to receive more free allowances. Therefore, it is crucial to verify the accuracy and reliability of the information reported by the regulated entities.

Verification occurs when an independent party reviews an emissions report and assesses that the reported information is an appropriate estimate of emissions, based on the available data.[252] Quality assurance used by regulators comes in three forms. First, self-certification is where the reporting entity makes a formal assertion of the accuracy of its emissions report, often combined with auditing requirements and large punishments for misreporting. A second option is an external review by program administrators, to assess accuracy. Finally, third-party verification also provides for external review, but in this case the review is done by a qualified/accredited third party.

The approach to quality assurance should take into account the administrative costs for the regulator and the regulated entities, the capacity of regulators and verifiers, and the context of business compliance with other government regulations in a jurisdiction, as well as the likelihood and value of incorrect emissions quantification. In practice, many jurisdictions use more than one or even all of these approaches. When there is a strong culture of regulatory compliance, it may be possible to rely on self-certification with spot-checking by regulators. However, most ETSs require third-party verification, which provides higher levels of confidence in reported data. Section 7.3 discusses the different options for regulating such verifiers.

Given the complexity and site-specificity of many emission reports, some jurisdictions (including, for example, California, Québec, and Korea) extend the need for verification to the monitoring plans, which outline the methodologies for measuring, calculating, and reporting data, and are subject to approval by the regulatory authority.

7.2.4 PROCEDURAL CONSIDERATIONS

Procedural considerations in the design and implementation of an MRV system include:

- **Phased implementation.** Establishing and managing compliance with MRV systems is a time- and resource-consuming process that requires significant upfront investments. Regulators can adopt a learning-by-doing approach, for example, through implementing MRV systems in stages, starting with major emission sources or simpler methodologies, or incorporating additional components over time. Continuous changes in MRV systems may, however, be a source of confusion for regulated entities, which should be carefully managed by the regulator. To allow regulated entities to adapt to the new regulatory requirements, jurisdictions including Korea have used mandatory emissions reporting prior to imposing constraints on emissions. Korea established its MRV requirements before the formal launch of the ETS, which facilitated the introduction of an ETS (for more details see Step 10, the case study on Korea's Target Management System). Early data collection can also be useful for cap setting and for distributing allowances (see Step 4 and Step 5, respectively).
- **Case-by-case technical decisions.** Where guidance is inconclusive, decisions will need to be made on a case-by-case basis by the regulator. This process of interpretation and technical decision-making can be supported by a technical panel or advisory committee.
- **Managing disclosure of sensitive data.** Businesses may be concerned that the data monitored and collected during emissions reporting may reveal confidential and commercially valuable information. The benefits of public disclosure of emissions and broader (market) transparency in the ETS need to be balanced with the objective to protect commercially sensitive information.[253] It is important to consult regulated entities on what information will be made publicly available before the system starts (see Step 2). Despite business concerns, it is likely that much of

STEP 7 COMPLIANCE

252 IPCC 2000.
253 The PMR's *Designing Accreditation and Verification Systems: A Guide to Ensuring Credibility for Carbon Pricing Instruments* discusses this in further detail.

the data is often already published by companies and/or business associations. Policymakers should test whether disclosing such information would compromise commercially sensitive information. The timing of the disclosure could also present issues. In California, all emissions data is released at the same time following verification. This alleviates concerns over some entities having early access to the data, which may inform them of potential market demand.

7.3 MANAGING THE PERFORMANCE OF VERIFIERS

As discussed in Section 7.2, MRV in most ETSs require the use of third-party verifiers. This section discusses the process of accrediting third-party verifiers (Section 7.3.1), and balancing risks and costs in the verification process (Section 7.3.2). For further reference see the PMR's *Designing Accreditation and Verification Systems: A Guide to Ensuring Credibility for Carbon Pricing Instruments*.

7.3.1 ACCREDITING THIRD-PARTY VERIFIERS

To ensure the quality of third-party verifiers, the regulator should establish a verifier accreditation process — either internally or involving a domestic or accessible international accreditation body.[254] This is useful in providing an independent assessment of the verifier's technical competence in emissions accounting, calculation, and measurement of emissions from specific sources and sectors. It may also help ensure that the verifier can retain impartiality while conducting the verification in accordance with program rules.

There are internationally recognized standards that a regulator can use or adapt for this purpose, such as those by the Clean Development Mechanism Executive Board and the International Organization for Standardization (notably ISO 14064-3 and ISO 14065, as well as ISO 17011, which provides general requirements for accreditation bodies assessing and accrediting verifiers).[255]

7.3.2 BALANCING RISKS AND COSTS IN THE VERIFICATION PROCESS

Typically, verification requires that regulated entities have their reports scrutinized by an accredited verifier who must confirm that the regulated entity is complying with all of the requirements of the monitoring and reporting system. This is generally based on detailed guidelines and standards from the ETS regulator, including checklists and risk registers to establish the levels of compliance with the requirements. Verifiers must also use their own professional judgment to understand the regulated entity's key risks of noncompliance, assess compliance with the program requirements, and undertake sufficient investigations so that they have enough confidence to issue their assurance statement.

This approach is intended to achieve good risk management. However, there are options that a regulator might consider if there are concerns that this might create excessive regulatory burden, including

- allowing or requiring regulated entities to provide quality assurance statements or self-certification for all reports, with legal liability assigned for false reporting;
- assessing only a sample of reports selected by the ETS regulator for detailed review and/or third-party verification after they have been submitted;
- focusing reviewing and auditing only on compliance in the areas of high risk that have been identified by the ETS regulator (for a specific regulated entity); and/or
- reducing the frequency of review or verification.

Regulated entities may have an incentive to avoid compliance to reduce their costs, with auditors potentially allowing this behavior to maintain relations with clients. Therefore, while the approaches to reduce the regulatory burden may reduce the costs that regulated entities need to incur, they also increase the risk that entities fail to comply with the ETS requirements, which could undermine the credibility of the system. One solution to minimize costs for regulated entities, as applied in some of the Chinese ETS pilots, is to maintain the more rigorous procedures but for the government to fund the verification process.[256]

254 This option is in the European Commission Regulation (EU) No 600/2012: "A Member State that does not consider it economically meaningful or sustainable to establish a national accreditation body or to carry out accreditation activities should have recourse to the national accreditation body of another Member State. Only national accreditation bodies that have undergone a successful peer evaluation organized by the body recognized under Article 14 of Regulation (EC) No 765/2008 should be permitted to perform the accreditation activities pursuant to this Regulation."

255 ISO 2006, 2007, 2011.

256 SinoCarbon 2014.

Regulators may choose to establish verification guidelines. As verifiers need time to form specialist teams and develop the right tools and methods to perform verification tasks, it is important for the ETS regulator to carefully monitor and manage their performance, particularly in the early stages of the ETS. In some of the Chinese pilot ETSs, for instance, some verification reports are double-checked by experts or other verifiers appointed by the regulators. In the pilots, it is only in the case that a verification report is of poor quality that verifiers will be asked to revise the report. In addition, regulators may stipulate a period of time after which accreditation must be renewed.

In deciding whether to involve third-party verifiers, it is important to consider the local context in which the ETS is operating. For instance, in some jurisdictions, company financial reporting is regulated through audited self-reporting, with civil and criminal penalties for misreporting. With robust compliance mechanisms, using a similar approach in an ETS could ensure a credible MRV system that is aligned with common practice in the jurisdiction. Similarly, review by program administrators may alleviate the need for third-party verification in jurisdictions where there is strong infrastructure in place for program administrators. Considering the efficacy of approaches used in other areas of government regulation can provide guidance on the most appropriate quality assurance options.

7.4 DESIGNING AN ENFORCEMENT APPROACH

Effective compliance relies on establishing processes that are transparent and well communicated. If information about compliance is easy to understand, accurate, complete, and accessible, then regulated entities will be more likely to comply on time and without errors. Appropriate capacity-building measures targeting regulated entities are key in this regard (see Step 2). In addition, consideration of the local legal frameworks already in place and the type of enforcement that has worked in other policy areas is key to designing a successful enforcement approach. New Zealand's enforcement for their ETS uses the pre-existing enforcement framework. New Zealand tax legislation trusts the liable entity to report correct figures with minimal oversight and self-assessment of figures but has large penalties in the case of noncompliance.[257]

While well-designed MRV processes can increase compliance rates, to ensure full compliance across the whole of the ETS, a credible enforcement regime with appropriate penalties must be developed. These penalties should be sufficiently punitive to incentivize compliance and should thus incur a substantial additional cost compared to the cost of complying with the ETS. The regulator needs to ensure it can enforce penalties and that, in the event of noncompliance with penalties, it can invoke powers to investigate or prosecute through fines or other civil or criminal sanctions. For example, in New Zealand, the law gives the regulator extensive prosecution provisions for noncompliance, which can result in significant financial and criminal sanctions.[258]

Penalties should be set at a level that exceeds an entity's expected benefits of noncompliance. Typically, there are three categories of noncompliance that carry penalties:

- emitting in excess of the number of allowances surrendered;
- misreporting or not reporting emissions and other data before specified deadlines; and
- failing to provide, or falsifying, information to the regulator, verifiers, or auditors.

Some ETS pilots in China also penalize verifiers who provide fraudulent information or reveal confidential information.[259]

Penalties, which are often used in combination, may include the following:

- **"Naming and shaming."** The names of noncompliant entities can be published. This may be particularly useful in jurisdictions where a company's reputation would be significantly affected by such a statement.
- **Fines.** These can either take the form of a fixed amount or be set pro rata to the extent of the noncompliance, for example, per ton of emissions without a corresponding surrendered allowance. The value of the fine can be set by reference to the observed market prices for allowances. A fine may be higher for intentional noncompliance than for unintended mistakes.
- **"Make-good" requirements.** This can help maintain environmental integrity. Installations may have to comply within a certain time period, by buying allowances from

257 New Zealand Environmental Protection Authority 2020.
258 New Zealand Environmental Protection Authority 2013.
259 SinoCarbon 2014.

the market or borrowing from their future allocation (usually at an unfavorable exchange rate).

- **Further measures.** Ongoing or repeated intentional noncompliance may call for stronger penalties, including criminal charges. In addition, or alternatively, penalties outside of the ETS might be used. For example, some of the Chinese pilot systems linked ETS performance with new construction project approvals, performance evaluation for state-owned companies, eligibility to enjoy some preferential financial policies, and credit records.[260]

Table 7-3 shows details of penalties for noncompliance with allowance surrender obligations applied across different jurisdictions, with most jurisdictions requiring a make-good surrender alongside other penalties. In general, the more mature ETSs have larger penalties for noncompliance. A range of other penalties are applied in most jurisdictions for other offences relating to MRV requirements, such as not reporting on time or withholding information from a verifier.

Table 7-3 Penalties for noncompliance with surrender obligations across jurisdictions[261]

Jurisdiction	Penalties
California	*Make-good requirements and fines:* Under the Cap and Trade Regulation, if an entity fails to surrender sufficient compliance instruments to meet its obligation, California requires that the entity submit four compliance instruments (only one quarter of which can be offsets) for each instrument the entity failed to surrender. Of these four instruments, one is permanently retired, and three allowances are recirculated through the auction mechanism. If an entity fails to submit these four compliance instruments, California may institute formal enforcement actions, including seeking penalties. This includes penalties of USD 1,000 to USD 10,000 (EUR 901–EUR 9,008) per day per violation (i.e., per metric ton that remained unsurrendered) for strict liability, and increasing amounts depending on the level of intent.
European Union	*Naming-and-shaming, make-good requirements, and fines:* The name of the noncompliant entity is published. Regulated entities have to buy and surrender the equivalent amount of allowances for each tCO_2 emitted for which no allowances have been surrendered. A fine of EUR 100 for each tCO_2 emitted for which no allowance has been surrendered.
Kazakhstan	*Make-good requirements and fines:* The noncompliance penalty equals five monthly standard allowances for each ton (approximately KZT 12,625 per tCO_2 [EUR 29.99 per tCO_2] in 2019). In 2013 and 2014 penalties for noncompliance were waived.
Korea	*Fines:* A fine of up to three times the average market allowance price of the given compliance year or KRW 100,000 per ton (g) (EUR 77.30 per ton) for each tCO_2 emitted for which no allowance has been surrendered.
Mexico	*Other measures:* The Mexican ETS pilot is designed to pose no economic burden on regulated entities; however, in case of noncompliance, entities lose the opportunity to bank unused allowances for the next compliance periods within the pilot. Moreover, noncompliant entities will receive fewer allowances during the operational period of the national ETS (two fewer allowances for each nondelivered allowance during the pilot).
New Zealand	*Fines:* An automatic surrender/repayment penalty will apply when an entity has failed to surrender or repay allowances by the due date. Each overdue unit will incur a cash penalty of three times the current market price.
Québec	*Make-good requirements, fines, and other measures:* Companies failing to surrender enough allowances to match their emissions have to surrender the shortfall plus three additional allowances for each allowance they failed to remit. Furthermore, depending on the infraction, they can face additional charges varying from CAD 3,000 to CAD 600,000 (EUR 2,064–EUR 382,045) for each tCO_2 emitted for which no allowances have been surrendered as well as CAD 10,000 (EUR 6,883) administrative sanction. Fines are doubled in the case of a second offence. In addition, the Minister of the Environment and the Fight against Climate Change may suspend the allocation to any emitter in case of noncompliance.

260 Information about penalties outside the ETS in the Chinese pilots are noted in Hongming 2015.

261 The information about noncompliance penalties in jurisdictions other than California and New Zealand are retrieved from the ICAP website, “Introduction to ETS, MRV and Enforcement”: https://icapcarbonaction.com/en/mvr-and-enforcement. Information about penalties in California are also sourced from California Air Resources Board 2018b and Government of California 2016, while those in New Zealand are sourced from Shaw 2019.

Table 7-3 Penalties for noncompliance with surrender obligations across jurisdictions *(continued)*

Jurisdiction	Penalties
RGGI	*Make-good requirements and fines:* In the case of excess emissions, compliance allowances for three times the amount of excess emissions have to be surrendered in future periods. Furthermore, regulated entities may also be subject to specific penalties imposed by the RGGI Member State where the entity is located.
Switzerland	*Make-good requirements and fines:* Missing allowances and/or international credits have to be surrendered in the following year. In addition, a fine of CHF 125 (EUR 117) for each tCO_2 emitted for which no allowance has been surrendered.
Tokyo	*Make-good requirements, naming-and-shaming, and fines:* First stage: The governor orders the facility to reduce emissions by the amount of the reduction shortage multiplied by 1.3. Second stage: Any facility that fails to carry out the order will be publicly named and subject to penalties (up to JPY 500,000 [EUR 4,124] and surcharges of 1.3 times the shortfall).

7.5 DEVELOPING AN ETS REGISTRY

Regulators must ensure that regulated entities surrender the correct number of eligible allowances by the relevant compliance date. To keep track of market transactions and surrendered allowances, an ETS requires a registry where transfers of allowances are recorded and monitored. At the end of each compliance cycle, regulated entities can then transfer (or surrender) allowances via the registry to the ETS regulator to meet their emissions liability for the period.

Section 7.5.1 discusses the process of setting up a registry. Section 7.5.2 discusses prevention of fraud. Section 7.5.3 discusses how registry data and design can support market operations. The PMR's *Emissions Trading Registries* guide has further details on regulation, development, and administration of registries.

7.5.1 SETTING UP A REGISTRY

Registries are IT databases that assign a unique serial number to each allowance and track those serial numbers from their issuance onward. Registries contain information on who has been issued allowances, who holds those allowances as well as other allowances, and details on surrendered or canceled allowances. Market participants sign up to the registry and create an account where their allowances are stored. In creating a registry, policymakers may look to use an existing registry used by a different jurisdiction as a template, while still retaining control of their own registry. The registry can serve a broader purpose than just putting the ETS into action, potentially supporting other climate policy instruments (for instance, renewable energy trading systems) and providing information relevant for development of climate change policy design and mitigation strategies.

Establishing an ETS registry involves the following steps:

- **Creating the legal framework for a registry.**[262] The legal framework for a registry will ideally reflect the nature, scope, and scale of the proposed ETS. The regulator must establish timelines for drafting, conducting consultations on, and implementation of, this framework. The registry design may need to be aligned with other areas of law — such as property, tax and accounting, insolvency, and financial laws — and address these with the bodies responsible for those laws. If necessary, external expertise and support should be drawn in. The most challenging legal aspects often relate to the determination of the legal nature of the allowances[263] and the allocation of responsibilities to all the bodies involved. These should be identified and addressed at an early stage to avoid later disputes.
- **Setting up the institutional framework for administering a registry.**[264] The regulator should list the responsibilities of the registry administrator and determine the terms of use and fees for registry users, as well as the size and structure of the budget for registry administration. On this basis, it should decide which entity is best placed to assume this role. Combining the registry administrative functions with other ETS public functions may be beneficial for specialization, knowledge pooling, and providing a single point of

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262 For more information on creating the legal framework for registries, please refer to Zaman 2015.
263 It is important to decide on the legal nature of emissions allowances, for example, whether they are an administrative grant, license, or property. Where this is not stipulated in law, opportunistic speculation may occur. This is further discussed in a PMR background note on legal arrangements (Zaman 2015).
264 For more information on creating the institutional framework for registries, please refer to Dinguirard and Brookfield 2015.

contact between government and stakeholders. It should establish cooperation procedures between the registry administrator and relevant authorities (for example, market oversight and regulation).

- **Specifying the functional and technical requirements for a registry.**[265] This includes procurement of the relevant IT systems; identifying and addressing security issues and options; defining the data to be managed; estimating the volume of data and number of transactions to be processed; establishing traceability procedures including audit logs, notifications, and messages; formulating the main business rules and alerts; specifying the main reports to be produced by the registry; and creating the main pages of the registry website.

7.5.2 PREVENTING FRAUD

Robust technical systems and transaction security measures are necessary to ensure the integrity of the ETS registry and to minimize the risk of unauthorized use for criminal purposes such as fraud and theft of allowances. A key function of an ETS registry is the prevention of fraud. Along with the direct losses suffered as a result of fraudulent activity, fraud can compromise the reputation of the system and threaten confidence in the market. If fraud is discovered, a quick reaction to the events, and the appropriate strengthening of systems, can help minimize long-lasting damage.

Good security practices when setting up a registry provide the registry administrator with the authority to refuse the opening of an account, block or close an account, and freeze or revoke a user's access to the registry in a flexible manner. This requires the continuous supervision of daily transactions by the market monitoring authority to detect unusual behavior. In turn, detection of suspicious events or transactions and a prompt response mechanism are crucial. Furthermore, cooperation between the registry administrator and authorities that carry out criminal investigations is required to ensure rapid interventions where necessary.

In addition to regulatory instruments, specific technical security measures can be useful in countering fraud or theft of allowances within the registry. These measures include

- two-factor authentications and session time-outs;
- limitation of the registry's opening hours to working hours to facilitate intervention in case of misuse;
- password or other protection of sensitive operations (for example, transfers);
- enabling the registry to automatically use emergency stop functions, block accounts, and reverse operations; and
- performance of independent security audits of registry providers.

These measures are now common practice for most registries, in part due to lessons learned in the context of the EU ETS (see Box 7-6).

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265 For more information on creating the technical infrastructure for registries, please refer to Dinguirard 2015.

Box 7-6 Case study: Fraud and cyberattacks in the EU ETS

During the first two phases of the EU ETS, the sensitivities regarding national sovereignty and the jurisdictional limitations of the European Commission's mandate resulted in each EU Member State having its own registry system with varying functional and security arrangements. A Community Independent Transaction Log was used for checking and recording transactions of allowances between accounts. In several instances, heterogeneous registry account access requirements enabled cyberattackers to identify and exploit the weakest point of entry in a particular registry to hack and misuse EU ETS allowances. Major cases of fraud and cyberattacks against the registry accounts of the EU ETS included the following:

- **Phishing** (fraudsters impersonating a legitimate and trusted entity to make participants provide access to sensitive data). In January 2010 a handful of account holders in Germany had allowances stolen after responding to a fraudulent email requesting details to access their accounts.
- **Hacking**. In January 2011 several million EU allowance units (EUAs) were stolen from national registries of five Member States: Austria, Romania, the Czech Republic, Greece, and Italy.

In response, the EU ETS established the Union Registry, an EU-wide registry system, in 2012 along with the European Union Transaction Log, which replaced the original log. The unified registry system and security protocol made it easier to control transactions and prevent fraud. Some of the new EU ETS registry security measures include

- enhanced control for account opening consisting of stronger and harmonized know-your-customer checks;
- enhanced transactions security, including a range of security measures like a 26-hour delay at initiation of a transfer, a trusted account list, and better authentication methods for carrying out transactions (application of a "four eyes" principle, whereby transactions must be approved by at least two people);
- strengthened registry oversight, including administrator power to suspend registry access and block transfers;
- enhanced protection of the good-faith acquirer by acknowledging the holding of allowances in an account in the Union Registry as prima facie and sufficient evidence for title over them, and establishing rules on finality of transactions (rendering them irrevocable); and
- serial numbers of allowances became only accessible by administrators.

The interaction between the tax treatment of allowances and vulnerabilities within the ETS registry can also be the target of criminal activity. One example is the EU ETS tax regime, which until 2010 treated the transfer of an allowance as a service that attracted value-added tax (VAT) collected by the seller. A number of exchanges offered spot products (exchange-traded products with physical settlement by way of delivery of an allowance within 1–3 days of the transaction date). These products, along with the real-time transfer and settlement capability of EU Registries, allowed multiple transactions to be carried out in quick succession. Criminals exploited this to commit VAT carousel fraud: the acquisition of carbon allowances without paying VAT (because of the cross-border nature of the transactions), which were then sold in the same country at a price charging VAT, with the fraudsters then disappearing before the tax was handed over to the tax authorities. Europol estimated that approximately EUR 5 billion was lost to VAT carousel fraud between June 2008 and December 2009.

In response, the European Commission adopted legislation in March 2010 that allowed an optional reverse charge mechanism on emissions allowances. This means that the buyer instead of the seller is responsible for surrendering VAT on domestically traded emissions allowances. The reverse charge mechanism is most effective in stopping VAT carousel fraud if all EU members adopt and apply it simultaneously.[266]

7.5.3 SUPPORTING MARKET OPERATION

Some registry data can be made available to market participants and the public to allow interested parties to form views on the balance of demand and supply. This could facilitate the emergence of a liquid allowance market with robust price information. To this end, the registry should provide sufficiently granular data on emissions, allowance allocation and surrender, and compliance, while ensuring that appropriate standards of confidentiality and security are maintained.

Registry design can support the design of secondary markets and linking with other markets. A well-designed registry can help with the expansion of liquid secondary markets by facilitating trade. This helps reduce the administrative burden of trading for both participants and administrators (see Step 6). For instance, the EU

266 Adapted from PMR and Forest Carbon Partnership Facility 2016; Kossoy and Guigon 2012; Berrittella and Cimino 2017.

ETS registry is designed to facilitate automatic transfers of allowances on linked private exchanges if they meet standards for security and operation. By directly linking the registry and secondary markets, trades can be executed with a lower amount of effort by market participants, which facilitates trade. The adoption of consistent data standards, methodologies, and registry design can also facilitate linking between different ETSs, as discussed further in Step 9.

7.6 OVERSIGHT OF THE MARKET FOR ETS ALLOWANCES

In addition to MRV of emissions — and the associated surrender of allowances — the market for trade of allowances also requires oversight.[267] On the one hand, under-regulation and a lack of oversight risks fraud and manipulation; on the other hand, over-regulation may lead to spiraling transaction costs, restrict entities' ability to access financial risk-management tools, and stifle uptake of mitigation options.

The scope of ETS market oversight includes

- *who* can participate in the market;
- *who is* responsible for overseeing the market;
- *what* can be traded on the market;
- *where* transactions may take place; and
- other rules that affect the market's safety, volatility, and vulnerability to fraud, including those related to oversight of other financial and commodity markets.

These oversight rules need to be set both in the primary market (i.e., at the point of initial distribution of allowances) and in the secondary market (i.e., any subsequent transactions of allowances). The secondary market relates to both trades in the actual allowances (direct "over the counter" [OTC] trades as well as trades through exchanges), and trades in the derivatives of the allowances, such as contracts for future sales of allowances.[268] The experiences of existing ETSs also show that these oversight rules should be developed from the beginning of any ETS and that compliance with them should be rigorously monitored. The legal framework (see Section 7.1) plays an important role in enabling transactions in the market and balancing the legal rights of buyers and sellers of allowances through contractual arrangements and provisions on dispute settlement (see Box 7-7).

Box 7-7 Technical note: Contracting ETS transfers

When market participants engage in a transaction to transfer allowances or allowance derivatives, they enter into a contract. In this contract, the parties to the transaction agree on various terms, such as the amount, type, and vintage of transferred allowances or allowance derivatives; settlement and payment details, including price, delivery date, and currency; consequences of default, such as liability and termination; and applicable law and dispute settlement. For OTC transactions, each contract can, in principle, be entirely unique and tailored to the specific circumstances and requirements of its parties.

In practice, however, market participants tend to rely on standardized contracts issued by professional bodies, such as the International Emissions Trading Association, the International Swaps and Derivatives Association, or the European Federation of Energy Traders. These contracts are typically referred to as "Master Agreements"[269] and help streamline the contracting process by clarifying ambiguous regulatory concepts, providing greater certainty to counterparties, and enhancing overall market liquidity by lowering transaction costs for market participants.

When allowances or allowance derivatives are traded on exchanges, such as the European Energy Exchange in Leipzig or the Intercontinental Exchange in London, the terms of the transactions are set out in the conditions and administrative procedures governing access to the exchange, as well as — in the case of derivatives — the contract specifications of that financial product.

267 See Kachi and Frerk 2013 for a brief summary of key elements of market oversight.
268 Derivatives are financial products that derive their value from an agreement to buy or sell an underlying asset or commodity for a certain price in the future.
269 See, for instance, IETA 2019.

As in commodity and financial markets, several measures can be taken by regulators at various levels to minimize the risk of market misconduct, prevent systemic risk, and safeguard against manipulation. In general, approaches to reducing risks focus on knowing who is trading in the market, excluding traders with a history of market misconduct, ensuring that participants have the financial resources to honor their trades, and limiting the position that an actor can take in the market. Specific strategies to apply these safeguards include:[270]

- **Supporting exchange-based trading.**[271] Transactions on OTC markets are less transparent than those on exchanges and thereby lead to a degree of systemic risk. For example, if a single buyer and counterparty amass a very large share of transactions and either is incapable of fulfilling contractual obligations, the result may be a complete market failure. Exchanges may play a regulatory role with their own procedures in case of violations, such as membership suspension. They may also be useful in providing information on prices, volume, open interests, and opening and closing ranges.
- **Clearing and margin requirements.** While trading on exchanges is always cleared (i.e., there is a clearinghouse that becomes the central counterparty to the trade), this is not necessarily the case with OTC trading. Regulators are therefore increasingly requiring OTC clearing of standardized contracts. As clearinghouses require a deposit as collateral to cover the credit risk until a position is closed (also called a "margin"), this greatly reduces not only systemic, but also counterparty risk. Clearinghouses reduce counterparty risk because they ensure that each party has sufficient resources to clear any transaction. This provides confidence to both parties of the transaction and wards off financially unsuitable or fraudulent actors.
- **Reporting and disclosure.** In the absence of mandatory clearing or exchange trading, trade repositories or a central limit order book[272] can function as a registry for market orders and an archive of trades to provide regulators with information on market movements.
- **Position limits.** A position limit imposes a restriction on the total number of allowances or derivatives that may be held by a market participant or a group of market participants with business relationships to prevent the possibility that they seek to distort the market. Position limits can be enforced through transparency at the registry level, at the central clearinghouse level, or by an exchange.
- **Participation and licensing requirements.** Regulators have the option to impose restrictions on who can trade on what markets and decide whether licenses for these activities are required. For example, Korea limited market participation in Phases 1 and 2 to regulated entities and a small number of banks (i.e., market makers). Since Phase 3 financial intermediaries have been able to participate in the secondary market. Regulators can also introduce capital requirements to reduce systemic risk and disclosure rules covering business relationships with participants registered in the system. Generally, having more market participants will create a more liquid market, which is desirable. However, verification of identities and previous records for all market participants is important to reduce the risk of manipulation and fraud.

Utilizing existing regulatory tools. Some jurisdictions have regulated emissions allowances in the same way as financial instruments. Regulating this way allows for financial market regulatory tools and regulations to apply. The EU classified ETS allowances as financial instruments subject to EU financial regulation, including the Markets in Financial Instruments Directive, which regulates financial markets. Given credible financial market regulation, the EU determined that existing supervisory structures could perform the market-monitoring role. In California, while the auctions are overseen by the environmental regulator Air Resources Board, secondary market activity falls under the financial markets, which could require the involvement of both state and federal agencies within the United States. However, some jurisdictions, like New Zealand, do not define allowances as financial products but regulation governing trade is still based on existing financial regulation. Not classifying allowances as financial products may increase the risk of misconduct.[273]

- **Market monitoring reports.** These reports review and evaluate auction and secondary market activity to identify potential inappropriate activity and violations of regulation. The frequency and detail of these reports vary; for instance, RGGI's market monitor prepares an annual report that provides a comprehensive summary on pricing trends, participation levels, and market monitoring. More frequent and less extensive reports on prices and trade volumes are published each quarter, in addition to monitoring reports after each auction.

270 Kachi and Frerik 2013.

271 OTC trades involve a buyer and a seller coming to a negotiated terms of transaction which is represented in a contract. Usually, OTC transactions use standardized contracts particular to that ETS or jurisdiction.

272 Central limit order book (CLOB) are a centralized record of outstanding limit orders. Each limit order specifies to buy or sell allowances at a predetermined (or better) price.

273 Denne, Campbell, and Wright 2015.

7.7 QUICK QUIZ

Conceptual Questions

1. Why is compliance and market oversight important for an ETS?
2. What methods can be used to identify regulated legal entities?
3. How can ETS registry data be used to support market operation?

Application Questions

1. In your jurisdiction, are there existing environmental, tax, legal, and market administrative or regulatory processes that could be replicated or used for the ETS?
2. What type of legislation would be used to establish an ETS in your jurisdiction?
3. What are the benefits of a stand-alone MRV phase ahead of compliance requirements?

7.8 RESOURCES

The following resources may be useful:

- Developing Emissions Quantification Protocols for Carbon Pricing: A Guide to Options and Choices for Policy Makers
- Designing Accreditation and Verification Systems: A Guide to Ensuring Credibility for Carbon Pricing Instruments
- Emissions Trading Registries: Guidance on Regulation, Development and Administration
- Greenhouse Gas Data Management: Building Systems for Corporate/Facility-Level Reporting

STEP 8
Consider the use of offsets

BOXES

FIGURES

TABLES

AT A GLANCE

Checklist for Step 8: Consider the use of offsets

- ✔ Outline the potential role of offsets within an ETS
- ✔ Decide on the type of offsets allowed within the system (both geographical scope and governance of program)
- ✔ Weigh costs of establishing a domestic crediting mechanism versus making use of an existing crediting mechanism
- ✔ Decide on qualitative criteria and quantitative limits on the use of offsets

Carbon crediting is the process of issuing tradable emission reduction units to actors implementing approved emission reductions or removal activities. Emissions trading systems (ETSs) may allow for these carbon credits to be used as "offsets," and used for compliance in place of allowances to compensate for (i.e., offset) emissions by a regulated entity. Allowing offsets in an ETS is an option that brings a range of benefits and challenges but is not required for an ETS to operate. Nonetheless, some form of offsets is accepted to some extent in most existing ETSs.

For offsets to be credible it is essential that any credited emissions reductions or removals are "additional," that is, these reductions or removals would not have occurred if the crediting mechanism[274] did not exist. Offsetting works by allowing emissions from covered sources to increase to a level above the ETS cap so long as additional emissions are compensated for by emissions reductions or sequestration elsewhere. This means that offsetting would have no net impact on the overall emissions outcome, as long as carbon credits represent real, permanent, and additional emissions reductions.

Offsets may differ in two main dimensions: the geographic scope of mitigation activities and the governance of the crediting mechanism. The crediting mechanism may be limited to crediting emissions reduction or removal activities within the same jurisdiction or may include offsets generated outside the ETS jurisdiction. The program itself may be designed and governed by a domestic administrator, or it may rely on existing crediting mechanisms to varying degrees.

Crediting mechanisms broaden the carbon price signal to uncovered sectors and provide an avenue to generate abatement incentives in sectors that are difficult to include in the scope of the ETS for technical, political, or other reasons. This can increase the economic efficiency of the ETS by expanding the set of mitigation opportunities available. It also supports investment flows into those sectors and allows entities with the required capacity and willingness in uncovered sectors to "opt in" to emissions reduction activities. By lowering compliance costs and creating a new, supportive political constituency for the ETS in the form of project proponents,[275] allowing offsets may make an ETS more attractive to the private sector. This may in turn allow policymakers to set a more ambitious cap and may support policy stability. Crediting mechanisms can also be designed to target specific policy goals including improved air quality, restoration of degraded land, and better watershed management. Finally, crediting mechanisms can also support low-carbon investment, learning, and engagement among uncovered sources.

At the same time, the acceptance of offsets in an ETS presents potential challenges. Offsets represent a risk to environmental integrity if they are not additional (for example, if an actor would have undertaken an activity even in the absence of the crediting mechanism), not real (for example, if the emissions reductions did not occur), or not permanent (for example, if they are reversed and released into the atmosphere at a later stage). The inclusion of offsets, if not designed properly considering both domestic and international climate commitments, may also create perverse incentives for jurisdictions to implement lax climate commitments in offset-generating sectors and sources, weakening global environmental outcomes. Furthermore, there might be potential for double counting of offsets (for example, if the emission reduction benefits are claimed by both the host and buyer jurisdictions). This highlights the need for robust and transparent accounting measures.

Systematic approaches to manage these challenges include the use of additionality tests, mandating conservative baselines, requiring guarantees by the host jurisdiction, or setting aside a portion of the credits issued by every project in a common pool to act as insurance against the risk of reversal, leakage, or lack of additionality.

The use of offsets may also result in governance challenges. By providing flexibility in terms of mitigation opportunities, offsets can reduce prices and therefore dampen incentives to invest in abatement technologies in covered sectors. The use of offsets can also carry high transaction costs for both administrators and participants of the crediting mechanism. The shifting of mitigation effort between sectors may also raise distributional concerns. Offsets may create challenges for expanding ETS coverage over time as offset-generating

274 Crediting mechanism refers to initiatives that issue tradable credits to actors that voluntarily implement emission reduction or removal activities that are additional to business-as-usual operations. Other sources may use "crediting program" or "offset program" to describe the same initiative.

275 Project proponents are the entities responsible for implementing the emission reduction or removal project. Other sources may use the terms "project developers," "project owners," or "project designers" to describe the same entities.

firms resist the change from receiving offset revenues to incurring a liability for emissions.

To promote the integrity of carbon credits, it is important to ensure that they are generated in accordance with robust rules and methodologies, either by using an existing crediting mechanism for sourcing reductions domestically or internationally, or by creating a new crediting mechanism to achieve a set of specific domestic policy objectives. Ensuring the credibility of carbon credits also requires adopting a process for project registration and credit issuance, and determining liability in case of reversal of emissions reductions. Integrity concerns mean that careful consideration is required when deciding which crediting mechanism, geographic regions, gases, sectors, and activities generating carbon credits to accept into an ETS. Qualitative criteria for accepting carbon credits, for example, may be based on environmental integrity or the jurisdiction of origin. For carbon credits that are classified as eligible, quantitative limits may also be used to control the inflow of low-cost offset credits and the relocation of mitigation co-benefits.

Box 8-1 highlights some questions policymakers should ask themselves when considering allowing offsets within their ETS design.

Box 8-1 Technical note: Offsets and ETS

Policymakers should consider the following questions when determining whether, how, when, and from whom to allow offsets.

- Which sectors are not covered by the ETS? What is the potential for inclusion of these sectors in the ETS? Is there potential to manage the sectors through offsets?
- What should be the contribution of these uncovered sectors to national goals over time? How can this contribution be incorporated into offset design, for example through baselines?
- What role does the ETS play in the jurisdiction's long-term decarbonization trajectory and what role could removals play in the ETS?
- Is the recognition of offsets from outside the jurisdiction consistent with the goals of the ETS?
- How can it be ensured that offsets do not undermine the environmental integrity of the ETS?
- Will offset use be unlimited, or will it face restrictions?
- What approaches are most feasible for managing reversals and other risks?

This chapter provides an overview of offsets and the role they can play within an ETS. Further detail on designing crediting mechanisms to meet jurisdictional objectives can be found in the Partnership for Market Readiness's (PMR) *Guide to Developing Domestic Carbon Crediting Mechanisms*.

Section 8.1 explains what offsets are and how they affect emissions in an ETS. Section 8.2 elaborates some of the advantages of using offsets and potential challenges. Section 8.3 explains the types of offsets and how they may be sourced. Section 8.4 sets out an approach to applying qualitative criteria to the use of offsets — i.e., the geographic origin, types of gases, sectors, time periods, and types of activities eligible for carbon credit generation. It also discusses quantitative criteria.

8.1 WHAT ARE OFFSETS?

Carbon crediting is the process of issuing tradable credits to actors implementing approved emissions reductions or removal activities. ETSs may allow for these carbon credits to be used as "offsets," for compliance in place of allowances to compensate for (i.e., offset) emissions by a regulated entity.

The use of offsets typically allows for emissions from covered sources to increase to a level above the ETS cap so long as additional emissions are compensated for by emissions reductions or sequestration elsewhere. This means that the overall emissions outcome is unchanged (assuming that the emissions reductions or removals represented by the offsets are real, permanent, and additional). Carbon credits should only be awarded to activities that are driven by the incentive provided by the crediting mechanism, that is, if they demonstrate additionality. If an actor would undertake an activity even in the absence of the crediting mechanism, the activity is not additional and the emissions reductions or removals should not be recognized by the crediting mechanism.

Offsets may be sourced domestically from uncovered sectors,[276] or from outside the jurisdiction. Offset generation may be governed by the same authorities as the ETS, or by a regulator outside the ETS jurisdiction or a third-party private operator. The options for the geographic scope of offsetting activities, and the governance of the offset program, are discussed further in Section 8.3.

Table 8-1 provides a simplified illustration of how an ETS with access to offsets operates. It considers the case where the carbon credits are generated by entities in the same jurisdiction, and the crediting mechanism is governed by a domestic regulator. Without offsets, entities covered by an ETS cap can emit 100 megatons of carbon dioxide equivalent ($MtCO_2e$). The regulator has created a crediting mechanism in which uncovered sources (which currently emit about 20 $MtCO_2e$) can obtain carbon credits for emission reductions. Sources under the crediting mechanism choose to implement practices to reduce their emissions by half and sell these reductions totaling 10 $MtCO_2e$ to covered sources. In this example, typical of how most crediting mechanisms to date have been designed to operate, each carbon credit represents an emissions reduction equivalent to exactly one allowance.[277] Covered sources can purchase these carbon credits and increase their emissions by 10 MtCO2e (i.e., to 110 $MtCO_2e$). Total emissions of the covered and uncovered sources remain unchanged through the use of offsets, but overall costs fall if the abatement costs of sources under the crediting mechanism are lower than the abatement costs of sources covered by the ETS.

Table 8-1 A simple illustration of offsetting in an ETS

Sources	No offsets ($MtCO_2e$)	With offsets: Before trading ($MtCO_2e$)	With offsets: After trading ($MtCO_2e$)
Covered emissions	100	100	110
Uncovered emissions within crediting mechanism	200 (before offset program there is no distinction between these categories)	20	10
Other uncovered emissions		180	180
Total emissions	300	300	300

8.2 USING OFFSETS: ADVANTAGES AND CHALLENGES

8.2.1 ADVANTAGES

There may be several advantages to using offsets:

- **Broadening the carbon price signal to uncovered sectors.** Crediting mechanisms provide an avenue to generate abatement incentives in sectors that are difficult to include in the scope of the ETS for technical, political, or other reasons. This increases the economic efficiency of the ETS by expanding the set of mitigation opportunities available.[278] Crediting mechanisms also support investment flows into those sectors, and allow entities with the required capacity and willingness in uncovered sectors to "opt in" to emissions reduction activities. By lowering compliance costs and creating a new, supportive political constituency for the ETS in the form of project proponents, allowing offsets may make an ETS more attractive to the private sector. This may in turn allow policymakers to set a more ambitious cap and also may support policy stability. It could also provide incentives for investing in negative emissions technologies, as discussed in Box 8-2. Finally, crediting mechanisms may build capacity in uncovered sectors, making it easier to eventually include them within the scope of the ETS.

276 In theory it would be possible to have covered sectors (but uncovered sources within those sectors, e.g. from facilities/installations under the participation threshold) generating offsets. This, however, is not implemented in any system and is likely to exacerbate the competitive distortions.

277 Some parties, however, including France, decided to deliver only 90 percent of the emissions reductions achieved in their territories as carbon credits to the project participants, creating a net benefit for the compliance of the host party with its international commitments.

278 The US Environmental Protection Agency's economic analysis of the national cap and trade proposal in the US Senate in 2010 provides a case in point. It estimated that including domestic and international offsets (mostly from forestry and agriculture mitigation) would cut allowance prices by more than 50 percent and have a larger effect on compliance costs than the deployment of key technologies such as carbon capture and storage or nuclear power. See US Environmental Protection Agency, Office of Atmospheric Programs 2010.

Box 8-2 Technical note: Negative emissions technologies as offsets

In order to meet the Paris Agreement targets, the Intergovernmental Panel on Climate Change's *Special Report on Global Warming of 1.5°C* highlights the need for significant action in both reducing global greenhouse gas (GHG) emissions and removing GHGs from the atmosphere. Such removals take place through technologies and practices often referred to as "negative emissions technologies" (NETs). Many of the scenarios considered in the report rely heavily on removals from NETs, particularly in the second half of the twenty-first century. Despite this, NETs, especially those that involve deployment of emerging technologies, have scarcely been discussed in the context of emissions trading.

The common and distinguishing feature of NETs is that they remove GHGs that are already in the atmosphere due to past emissions. In other words, they reduce the GHG concentration in the atmosphere. This is in contrast to most traditional emissions reduction credits used as offsets, which stop emissions that would have otherwise occurred, preventing a rise in the GHG concentration.

Most prominent NETs focus on carbon dioxide (CO_2) and cover a wide spectrum of techniques including reforestation and other agriculture, forestry, and other land use (AFOLU) practices; bioenergy with carbon capture and storage (BECCS); direct air carbon capture and storage (DACCS); and enhanced weathering, which leverages the natural properties of minerals that consume CO_2 when they dissolve by pulverizing and distributing them using industrial infrastructure. The costs of removing CO_2 from the atmosphere using NETs also vary widely. Typically, forestation practices are on the lower end of the spectrum with costs lower than allowance prices observed in many existing ETSs in 2019, while the costs of some enhanced weathering techniques are about double the highest allowance prices in 2019. At the higher end of the range are BECCS and DACCS, which are still emerging technologies and remove CO_2 at a cost many times the highest allowance prices ever observed.[279]

Many of the advantages and challenges associated with negative-emission AFOLU practices as offsets are similar to those identified in Sections 2.1 and 2.2, not least because several existing offset programs are built around AFOLU practices. The higher cost of technology- and capital-intensive BECCS, DACCS, enhanced weathering, and other techniques implies that they cannot currently help with cost containment but also will not put downward pressure on prices. Therefore, the recognition of these NETs as legitimate offset generators could be viewed as an R&D subsidy mediated through emissions trading, which may support the NETs' development and upscaling. This in turn can provide cost containment services in the second half of the twenty-first century when residual emissions with extremely high marginal abatement costs need to be compensated for (in addition to the large-scale removal of GHGs from the atmosphere required for achieving the Paris Agreement targets).280 That said, as with conventional offset programs, policymakers may require assurance on quality and permanence of removals by NETs and consider placing quantity limits on NETs to ensure co-benefits from emissions abatement are not compromised.

- **Ability to target specific policy goals.** Crediting mechanisms can target specific economic, social, and environmental co-benefits, including increased air quality, restoration of degraded land, poverty alleviation, and better watershed management. When this aligns with policy priorities, for instance in relation to international cooperation or improving livelihoods in rural, agricultural, or forested areas, allowing offset use in an ETS will be an advantage. While all instruments that incentivize mitigation activities produce co-benefits, a crediting mechanism can be design to target specific benefits more easily by focusing on key activities or geographical locations.
- **Increase capacity for implementing carbon pricing instruments.** A crediting mechanism can engage both domestic sectors not currently covered by the ETS and international jurisdictions. It can lead to innovation and learning about carbon pricing instruments, and pave the way for these sectors to be covered by the ETS. Internationally, this learning process can support the adoption of carbon pricing instruments in the host countries. More than half of carbon credits generated by the Clean Development Mechanism (CDM) to date originate from China — reviews suggest this extensive experience is likely to have played a role in China's decision to implement an ETS.[281] However, in both cases sectors may resist the change from getting revenue from abatement activities (under an offset scheme) to incurring a liability for emitting (under an ETS).

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279 Fuss et al. 2018.
280 Dietz et al. 2018.
281 CDM Policy Dialogue 2012.

8.2.2 CHALLENGES AND OPTIONS TO ADDRESS THEM

There are several potential challenges that must be addressed when considering the use of offsets. These can be grouped into two broad categories: environmental integrity and governance.

Environmental integrity

Ensuring environmental integrity is paramount for crediting mechanisms to achieve credible emissions reductions. The main challenges to environmental integrity are around:

- **Establishing additionality.** An activity is considered additional if it would not be implemented in the absence of the crediting mechanism, holding all other factors constant.[282] Additionality is an essential element to ensure carbon credit quality. However, determining additionality can be challenging as it requires an assessment against a counterfactual (that is, what would have happened in the absence of the crediting mechanism). The difficulty of the assessment can vary across different project types. Good practice is to use informed assumptions and ensure there is sufficient evidence to have a high level of confidence in a proposed project's additionality. Crediting mechanisms use a range of tests to help determine whether an activity is likely to be additional, as discussed below.[283]
- **Reversals.** Some project activities generate carbon credits through carbon sequestration or carbon capture and storage. However, there is a risk that abatement achieved from such activities could later be unintentionally or intentionally reversed and provide only temporary ("nonpermanent") climate benefits. For instance, a forest planted to sequester carbon may be harvested prematurely or burned down and not replanted, releasing the credited carbon. Similarly, a field that has been converted to no-till cropping may be turned back into conventional tillage, releasing soil carbon.
- **Carbon leakage.** Crediting mechanisms can generate carbon leakage through *shifting activities* or through *market leakage*.[284] Shifting activities may occur, for example, in avoided deforestation and forest degradation projects: paying to protect one part of a forest does not necessarily protect other areas, and may result in deforestation shifting to unprotected areas. Market leakage may occur if the crediting mechanism skews market dynamics toward a higher emissions outcome — for instance, if an entity that is selling carbon credits has an incentive to increase production to generate more carbon credits, resulting in a net increase in emissions compared to the counterfactual without the crediting incentive. In another scenario, activities reducing the harvest of timber from forests could incentivize the use of more emissions-intensive products such as steel in buildings.
- **Environmental integrity of climate commitments.** Carbon credits generated outside the jurisdiction of an ETS bear the risk of being counted against both the host and the buyer jurisdiction's climate commitments if thorough and transparent accounting procedures are not followed. This puts the environmental integrity of the climate commitments (for example, NDCs) at risk. Furthermore, the revenue generated through selling carbon credits internationally may incentivize the host country to set lax climate commitments, as tightening of the commitments in the host country may reduce their ability to earn revenue for mitigation activities.[285]

However, many of these issues can be addressed by building certain preemptive approaches to addressing these challenges into the design of a crediting mechanism. This can include:

- **Additionality tests.** Crediting mechanisms use a variety of tests to assess additionality. These include assessments of whether the activity is required or mandated by other relevant laws, regulations or requirements; the financial viability of the activity; barriers that may prevent the implementation of the activity; the market penetration of the activity; and various performance tests (for example, assessing whether the activity meets emissions benchmarks or leads to lower emissions than well-established technologies). Additionality tests may be applied to individual activities (such as through eligibility criteria) or at the program level, such as automatically classifying types of activities, practices, or technologies as additional (for example "positive lists"); or conversely excluding certain project types deemed unlikely to be additional. In practice, crediting mechanisms typically use a combination of tests to provide a robust method for assessing additionality. The different types of additionality tests are described further in the PMR's *A Guide to Developing Domestic Carbon Crediting Mechanisms.*
- **Conservative baselines.** Crediting mechanisms require each project to establish a baseline scenario. This is important because baseline scenario emissions are compared to project emissions (that is, emissions from the project activity once the project has been

282 Gillenwater 2008.

283 The new context of the Paris Agreement, where all countries have mitigation targets Nationally Determined Contributions (NDCs), can complicate additionality and other assessments. NDCs, the policies to achieve them, their accounting aspects, and, possibly, the progression of the targets over time, may need to be taken into account in such assessments.

284 Leakage could also occur through investment leakage, where offsetting leads to investment relocations from covered jurisdictions to jurisdictions where the company could benefit from baseline-and-credit mechanisms. However, this will only rarely be plausible.

285 Schneider and La Hoz Theuer 2019.

implemented) to quantify abatement. For this reason, it is critical that the baseline scenario emissions are conservative — baseline scenarios should err towards underestimating emissions. Overestimating baseline scenario emissions would inflate calculated abatement, undermining environmental integrity. This is the case even if a crediting mechanism has determined the project activity to be additional.

- **Buffers and reserves.** A portion of the carbon credits issued by every project is deposited in a common pool, which acts as a general insurance against the risk of reversal, leakage, or lack of additionality. The credits in the buffer pool cannot be traded (at least for a predetermined amount of time). The amount set aside can be based on a project-specific assessment (for example, 10 to 60 percent under the Verified Carbon Standard), or can be common for all projects.[286] Credits in the buffer pool can be used to "cover" for projects where stored emissions are released into the atmosphere (for example, if a forest is burned down and not replanted, or if it is discovered that emissions reduction would have occurred even in absence of the crediting incentive).
- **Host-country guarantees.** This is a guarantee at the national level, where the country hosting an emissions reduction project guarantees these emissions reductions against its own nationwide emissions reduction targets. This would ensure that even if there are issues with additionality or reversal, the country hosting the project will make good any emissions reductions needed through actions to drive additional emissions reductions elsewhere in the economy. This has, however, been difficult to implement and enforce in practice.

Systems also often establish rules that assign responsibility to the buyer or the seller in case the safeguards identified above fail and the credited emissions outcomes are not achieved. This is discussed in detail in Box 8-3.

Box 8-3 Technical note: Buyer and seller liability

Crediting mechanisms may need to assign liability for achieving the underlying environmental outcome as a final safety net — for instance, in cases of emissions reversals, if the monitoring, reporting, and verification (MRV) process uncovers that, retrospectively, carbon credits have not met the required quality standards, or that there have been acts of fraud. There may be no liability assigned (in which case the environmental outcome suffers) or, in some cases, a legal process may be followed to assign liability. However, crediting mechanisms establish rules that assign responsibility to either the buyer or the seller:[287]

- With **buyer liability**, it is the responsibility of the purchaser to take action if issues with the quality of the acquired credits are identified. In this case, regulated entities in possession of invalid carbon credits would have to buy new credits or allowances as a replacement. Buyer liability may be acceptable if there is reason to believe that the buyer is more capable than the seller to manage and insure against associated risks, including through selection of less-risky project types, diversifying offset purchases, or buying third-party insurance. Additionally, in some jurisdictions legal liability can only be assigned to buyers. An example of buyer liability is in California, where rules allow the regulator to invalidate a carbon credit up to eight years after the end of the reporting period and the liability for replacing this offset is placed on the buyer.
- With **seller liability**, project proponents are required to reimburse the regulator in case carbon credits submitted for compliance are later found to fall short of mandatory conditions: for example, in the case of an intentional reversal. If it is not considered appropriate to adopt buyer liability, it can be better for the regulator to impose liability on sellers and seek redress in the event of reversals or where sellers are later found to have violated mandatory standards. This places an additional burden on regulators, however, and can be especially challenging for offsets generated outside the jurisdiction of the ETS, which is why some existing crediting mechanisms favor buyer liability. Seller liability may be preferable if the project proponent can be made a legal participant in the ETS with obligations to monitor and report on their level of carbon storage. However, this may be difficult to enforce, particularly in an international context, and may not be appropriate if sellers are not able to readily pool their risks or otherwise manage their liability.[288]

Even where buyers are liable for replacing units (i.e., offsets or allowances) in case of invalidation or reversals, buyers can shift liability to sellers on a private contractual basis, with commensurate increases in transaction costs. It is also possible for regulators to create a tiered system of liability where sellers are primarily liable but, ultimately, if the seller's liability cannot be enforced, buyers become liable. →

286 For example, the former Australian Carbon Farming Initiative applied a 5 percent automatic deduction for sequestration activities. The Gold Standard applied a 20 percent deduction.
287 Liability could also be allocated to the third-party validator and/or verifier.
288 See PMR 2015f and Murray et al. 2012.

Approaches to managing these liabilities tends to take two main forms:

- **Commercial insurance.** Participants may secure additional private insurance for the environmental integrity risks associated with a project or projects. This could be purchased by either the buyer or the seller, depending on liability. Such insurance could serve in place of a buffer or reserve account or provide additional insurance in the event other mechanisms are insufficient.
- **Compensatory activities by project developer.** The project proponent (in the case of seller liability) compensates for the carbon that is released back into the atmosphere through implementing extra activities; for example, replanting of areas where reversals occurred, or planting new areas.

Furthermore, jurisdictions may place qualitative restrictions on the type of offsets that can be used for compliance in their ETS (see Section 8.4.2). This can be useful for carbon credits coming from nondomestic programs, or programs not managed by the ETS authority where policymakers do not have control over what systemic risk mitigation approaches are built into the design of the crediting mechanism.

Governance risks

General governance risks include challenges in establishing or operating a crediting mechanism, or in its interaction with the ETS. These risks include:

- **Pressure on allowance prices.** While the inclusion of offsets can reduce business compliance costs, it also reduces incentives to cut emissions and to invest in mitigation technologies in the covered sectors (see Step 6 for a discussion of the problems associated with volatile and low prices).[289] In the European Union (EU) ETS, the availability of low-cost offsets from the CDM has contributed to low prices and the accumulation of an excess supply of allowances, which policymakers have subsequently sought to reduce to increase scarcity in the system (see Box 8-4). These impacts on prices can be addressed through the use of price and supply adjustment measures (see Step 6) and/or quantitative limits on offset use (see Section 8.4.2).

Box 8-4 Case study: International offsets and imported risk

Upon establishing their systems in 2005 and 2008, both the EU and New Zealand sought to use the potential of the Kyoto Protocol flexibility mechanisms.

The New Zealand ETS (NZ ETS) was initially designed to be nested within the international Kyoto cap and, therefore, operated without a domestic cap, allowing for the unlimited use of international credits for compliance. The system started with a New Zealand Unit (NZU) price around 20 New Zealand dollars (EUR 8.11), but once Certified Emission Reduction (CER) prices began to fall in 2011, the NZU prices also declined dramatically. This resulted in negligible incentives for domestic mitigation.

New Zealand regained control of its carbon price only when it announced in 2013 its intention to restrict the use of international Kyoto units, including CERs (qualitative limits on international units from certain project types had applied since 2011). However, this created a divergence of prices between 2013 and 2015, as NZUs (with unlimited banking) became more valuable than international credits (with a sunset date). The result was a range of technical problems related to arbitrage opportunities and stockpiling of NZUs. The NZ ETS subsequently became a domestic-only system as of June 1, 2015.

While the low price may have protected the NZ ETS from political pressure, it also shook investor confidence in future carbon prices and public confidence in the system.

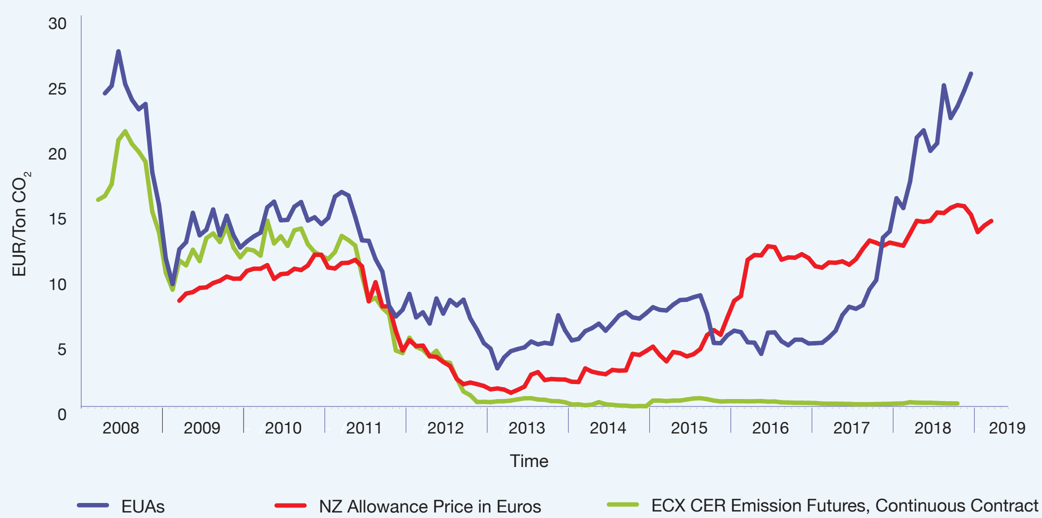
The EU ETS also allowed the use of CDM and Joint Implementation (JI) credits for compliance but capped offset use through national and EU legislation for the period 2008–2020. In addition, offset eligibility was subject to a number of qualitative restrictions: land use, land-use change, and forestry projects and nuclear activities were excluded, while specific requirements were established for large hydropower projects.

As in New Zealand, the availability of a large volume of low-cost units generated under JI and CDM between 2008 and 2012 led to a substantial surrendering of such credits for compliance in the EU ETS. This, along with declining emissions due to the 2008–2009 global economic downturn, contributed to low European Union Allowance prices. As a consequence, during Phase 3 (2013–2020), the EU imposed additional restrictions on offsets and limited →

289 See, for example, Szolgayová, Golub, and Fuss 2014; Koch et al. 2016.

the use of international credits generated post-2012 to those originating from least developed countries, and excluded industrial gas (hydrofluorocarbon [HFC] and nitrous oxide [N_2O] from adipic acid production) projects.

Figure 8-1 International offsets and imported risk



Note: EUA = EU Allowance; NZ = New Zealand, ECX CER ECX contracts (EUA and CER futures, options, and spot contracts) are standardized exchange-traded CERs (certified emissions reductions).

Source: ECX CER Emissions Futures 2019 and OM Financial 2019.

The EU does not foresee the use of international credits in Phase 4 of the EU ETS (2021–2030), having committed to a domestic-only overall EU climate target for 2030. New Zealand, on the other hand, has committed to an NDC based on both domestic and international abatement. The NDC is based on relatively limited domestic emission reduction potential and high abatement costs due to an already clean electricity mix and high emissions from land use. New Zealand is considering options for reopening its ETS to high-quality international carbon markets, but has initially set no provision for international credits when auctioning begins in 2021.

- **High transaction costs.** The transactions costs associated with a crediting mechanism may be high for both administrators and participants. For example, project proponents face relatively high MRV costs, while program administrators face a range of implementation costs, such as those associated with confirming project eligibility (which can be complex and resource intensive), registering projects, accrediting auditors, and certifying and issuing credits. The high costs for both regulators and businesses of covering smaller and potentially difficult to measure sources are often the reason policymakers elect to not cover these sources under an ETS in the first place (see discussion of emissions thresholds and scope considerations for different sectors in Step 3). However, while costs can be high, project proponents are able to self-select into the crediting mechanism and will participate only if it is cost-effective for them to do so. This means that costs are not spread equally across a sector and actors facing relatively high transaction costs can choose to not participate in the offset market. This also highlights the importance of designing crediting mechanisms to have low costs, for example by using positive lists or preapproved rules for eligibility, making validation and verification as administratively simple as possible.
- **Distributional issues.** Crediting mechanisms may give rise to distributional concerns over resource transfers to uncovered sectors, whether domestic or international. As noted above, this transfer of resources and of potential co-benefits may align with other policy objectives, but it can be a disadvantage in cases where there is misalignment. This misalignment can be exacerbated if resources are transferred abroad, also compromising international competitiveness. There are also equity issues where certain sources are included within an offset program, effectively receiving a subsidy for reducing emissions, while other sources covered by an ETS incur a cost for emitting.
- **Subsidy lock-ins.** If an ETS intends to expand its coverage over time, allowing the generation of offsets before sectors are covered could make it more

difficult to subsequently extend the coverage. That is, businesses in these sectors would prefer to receive revenue from abatement activities rather than incur a liability for emitting. If the ETS allows offsets generated abroad, policymakers should seek to manage seller jurisdictions' expectations around the revenues from offsets. Abrupt changes to the demand for offsets (for example, by disallowing them in the ETS) may affect host countries negatively.

- **Adverse effects in host countries.** If not well designed, crediting mechanisms might also lead to perverse incentives in the host country. For example, without adequate protections forest communities may be adversely affected by policies seeking to comply with reforestation guidelines to generate offset revenue. Policymakers should require social safeguards to ensure crediting mechanisms cause no harm.

One way that jurisdictions have managed these impacts is through the imposition of quantitative limits and qualitative criteria on offset use (see Section 8.4). In addition, costs and supply of offsets may be challenging to anticipate, and when information has been collected, there may be a need for a review of any quantitative limits.

8.3 SOURCING OFFSETS

Policymakers must decide on the type of crediting mechanism they wish to include in their ETS. Crediting mechanisms differ across two primary dimensions: the geographic scope of mitigation activities (Section 8.3.1) and the governance of the offset program (Section 8.3.2).

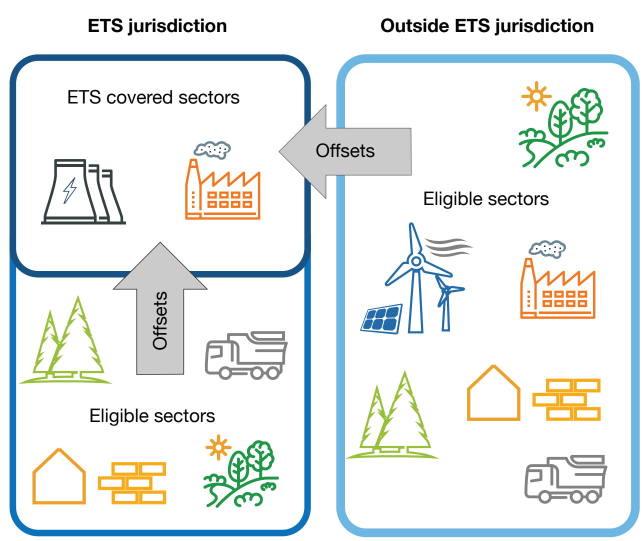
8.3.1 GEOGRAPHIC SCOPE OF OFFSETS ELIGIBLE FOR ETS USE

The geographic scope of offsets eligible for ETS use refers to the permitted location of potential projects or activities.[290] This can include activities:

- **Within the jurisdiction,** comprising emissions reductions and sequestration activities that occur within sectors not covered by the ETS in the same subnational jurisdiction, country, or supranational entity. Accepting offsets only from within the jurisdiction may be preferable if domestic emissions reductions are a key priority and can also ease compliance monitoring and enforcement concerns. Additionally, any co-benefits of mitigation are kept within the jurisdiction. In the California Cap-and-Trade Program, for example, for compliance obligations starting with 2021 emissions, at least half of the offset usage limit must come from activities that provide direct environmental benefits to the state.
- **Outside the jurisdiction,** comprising emissions reductions and sequestration activities that take place outside the subnational jurisdiction, country, or supranational entity. Accepting offsets from outside the jurisdiction expands potential sources of supply and offers more low-cost abatement opportunities. Crediting mechanisms may target a wide range of countries (for example, CDM), certain regions (for example, the Mexico Forestry Protocol within the Climate Action Reserve), or specific sectors and projects based on bilateral agreements (for example, Japan's Joint Crediting Mechanism). The choice regarding the scope of outside-jurisdiction coverage will largely depend on how policymakers wish to balance enhanced cost-effectiveness (which will favor a broad geographic scope) versus attainment of other policy objectives (which may favor a narrower scope to direct the subsequent financial flows toward certain recipients), taking into account the environmental integrity of carbon credits from a particular location.

Figure 8-2 illustrates the geographical sources of offsets and Figure 8-3 provides examples of the sources of offsets used in different ETSs globally.

Figure 8-2 Sources for offsets for an ETS



Note: Sectors need to be deemed eligible by the ETS jurisdiction.

290 Note that offsets may be sourced from a crediting mechanism that has a different geographical scope than that allowed within the ETS. ETS policymakers may only allow a subset of carbon credits from external crediting mechanisms by applying different qualitative criteria (described in more detail in Section 4.1).

STEP 8 OFFSETS

8.3.2 GOVERNANCE OF OFFSET PROGRAMS

In considering the governance of crediting mechanisms, policymakers first need to decide whether to make use of an externally administered crediting mechanism (such as the CDM and any other future United Nations Framework Convention on Climate Change [UNFCCC] crediting mechanisms, offsets from other jurisdictions, and/or voluntary market programs; see Box 8-5 for details) and if so, how and the level of reliance (see “Reliance on externally administered crediting mechanisms” below).

If policymakers choose to set up a domestic crediting mechanism, a host of further decisions will need to be made (described in “Designing a domestic crediting mechanism” below). The rules governing the crediting mechanism will need to be developed by the relevant domestic authority (which may or may not be the same as the ETS authority) to meet the needs of that jurisdiction.

Figure 8-3 Offset programs around the world

1 - California and Québec allow offsets mutually sourced from linked jurisdictions
2 - The Swiss and EU ETS no longer use offsets from 2021
3 - New Zealand may readmit international offsets contingent on access to high integrity sources
4 - Korea allows domestic credits as well as international CDM credits developed by Korean companies
5 - Nova Scotia's cap-and-trade legislation includes provisions for an offset program, however as of 2020 the program is not yet operational

Box 8-5 Case study: From Kyoto to Paris – market mechanisms in the international climate regime

Under the Kyoto Protocol, actions to reduce emissions by countries with mitigation commitments could be supplemented by three flexibility mechanisms. These were designed to create an interlinked system of tradable units among nations and facilitate the transaction of emissions/mitigation units. The three flexibility mechanisms were:

1. **International emissions trading.** Countries with mitigation commitments under the Kyoto Protocol could acquire emissions units called Assigned Amount Units from other countries with mitigation commitments under the protocol and use them to meet part of their targets (Article 17 of the Kyoto Protocol).
2. **The Clean Development Mechanism.** The CDM allows emissions reduction (or emissions removal) projects in developing countries to earn CER credits, each equivalent to one ton of CO_2 equivalent. These CERs could be traded and used by countries with mitigation commitments under the Kyoto Protocol to meet part of their obligations under the protocol. The mechanism gives countries with mitigation commitments some flexibility in how they comply with their emissions reduction targets, while stimulating emissions reductions in other countries. The projects qualify through a registration and issuance process designed to ensure real, measurable, and verifiable emissions reductions that are additional to what would have otherwise occurred. The mechanism is overseen by the CDM Executive Board, answerable ultimately to the countries that ratified the Kyoto Protocol (Article 12 of the Kyoto Protocol).
3. **Joint Implementation.** A country with a mitigation commitment under the Kyoto Protocol could participate in an emissions reduction (or emissions removal) project in any other country with a commitment under the protocol and count the resulting units toward meeting its Kyoto target. This project-based mechanism was similar to the CDM, but only involved parties with commitments under the Kyoto Protocol.

The CDM was the first and remains the largest international crediting mechanism. Overall, it has fostered USD 304 billion of investment in GHG-reducing activities in developing countries. Entities regulated under the EU ETS were able to reduce the costs associated with 2 billion tons of emissions reductions by buying CERs to meet their compliance obligations.[291]

→

291 UNFCCC 2018.

The size, scope, and operation of the CDM have drawn some criticism. In particular, some stakeholders have questioned the environmental integrity of some CDM projects, such as those generating CERs from the destruction of industrial gases like HFCs, which accounted for approximately 70 percent of CERs issued in 2009 and 2010.[292]

Prices on the CDM market have dropped dramatically in recent years, from over USD 20 per unit before the 2008 recession to USD .25 per unit in November 2019. The price decline was likely driven by a number of factors, including the drop in emissions caused by the 2008–2009 financial and economic crisis and the resulting oversupply of compliance units in the EU ETS (also in the context of a large supply of offsets); Japan and New Zealand declining to participate in the second commitment period of the Kyoto Protocol; and a strong reduction in the allowable use of international offsets in some ETSs, in part also due to environmental integrity concerns.

As the world transitions from the Kyoto regime into the Paris regime, the CDM finds itself in a phase of uncertainty, with countries still at odds on whether and how the mechanism should be transited to the Paris Agreement. Countries will begin to implement their NDCs and are in the process of negotiating the rules for the two market mechanisms established under Article 6 of the Paris Agreement. This includes developing guidance for cooperative approaches (Article 6.2) and the modalities for the new centralized mechanism (Article 6.4).

In the international negotiations under the Paris Agreement, countries are working to define what elements of CDM governance, rules, projects, and credits will be transitioned into the Paris era through Article 6.4. A key area of contention relates to the so-called carryover of CDM credits generated for emission reductions prior to 2020 toward the post-2020 targets under the Paris Agreement. At the same time, as negotiations under Article 6 remain deadlocked, countries diverge on whether and how the CDM should continue to operate and whether and how its credits could be used under the Paris Agreement.

Reliance on externally administered crediting mechanisms

Externally administered crediting mechanisms are run by institutions or governments external to the jurisdiction implementing the ETS. They are often recognized by multiple jurisdictions (for example, a body within an international organization, or a nonprofit organization). The rules are clearly defined for all participating jurisdictions, and the credits are sourced from multiple sources and sold across multiple markets. The Kyoto Protocol's project-based mechanisms — the CDM and JI — are examples of international crediting mechanisms (see Box 8-5). Article 6.4 of the Paris Agreement introduces a future mechanism for which rules and guidelines have yet to be developed but is expected to draw on the example of offset mechanisms developed to date.

There are four main scenarios by which ETSs may draw upon externally administered crediting mechanisms:[293]

- **Full reliance.** International crediting mechanisms are responsible for credit generation, oversight and enforcement of process, and review of projects. The ETS policymaker chooses which international crediting mechanism to include and oversees retirement of international carbon credits for ETS compliance. This option is the least complex and easiest to implement from the point of view of a policymaker designing an ETS, but cedes control over crediting mechanism design. It may be suitable for jurisdictions with limited capacity to develop their own crediting mechanism, or for those looking for a quick and cost-effective way to include offsets in their ETS.
- **Gatekeeping.** As with full reliance, but with the ETS regulator placing qualitative and/or quantitative restrictions on the activities generating carbon credits in existing crediting mechanisms that can be used for compliance. This allows for more control over the quantity and quality of offsets in the ETS but requires more capacity on the part of ETS policymakers. This approach is discussed in more detail in Section 8.4.
- **Outsourcing.** Under this approach, the responsibility for certain design elements is "outsourced" to existing crediting mechanisms. This could include, for example, using methodologies developed by other mechanisms, or the accreditation framework for validators and verifiers. There is, however, a domestic review and approval of projects. Moreover, domestic institutions generally retain responsibility for oversight and enforcement, including issuance of credits. This approach provides policymakers with a higher degree of control over the crediting mechanism and more transparency on the projects being credited than the gatekeeping option, but correspondingly requires a higher level of capacity and financial resources.
- **Drawing examples and lessons learned (indirect reliance).** Externally administered crediting mechanisms provide examples that inform development of a domestic crediting mechanisms. Domestic institutions are responsible for developing rules

292 Cames et al. 2016.
293 PMR 2015f.

and methodologies, issuing credits, oversight and enforcement, and review of projects (see "Designing a domestic crediting mechanism" below). This is the most involved approach in terms of capacity and financial resources required, but provides the greater control over the crediting mechanism.

Ultimately, the level of reliance and the specific aspects relied upon will be based on a range of factors. Table 8-2 summarizes the key aspects policymakers need to consider when determining the level of reliance on externally administered crediting mechanisms.

Table 8-2 Key considerations for reliance on externally administered crediting mechanisms

Consideration	Preferred offsetting approach
Importance of alignment with domestic priorities	A greater need for alignment means that it will be more beneficial to develop domestic crediting mechanisms.
Current technical and institutional capacity	The greater the concern over domestic capabilities to administer a crediting mechanisms, the more reliance might be placed on externally administered crediting mechanisms .
Financial resources available for the offset program	Developing a domestic crediting mechanism will be more expensive than alternatives that rely more heavily on externally administered crediting mechanisms.
Importance of aligning with international practices	If alignment with international practices is desirable (for example, to help facilitate future export of credits), then there is an increased need for integration with the relevant international crediting mechanisms.
Importance of building domestic capability (for example MRV, registry)	If this a priority, then a domestic crediting mechanisms might be preferred.
Importance of cost containment	If low-cost abatement is a priority, it may be preferable to source credits from crediting mechanisms that cover a wide range of sectors, activities, and regions.
Importance of near-term offset generation	Greater reliance on externally administered crediting mechanisms will likely expedite access to offsets, especially if a domestic crediting mechanisms needs to be established.
Importance of retaining policy control	If there is a desire for a strong level of control, then this may suggest the establishment of a domestic crediting mechanism.

Designing a domestic crediting mechanism

If policymakers decide to create a new, domestic crediting mechanism, there is a range of further considerations. One of the most important is developing the rules and procedures to ensure that the crediting mechanism is only crediting projects that are delivering genuine and additional emissions reductions and removals. These rules and procedures also ensure that offsets are consistent with the jurisdiction's objectives, including its emissions reductions targets. They set out detailed policy settings, which can include project eligibility, demonstration of additionality, quantification of GHG emissions, safeguards against environmental or social harm, and project monitoring. These rules are referred to as methodologies.[294]

The rules can be defined along two dimensions: their overall degree of standardization and how methodologies are developed — whether they are bottom-up or top-down. Finally, policymakers must also put in place a procedure for registering projects and issuing credits.

These issues are discussed briefly below. Additional detail on these and other issues is provided in the PMR's *Guide to Developing Domestic Carbon Crediting Mechanisms.*

The degree of standardization

Crediting mechanisms can develop methodologies that employ either a project-specific approach that relies on analysis of an individual project's characteristics and circumstances, or a standardized approach where key components (additionality and the baseline scenario and emissions) are uniformly assessed or determined for specific classes of project activities. Where possible, a standardized approach is preferable because it can reduce transaction costs for project proponents by simplifying project development and auditing. However, standardized approaches can be resource intensive to establish and maintain for program administrators and are not suitable for all project types. Also, in order to ensure credibility and environmental integrity standardized approaches must be more restrictive and be designed in a more conservative manner.

294 The legal definition of what is covered by a methodology is decided by the specific crediting mechanism. For example, some programs may only consider the setting of baselines and emissions quantification as part of the methodology, and other rules on eligibility, additionality, social safeguards, and so on to be supplementary.

Standardized and project-specific approaches are not binary alternatives — policymakers may incorporate a combination within a methodology and/or different methodologies across the crediting mechanism. Existing crediting mechanisms typically use a combination of both. For example, some CDM methodologies employ at least some standardized baseline and quantification assumptions, while still prescribing project-specific additionality determinations. Conversely, methodologies used by programs such as California's Compliance Offset Program apply standardized additionality tests (as well as project-specific approaches) but have project-specific requirements associated with baseline, monitoring, and quantification methods.

Table 8-3 lists different elements of methodologies that could be standardized. Elements of methodologies that are commonly standardized include default parameters to measure emissions reductions and the use of sector-wide performance standards to assess additionality and set the baseline.

Table 8-3 Aspects of standardization of methodologies

Standardized approach	Definition	Examples
Common criteria	Terms or conditions applied across multiple methodologies	▲ "Not mandatory by law" ▲ "Does not generate non-carbon related revenue" *(As part of additionality language)*
Common methods, factors, and equations	Emissions factors, default value, and estimation methods used to address common circumstances in a consistent fashion across multiple project types	▲ Avoided electricity emissions module used across CDM methodologies ▲ Denitrification-Decomposition model used to estimate methane emissions from rice cultivation projects
Project-specific default values	Used to calculate baseline/project emissions; only applicable to a specific project type	▲ 90 percent N_2O destruction as baseline for adipic acid JI projects
Performance standard: emissions intensity benchmark	Baseline emissions rate (emissions per unit of output, input, or throughput) *(Applied to baseline/additionality determination)*	▲ Emissions rate: X tons of CO_2 per ton of cement ▲ Average of top 20 percent (often used in CDM)
Performance standard: market penetration rate	Market share of current production sales or cumulative market penetration rate (of existing stock) of a technology or practice *(Applied to additionality determination)*	▲ Market share: < X percent of current sales ▲ Cumulative penetration rate: technology in use at < X percent of all installations
Positive lists	Technology-specific list that deems all projects of that technology additional	▲ Specific project types (for example, agricultural methane destruction, solar photovoltaics) might be automatically eligible — no additionality assessment required
Standardized monitoring	Standardization of requirements for baseline and project monitoring across project types	▲ Prescription of minimum accuracy of measurement equipment ▲ Tools for determination of boiler efficiency

Source: PMR 2015d.

Bottom-up and top-down methodology development

Methodologies can be incorporated from existing crediting mechanisms (see "Reliance on externally administered crediting mechanisms" below) or developed from scratch, via either a top-down or a bottom-up process.

- In a bottom-up approach to methodology development, third parties (usually project proponents) submit a proposed methodology to a program administrator for approval. If approved, that methodology can then also be used by other projects that meet the requirements of the methodology.
- A top-down approach leaves the development of methodologies to policymakers or a program administrator. Often methodologies will draw on similar methodologies developed in existing crediting mechanisms. Project proponents who want to generate carbon credits must comply with the standards set in the relevant methodology for their project type.

Crediting mechanisms can also use a mix of bottom-up and top-down methods, with both project proponents and policymakers actively developing methodologies. There are also a set of intermediate options that combine elements of bottom-up and top-down approaches. Table 8-4 provides an overview of the advantages and drawbacks of both approaches.

Table 8-4 Bottom-up versus top-down approaches to developing offset methodologies

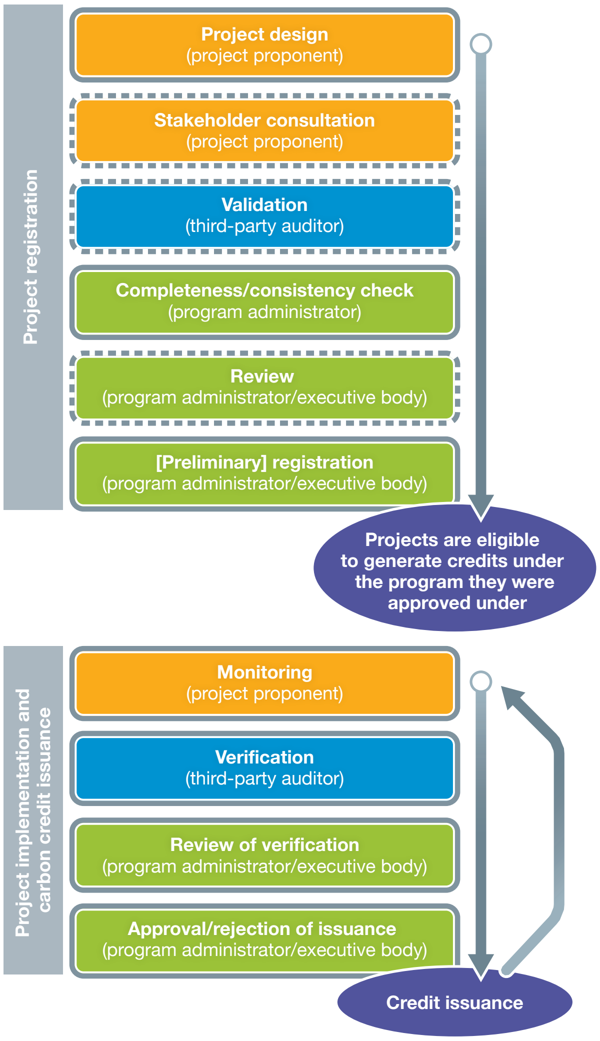
	Bottom-up	Top-down
Typical qualities	Crediting mechanism has broader coverage	Crediting mechanism has more selective coverage
Examples	Clean Development Mechanism Joint Implementation Verified Carbon Standard Gold Standard Chinese Certified Emission Reduction Program Alberta Emission Offset System	Clean Development Mechanism California Compliance Offset Program Québec Compliance Offset Program Climate Action Reserve Voluntary Program
Pros	Allows for quick start Once developed, may be used by others Greater consistency in approaches and applications of criteria	Provides more certainty to project proponents Provides policymakers with greater control over prioritizing project types and methodological choices
Cons	Potentially costly for project proponents and administrators	Requires more up-front time and public resources to develop

Source: Adapted from information in PMR, 2015d.

Project registration and credit issuance

To complete the process of carbon credit creation, projects must be registered, activities implemented, and the appropriate carbon credit issued. This is known as the project cycle — it sets out the actions a crediting project must undergo from conception to credit issuance to project closure. The decisions on the elements included in a project cycle involve balancing program rigor against regulatory burden and administrative costs. Figure 8-4 depicts the steps involved, providing examples of "full" and "streamlined" project cycles. Dashed lines refer to actions that some, but not all, crediting mechanisms include. As highlighted in Figure 8-4, many crediting mechanisms require a validation step to allow project registration. In most cases projects must undertake regular monitoring and some form of verification and checks by third-party auditors and the program administrator to enable credit issuance. Once credits are issued, there might also be a process of continued monitoring to identify and address potential invalidation and any reversals (see Section 8.4).

Figure 8-4 The general process for project registration and credit issuance



Note: The colors of the boxes differentiate steps according to the responsible entities. Dashed box borders indicate steps that are skipped by some of the examined crediting mechanisms.

Source: Adapted from PMR 2015d.

8.4 OFFSET CONTROL MEASURES

Policymakers may decide to put in place qualitative criteria (Section 8.4.1) or quantitative limits (Section 8.4.2) to mitigate some of the risks involved in using offsets, or the impact of offsets on the operation of the ETS.

8.4.1 QUALITATIVE CRITERIA

It will generally be preferable to include industries, sectors, gases, or activities when they have:

- mitigation potential (to ensure that the inclusion of offsets has an impact);
- MRV capacity (to ensure that emissions reductions can be measured, reported, and verified);
- low mitigation costs (to promote cost-effectiveness);
- low transaction costs (to promote cost-effectiveness);
- high likelihood of additionality, permanence, and absence of leakage (to ensure environmental integrity);
- environmental and social co-benefits (to allow these opportunities to be realized); and
- potential to encourage investment in new technologies (so that offsets can provide an appropriate incentive).

To give effect to these considerations, many ETSs require the credits they accept to meet certain qualitative criteria. These criteria typically reflect assessments of co-benefits and distributional implications, as well as additionality, leakage, and reversal risk. Both Europe and New Zealand blocked the use of credits from large hydro projects (for political and environmental sustainability reasons) and industrial gas destruction (because of additionality concerns). Further, the EU has not accepted temporary credits[295] issued under the CDM, thereby excluding credits from certain projects for afforestation and reforestation, which the CDM treats as only temporary. Although New Zealand has a domestic program to reward forestry sequestration, it also did not accept temporary CERs based on the argument that it could not control the risk of reversals outside its borders.

Qualitative restrictions can also be seen as a positive incentive for the types of projects that are accepted. Projects that are deemed likely to lead to learning and transformation could be bolstered by becoming eligible offset categories. For example, the Shenzhen Pilot ETS targets particular clean energy and transport projects as well as ocean carbon sequestration. The EU ETS, since 2013, accepts only new projects from least developed countries, as access to mitigation finance is most restricted there.

Some systems have also chosen to use offsets to recognize early action before the ETS is implemented, given the learning benefits and reduced risk of lock-in to high-emission technologies that such early action provides. The Chinese pilots accept mitigation credits accruing from the early action that some participants have had with the CDM generated under China's GHG Voluntary Emission Reduction Program. Other goals included ensuring environmental quality, reducing programmatic compliance costs, and producing co-benefits (see Box 8-6).[296]

STEP 8 OFFSETS

295 Temporary certified emission reductions (tCERs) are units issued under the CDM (Article 12 of the Kyoto Protocol). Unlike CERs, tCERs expire at the end of the commitment period following the one in which they were issued.

296 Margolis, Dudek, and Hove 2015.

Box 8-6 Case study: Offset use in the Chinese ETS pilots and China's national ETS

China's GHG Voluntary Emission Reduction Program was established in 2012 by China's national climate authority. The emission reductions generated under that program are called China Certified Emission Reductions (CCERs). The program was established mainly for the purpose of providing authoritative information regarding China's domestic voluntary mitigation market to avoid possible negative consequences caused by the fragmented market and imperfect market information.

Rules and procedures of the program are very similar to those of the CDM; a large part of the technical standards used in the program were specifically adapted from those under the CDM. For example, 151 of the approximately 200 currently available methodologies used in the program have been translated directly from the CDM methodologies, with minor revisions when necessary, mainly removing those provisions that are not applicable to China, and the remaining methodologies have been developed and approved specifically for the program, mostly in the forestry sector.

Although the program was not developed specifically to serve China's ETS, it has played an important role in the pilot systems as a cost containment measure and as a mitigation incentive to uncovered sectors. The program also supplies offsets to the Chinese national ETS since its operational launch in 2021. The program is also expected to supply offsets to the forthcoming national ETS. For the national ETS, the limit is 5 percent.

In all of China's seven pilot ETSs, the regulated entities are allowed to use CCERs, besides some local credits which are of much smaller scales, to offset a certain amount of emissions, usually up to 5 percent or 10 percent of the verified emissions or the number of allowances freely allocated to the entity.

Besides the quantitative limitation, there are also other restrictions on the use of CCERs toward offsetting purposes, including project types, geographical origination, vintage of credits, and project boundary. In some pilots, CCERs generated from hydropower, industrial gases (HFCs, perfluorocarbons, N_2O, and sulfur hexafluoride) mitigation, fossil fuel–based power generation, and heat supply projects are not allowed. With regard to geographical location of the eligible CCER projects, several pilots require that a minimum ratio of the CCERs used for offsetting purposes should come from projects located in their own jurisdiction or jurisdictions that have signed cooperation agreements with them, varying from 50 percent to 100 percent. In terms of credit vintage, some pilots require that the underlying emission reductions have happened after a certain time point, for example, 2013, when most of the pilots started their operation. In order to avoid double counting, none of the pilots allows the use of CCERs generated within the boundary of covered installations. For the national ETS, CCERs from projects in renewable energy, carbon sinks, methane utilization, and others will be admissible; details were still pending at the time of writing.

The International Civil Aviation Organization Council recently unconditionally accepted the CCER program to supply the pilot phase of the global aviation offset system Carbon Offsetting and Reduction Scheme for International Aviation.

8.4.2 QUANTITATIVE LIMITS

Policymakers generally limit the use of offsets in an ETS to meet particular policy goals. For example, quantitative limits may assist in realizing local mitigation and co-benefits. While carbon credits used as offsets are equivalent to allowances for the purpose of compliance, they often trade at a lower price than allowances when quantitative limits are binding. If firms use their full allocation of offsets, these units can no longer be used for compliance, which leads demand and prices to fall relative to the price of allowances. Quantitative limits on offsets can also be used in conjunction with price or supply adjustment measures (see Step 6) as a price management tool.

The most straightforward and commonly used quantitative limit is to restrict the share of entities' compliance obligation that can be met with offsets. In the Republic of Korea, for example, each regulated entity can only use offsets to cover up to 10 percent of its compliance obligation. In addition to limits on the share of compliance obligation for regulated entities, the use of international offsets was limited to 50 percent of estimated aggregate emission reductions in Phases 2 and 3 of the EU ETS. Saitama also uses a limit relative to emission reductions and further differentiates limits by entity, allowing factories to use more offsets for compliance than offices.

8.5 QUICK QUIZ

Conceptual Questions

1. What are the benefits of allowing offsets into your ETS?
2. What are the potential challenges from including offsets?

Application Questions

1. What are the primary motivations for including offsets in your system and how might they affect the type of offsets you accept?
2. Does your jurisdiction want to use existing units or reward early action by sources that will be covered in your ETS?
3. How could your jurisdiction manage the challenges of allowing offsets?
4. Do you have the administrative capability and mitigation potential among uncovered emissions sources to make it worthwhile to create your own offset program?

8.6 RESOURCES

The following resources may be useful:

- Establishing Scaled-Up Crediting Program Baselines under the Paris Agreement: Issues and Options
- A Guide to Greenhouse Gas Benchmarking for Climate Policy Instruments
- A Guide to Developing Domestic Carbon Crediting Mechanisms (forthcoming)

STEP 9
Consider linking

BOXES

FIGURES

TABLES

AT A GLANCE

Checklist for Step 9: Consider linking

- ✔ Identify potential linkage partners
- ✔ Determine the type of link
- ✔ Identify the benefits and risks associated with the link
- ✔ Discuss compatibility of key program design features
- ✔ Form and govern the link

Linking occurs when an emissions trading system (ETS) allows regulated entities to use allowances from one or more other systems for compliance purposes. A jurisdiction can consider various types of linkages, along two dimensions of choice — the direction of flow of allowances and whether there are restrictions placed on allowances from the linked system. Linking can be bilateral (or multilateral), where all systems recognize the allowances of the other system(s), or unilateral, where the flow of allowances goes in only one direction. Additionally, systems may or may not place qualitative or quantitative restrictions on allowances from the linked system(s).

There are several economic, environmental, political, and administrative benefits to linking. First, it reduces aggregate compliance costs: allowing two systems to trade allowances increases efficiency in the same way as trade between two companies. The larger the difference in allowance prices between the systems prior to linking, the greater the potential for economic gains from trade. Linking also increases market liquidity and depth, promotes price stability, and can reduce the risk of carbon leakage. Linking can increase the political momentum for climate action, allowing jurisdictions to demonstrate climate leadership on a global level and build domestic support for mitigation policies. It may also help lock in the ETS, making it more politically challenging for subsequent administrations to undo carbon pricing policies or walk back climate ambition. Finally, the lower aggregate compliance and administrative costs resulting from linkage may also help with the political sustainability and durability of an ETS.

However, for linkages to work, jurisdictions may need to find compromises to make their systems compatible and to guarantee the environmental integrity of allowances across systems. If prices differ significantly between jurisdictions prior to linking, their subsequent convergence can be challenging — either because high-price jurisdictions will be concerned that their climate ambition is being diluted and co-benefits are reduced, or because low-price jurisdictions will be concerned about the higher prices they will experience. The associated financial and allowance flows may also be politically challenging for governments to defend. In addition, there is a risk that linking transmits shocks from one system to another that otherwise would have been restricted to a single jurisdiction's ETS, with potentially undesirable effects.

To address these potential disadvantages, jurisdictions should choose linking partners carefully and consider safeguards, such as restricting the extent to which they link or defining conditions under which the link is terminated. These restrictions will reduce the cost-effectiveness of an ETS but may be useful if there is a need to trade off some of the advantages of linking with a reduction of potential risks.

Clearly identifying the objectives of linking can help in the search for an appropriate linking partner. Given the close cooperation required to run a linked market, linking with a partner that the jurisdiction already trusts and has a relationship with may be preferable. In some cases, ETSs were designed from the outset to link with a larger market or operate as a multi-jurisdictional system.

When a jurisdiction has identified a potential linking partner or partners, an in-depth review of the respective systems helps identify the design elements that need to be discussed and possibly aligned. Linking requires clear understanding and acceptance of the current and future levels of ambition, standards for environmental integrity, strategies for stabilizing prices, and direction of future ETS policy in partnering jurisdictions. Specific design features that require compatibility include the voluntary or mandatory nature of the system, the type of cap, price or supply adjustment measures (PSAMs), the use and environmental integrity of offset credits, rules on borrowing and banking allowances, and the potential for linking with further systems.

Certain key design features require not strict compatibility, but rather confidence that the linking partner or partners' ETS designs will deliver comparable outcomes. This includes the stringency of the cap, the robustness of monitoring, reporting, and verification (MRV) systems, capacity of regulators to manage risks of misconduct in the secondary market, the administration of registry and tracking allowances, and ability and willingness to enforce ETS rules. Coordinating on and understanding other design elements such as the system's scope, point of regulation, allowance allocation methods, or the length of commitment periods may improve the functioning of a link or address political considerations, but are not strictly necessary.

Jurisdictions must also consider the timing of the link, the legal instrument by which to implement it, and institutions and processes for governing the link. Further, arrangements should include a contingency plan for de-linking.

Section 9.1 explains the different types of linking. Sections 9.2 and 9.3 consider the benefits and risks of linking. Section 9.4 examines how jurisdictions might look to balance these benefits and risks through both their choice of linking partner and the possibility of limiting the degree of linking. Section 9.5 considers the extent of design and regulatory alignment required by linking. This chapter concludes with a discussion on the formation and governance of the link in Section 9.6.

9.1 DIFFERENT TYPES OF LINKING

A jurisdiction can consider various types of linkages, with two dimensions of choice — the direction of flow of allowances and the restrictions placed on allowances from the linked systems.

The direction of flow of allowances can be

- **Unilateral.** Under unilateral or one-way linkage, a system accepts allowances from one or more other systems, but not vice versa. One-way linkages may represent the starting point for a potential two-way link. Norway had a one-way link with the European Union (EU) (where Norwegian entities could buy EU allowances but not vice versa) as a first step to a two-way link. A similar staged accession was planned for the intended link between the EU ETS and the Australian ETS.
- **Bilateral or multilateral.** Allowances from one or more markets are eligible for use in the others and vice versa. Linkages may be bilateral or multilateral. An example of bilateral linkage is that between California and Québec. The Regional Greenhouse Gas Initiative (RGGI) launched as a multilateral linked system of almost identical ETSs, each enacted at the state level, but operating from the beginning as a single, unified system.[297]

Indirect linkages may also be created when two separate systems (A and B) each link to a common, third system (C). Although they are not formally linked, activity in system A could then impact the market in system B and vice versa through impacts on the allowance price in the common shared partner system, C. Linkages to C could be one- or two-way. An example of this is New Zealand's ETS, which was linked indirectly to the EU ETS through their mutual acceptance of Certified Emission Reductions (CERs) generated under the Clean Development Mechanism (CDM).

Additionally, systems may place qualitative criteria or quantitative limits on allowance flows from the linked system(s).

- **Full or unrestricted linkages.** Allowances from all systems are mutually recognized and equivalent for compliance purposes without any restrictions, effectively creating a unified market.
- **Restricted linkages.** Limits are placed on the flow of allowances from the linked system. These may be quantitative or qualitative, similar to the limits most ETSs have on the use of offset credits (see Step 8).

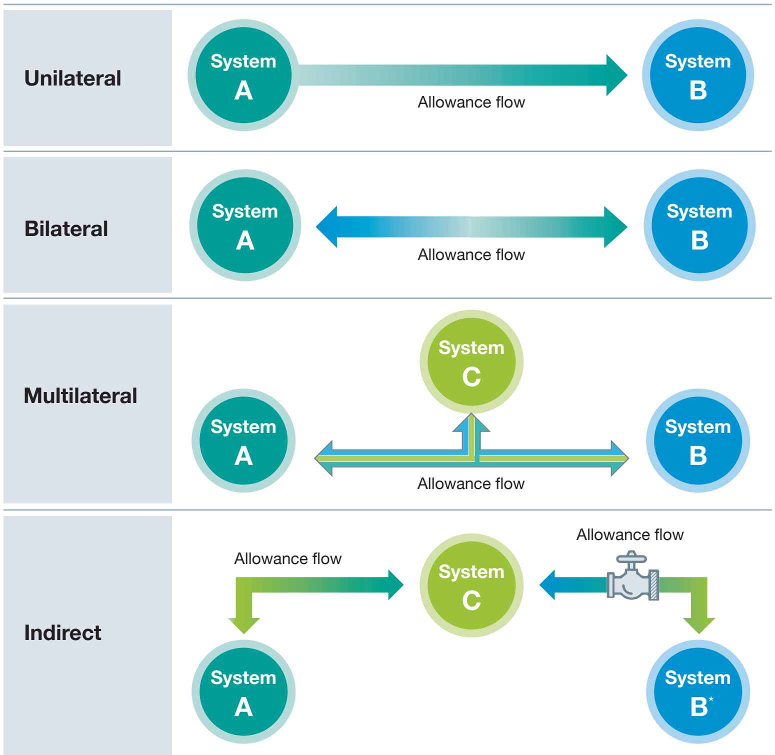
While not a formal link, collaboration among systems may be an important step along the way to full linkage — or may be considered desirable in itself. By coordinating on and promoting alignment of program objectives, enforcement mechanisms, or other features, systems can share information and best practices, increase comparability of effort, provide political support, reduce competitiveness and leakage concerns, and simplify administrative procedures for companies operating across the systems. Collaboration can also be an opportunity for an established ETS to share information with a new system, streamlining technical, legal, and administrative burdens and lowering costs while also smoothing the potential path toward eventual full linkage.[298]

These interactions between systems are summarized in Figure 9-1, with some examples of linking ventures to date summarized in Table 9-1. Further details on linking ETSs can be found in the International Carbon Action Partnership's (ICAP) *Guide to Linking Emissions Trading Systems*.

297 There is a legal and theoretical difference between a uniform ETS that covers many jurisdictions, and a set of highly aligned but separate, linked ETSs. However, in practice, cases are often on the boundary and difficult to put into one category or another. For example, the EU ETS is a multi-jurisdictional system in which the EU and the Member States have rule-making and executive functions, and in which the implementation across Member States differs in certain details (for example auctioning and revenue use, definition of installation, etc). RGGI is likewise a multi-jurisdictional system in which the jurisdictions set rules and implement them at the collective level (for example Model Rule, RGGI, Inc.) and individually (state legislatures, state administrations), and in which the implementation across states differs in certain details (for example, revenue use). Allowances in both systems are common, not distinct but fungible. They key distinction between the systems is that EU Member States cannot choose to join or opt out, whereas RGGI states can. For the purpose of this document we therefore refer to RGGI as a system of linked ETSs and discuss the EU ETS as a single system. Further discussion of these borderline cases can be found in Mehling 2016.

298 Burtraw et al. 2013.

Figure 9-1 Types of linkages



*The valve illustrates qualitative and/or quantitative restrictions imposed by System B on allowance inflows from System C. This is illustrative and without loss of generality because restrictions can be imposed in any type of linkage and in multiple systems simultaneously.

Table 9-1 Past, present, and future of linkages between ETSs

Systems involved	Main characteristics	Key events
California and Québec (current)	▲ Two-way link ▲ Separate caps ▲ Similar design features ▲ Joint auction and registry system	2011 — California and Québec adopt design recommendations of Western Climate Initiative (WCI) 2013 — California and Québec independently adopt regulatory changes to recognize each other's programs 2014 — California and Québec programs link
California and Québec with Ontario (past; active only during the first half of 2018)	▲ Linked and then de-linked with California and Québec ▲ Separate caps ▲ Similar design features ▲ Joint auction and registry system	2017 — Linking agreement reached between all three jurisdictions 2018 — Link becomes operational (linkage occurred from January–June 2018) 2018 — Ontario withdraws from linked market following election of new provincial government, but new linking agreement remains valid for California and Québec
EU and Australia (past; planned but never took effect)	▲ Eventual two-way link beginning with one-way link in which Australian entities could use EU allowances ▲ Separate caps ▲ Some design features were in process of alignment	2012 — Agreement to enter negotiations on eventual two-way link starting 2018 2014 — Australia repeals its Carbon Pricing Mechanism (CPM), which ends discussion of possible EU link

Table 9-1 Past, present, and future of linkages between ETSs *(continued)*

Systems involved	Main characteristics	Key events
EU and Norway (past; active between 2005 and 2012)	▲ Began as a one-way link with Norway accepting EU Allowances (2005–2007) and evolved into a two-way link (2008–2012) ▲ Common cap ▲ Similar design features ▲ Separate auctions and registry systems	2005 — One-way link starts 2007 — Agreement reached on two-way link 2008 — Two-way link starts 2012 — Directive establishing third phase of EU ETS (2013–2020) incorporated into revised European Economic Area agreement, making Norway part of the EU ETS
EU and Switzerland (current)	▲ Two-way link ▲ Separate caps ▲ Similar design features after Switzerland undertook actions to align its ETS with the EU ▲ Separate auctions	2011 — Negotiations on linking agreement formally begins 2017 — Linking agreement signed 2020 — Link enters into force
RGGI (current)	▲ Multilateral link among participating states ▲ Set of participating states evolves over time as states join/leave ▲ Common cap ▲ Similar design features ▲ Joint auctions ▲ Same registry systems	2005 — Agreement reached among original seven signatory states 2006 — Model Rule establishing regulatory framework published 2009 — Operations begin in 10 states 2017 — Model Rule for 2021–2030 published
RGGI and New Jersey (current)	▲ De-linked and then re-linked with RGGI ▲ Common cap ▲ Similar design features ▲ Joint auctions ▲ Same registry systems	2005 — New Jersey is among the original signatories to RGGI 2009 — RGGI operations begin 2011 — New Jersey exits RGGI under new governor 2019 — New Jersey passes legislation to rejoin RGGI 2020 — New Jersey rejoins RGGI
RGGI and Pennsylvania (under consideration)	▲ In the process of designing regulation with intention to link with RGGI from 2022 ▲ Common cap ▲ Similar design features ▲ Joint auctions ▲ Same registry systems	2019 — Executive order by Pennsylvania governor requests development of ETS regulation proposal aligned with RGGI 2020 — Pennsylvania proposes first draft ETS regulation aligned with RGGI with the aim to link from 2022
RGGI and Virginia (current)	▲ Adopted legislation to link with RGGI from 2021 ▲ Common cap ▲ Similar design features ▲ Joint auctions ▲ Same registry systems	2017 — Virginia proposes ETS regulation aligned with RGGI with aim to link by 2020 2018 — Virginia releases revised and final ETS regulation 2019 — Virginia adopts ETS regulation incl. RGGI linkage by 2020; state legislature adopts budget blocking RGGI linkage 2020 — Newly elected state legislature adopts ETS legislation including RGGI linkage from 2021
Tokyo and Saitama (current)	▲ Two-way link ▲ Separate caps ▲ Similar design features ▲ Separate allocation mechanisms and registry system	2011 — Link is operational immediately at the launch of Saitama's ETS
Transportation and Climate Initiative (TCI) (under consideration)	▲ Currently finalizing a memorandum of understanding (MoU) to establish a multilateral link among participating states from 2022 ▲ Common cap ▲ Similar design features ▲ Joint auctions ▲ Same registry systems	2018 — Subset of TCI jurisdictions announce development of carbon pricing mechanism for transport sector 2019 — Subset of TCI jurisdictions propose draft framework and draft MoU for transport sector ETS

Note: This table covers only links between ETSs. It does not include links to offset systems, government-level only links (for example under Kyoto), or indirect links among ETSs caused by offset systems (i.e., as existed between the EU ETS and the New Zealand ETS due to prior link to CDM and other Kyoto units).

9.2 BENEFITS OF LINKING

Linkage can provide economic, political, and administrative benefits that help support the design objectives of an ETS. This section identifies some of the most important benefits.

9.2.1 ECONOMIC BENEFITS

The economic argument for linking is based on lowering compliance costs, increasing market depth and liquidity, improving price predictability, and reducing leakage concerns. Each of these benefits is discussed in the subsections below.

Lowering aggregate compliance costs

Allowing two systems to trade allowances enables efficiency gains in a similar way to trade between two companies (as described in Step 1). The system with higher prices overall will be able to buy allowances from the system with lower prices, reducing the cost of achieving its cap. Net sellers will have to emit less but benefit from the increased revenues from exporting allowances. Thus, linkage can reduce costs while keeping total emissions unchanged, assuming caps in both systems are robust and compliance obligations are enforced (see Box 9-1).

Box 9-1 **Technical note: Gains from trade via linkage**

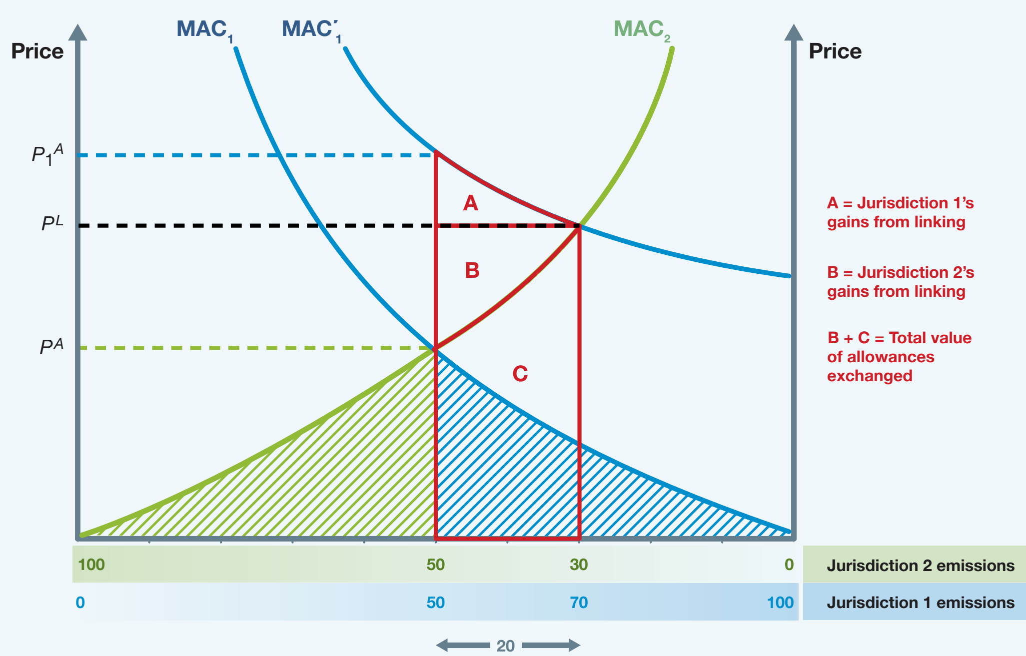
To illustrate the sources of the economic gains from trade via linkage, consider the simple and stylized setup with two identical jurisdictions labeled 1 and 2 in the figure below.

These jurisdictions have business as usual emissions of 100 units. Their marginal abatement cost (MAC) curves are represented by blue and green respectively. The emissions from Jurisdiction 2 decline moving from left to right along the horizontal axis and its MAC increases as depicted by the green MAC curve. The emissions from Jurisdiction 1 decline moving from right to left along the horizontal axis with analogous implications for its MAC shown in blue.

Suppose each jurisdiction caps emissions at 50 units, issues 50 allowances, and allows *domestic* regulated entities to trade allowances freely among themselves. Since the jurisdictions are identical, the market-clearing price of these allowances will be the same. This price is denoted P^A in the figure where A is for autarky because only domestic firms can trade. In each jurisdiction the total cost of complying with the cap is equal to the blue and green shaded areas. In this setup, if the systems were linked, there would be no allowance trades between jurisdictions. This is because when the prices, and therefore MACs, are equal, there is no incentive to trade between jurisdictions and so no gains from trade via linkage.

However, there would be an incentive to trade if there is a difference between the autarky prices in the two jurisdictions. Such a difference would emerge if the MAC curve in Jurisdiction 1 is given by MAC'_1. In this case, regulated entities in Jurisdiction 1 place a greater value on the allowances because $P_1^A > P^A$. A linkage between the two systems would incentivize

Figure 9-2 Illustration of gains from trade in a bilateral linkage



trades that transfer 20 allowances from entities in Jurisdiction 2 to those in Jurisdiction 1 at the price of P^L where L is for linking. This implies that the abatement effort in Jurisdiction 2 ramps up from 50 to 70 (and its emissions decline to 30) and declines from 50 to 30 (and its emissions increase to 70) in Jurisdiction 1.

The region outlined in red and divided into areas A, B, and C provide additional insights regarding this reallocation of abatement effort and helps pin down the gains from trade. The value of the financial transfer from Jurisdiction 1 to Jurisdiction 2 is equal to the area B+C. It is greater than the increase in the total costs of Jurisdiction 2 for increasing its abatement effort, which is given by area C. Therefore, Jurisdiction 2 has a net gain of area B via linkage. The cost savings in Jurisdiction 1 from reducing its abatement effort is given by the area A+B+C but it only pays B+C for the allowances. Therefore, Jurisdiction 1 has a net gain of area A via linkage. In fact, the total cost of meeting the aggregate cap is lower by precisely the sum of individual jurisdictions' gains from trade via linkage, namely the area A+B.

While this clarifies the *magnitude* of the gains from trade via linkage, the discussion is silent on the *source* of the gains, that is, the reason for the difference between MAC_1 and MAC'_1. The latter curve could be the result of relatively higher cost abatement options being available in Jurisdiction 1. In this case greater effort is required to comply with the cap and the resulting gains from trade via linkage are due to enhanced effort sharing between the jurisdictions. Alternatively, the difference can be interpreted as the difference between the expected (at the time the system is designed) and realized (at the time the system is in operation) MAC curves in Jurisdiction 1. This can be the result of those changes in economic and technological conditions that are difficult to forecast.[299]

Linkage between ETSs may also be a strategic step toward a more integrated global carbon market and the resultant cost savings. As a case in point, the European Commission cites supporting global cooperation through the bottom-up creation of a better functioning and more cost-effective network of markets as one of the major reasons to consider linkage of its system.[300]

Increasing market depth and liquidity

Linkage can improve market function by increasing the number and diversity of market participants. In turn, this will improve market liquidity — how easy it is to buy or sell allowances — and market depth, that is, the number and volume of buy-and-sell orders at each price. This has several benefits, including

- improving the market's ability to form prices;
- restricting the potential for market manipulation as a result of buyer or seller power; and
- encouraging the provision of services by market intermediaries, making market functioning smoother (for example making it easier to trade in a timely and low-cost manner through electronic exchanges, greater access to financial and risk-management instruments such as futures and options, and easier negotiation of trades).

Similarly, linking provides smaller economies that may not have a diversity of emitting sectors, or the required depth of market players, an opportunity to join a larger market. Examples include Québec's linkage with California; Switzerland's linkage with the EU; and where individual US states have created the joint system RGGI.

Improving price predictability

Another advantage of linking is that a larger, deeper market with a variety of participants from different sectors and geographies can reduce price volatility, as shocks to any one system are spread across the broader linked network. Larger, more diverse systems will be able to better absorb day-to-day, company-, industry-, or jurisdiction-specific shocks, as it is less likely that all actors in the linked market will be simultaneously hit by the same economic shock. This is particularly the case if linking partners have economies that are not closely correlated.

Reducing concerns around leakage and competitiveness

Linkage can help reduce leakage, particularly among close trading partners. When two systems link bilaterally without any restrictions, prices will converge. As long as vulnerable sectors are covered in both jurisdictions, there should thus be little (carbon price related) incentive for shifts in production/emissions between the linking jurisdictions (unless they can get other benefits, such as free allocation).

Linking may also ease the concerns of market participants and other stakeholders around the competitiveness impacts of an ETS. These concerns, often a political challenge in the implementation of carbon pricing, will be reduced if neighboring jurisdictions' and trade partners' carbon prices are similar, as would be the case with a linked market where prices converge.

299 Ranson and Stavins 2016 and Zetterberg 2012 develop these ideas informally and provide a broad overview of linking in practice. Doda and Taschini 2017 and Doda et al. 2019 analyze gains from trade formally in the context of bilateral and multilateral linkages.

300 European Commission 2015c.

9.2.2 ENVIRONMENTAL BENEFITS

Linking lowers the cost of mitigation through a deeper, larger market, as well as the cost of operation through administrative synergies. In theory, these cost savings could allow policymakers to ratchet ETS ambition further or invest in other climate policies, such as support for research and development of mitigation technology.[301]

Furthermore, it may be more politically feasible to increase climate ambition as part of a linked system including multiple members, as compared to an individual jurisdiction. For example, each of RGGI's program reviews (2012 and 2016) has lowered the regional cap, tightening the annual reduction factor in each of the successive phases (2.5 percent through to 2020 and around 3 percent for 2020–2030 respectively).[302]

9.2.3 POLITICAL AND ADMINISTRATIVE BENEFITS

Linking may also offer political benefits such as increasing the momentum for climate action and delivering administrative efficiencies, as discussed in the subsections below.

Increasing momentum for climate action

Linking provides an opportunity for jurisdictions to demonstrate climate leadership on a global level and to build domestic support for mitigation policies. For example, one of the goals of the WCI is to foster greater market development for reducing greenhouse gas (GHG) emissions through regional collaboration, including linkage, of subnational jurisdictions in the United States and Canada.

Linking may also help lock in the ETS, making it more politically challenging for subsequent administrations to undo carbon pricing policies or walk back climate ambition. This was identified as a key driver for the EU and Australia in pursuing linking of the EU ETS with the former Australian ETS.[303]

While linking can go some way in solidifying commitment to achieving environmental targets set out in the ETS, implementing an ETS remains a political decision that can still be undone by subsequent governments. For instance, both Australia and Ontario were unable to retain their ETSs due to changing governments, despite agreed and operational links to the EU ETS and California-Québec systems, respectively.[304]

The lower aggregate costs resulting from linkage may also help with the political sustainability of an ETS and hence create greater confidence in the durability of the system. These considerations will depend on the particular political circumstances but, for example, participation in a linked market with California appears to have helped build support for the carbon market in Québec, and this dynamic seems to be potentially extending to other states in North America.

Increasing administrative efficiencies

Linkage could bring efficiencies and cost savings from joint market operations. This might be particularly relevant for subnational jurisdictions, developing countries, or small countries with greater resource constraints. For example, California and Québec conduct joint auctions through an auction platform administered by WCI, Inc. (a nonprofit corporation that provides cost-effective technical and administrative support to participating member jurisdictions) to reduce program costs and streamline operations. Nova Scotia, which is operating an independent carbon market, also relies on WCI, Inc. infrastructure for auctioning. The Pacific Alliance jurisdictions (Chile, Colombia, Mexico, and Peru) are cooperating in a range of areas, including MRV, registries, information platforms, standards, and accreditation, which may simplify future linking of carbon markets. Linkage can also simplify ETS operations and administrative procedures for multinationals or other companies operating across systems if each recognizes the same allowances and uses similar reporting procedures.

301 See IETA 2019, IETA, University of Maryland, and CPLC 2019, and Piris-Cabezas et al. 2019 for a discussion on how global markets could enhance environmental ambition.
302 ICAP 2018a.
303 Evans and Wu 2019.
304 Both these systems were relatively new, and it can be argued that the agreements would have been harder to pull out of had the systems had time to produce environmental results and raise revenues.

9.3 RISKS POSED BY LINKING

While the discussion above highlights some of the key benefits of linking, this section discusses the economic, environmental, and political risks that stem from linking.

9.3.1 ECONOMIC AND ENVIRONMENTAL RISKS

The economic and environmental risks from linking include challenges from price convergence, the potential for importing shocks or misconduct from linked jurisdictions, and the potential for resource transfers to incentivize low environmental ambition, as discussed in the three subsections below.

Challenges from price convergence

Full linking converges prices between the linked systems, with the higher mitigation cost/higher allowance price jurisdiction seeing a decrease in price, and the system with the lower mitigation cost/lower allowance price seeing an increase in price. Although this reflects the gains from trade generated by linking, it can also cause challenges.

For jurisdictions in which linking leads to a significantly lower carbon price, linking may undermine the incentive to reduce emissions. The fall in carbon price could depress incentives for domestic innovation; the deployment of newer, low-carbon technologies; and the delivery of co-benefits associated with domestic emissions reductions (see Step 1). Indeed, such concerns have been one of the main reasons for limiting the number of international offsets that can be used for domestic compliance purposes. The new, lower price will also lead to a reduction in revenues raised by the ETS; this is discussed further in the section below, "Concerns around distributional impacts." Linking partners may wish to consider the implementation of price and supply adjustment measures (such as price floors) to stop prices from falling too low (see Section 9.6 in this chapter and Step 6).

Risk of shocks or misconduct being imported from linked jurisdiction(s)

While linking can improve price stability, it also means that shocks from one system may be imported into any system with which it is linked, leading to the possibility of a dramatic move in price due to external factors. Shocks originating in one system — such as boom-and-bust cycles or ETS policy changes — will likely affect all the linked systems. Smaller systems are particularly vulnerable to such "imported risk," as the impact of activities in the larger, linked system will be relatively more significant.

The potential for asymmetric market oversight may also be a major concern from the perspective of financial regulators, especially in cases where the respective regulations and institutions of a linking partner are considered significantly less robust than the domestic context. The secondary market for emissions allowances operates as part of a complex financial system, and can be subject to various types of misconduct, which may have impacts across borders in the context of linked ETSs. Misconduct can undermine the efficiency and integrity of an ETS and create operational challenges, for instance through the suspension of registry operations. Therefore, robust financial market regulation and established processes for cooperation between relevant regulators is needed to reduce these risks.

Potential for resource transfers to incentivize low environmental ambition

Financial flows from high-cost to low-cost systems may incentivize jurisdictions that expect to be net sellers to set looser caps (or baselines in the case of crediting systems) in order to sell more allowances internationally. Some buying jurisdictions could be tempted to support this so they would be able to purchase low-cost allowances and/or may not tighten their caps in light of available cost savings.[305] Conditioning the choice of linkage partners on a willingness to take on acceptable levels of program ambition, as discussed in Section 9.4 below, is thus an important way for both systems to take advantage of potential gains from linkage while guarding against perverse incentives.

9.3.2 POLITICAL RISKS

The political risks from linking include concerns around distributional impacts, the risk of transfers of resources and co-benefits abroad, and the potential loss of domestic control over decisions on ETS design, as described in the subsections below.

Concerns around distributional impacts

The increase in price in the previously lower-cost jurisdiction may create political challenges for the ETS as there may be large distributional and competitiveness implications for individuals and companies; for instance, in low-income households due to rising energy costs. A related distributional challenge is that auction revenues in high-cost/high-revenue jurisdictions will fall, potentially jeopardizing domestic initiatives funded through those revenues. These may need to be addressed with additional policy measures including identifying other sources of funding for the initiatives.

305 Green, Sterner, and Wagner 2014.

Concerns around transfers of resources and co-benefits abroad

If the financial and allowance flows across linking jurisdictions are significant, this could also cause political challenges. In particular, the recipients of the financial flows will be those in jurisdictions with lower costs/prices; in cases where these low costs/prices are the result of lower policy ambition, this could be seen as rewarding low-ambition jurisdictions or "outsourcing" of emissions reductions overseas.

As emissions reduction shifts from the high-cost jurisdiction to the low-cost jurisdiction, the location-specific co-benefits of these abatement actions will also shift to the lower-cost jurisdiction. This may be challenging for policymakers to accept, especially in cases where co-benefits like reductions in air pollution and job generation are important carbon pricing objectives.

Loss of domestic control over decisions on ETS design

While an ETS is developed in light of national circumstances, linking requires partners to coordinate on ETS design features to ensure compatibility, especially in cases where a full link is being established. Each party participating in the link will need to be satisfied with the environmental integrity of the allowances used in the other system, as after linking these allowances could be used across all linked systems. Jurisdictions may be reluctant to revise ETS design elements to increase compatibility at the expense of domestic circumstances. This is explored in greater detail in Section 9.5.

The discussion above highlights a series of benefits and risks associated with (different forms of) linking. These are summarized in Table 9-2.

Table 9-2 Benefits and risks of linking

	Benefits	Risks
Economic	+ Lowers aggregate compliance costs across systems + Increases market liquidity and depth + Can reduce leakage and competitiveness concerns + Can attract external resources for reducing emissions	- Can increase domestic emissions and reduce environmental and social co-benefits
	± Can promote price stability, although it can also import price volatility from abroad ± Can prompt significant financial transfers ± May create administrative efficiencies: pre-linkage negotiations and possible program modifications can be costly, while linked systems may lower administrative costs through pooled resources	
Political	+ May strengthen domestic ETS legitimacy and durability through reduced costs and international collaboration + May increase potential for raising ambition	- May create domestic political concerns over distributional impacts and resource transfers abroad
	± Can help shape and build momentum on global climate action, but also decreases independent control over program design and ambition	
Environmental	+ Can encourage policymakers to adopt a more ambitious target given the cost-efficiency gains from linking	- Linking to a system that is not equally robust can incentivize weak reduction targets

9.4 BALANCING THE ADVANTAGES AND CHALLENGES OF LINKING

This section discusses three issues that will be important to policymakers in trying to maximize the advantages of linking while minimizing the effects of challenges it presents. Specifically, Section 9.4.1 discusses the choice of linking partner and Section 9.4.2 discusses the options for qualitative and quantitative limits on linking.

9.4.1 CHOOSING LINKING PARTNERS

While the primary goal when choosing a linking partner is to ensure environmental integrity is maintained and environmental ambition is increased, jurisdictions need to manage a tension between

- linking with jurisdictions with similar economic characteristics (which will often be geographically proximate), something that may be politically and institutionally easier; and

- linking with jurisdictions that have very different economic characteristics, which may be more economically advantageous.

How jurisdictions choose to trade off this tension will depend, in part, on the objectives they have for linking.

On the one hand, economic similarities and geographic proximity often imply close political and trade ties. These will provide preexisting working relationships that may facilitate a link, including agreement on acceptable levels of program ambition.[306] Linking between trade partners will also be more effective in addressing leakage concerns.

On the other hand, if the economic attributes of a prospective linking partner are different, and this is reflected in an abatement cost differential, then the opportunity to realize gains from trade and achieve lower aggregate compliance costs will be greater (see Section 9.2.1).[307] Such differences are more likely to prevail between developed and developing country systems, between systems that are subject to different shocks at different times, or between economies that have different sectoral structures and hence have different abatement opportunities.

This suggests that the choice of linking partners depends on how much weight jurisdictions place on different benefits and risks. If the primary purpose of linking is to increase market liquidity and depth, and if there is also a concern about the accompanying effects of price convergence, then linking with economically similar (and geographically proximate) jurisdictions may be preferred. If the focus is more on lowering aggregate compliance costs or addressing leakage risk, then dissimilar linking partners may be preferred.

Supporting greater climate ambition through regional and international cooperation is often the underlying rationale for linking, with jurisdictions looking to ensure that linking partners take on a fair share of mitigation effort. Domestic political considerations can also play an important role in the decision to link. For instance, reducing the (real or perceived) cost of climate policy or risks of carbon leakage may be a key driver for linking. Further linking may be used to try to cement carbon pricing policies and prevent future governments from rolling back on ambition. International political considerations including the prestige associated with leading on climate action and exerting influence on the direction of global policy may also play a role.

Some institutional factors can also facilitate linking between two jurisdictions. These include shared cultural factors like language and norms, which may ease communication; close geographic ties, which enable strong political and business links; and compatibility of institutional frameworks of existing ETSs (see Section 9.5 for more detail).[308] Figure 9-3 summarizes both the factors that drive linking and characteristics that facilitate the process. The examples of linkage through the EU ETS, Regional Greenhouse Gas Initiative (RGGI), California-Québec, and the Tokyo-Saitama link suggest that most jurisdictions have linked with systems where there is some degree of geographic proximity, existing economic and political ties, and relatively similar environmental ambition as well as economic and abatement cost profiles.[309]

9.4.2 RESTRICTIONS

A further way to manage the benefits and risks of linking is to consider restricted linking as either an initial or more permanent option. This will be less cost-effective than unrestricted linking but may be useful if there is a need to trade off some of the advantages of linking against some of the risks, especially around the desire to preserve incentives for domestic emission reductions. It may also make de-linking easier if conditions change and the linkage is no longer beneficial.

Quotas or quantitative limits can be applied, limiting the use of external allowances to a certain percentage of an entity's compliance obligation, or to a certain system-wide aggregate number of allowances per year, which can then be applied as an entity-level percentage limit. While they would have featured in the proposed Australia-EU link, quotas have not been applied to date in the context of linking across ETSs, although they have often been included in links to offset programs, such as the CDM (see Step 8).

One-way linking, as described in Section 9.1, can also be used to manage risks and requires less coordination than full linking. Asymmetrically trading allowances through trading ratios or exchange rates has also been proposed in the past, but these options are currently not being used in any jurisdiction.[310]

306 This can be seen in the linkages of Norway, Lichtenstein, and Iceland with the EU under the European Economic Area; the link of Tokyo and Saitama subnational governments in Japan; and the linkage of California and Québec (and the announced planned link of Ontario) under the Western Climate Initiative.
307 Doda and Taschini 2017.
308 Evans and Wu 2019.
309 Ranson and Stavins 2015.
310 Trading ratios implement a conversion factor that dictates the quantity of foreign units or offsets that must be surrendered to replace one domestic allowance. Exchange rates are a special case of trading ratios that operate symmetrically, akin to an exchange rate for currencies. See Schneider et al. 2017 and Quemin and de Perthuis 2019 for details.

9.5 ALIGNMENT OF PROGRAM DESIGN

One of the key aspects of linking is that it requires a degree of compatibility between different systems in order to ensure equivalent environmental integrity of allowances and a well-functioning emissions market. Systems may already be compatible or may require adjustments to design features in one or more systems. Where systems are being designed with potential future linking in mind, conversations around compatibility of design should be had as early as possible. This section provides guidance on identifying the design features where alignment is needed to enable successful linking.

Aligning design features does not mean that they need to be identical across systems. In fact, design features fall along a spectrum of alignment. Some elements require a high degree of compatibility to make linkage work (Section 9.5.1), others require only that design features result in comparable outcomes (Section 9.5.2), and finally, some would benefit from coordination and mutual understanding, but do not strictly need it (Section 9.5.3). However, while the alignment of some design elements is optional in principle, alignment may be necessary politically or because linking will lead to the effective transmission of design features across the linked system.[311]

While this section provides a generalized hierarchy of importance for compatibility, each linking arrangement is unique and will require policymakers to make decisions on the relative importance of the ETS design features based on their jurisdictional circumstances. ICAP's *Guide to Linking Emissions Trading Systems* provides a more detailed analysis of the implications of a lack of alignment of each design feature on three factors:[312]

- **System robustness.** Linking partners must be certain that the combined market is robust enough to deliver the emissions reductions necessary and to comply with the combined cap.
- **Environmental ambition.** Linking partners should be confident their partner's ETS will drive a certain level of mitigation. As the environmental ambition of the system is largely determined by the cap, the stringency of that cap and the reduction pathway it sets out will be critical factors for consideration.
- **Possible side effects.** This includes any additional positive or negative effects of differences between linking systems. For example, differences in design may give rise to competitiveness or fairness issues if one system is perceived to confer a competitive advantage over the other. On the other hand, some differences in design may incentivize a higher level of mitigation.

9.5.1 DESIGN FEATURES REQUIRING COMPATIBILITY

Mutual trust between systems is a precondition for successful linking. Without this overarching confidence in each other's design and governance processes, it is difficult to enter into discussions on specific questions regarding system compatibility.

Policymakers must assess the compatibility of key ETS design features, particularly those relating to the ambition and environmental integrity of emissions reductions. Incompatibility on these features leads to significant challenges and, potentially, failure to successfully establish or maintain a link.

There are six key design elements that need to be compatible to enable linking. In addition to these features, communication regarding future changes to ETS policy and ambition is also essential. Once linked, a clear process for policy changes should be established, and expectations on communication defined early in the process of linking.

- **Participation.** Bilateral or multilateral linking requires systems to align on whether participation is voluntary or mandatory, without which linking is not viable. For example, Switzerland redesigned its ETS from a voluntary opt-in system to a mandatory ETS as part of preparations to link with the EU. A voluntary system might, however, seek a one-way link where it is able to buy allowances.
- **Cap type.** Linking a system with an absolute cap with a system with an intensity-based cap (indexed to output or gross domestic product, for example) is theoretically possible, but practically very challenging. Intensity-based targets are often perceived as less stringent than absolute caps (though this technically depends on relative economic growth rates). This may lead to challenges in reaching agreement over whether the ambition in the two systems is sufficiently similar which, as discussed in Section 4.1, can often hold back linking.[313]
- **PSAMs.** Full bilateral or multilateral linking effectively provides all market actors with access to the most economically favorable price anywhere within the system, affecting the efficacy of PSAMs. For example, a price floor in one system will no longer be effective if there are enough allowances below that price in the other

311 See Kachi et al. 2015.
312 ICAP 2018a.
313 PMR 2014a.

system. Similarly, a hard price ceiling in one jurisdiction could compromise the cap for both jurisdictions.[314] In general, when a small ETS links with a much larger ETS, PSAMs in the smaller system will become ineffective as the larger ETS will dominate. ETSs of similar size may be able to maintain independent PSAMs, but alignment is preferable to avoid these measures operating in contrary directions or driving large flows of funds. Careful management of these interactions is therefore needed to avoid perverse outcomes.[315]

- **Offsets.** The robustness of rules for offsets dictates the quality of allowances in the system and must be aligned to ensure environmental integrity. While different offset types need not be an intrinsic problem (and could potentially even improve cost-effectiveness and liquidity), understanding a potential linking partner's rules on quality is important. As for quantitative limits on offset use, alignment will benefit market functioning as offset limits in one system can be undermined by more lenient limits in the other system.
- **Borrowing and banking.** If one system allows borrowing to a greater degree than the other, and if prices rise upon linking, entities in the former system may be incentivized to borrow more. They could then sell those borrowed allowances (or the present-day vintage allowances they replace) to the second system, even though entities in that system may not borrow for themselves. Most jurisdictions in a linked system therefore allow banking but highly restrict borrowing.
- **Linking with other ETSs.** It is essential for partners within the linked system to have compatible views on if and how the linked system will grow, and what the decision parameters for including another system are. This could include the environmental integrity of allowances and the overall ambition level of the other ETS, in order to ensure meaningful mitigation outcomes and a consistent policy signal.

9.5.2 DESIGN FEATURES REQUIRING COMPARABLE OUTCOMES

Some design features do not need to be identical or highly compatible; instead, ensuring that comparable outcomes are achieved despite differences in design features may be sufficient for successful linking. These design features will affect the linked system and therefore need to be considered carefully by policymakers.

- **Stringency of the cap.** Linking partners should find the stringency of others' cap acceptable, particularly with regard to achieving comparable levels of ambition and environmental integrity. It is essential to understand a linking partner's process for cap setting and to have trust in its system's environmental integrity when this differs across systems. While there may be greater gains from trade when there are differing degrees of ambition, there are likely to be significant political difficulties from extensive asymmetries.
- **Robustness of MRV systems.** Confidence in the robustness of the linking partners MRV systems is critical to ensuring comparability in terms of the environmental integrity of allowances.
- **Stringency of enforcement.** If systems are not able to effectively enforce regulation at a comparable level (due to lack of ability or willingness, or due to wholly different legal enforcement structures), environmental integrity in all linked systems will suffer. Penalties for noncompliance should also be comparable; otherwise, noncompliance will happen mainly in the system with less-stringent penalties.
- **Registry and tracking.** While systems can be theoretically linked without a direct registry connection, having comparable registry systems can greatly facilitate the creation of a linked market. The proposed link between Australia and the EU raised issues that other jurisdictions will have to address when linking registries, for instance identifying protocols for approving transactions across registries and ensuring sufficient protections for the security of transactions and user information. An example of successful linkage between registries is the Kyoto Protocol's International Transaction Log (ITL). In order to trade Kyoto Protocol units (such as CERs) with one another, jurisdictions (and the CDM registry) must go through the ITL. The ITL verifies the trades in real time, checking that national registries are recording unit holdings correctly and making sure transactions are in alignment with Kyoto Protocol rules.[316]
- **Financial market regulations.** Regulators in jurisdictions considering linking must have confidence in the ability of their counterparts to contain and minimize risks of market misconduct that can undermine the efficiency and perceived integrity of an ETS. Robust financial market regulation and established processes for cooperation between relevant regulators will reduce these risks. It also ensures comparably smooth facilitation and enforcement of trades between the systems. Aligning the content and timing of publicly disclosed market-sensitive information can also ensure equal treatment across jurisdictions.

314 These types of dynamics have meant that the design of price and supply adjustment measures have been a focus of linking negotiations in the past. For instance, Australia agreed to remove its price floor as part of negotiations to link its former carbon pricing mechanism with the EU ETS, while California and Québec operate harmonized price and supply adjustment measures implemented through each system's cost containment measures and joint auctions.

315 This is discussed in detail in Vivid Economics 2020, which lays out a framework to investigate the effects of linking between carbon markets with different design aspects and characteristics. In particular, it assesses the impact of linking ETS with PSAMs to other markets, including offset markets.

316 For more information on the ITL, see the United Nations Framework Convention on Climate Change's (UFCCC) webpage on the subject (UNFCCC 2014) as well as Wabi et al. 2013, which details the more technical aspects and requirements of the ITL.

9.5.3 OTHER DESIGN ELEMENTS THAT WOULD BENEFIT FROM COORDINATION AND UNDERSTANDING

Other ETS design features do not need to be aligned for a link to function, but could benefit from coordination. However, in practice policymakers may prefer a higher degree of coordination than is strictly necessary for efficient market functioning. These design elements include

- **Scope.** Linked systems need not have exactly the same scope and, in fact, linking systems that contain different sources of emissions reductions can be a key economic rationale for linking. On the other hand, linking systems that cover trade-exposed sectors can help address competition and potential leakage issues. For example, the European Commission considered expanding the coverage of the Swiss ETS to domestic aviation as essential for its link with the EU ETS in order to address potential carbon leakage issues (see Box 9-2).
- **Point of regulation.** Different points of obligation are not necessarily barriers to linking, but they will require careful accounting adjustments. For example, if one system regulates emissions at the point of electricity generation and another system at the point of electricity consumption (for example, industrial facilities or residential buildings), there would need to be accounting adjustments where electricity is traded across the borders of linkage partners in order to ensure coverage and avoid double counting of emissions.
- **Allocation methods.** Different allocation methods do not affect environmental integrity as long as the cap is fixed. However, they could present political, competitiveness, and distributional challenges for linking. If a system with free allocation links with one that auctions allowances, industries might view their competitors' free allocations as being unfair. The EU and Australia identified provisions to preserve competitiveness in sectors subject to carbon leakage as one of the issues to be negotiated (see Box 9-4). Also, linking can change the distribution of auction revenues across systems, creating a potential need for agreement on a division of auction proceeds.
- **Phases.** Aligning time horizons across systems is not necessary, but may play a role in reaching agreement on programs' ambition, as well as in improving market functioning. Asynchronous phases could produce uncertainty over the future reduction targets of the system with the shorter compliance time-horizon. For example, the linked ETS programs of California and Québec both currently run through 2030 (see Box 9-3).
- **Compliance periods.** Equivalent compliance periods for entities could facilitate joint program administration. However, different compliance periods are also possible, and could in fact be beneficial, as they may improve liquidity.

Box 9-2 provides more detail on the discussions between the EU and Switzerland surrounding consistency and convergence of the design of their ETSs.

Box 9-2 Case study: EU-Switzerland linkage

The road to linking the Swiss and EU ETSs has been long, with the process beginning in 2011 after the former launched its ETS in 2008. In fact, the Swiss government signaled its intention to link to the EU ETS before finalizing its own ETS to help build support for the market-based instrument within the Swiss business community. This forward-thinking approach was motivated by the anticipated small size of the Swiss ETS, the importance of the country's trading relationship with the EU, and the expectation of access to lower-cost allowances from the EU for compliance by Swiss entities.[317]

Exploratory talks began in 2008, followed by formal mandates to enter negotiations issued by the Swiss Federal Council in December 2009 and the Council of the EU in December 2010. Formal negotiations ran in seven rounds from 2011 to 2016 and covered key elements of regulatory alignment and technical details, including the scope of emissions trading, handling of auctions, and registries. The two parties completed and signed a linking agreement in November 2017. After both sides ratified the agreement and Switzerland finalized the regulatory changes that were necessary to ensure alignment with the EU ETS, the link entered into force in January 2020.

The early intention to link the Swiss and EU systems, combined with years of direct engagement between the two jurisdictions, has aligned the design of the Swiss system broadly with that of the EU. In line with the EU ETS, the link resulted in an expansion of coverage in the Swiss ETS to include aviation and power, albeit nominal in the case of power because Switzerland does not have any fossil fuel–burning installations. The inclusion of aviation in the Swiss ETS has required data collection, setting up of new administrative systems, and overcoming industry opposition. While the Swiss have maintained their quality criteria on offsets, they aligned with the EU in some keys ways, including limiting CERs to those from least developed countries and excluding offsets from land use and forestry. →

317 ICAP 2018a.

Some notable differences were not considered essential for full alignment and will continue. For instance, the Swiss are not adopting the EU's Market Stability Reserve, an instrument that automatically adjusts auction volumes for over- or under-supply of allowances. However, in the Swiss ETS another PSAM is implemented as of January 1, 2020, and will be reviewed for the 2021–2030 period. The two sides will also continue to run separate auctions partly due to legal restrictions, but allowances from both systems will be acceptable for compliance.

Table 9-3 presents a summary of factors to be considered regarding linkage, including those requiring compatibility, those requiring comparable outcomes, and elements where coordination and understanding is preferred.

Table 9-3 Summary of factors to be considered in linking

Step	Requires compatibility	Requires comparable outcomes	Coordination and understanding preferred
	Greater alignment ←		→ Less alignment
Step 3: Scope	Mandatory versus voluntary participation		Scope of coverage Point of obligation
Step 4: Cap setting	Type of the cap	Stringency of the cap	Compliance period
Step 5: Allocations			Allocation methods
Step 6: Markets	PSAMs Banking and borrowing	Financial market regulation	
Step 7: Compliance		Enforcement stringency Robustness of MRV Registry operation	
Step 8: Offsets	Use of offsets		
Step 9: Linking	Linking with third parties		
Step 10: Implement and improve			Phases

9.6 FORMATION AND GOVERNANCE OF THE LINK

Establishing the required governance arrangements is a crucial step in the linking process. This involves considering the timing of the link (Section 9.6.1), choosing the linking instrument (Section 9.6.2), identifying institutions to govern the link (Section 9.6.3), and preparing a contingency plan for de-linking (Section 9.6.4).

9.6.1 TIMING OF THE LINK

Whether linkage occurs alongside the launch of an ETS or afterward may depend on several considerations, including

- **Objectives for linking.** In cases where linking is sought mainly to provide depth and liquidity, early linking may be desirable to promote the viability of trading within the ETS. By contrast, if linking is pursued to minimize costs, then immediate linkage may not be as critical. Other features like free allowances in the early stages of the ETS will tend to keep costs low to smooth the transition into the system.

- **Possibility of significant change in design features.** The history of ETSs, notably the EU ETS, suggests that various design features tend to evolve in the early years of the system. This is consistent with the discussion in Step 10 regarding pilots. In cases where there is a reasonable probability that design features may be subject to change or evolution, it may be better to delay a formal link, as it is more challenging to refine the design of an ETS when it is linked.
- **Level of preexisting compatibility.** The timing of the link also depends on the extent to which systems are pre-aligned. California and Québec engaged in a multi-year collaborative process through WCI discussions, and later bilaterally, to develop a framework to harmonize their respective emissions trading programs before formally enacting regulatory amendments to link the two programs in 2014 (see Box 9-3). By contrast, the proposed EU and Australia link would have occurred between ETSs that formed independently, without an initial intent to link; in this case a two-step approach was proposed, with a unilateral and then bilateral linkage in order to provide sufficient time for the negotiation process and subsequent coordination (see Box 9-4).

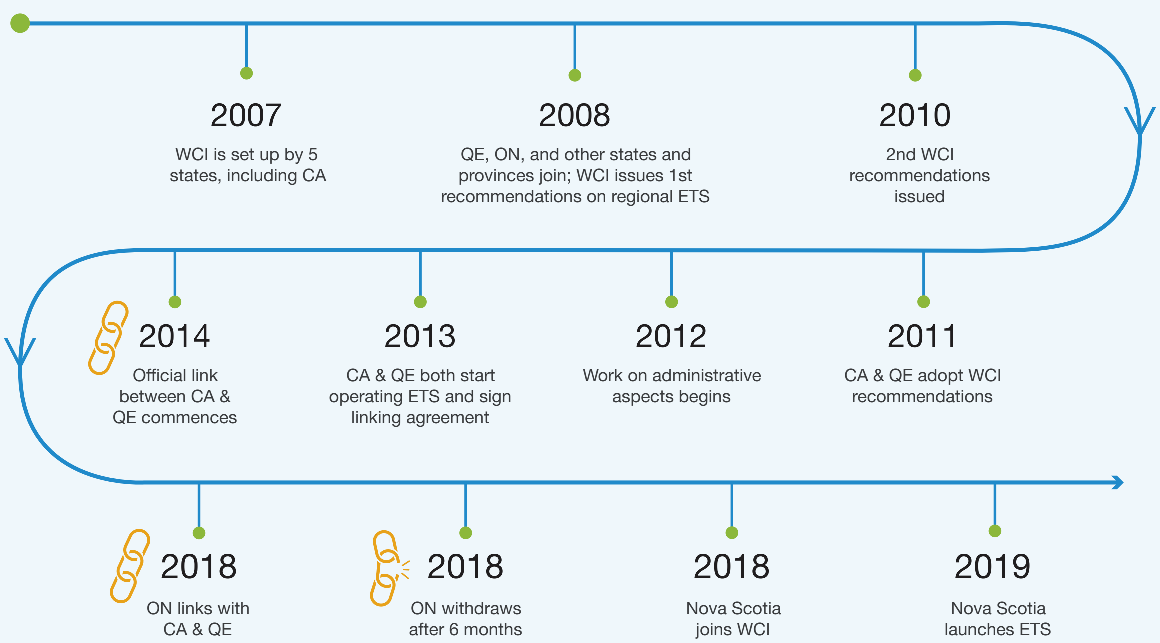
Box 9-3 Case study: Linkage between California and Québec based on the design recommendation developed through the WCI

Both California and Québec have set GHG reduction targets to 2030 that align with a steadily declining cap on emissions, making emissions trading one of the pillars of achieving their climate goals. From an early stage in the development of their respective ETSs, the jurisdictions intended to eventually link their systems. The two systems officially linked on January 1, 2014.

Both jurisdictions built their climate policies on the design recommendations of the WCI, a group of US and Canadian states and provinces that worked together to design a cap and trade reference model. However, only Québec and California went ahead with implementing their own system based on that design and linked their markets in 2014.[318, 319]

Before linking their two programs through their independent regulatory processes, they embarked on a process of regulatory harmonization by systematically comparing their regulations and identifying which provisions needed to

Figure 9-3 Chronology of WCI linkage events



→

318 Purdon et al. 2014.
319 WCI 2015.

be exactly the same (or have the same effect) and which could differ. In the end, the provisions that were completely harmonized included coverage and arrangements for auctions, floor price, an allowance price containment reserve, banking (with enforced holding limits), and multi-year compliance periods. Design features on which they allowed for differences include offset methodologies and recognition of early emissions reductions.

After launching its own ETS in 2017, Ontario joined California and Québec in January 2018. The three jurisdictions adopted regulatory provisions recognizing each other's programs, as well as developing a linking agreement in September 2017 following an extensive history of collaboration, as all three were involved in the WCI at some point. Ontario's ETS was also designed with the advice and support of California and Québec.[320] However, the link lasted only six months: a newly elected provincial government that opposed emissions trading withdrew Ontario abruptly from the joint market in July 2018. California and Québec took firm and immediate action in response and prevented transactions with entities in Ontario. This intervention was successful and prevented market instability. Ontario formally ended its ETS in October 2018 with the passage of the Cap and Trade Cancellation Act of 2018 (Bill 4).[321] For more information on Ontario de-linking, refer to Box 10-3.

Despite Ontario's abrupt exit from the linked market, both California and Québec remain open to new linkages.

Box 9-4 Case study: Australia and the EU: Learning about alignment

In August 2012, Australia and the EU agreed to negotiate and finalize a full two-way link between the EU ETS and the Australian CPM following nearly a year of bilateral discussions. Unlike the systems in California and Québec, the EU and Australia ETS were not designed with an expectation of eventually linking with each other. The Australian Government had designed the CPM with linking envisioned as a potential long-term option, but without identifying a specific system or linking partner.

Full linking between two independently designed systems is possible. Once the necessary adjustments have been identified, partners can choose to implement the required changes before fully linking or adopt a multistage approach where design differences are gradually reconciled.[322, 323] In the case of the EU and Australia, the latter approach had been chosen: the linking agreement was to be implemented in stages to analyze, negotiate, and implement any changes to either system that would need to occur in order to facilitate full linking.

The 2012 announcement had envisioned two stages of future linking and included changes to the Australian CPM that were enacted shortly thereafter: a repeal of the price floor and applying a limit on the use of Kyoto offsets. The first stage entailed a one-way link through which Australian entities would have been able to use EU allowances to cover 50 percent of their compliance starting at the end of Australia's fixed price period on July 1, 2015. A full bilateral link was planned to commence on July 1, 2018, in the second stage and would have made EU and Australian allowances interchangeable.

However, a change in government in Australia following elections in September 2013 led to the repeal of the CPM and, thus, the link with the EU ETS was abandoned. Although evidence from the negotiators involved suggest that substantial design differences were likely to persist between the two systems, the abandonment of the link makes it impossible to gauge them accurately and assess the extent of further changes that may have been negotiated by the jurisdictions.[324, 325]

9.6.2 CHOOSING THE LINKING INSTRUMENT

Bilateral or multilateral linking arrangements may include formal treaties, nonbinding agreements, and MoUs, while unilateral links may only require action by one government, as long as the selling jurisdiction enables the sale of allowances. Important questions to consider regarding a linking arrangement include

- Should the arrangement be legally binding or not?
- If a linking arrangement is nonbinding, how can each linking partner find assurance that the other partner will not unilaterally initiate changes that might negatively affect the operation of the link and of the linked ETS?

320 Carmody 2019.
321 Legislative Assembly of Ontario 2018.
322 Burtraw et al. 2013.
323 ICAP 2018a.
324 World Bank 2014.
325 Evans and Wu 2019.

- How will the arrangement be designed to provide sufficient certainty about the link's longevity?
- How will the linked parties continue collaboration? How will design changes, including revisions to the cap and the potential to de-link, be addressed in future?
- Which institutions should be established or designated by the instrument to govern the link, and which governance procedures need to be established to enable a stable and functioning link?

The answers to these questions will depend on the particular legal context in the respective linking jurisdictions. To date, only the EU–Switzerland link has been formalized via a treaty, although the EU–Australia link would have also used that mechanism had linking gone ahead. In the case of California and Québec, the linkage became operational through their respective regulations, and the jurisdictions also signed a nonbinding agreement. Each partner's ability to create a binding linking agreement was limited by its subnational status. In the United States, treaty-making is solely reserved for the federal government and federal law restricts states from entering into certain other types of binding agreements with other jurisdictions. Thus, both California and the RGGI states use nonbinding agreements that, when coupled with their regulatory processes, provide a sufficiently transparent and reliable approach to linkage.[326] Subnational jurisdictions are not formal parties to the Paris Agreement and may therefore face further limitations or additional procedural requirements regarding the legal recognition of their mitigation cooperation.[327]

Regardless of the legal nature of the linking arrangement, the process of developing these arrangements allows all parties to lay out transparently what they would like to achieve through a collaborative information sharing process. Furthermore, all arrangements should establish the framework for the linked market. This includes the linking objectives, design mechanisms agreed at the current phase of the link, procedures for coordination as the systems evolve, and Nationally Determined Contribution (NDC) accounting arrangements where applicable.

9.6.3 ESTABLISHING INSTITUTIONS TO SUPPORT LINKAGE

A well-functioning linkage requires institutions to help administer, or in some cases, oversee its governance. This may include a market service provider and a transparent system for design changes, among others.[328]

- **A single provider for market services and oversight.** California and Québec, and (separately) the RGGI states, have set up a not-for-profit entity that provides program administration services. These services include administering an allowance tracking system, administering auctions, and contracting for third-party, independent market monitoring analysis. This creates administrative efficiencies and reduces costs.[329] Joint auctions can also help harmonize carbon price across linked markets.
- **A transparent system for ETS design changes and dispute resolution.** Coordination on design features and the future direction of linked systems requires a transparent process and a procedure for dispute resolution. This is especially important for linked systems with nonbinding linking instruments that retain complete sovereignty for each participant, such as the link between California and Québec. Both these jurisdictions have regulatory processes that require notice and opportunity for public comments before changes are adopted. They specifically recognize the need to continue harmonizing their ETS design and to provide adequate notice of any changes.[330] RGGI, working with a larger collaboration of states, relies on a Model Rule, a set of proposed regulations, that is reviewed every three years.[331] States adopted individual regulations based on the original model rule and can update their regulation as the overarching Model Rule changes.

Other forms of cooperation are also possible. In the case of linking between national jurisdictions, respective rules and governing institutions are likely to be established through linking treaties. Like trade agreements, these linking agreements could establish various forms of delegation of responsibility or decision-making processes. Further details on governance and management of a linked market, as well as on stakeholder engagement with respect

326 The legal forms of linking arrangements are discussed further in Mehling 2009.

327 For example, even though Québec and California are transferring emission reductions across the Canada-US border through their linked carbon market, they will not be able to authorize internationally transferred mitigation outcomes under Article 6.3 of the Paris Agreement by themselves. Only their national governments can authorize the use of this mitigation toward their own NDCs. However, the jurisdictions have developed their own accounting program for transparently allocating emissions reductions toward their subnational targets. Article 8 of the 2017 linking agreement between California, Québec, and Ontario, which is still in place for the first two jurisdictions, provides for the development and implementation of an accounting mechanism based on transparent and data-driven calculations attributing to each Party its portion of the total GHG emission reductions achieved jointly through the linked cap and trade programs. These emission reductions can be applied to assess progress toward meeting each jurisdiction's subnational emission reduction target, provided there is no double counting.

328 Further detail on institutional governance can be found in the German Emissions Trading Authority's guidance on designing institutions to promote linking. It suggests that structures must be put in place to manage routine operation, to handle adjustments to this operation, to manage periodic reviews, and to handle unforeseen or extraordinary developments (Görlach et al. 2015).

329 Kachi et al. 2015.

330 Government of Ontario and Government of Québec 2017.

331 RGGI 2014.

to linking, can be found in the ICAP's *Guide to Linking Emissions Trading Systems*.

Rules governing the linked system's interactions with international mechanisms and agreements must also be established. Box 9-5 discusses how linking affects countries' climate commitments under the Paris Agreement.

Box 9-5 Technical note: ETS links and accounting under the Paris Agreement[332]

Linking ETSs supports the ability of jurisdictions to achieve their aggregate mitigation targets at lowest cost. This affects the emissions balance of the jurisdictions involved: importing allowances from Jurisdiction B into Jurisdiction A allows the regulated entities in Jurisdiction A to emit more. As a result of the link, emissions "shift" between jurisdictions; in our schematic example, emissions from ETS sectors in Jurisdiction A would be higher than the initial ETS cap.

When ETSs link internationally, this shift in emissions can affect countries' progress in achieving their individual NDCs: if the shift in emissions is not accounted toward countries' (individual) NDCs, linking ETSs could make it more difficult for the importing country (Jurisdiction A) to achieve its NDC. The same may hold for subnational jurisdictions that use ETSs to achieve jurisdictional mitigation goals. Similarly, international transfers among subnational jurisdictions may affect the ability of countries to achieve their NDCs.

Jurisdictions could pursue different options to ensure that internationally linked ETSs are appropriately reflected in formulating and accounting for NDCs and other jurisdictional mitigation goals:

- They could decide simply not to account for the link; for example, where the shift in emissions from linking is very small in relation to the countries' total emissions.
- Alternatively, countries with a linking agreement or a joint ETS could communicate a single NDC or communicate two targets in their NDC: a common ETS target and separate targets for their non-ETS sectors.
- Finally, they could account for linking ETSs under Article 6.2 of the Paris Agreement, by translating the shifts in emissions into internationally transferred mitigation outcomes (ITMOs) and effecting corresponding adjustments in order to avoid double counting.

The Paris Agreement outlines general principles for international transfers under Article 6.2, such as sustainable development, environmental integrity, transparency, and robust accounting. At the time of writing, however, countries under the UNFCCC are yet to agree on the rules for the operationalization of Article 6, such as the definition of an ITMO. Consequently, no accounting methods under Article 6.2 exist for calculating ITMOs and effecting corresponding adjustments related to ETS links. Ideally, the number of ITMOs would exactly correspond to the shift in emissions that occurs in each jurisdiction as a result of linking. A key challenge is that the actual shift in emissions cannot be empirically observed: once two systems are linked, it is impossible to determine the counterfactual emissions scenario had the link not occurred. Policymakers from both jurisdictions therefore need to identify and agree on methods to *estimate* the shift in emissions.

Schneider et al. identified four methods to estimate this shift: (a) comparing emissions with caps; (b) net transfers of allowances; (c) surrender of allowances; and (d) combined information on transfer and surrender of allowances.[333] Each method yields a different estimate, with different advantages and disadvantages (such as the treatment of allowance holdings). Nevertheless, approaches based on the *number of allowances surrendered* by the regulated entities seems to be the most robust method. In this case, ITMOs would represent the net result rather than individual movements of ETS allowances.[334]

332 This box is based on Schneider et al. 2018.
333 Schneider et al. 2018.
334 Paragraph 77(d)(ii) of the "Modalities, procedures and guidelines for the transparency framework for action and support referred to in Article 13 of the Paris Agreement" (Decision 18/CMA.2) states that corresponding adjustments are to be undertaken "by effecting an addition for internationally transferred mitigation outcomes first-transferred/transferred and a subtraction for internationally transferred mitigation outcomes used/acquired," which would be compatible with this approach, especially if ETS allowances are not regarded as ITMOs. The suitability of this approach thus depends on the ongoing Article 6 negotiations and how countries choose to apply Article 6 provisions to internationally linked ETSs.

9.6.4 PREPARING A CONTINGENCY PLAN FOR DE-LINKING

There are four issues to consider when structuring a linking agreement, to ensure any potential de-linking in future is non-disruptive:

1. **Adjustment of the cap.** If one system de-links from the other(s), this will affect prices in all previously linked systems. Policymakers may wish to consider in advance whether such a development would require a change in the cap or other market features. See Step 10 for more discussion on responding to evolving circumstances.
2. **Treatment of allowances from another system.**[335] To protect the environmental integrity of the market, jurisdictions may need to consider steps to suspend or revoke linkage, including by limiting transfers of instruments in or out, if official action is taken by a system to suspend its ETS or de-link. If allowances from another system can be identified as such and are no longer valid after de-linking, any speculation about de-linkage will cause prices of allowances in the linked systems to diverge. The cheaper allowances will be used as much as possible before de-linking and valuable allowances will be banked.[336]
3. **Process for de-linking.** De-linking may occur due to a buildup of issues over time or a sudden (political) event. For example, political changes in New Jersey led the state to withdraw from RGGI, and similar political changes saw Ontario withdraw from its link with California and Québec (see Box 9-6). Under some circumstances (for example, a temporary enforcement issue), a temporary suspension of a link, rather than a complete de-link, might be desirable. A clear exit strategy will make negotiation of the inevitable changes to adapt to new conditions easier and will minimize problems if de-linking is necessary. This is especially critical for links between jurisdictions that do not have a close history of interaction on other issues.
4. **Enforcement of de-linking rules and procedures.** The legal form of the linking arrangement plays a role in enforceability. A nonbinding arrangement, such as a MoU, relies on mutual trust and good will but lacks legal enforceability. Jurisdictions cannot be compelled to follow procedures laid out to ensure an orderly exit. By contrast, linkage based on a treaty agreement would be considered binding law and can generate more accountability. A binding agreement reduces the likelihood of jurisdictions violating the de-linking conditions and process laid out in the treaty. It also opens the door for judicial action in case of violation (such as sanctions or compensation claims).

335 See Comendant and Taschini 2016, which includes a discussion of how to deal with such “contaminated” allowances.
336 See Pizer and Yates 2015 for an analysis of the impact of different treatments of banked allowances under de-linkage.

Box 9-6 Case study: De-linking in RGGI and WCI

Experiences with de-linking are rare, but two cases in North America provide insights on the implications of departures from an integrated carbon market: the withdrawal of New Jersey from the RGGI and that of Ontario from its linkage with California and Québec.

RGGI was originally made up of 10 Northeastern and Mid-Atlantic states in the United States that joined together to collectively reduce GHG emissions in their electricity sectors. The RGGI MoU set the overall cap and each state's share of the cap for each three-year compliance period. In May 2011, New Jersey's governor at the time, Chris Christie, announced that his state would withdraw from RGGI ahead of the second commitment period (2012–2014) by activating the relevant clause of the MoU under which a state "may, upon 30 days of written notice, withdraw its agreement to [the] MOU and become a Non-Signatory State."[337]

The RGGI cap had to be modified to consider the fact that 40 previously regulated emitters from New Jersey would be leaving the system. The only guidance given in the MoU was that, in the event of a state's withdrawal from the system, "the remaining Signatory States would execute measures to appropriately adjust allowance usage to account for the corresponding subtraction of units from the Program." New Jersey's withdrawal from the system reduced the cap from 188 million to 165 million short tons of carbon dioxide for the second compliance period.[338] New Jersey completed the first compliance period before officially withdrawing.

When New Jersey left, it had already sold approximately 300,000 carbon dioxide allowances for 2014 and as RGGI allows unlimited banking and was significantly over-allocated for the first compliance period, some of New Jersey's allowances remained in circulation and available for use. Consistent with RGGI's commitment to allow unlimited banking of allowances by market participants, the other RGGI Member States decided to recognize all outstanding New Jersey allowances for compliance purposes.[339] While the cap was adjusted to compensate for the withdrawal, other states may have lost some revenue as a result of New Jersey's action.

In this case, de-linking was actually part of a complete dismantling of the cap and trade system in New Jersey. Notably, the impacts on the broader RGGI program were minor, and the experience established a method by which an orderly withdrawal of a linked state could occur at the end of a compliance period. After completing the de-linking process, New Jersey decided to rejoin RGGI in 2018. This meant making its ETS rules consistent with the 2017 RGGI Model Rule and adopting final regulations. The linkage is operational as of January 2020.

In contrast to the process of New Jersey's exit from RGGI, the Canadian province of Ontario's abrupt departure from its linkage with California and Québec required swift action to ensure the environmental integrity and stringency of the linked market. In January 2018, Ontario, California, and Québec had linked their respective systems, but Ontario withdrew six months later following the election of a provincial government that was set on repealing its own cap and trade program. The move ran counter to the terms of the nonbinding linking agreement requiring parties to provide one year's notice of withdrawal and to time it with the end of a compliance period. Ontario's exit risked an overflow of allowances from regulated entities in the province that were no longer required to comply with the ETS.

Thanks to the regulatory frameworks underlying the California and Québec systems, both jurisdictions had the authority to intervene. They directed WCI, Inc. in its administrative support capacity to modify the joint registry to prevent compliance instruments belonging to entities in Ontario from being traded with those in California and Québec. However, California and Québec continued to recognize all of Ontario allowances already in the accounts of entities in California and Québec before Ontario's withdrawal.

California and Québec subsequently assessed how many allowances would need to be retired from their own allowances to compensate for Ontario allowances that remained in circulation to ensure the environmental integrity of their respective caps. To that end, they cancelled more than 13 million allowances in 2019. Before this cancellation, the California Air Resources Board included provisions in its 2018 regulatory reform strengthening its authority to cancel allowances to guarantee the environmental integrity of the program in the event of further episodes of de-linking in the future.[340]

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337 RGGI 2005.
338 RGGI 2016.
339 RGGI 2011.
340 California Air Resources Board 2018b.

9.7 QUICK QUIZ

Conceptual Questions

1. What are the main advantages of linking and what risks or downsides could this bring, taking into account economic as well as political and strategic factors?
2. What are different ways to link ETSs?
3. What program design features will require coordination under a link, and which ones would benefit from alignment?

Application Questions

1. How important may linking be for your jurisdiction's ETS?
2. What goals might different approaches to linking achieve for your ETS?
3. Who would be your preferred linking partners, and why, and when and how might you pursue linking discussions?

9.8 RESOURCES

The following resources may be useful:

- A Guide to Linking Emissions Trading Systems
- Accounting for the Linking of Emissions Trading Systems Under Article 6.2 of the Paris Agreement

STEP 10
Implement, evaluate, and improve

BOXES

FIGURES

TABLES

AT A GLANCE

Checklist for Step 10: Implement, evaluate, and improve

- ✔ Decide on the timing and process of ETS implementation
- ✔ Decide on the process and scope for reviews
- ✔ Identify why the design of the ETS may need to change over time
- ✔ Evaluate the ETS to support future improvement

Moving from design to operation of an emissions trading system (ETS) requires that government regulators and market participants assume new roles and responsibilities, embed new systems and institutions, and launch a functional trading market.

Every existing ETS has required an extensive *preparatory phase* to collect data and develop technical regulations, guidelines, and institutions. In addition, some jurisdictions have used explicit ETS *pilot periods.* These allow all parties to test policies, systems, and institutions; build capacity; and demonstrate effectiveness. However, if the pilot reveals challenges, it runs the risk of undermining public confidence in the ETS before it fully commences. If a pilot is considered desirable, policymakers will need to carefully determine the scope and length. On the one hand, pilots need to give policymakers a clear understanding of the market and policy, but costs and complexity should be kept low and in line with the objectives of the pilot phase.

An alternative or addition to pilot periods is to *gradually phase in some design features* of the ETS. This will allow learning by doing, easing the burden on institutions and sectors. Major design features of the ETS may be phased in over time, such as increasing coverage or increasing the stringency of the cap or monitoring, reporting, and verification (MRV) regulations.

Policymakers should design their ETS policy and institutions as an evolutionary process to facilitate change over time in a predictable and constructive way in order to respond to changing circumstances and to incorporate lessons learned from operating the ETS.

Reviews of ETS performance are important to enable this continual improvement and adaptation. Targeted reviews can be used to look at specific aspects of the ETS covering more technical details. Comprehensive reviews look at the ETS at a higher level, such as whether the ETS has met its objectives and how its fundamental design elements can be improved. Early planning can help ensure reviews are successful. For instance, starting data collection before reviews are scheduled and making this data available to the public can facilitate successful reviews and evaluations, as existing data sets and systems may not be sufficient. Any possible changes resulting from these reviews need to be balanced against the risks of policy uncertainty. The latter can be mitigated by establishing transparent and predictable processes by which ETS changes are communicated and implemented.

This chapter looks at the process of implementation, evaluation, and review. Section 10.1 considers how a full-scale ETS can be gradually rolled out and how program features can be designed to evolve over time in a predetermined manner. Section 10.2 examines how the ETS can be evaluated and reviewed, as well as how policy adjustments can be managed over time.

10.1 TIMING AND PROCESS OF ETS IMPLEMENTATION

The implementation of an ETS requires a wide number of timing and process decisions. Often policymakers start with a trial or pilot ETS period to test and confirm the appropriateness of some of their design decisions. For instance, Phase 1 of the European Union (EU) ETS served as a sort of trial phase, while China's eight regional pilots have helped inform the development of its national system. Kazakhstan similarly had a formal one-year trial phase.[344] By contrast, California launched its full ETS with no formal pilot or testing phase except for a practice auction; however, it phased in some elements such as coverage of certain sectors and the share of allowances auctioned.[345]

344 See Sergazina and Khakimzhanova 2013.
345 See California Air Resources Board 2014.

Pre-implementation phases that set out measures to collect data, establish MRV procedures, or create the necessary institutional arrangements can also build capacity and readiness in the lead-up to the ETS, for example the Korean Target Management System (see Box 10-1). Incentive structures are important and even highly technical elements of an ETS need to be tested. As the design and operation of an ETS is likely to change following a pilot phase, methodologies and procedures tested in initial phases or pilots may still require modifications once the ETS is fully operationalized, highlighting the importance for continual review and improvements over time.

This section discusses measures required before implementation; the objectives of and design choices to be made when starting with an ETS pilot; and the objectives and elements of gradual implementation.

10.1.1 BEFORE IMPLEMENTATION

It is crucial to allocate sufficient time before implementation to ensure the key infrastructure of an ETS is in place and to build capacity for policymakers and regulated entities as needed. Considerations that should be planned to be done before implementation include

- expert advice;
- development of ETS regulations, legal framework, and guidelines;
- designation or establishment of supporting institutions (such as the regulatory entity, or independent advisory bodies that may review the success of the pilot phase);
- establishment of registry and trading platforms;
- capacity building among regulators, ETS participants, trading entities, and other service providers or stakeholders (see Step 2); and
- public education about the system.

Before compliance or trading begins, it is necessary to ensure there are adequate MRV measures in place, including data collection. As discussed in Step 3, pre-ETS MRV measures can

- improve the quality of data used for setting the cap and in distributing allowances;
- support capacity building by both participants and regulators as well as legislators; and
- test government administrative and compliance mechanisms before allowances must be surrendered.

Most existing ETSs had mandatory reporting (see Step 7) in place before ETS obligations. New Zealand phased sectors into the ETS by having one year of voluntary reporting and, for most sectors, one year of mandatory reporting prior to the introduction of the ETS unit surrender obligation. The political and economic feasibility of introducing mandatory reporting before deciding to introduce an ETS will vary by jurisdiction. In Korea, the Target Management System (TMS) formed the basis for the ETS, as discussed in Box 10-1.

Box 10-1 Case study: Korea's Target Management System

Korea's TMS was introduced in 2012. It involved both mandatory reporting and firm-specific emission reduction targets, applied to the same parties that were expected to be regulated by the Korean ETS. The TMS smoothed the transition into the ETS by developing the necessary MRV processes. It also helped define the scope and the points of obligation, while the data collected provided the government with a basis for determining free allocation and the total cap for the ETS. For companies, the TMS yielded insights into how emissions/abatement costs can be reduced, further facilitating the implementation of the Korean ETS.

However, while mandatory reporting and related initiatives can yield important insights, in many cases, experience and capacity can be derived only from pilots or (phased) implementation of an ETS itself, including the respective incentive structures. These are discussed in the following two sections.

10.1.2 STARTING WITH A PILOT

A pilot is a mandatory program that is explicitly framed as a testing or learning period with a clear end date, and for which the regulator clearly signals that the system could significantly change after the pilot ends. The focus of the pilot is often on gathering data, testing systems, and facilitating learning for both government and business stakeholders. As such, it might explicitly have design characteristics that are not intended to persist beyond the pilot, for example a more lenient cap. This section outlines the objectives of pilots before discussing their implications for appropriate design.

Pilots have three main objectives:

1. **To test ETS policy, methodologies, systems, and institutions.** Pilots can help identify problems and facilitate learning related to, for example, data collection, data reporting, database management, conflicts with existing legislation, the need for new legislation, or the need for improved market oversight. They can highlight current policies and systems that should be adjusted to effectively implement an ETS. Box 10-2 describes how Mexico used a pilot ETS phase to develop the infrastructure and policy for full ETS implementation.
2. **To build capacity.** Pilots, in contrast to ETS simulations or voluntary trading (see Step 2), require

actual implementation of ETS legislation, systems, and the institutions that will support the ETS. If the pilot is successful, the institutions and infrastructure built for the pilot can usually be used in the full ETS. In addition, pilots can help build the capacity of regulated entities and regulators, as well as build advisory capacity by training ETS consultants, verifiers, and intermediaries.

3. **To demonstrate effectiveness.** As jurisdictions face different circumstances, pilots can be useful to test outcomes and demonstrate overall ETS impact within the jurisdiction. Pilots are also valuable if the jurisdiction is introducing design features that differ from existing ETSs or is fine-tuning ETS design elements. As a result, they can support implementation during subsequent phases, as policymakers can draw on practical experiences in addition to theoretical models.

Box 10-2 Case study: Mexico pilot ETS

The Mexican ETS pilot started operating on January 1, 2020. Mandated by Provisional Article 27 of the July 2018 reform to the "General Law of Climate Change" and implemented through its 2019 regulation, the pilot ETS will help test system design and will run for two years, plus one year of transition to the full operational ETS. It aims to enhance the quality of emissions data, test system design, and build capacity in emissions trading for regulated entities, ultimately improving the design of the operational period of the ETS, which will commence in 2023. Together, the pilot phase (2020–2021) and the transition phase (2022) constitute the test program of the Mexican system.

The pilot covers direct carbon dioxide (CO_2) emissions from stationary sources (combustion and industrial process) from entities in the energy and industry sectors generating at least 100,000 tons of carbon dioxide (tCO_2) per year. Around 300 entities are covered by the pilot, corresponding to ~40 percent of national emissions.

According to the law, the Mexican pilot is designed to pose "no economic impact" on regulated entities during the pilot years. However, in the case of non-compliance, entities will lose the opportunity to bank unused allowances into the next compliance periods within the pilot. Moreover, noncompliant entities will receive fewer allowances during the operational period of the national ETS (two fewer allowances for each nondelivered allowance during the pilot).

The Mexican Ministry for Environment and Natural Resources (SEMARNAT) announced regulations on the cap for the pilot, the annual sectoral distribution of allowances, and three allowance reserves at the end of 2019. SEMARNAT has also been working on different infrastructure elements for the ETS, including the system registry, offset methodologies, and the auction platform. Regulations for the transitional phase have not yet been published. The focus is on operationalizing primary and secondary carbon markets in preparation for the transition to the operational period of the ETS.

Pilot design

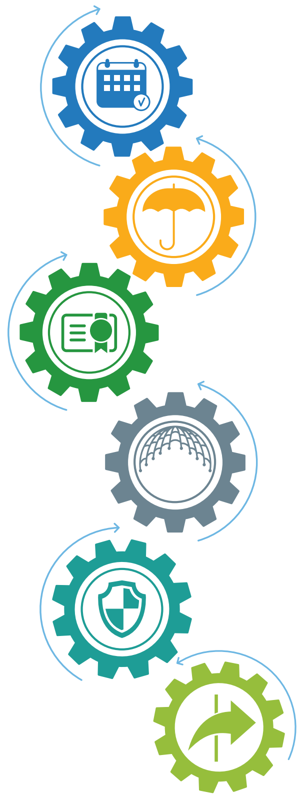
There are several choices policymakers must make when designing the pilot, summarized in Figure 10-1:

- **Length:** When choosing the length of the pilot period, it is important that the time frame chosen is consistent with its objectives. If the principal aim is to collect data, then a short pilot period of perhaps one year may be sufficient, and the first compliance phase can begin immediately after the end of the trial phase. However, if the objective is to build capacity and test systems, then a longer pilot phase of several years may be required. For example, the pilot phase for the Mexico ETS is three years, with the aim to improve the quality of data and build capacity. An interval prior to full implementation may also be needed to review the pilot's performance and make changes to systems.
- **Coverage:** Policymakers can choose to design a system-wide pilot that covers as many entities as are due to participate in the full compliance period. The first phase of the EU ETS, while not officially framed as a pilot phase, followed this model. Alternatively, the pilot might cover only large entities, fewer sectors or, as in China, have a more limited geographic scope (see Box 10-3). A narrower scope allows key policies and institutions to be tested without imposing the same costs (on both the government and regulated entities) as a broader pilot. However, there is a risk that the pilot is not representative if it does not cover all market participants.
- **Allocation approach:** The pilot presents an opportunity to test the allocation approach to be used in the full ETS. Efforts during the pilot should focus on gathering the required data needed for allocation (for instance, defining benchmarks for free allocations) and building the capacity of regulated entities to be able to report this data.
- **Cap stringency:** Some jurisdictions have decided to impose a less stringent cap in the pilot period. They choose to do this because it will not directly influence the functioning of the market in the long term if the pilot is a self-contained testing period. However, the benefits gained from this approach must be balanced against the downsides of lower incentives, a slower start to

full market operation, and lower initial ambition. Lower stringency in a pilot period may also create a path dependency and generate expectations, making it more difficult to transition to a significantly more ambitious ETS once the pilot ends.

- **Enforcement:** During the pilot, enforcement may be less strict than in the full ETS. Enforcement can focus on educating businesses about the ETS rather than imposing punitive measures for noncompliance. Clearly signalling the pilot as a learning phase can help avoid expectations of this enforcement being carried over to the full ETS.
- **Carryover of allowances:** A decision also needs to be made whether allowances from the pilot may be banked into the full-fledged ETS. As discussed in Step 6, restricting banking from a pilot to later phases can reduce the risk that undesirable market features in the pilot carry over into the full implementation phase. Restricting banking will also avoid carrying over lower levels of ambition if the pilot cap is less stringent. However, restricting banking increases the likelihood that allowance prices fall precipitously at the end of the pilot period, potentially undermining public support for the ETS.

Figure 10-1 ETS pilot design



1 **Length**
- Align the length of the pilot with its objectives.

2 **Coverage**
- Determine how broad or narrow the scope of the ETS pilot should be.

3 **Allocation**
- Test the allocation approach to see if it effectively reduces carbon leakage, raises revenue, and preserves abatement incentives.
- Use the pilot to gather the necessary data.

4 **Cap stringency**
- Determine the stringency of the cap and consider how it may affect participant expectations for full implementation.

5 **Enforcement**
- Determine the stringency of enforcement measures.
- Use pilot enforcement measures as an opportunity for covered entities to learn about the ETS.

6 **Carryover of units**
- Determine whether units from the pilot may be banked into the full ETS.

Box 10-3 Case study: Chinese regional ETS pilots

The operation of eight subnational pilot systems has been a key step in building capacity and knowledge in the lead-up to a national ETS in China. In 2011, China's National Development and Reform Commission (NDRC) issued a notice to establish ETS pilots, with the purpose of implementing the 12th Five-Year Plan's requirement to gradually establish national carbon trading markets and promote market mechanisms to achieve China's 2020 goal of controlling greenhouse gas at a low cost.[346]

The pilot approach is based on the Chinese tradition of *shìdiǎn* (试点), wherein prior to launching a large government program it is considered prudent to first test different variations of the proposal in multiple regions that feature different socioeconomic circumstances. This learning-by-doing approach allows policymakers to simultaneously avoid risks inherent in a one-size-fits-all policy, discard those approaches that have proven to be inadequate, and discover approaches that are particularly appropriate to China's diverse and unique circumstances. The pilot regions include the cities of Beijing, Chongqing, Shanghai, Shenzhen, and Tianjin, and the provinces of Hubei, Guangdong, and Fujian.[347] Collectively these areas have a population of approximately 300 million. The first pilot (Shenzhen) was launched in June 2013; the last (Fujian) was launched in December 2016.

There is substantive variation across the different pilots, as they differ in location, scale, and sector coverage among other details. Some of the pilots are in China's densest cities, such as Beijing and Shanghai; some are in provinces, such as Fujian; and some are in regions, such as Hubei. Allocation methods vary from free allocation based on grandparenting, such as in Chongqing and Shenzhen, free allocation based on benchmarking, such as in Hubei and Shanghai, and some level of auctioning, as in Guangdong. Sector coverage also varies, as all of the pilots cover the power and industry sectors, and some pilots also regulate domestic aviation (Shanghai, Guangdong, Beijing, and Fujian), buildings (Shanghai and Beijing), and public transport (Shenzhen and Beijing). Trading activity across markets also differs but is significant overall: by December 31, 2018, the accumulated trading volume of the allowance spot market in all the pilots had reached 282 million tCO_2, with a total value of CNY 6.2 billion.[348] →

346 NDRC 2011.
347 Zhang et al. 2014.
348 ICAP 2019.

STEP 10 EVALUATION

The design of the national ETS builds on the experience and lessons learned from the pilots, specifically the results of different approaches to sector coverage, allocation, and MRV (see also Box 2-9 on capacity building for China's ETS). The Chinese government also relies on the pilots to provide some of the key infrastructure for the Chinese national ETS. Hubei was selected to lead the development of the national ETS registry and Shanghai is responsible for developing the trading platform.

Initially, the pilots were scheduled to run for three years, though they have continued to run through 2020. Policymakers in the central government have thought carefully about the transition from the pilots to a national ETS. In the short term, as the national pilot covers only the power sector, the existing ETS pilots are operating in parallel to the national market, covering the non-power sectors. Over the medium to long term, many are likely to cease operations as the sectors are integrated into the national ETS. Some may continue operations in sectors not covered by the national ETS.

Limits of pilots

While well-designed pilots can achieve many of the objectives outlined above, the lessons they hold for policymakers in terms of effectiveness of ETS design are nevertheless limited. For example, they are unlikely to run long enough or be ambitious enough to trigger large investments that drive major emission reductions.

In addition, if ETS pilots are viewed as unsuccessful, they risk losing public support and damaging the public's perception of emissions trading. While the first phase of the EU ETS brought a wealth of market and operational experience for governments and companies, it culminated in a sharp allowance price decline, which had a negative impact on public perception, as discussed in Box 10-4. Clearly communicating and managing expectations regarding a pilot phase will be important to mitigate such risks.

Box 10-4 Case study: Lessons learned from Phase 1 of the EU ETS

Phase 1 of the EU ETS ran from 2005 through 2007 as a three-year pilot in preparation for effective functioning in Phase 2. In this learning-by-doing period, both regulators and regulated entities were able to gain experience with emissions trading. As stipulated in Article 30 of the ETS Directive, a full review of the EU ETS was then mandated before the end of Phase 1.[349] Banking allowances for Phase 2, however, was not allowed.

Phase 1 was successful in creating a functioning market for allowances and putting a price on CO_2 emissions so that, for the first time in Europe, emissions became a concern for the financial controllers/accountants and not just the environmental and production staff. However, overallocation of allowances during this trial phase ultimately led to a steep decline in carbon prices, with negative repercussions for the public perception of the EU ETS. Based on the experience in Phase 1, the working group charged with the review assessed possible policy options to improve the system going forward. In particular, they identified four major issues:

- The process by which Member States determined free allocation through the National Allocation Plans tended to overestimate emissions projections, allocating regulated entities more allowances than needed and leading to low prices. This weakened the incentive to invest and innovate.
- The lack of harmonization across Member States in their approach to determining National Allocation Plans distorted competition across EU jurisdictions.
- Firms in some sectors that received free allocation passed through the market value of allowances by increasing prices for consumers, leading to windfall profits, with negative distributional impacts.
- The approval of National Allocation Plans was complex and created some uncertainty about the overall cap of the EU ETS.[350]

The first phase was valuable in that it allowed these issues to be identified and addressed in subsequent phases.[351] In Phase 3, both the cap setting process and the free allocation method were centralized and harmonized at the EU level. Additionally, only sectors considered at a risk of carbon leakage receive free allowances.[352]

349 European Council 2003.
350 See European Commission 2008a; reports of all Working Group meetings are contained in Annex 1.
351 European Council 2009.
352 The power sector receives no free allocation in Phase 3 as it is considered capable of passing on the cost of carbon to consumers and industry. The rules for Phase 3 also include possible adjustments in the free allocation from year to year, depending on whether there were substantial changes in activity level at the covered installations, whereas in Phases 1 and 2 no ex post adjustment was allowed.

10.2 GRADUAL IMPLEMENTATION

In addition to — or instead of — a pilot, policymakers may wish to consider gradually implementing aspects of the ETS. Gradual implementation may envisage an end design of the ETS from the outset, but phase in some of the design elements. It will generally apply the intended policy design but look to manage complexity by building capacity over time, staggering implementation by sectors and managing potential political challenges from covering some sectors. This contrasts to a pilot that focuses on gathering data, testing systems, and learning.

This section outlines the objectives of such a transition, its benefits, and its key elements, as well as challenges stemming from this approach. A gradual approach to implementation can help embed an evolutionary approach to ETS design, with policy changes and improvements made as circumstances change. This reflects the processes of change in most ETSs operating to date, which have seen a mixture of ad hoc and planned revisions to design over time.

10.2.1 OBJECTIVES OF GRADUAL IMPLEMENTATION

The objectives of gradual implementation are:

- **To build capacity.** Gradual implementation builds capacity both inside and outside of government. It also builds confidence in effective ETS operation before obligations apply more broadly or with greater stringency, or before more complicated rules are introduced.
- **To test systems.** Gradual implementation provides an opportunity for early review of the first stages of implementation and to alter plans for later stages accordingly.
- **Early implementation of a carbon price.** Gradual implementation puts a carbon price in place more immediately than if the ETS implementation is delayed until all elements are ready.
- **To reduce upfront costs of implementation.** Introducing an ETS is a complex process, and the perceived risks and costs of failure can be high (environmentally, economically, socially, and politically). By moving gradually, policymakers can mitigate some of these risks and complexities.
- **To enable time for adjustments in interlinked regulatory frameworks.** An ETS introduces a new commodity into the market, with far-reaching ramifications for other regulatory frameworks, such as energy market regulation, competition policy, and financial market oversight. Not all interlinkages will be discovered fully ex ante or during a pilot phase.

10.2.2 ELEMENTS OF THE TRANSITION

Gradual implementation lets policymakers gradually scale up different components of an ETS to improve functioning over time. Some of the key design features where a gradual implementation approach might be adopted include

- **Coverage and scope:** An ETS might start with a limited number of sectors and with thresholds that target the most significant emitters and those that are relatively straightforward to include, as in the case of China discussed in Box 10-3. It can then expand to include additional sectors and/or a larger number of participants over time.
- **Cap stringency:** Gradual implementation can allow ambition, and associated costs to participants, to grow more slowly. The cap on emissions may be set at a less ambitious (more generous) level at the outset and increase in ambition over time.
- **Free allocation:** Levels and methods of free allocation could transition over time. A share of grandparenting for stranded asset compensation to prevent carbon leakage may be necessary at the start of an ETS. However, even if major trade competitors do not adopt comparable carbon pricing mechanisms, taxpayers may not be willing to support trade-exposed sectors indefinitely (see Step 5), and continued free allocation may be incompatible with long-term climate objectives. Therefore, free allocation methods may be reduced or phased out. Regardless, if grandparenting is used, there should be a shift to more sophisticated approaches (such as benchmarking) over time to avoid the drawbacks of grandparenting (see Step 5). If free allocation is reduced, the introduction of large-scale auctions needs careful testing and upscaling.
- **Price or supply adjustment measures (PSAMs):** The government may also wish to provide a higher degree of certainty at the outset of an ETS, when public and financial institutions needed for trading are at a nascent stage. The system may then transition toward greater liberalization as the market matures and linking to other markets becomes feasible. The Australian ETS was an example of where the government had intended to gradually relax price control features to allow time for the market to mature (see Step 6).
- **Linking:** Some ETSs may launch as linked systems with other jurisdictions from the beginning. However, in other cases, policymakers may want to preserve options for future linking in early phases and ensure their own ETS is robust before establishing formal linking arrangements (see Step 9).

Box 10-5 Case study: China ETS construction phases

In January 2021 China published a series of key policy documents[353] and announced compliance obligations for covered entities, operationalizing its national ETS. Given the immense challenge of building and implementing an ETS of this scale and complexity, the Chinese government used a phased approach to ETS construction, drawing also on extensive experience from the ETS pilots in eight subnational provinces and cities with diverse economic and industrial profiles.

The step-wise approach to the development of the national ETS was formally laid down in a roadmap endorsed in 2017 by the country's highest administrative body, the State Council. The first phase of the roadmap was to focus on the development of market infrastructure. Phase 2 was to test market operation covering the power sector only. The third phase should focus on deepening market implementation and expanding it towards a broader sectoral coverage.

Since 2017, the Chinese government consequently worked on various fronts to advance the preparation for the national ETS, including: reporting and verification of historical emissions data from eight energy intensive sectors; development of the national registry and trading infrastructure; development of the legislative and regulative framework; as well as a major effort to build capacity.

As laid out in the roadmap, the national system started operating covering only the power sector. It regulates over 2,200 companies emitting more than 26,000 tCO_2 per year. In the coming years, the ETS is then to gradually expand to further sectors including iron and steel, cement, chemical and papermaking.

10.2.3 CHALLENGES ASSOCIATED WITH GRADUAL IMPLEMENTATION

Jurisdictions should consider whether the benefits from gradual implementation outweigh its costs. The Partnership for Market Readiness's *Carbon Pricing Assessment: A Guide to the Decision to Adopt a Carbon Price* also provides further information on capabilities and readiness.

- **Reduces ETS impact.** The overall environmental impact of the ETS may be lower if fewer emissions are covered initially. Cost-effectiveness will also be reduced relative to a broader market. As a result, the overall emissions goals and cap need to be adjusted to account for lower coverage (see Step 4). Policymakers need to factor in the long-term trajectory and goals when implementing the ETS, given the need to ratchet up the ambition of climate targets and Nationally Determined Contributions (NDCs) in accordance with the Paris Agreement.
- **Carbon leakage risk.** A second related concern is the potential for leakage between covered and uncovered sources and sectors. This is likely to be only a short-term risk if the uncovered sources will be entering the system in the medium term. In this case, long-term investment decisions should not be affected. However, the extent to which this holds true depends on the substitutability between covered and uncovered sources and sectors.
- **Perverse incentives.** If sources are excluded from the initial stages of the ETS, but expect to be covered later, there may be an incentive to bring forward emissions from the future to an earlier point in time, to reduce their future liability. For example, actors downstream from the point of obligation could have an incentive to stockpile high-emission fuels or products to avoid future price increases. In New Zealand, even though forestry was the first sector covered, once it was known that forest clearing would be covered in the ETS as of January 1, 2008, actors increased forest clearance to reduce future liabilities (see Step 3).
- **Political expectations.** A high initial cap risks low prices that may harm system credibility and may reduce expectations for longer-term prices. Market participants may not be confident that the government will implement more ambitious caps in later stages. Clearly signalling the long-term emissions trajectory, with more ambitious caps once the ETS is fully implemented, can ameliorate this issue.
- **Stakeholders resistant to change.** There is a potential for initial market design to create lock-in effects by making stakeholders resistant to subsequent change, making it more difficult to move to the long-term desired design. For example, sectors that are excluded initially may find it easier to continue to resist entry (for example the agricultural sector in New Zealand (see Step 3). Early and ongoing stakeholder engagement is important to reduce or manage this resistance (see Step 2).

353 National Measures for the Administration of Carbon Emission Trading (Trial) http://www.mee.gov.cn/xxgk2018/xxgk/xxgk02/202101/t20210105_816131.html. 2019–2020 National Carbon Emission Trading Cap Setting and Allowance Allocation Implementation Plan (Power Generation Industry) https://www.mee.gov.cn/xxgk2018/xxgk/xxgk03/202012/t20201230_815546.html. List of covered entities 2019–2020 https://www.mee.gov.cn/xxgk2018/xxgk/xxgk03/202012/W020201230736907682380.pdf

10.3 ETS REVIEWS AND IMPROVEMENT

This section examines the rationale for reviewing an ETS, the main types of reviews, data requirements for reviews and evaluations, and processes for responding to a review.

10.3.1 REVIEWS AS A DRIVER OF POLICY EVOLUTION

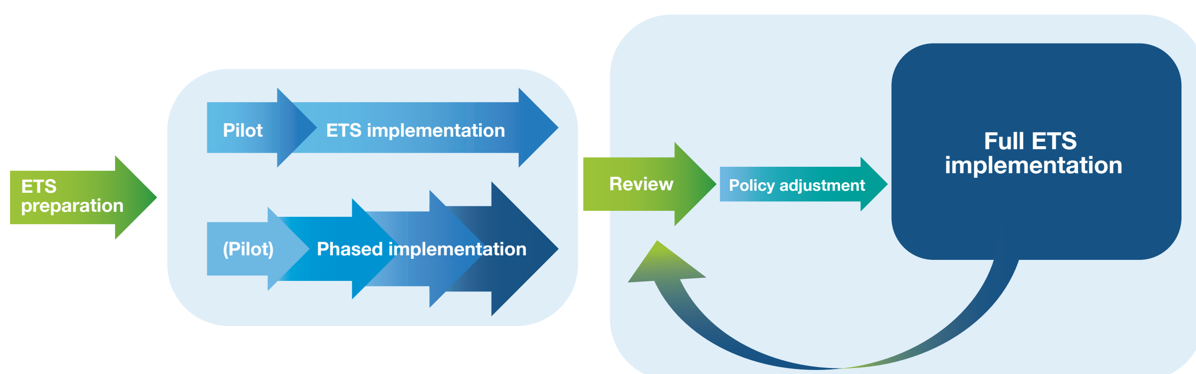
Reviews and policy evaluations provide crucial opportunities to assess the impacts of policy and make improvements. A successful review will feature an efficient and politically acceptable process to respond to new information on program performance and to respond to changing local and global circumstances. Figure 10-2 depicts a stylized model of an ETS policy cycle, including the stages of review and subsequent adjustments of the policy.

The main reasons why reviews are necessary are

- **Changes in external conditions.** For example, an economic shock or new technologies could alter the cost of meeting a given cap, requiring reassessment.
- **Changes in domestic and international climate policies.** For example, policy developments might require an increase in cap ambition to reflect ratcheting up of climate targets or offer new linking or offsets opportunities.
- **Correct errors and unintended consequences.** It is virtually impossible for policymakers to know exactly how businesses operate and exactly how they will respond to the new regulation, meaning some mistakes and unintended consequences will be realized.
- **Learning from ETS experience.** Issues will arise from lessons learned about emissions trading since the initial design that will need to be considered. New Zealand removed the use of international offset units after observing its ETS prices were strongly linked to the price of offset units (see Step 8).
- **Responding to administrative and legal issues.** An ETS is complex and interacts in complex ways with other laws and regulations. Review may be needed to respond to the changing legal environment. In order to manage the administrative burden of the ETS policymakers may also want to review the system for possible simplification options.
- **Reflecting the evolution of the energy and climate policy mix.** An ETS may interact with other energy and climate policies. These interactions need to be analyzed and reflected on a regular and systematic basis. This may have numerous effects — for instance, a policy that alters a sector's ability to pass through costs to consumers could affect mitigation costs and the way in which markets behave.

Policy reviews recognize that ETS design is dependent on a jurisdiction's circumstances and must evolve to reflect changes in circumstances over time. Ideally, ETSs need to be "predictably flexible"[354] — a robust and predictable process for review provides flexibility for making policy changes at a predefined point. Other aspects of ETS design can support predictability outside of the review process — for instance, introducing rules-based approaches to address price variability in the long term (see Step 6). Similarly, as discussed in Step 3, introducing complementary policies can help increase perceived political commitment to attaining climate targets.

Figure 10-2 Phases of ETS implementation



354 World Bank 2010 defines "predictable flexibility" as allowing "for timely revision when the underlying social and political circumstances have changed" while being "explicit in defining the conditions under which its terms should be revised." Similarly, among many others, Stern 2008 notes the importance of predictably flexible policy in order to provide long-term planning while being flexible enough to adapt to changing circumstances.

10.3.2 TYPES OF REVIEWS

Clearly defined objectives are critical to any effective review. Often, new policy objectives — or the need to create a new balance among them — can justify a review in the first place, regardless of the effectiveness of the ETS in meeting its original goals.

There are two main types of review:

1. comprehensive reviews, which consider fundamental aspects of the ETS; and
2. targeted reviews, which consider administrative or technical aspects.

Each review type serves a different purpose, summarized in Figure 10-3. Comprehensive reviews are generally scheduled reviews done toward the end of an ETS phase and may set in motion structural reform. Targeted reviews generally focus on the performance of particular aspects of an ETS and can be scheduled or unscheduled. In general, both types of review look to perform three roles:

1. to identify program features that are working well;
2. to inform redesign of elements that may not be working as well as they could; and
3. to assess the future role of emissions trading within the climate policy mix.

In assessing the performance of the ETS, reviewers often will want to isolate the impact of the ETS. Different components of the review will look to answer different questions, such as:

- **Environmental effectiveness:** Are emissions lower than they would be otherwise?
- **Cost-effectiveness:** Are costs acceptable and lower than they would be with alternative policies?
- **Fairness:** Do some groups, especially vulnerable ones, bear excessive costs?

When considering who should undertake a review, policymakers should use the range of stakeholders interested in finding out the impacts from the ETS. Ideally researchers in academia or NGOs will be able to make use of data from the review to independently explore their own research questions. Transparent evaluation and consultation with stakeholders and vigorous academic discussion will improve the quality of the work and facilitate its use to effectively revise the ETS.

Comprehensive reviews

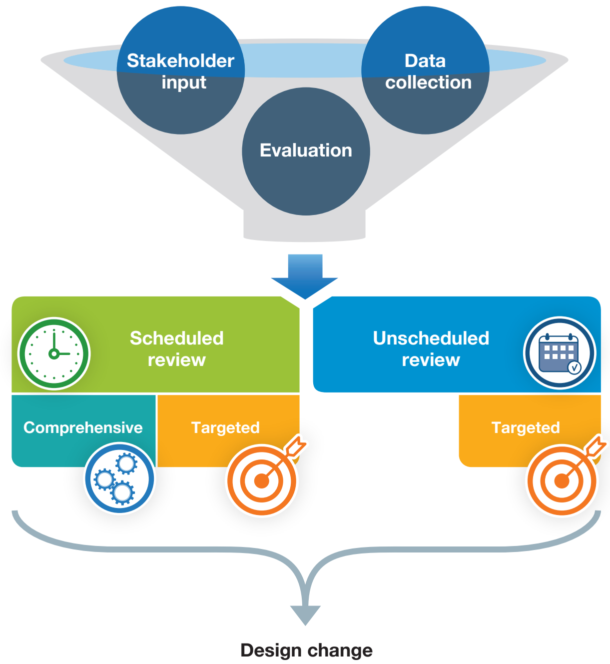
Comprehensive reviews partly assist in resolving the predictability–flexibility trade-off discussed above. Scheduling comprehensive reviews at planned intervals creates an expectation that fundamental changes will occur only at specific times, providing predictability between review periods. The scheduling of these reviews is sometimes included in ETS legislation. These reviews will look to assess the ETS as a whole. Some of the key issues that might be explored during a comprehensive review include the following:

- systematic cap adjustment to account for the broader context, including any change in the jurisdiction's overarching mitigation targets (for example ratcheting up of NDC targets), economic development trends, the availability of new technologies, and the relative ambition of carbon pricing or alternative mitigation policies in other jurisdictions;
- evaluations of how the ETS has performed relative to expectations for allowance prices, compliance costs, and potential for leakage and competitiveness impacts; and
- how much the emission price has influenced behavior and investment to reduce emissions, particularly relative to other drivers such as international energy prices, commodity demand, and other policies and regulations.

Reviews also offer an opportunity to engage with stakeholders and to refresh and refine stakeholders' and officials' understanding of how an ETS can most effectively operate, helping to protect core features. Step 2 discusses the types of stakeholders that could be considered.

An effective, comprehensive review process is likely to involve individuals and institutions who are respected for their competence, objectivity, and integrity. They should bring a wide range of perspectives and should ideally be politically independent or bipartisan. The process needs to be well resourced both financially and in terms of time frames, giving enough time for input, analysis, and deliberation.

Figure 10-3 Types of ETS reviews



The EU ETS is an example of how comprehensive reviews between different phases can allow for the design of an ETS to evolve over time, as explained in Box 10-6. However, this experience also illustrates that such planned reviews can provide less flexibility to respond to changing short-term circumstances. As a result, in practice, the design elements of the EU ETS have been reviewed and changed within phases. These unscheduled reviews are equally discussed below.

Box 10-6 Case study: Structural reviews of the EU ETS

Opportunities for reviewing and reforming the EU ETS were planned from the outset and provisions to that effect were included in the ETS Directive.[355, 356] In its subsequent version, the ETS Directive specified which elements of the ETS should be reviewed, what questions the review should answer, and also that the European Commission would submit a report on these matters including proposals for amendments of the Directive as appropriate. Article 3 of the Decision to establish the Market Stability Reserve (MSR)[357] also includes a timeline and general guidance for a review.

When first reviewing the system, the European Commission gathered information through a survey circulated to participants and stakeholders and established a Working Group consisting of representatives of Member States and sectors. This Group discussed scope, compliance, and enforcement, further harmonization and increased predictability, and linking with other ETSs.[358] Directive 2009/29/EC amended the original ETS Directive to take into account lessons learned from Phase 1 through this review process. Updates included changes to coverage, cap setting, and allocation.

Outside of planned reviews and the associated amendments to EU ETS legislation, the EU has made additional changes to the system in response to changing circumstances. Since 2009, a large surplus of allowances accumulated in the EU ETS, amounting to 2.2 billion at its peak in 2013. The resulting imbalance between supply and demand placed downward pressure on the allowance price, which went from EUR 30 in January 2008 to below EUR 5 in January 2013, where it remained for the next four years. The large surplus and low price triggered an intense debate on the orderly functioning and long-term credibility of the EU ETS. In response, the European Commission released the *EU Carbon Market Report* in 2012, putting forward options for measures to address the structural supply–demand imbalance of allowances.

After broad consultation, two measures were taken. As a short-term measure to respond to excess supply in the market, the European Commission postponed the auctioning of 900 million allowances until 2019–2020, changing the distribution of auction volumes over Phase 3. The auction volume was reduced by 400 million allowances in 2014, by 300 million allowances in 2015, and by 200 million allowances in 2016. This "back loading" of auction volumes was implemented through an amendment to the Auctioning Regulation in 2014. As a long-term intervention, the MSR was implemented in 2018 and operationalized in 2019 to increase system resilience to major shocks by adjusting the supply of allowances to be auctioned (see Step 6).

The EU ETS was last revised in 2018 to ensure the system would be well placed to deliver on the 2030 Climate and Energy Framework. The revision focused on three main areas: strengthening the EU ETS, ameliorating protection against carbon leakage, and fostering low-carbon investment. Agreed provisions included a steeper pace of annual emissions cap reductions and better targeted free allocation, as well as new financial support mechanisms to promote low-carbon innovation and to support modernization efforts in the industry and the power sectors of lower-income Member States. As part of Phase 4 revisions, the MSR was also reinforced. Between 2019 and 2023, surplus allowances will be placed in the MSR at the double rate of 24 percent, before the regular feeding rate of 12 percent is restored in 2024. In addition, from 2023 onwards, allowances held in the MSR exceeding the previous year's auction volume will be invalidated. Finally, the revised ETS Directive includes provisions for Member States to invalidate a portion of allowances to reflect additional policies in the energy sector; for example, a coal phase-out.

As a part of the European Green Deal, the EU ETS will undergo its next revision and modernization cycle. The Commission is expected to present proposals to revise and possibly expand the EU ETS in mid-2021.[359]

355 European Council 2003, Article 30.
356 European Commission 2008a.
357 European Council 2015, Decision (EU) 2015/1814 of the European Parliament and of the Council of 6 October 2015 concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission trading scheme and amending Directive 2003/87/EC.
358 See Ellerman et al. 2007 and Ellerman et al. 2010 on review and reform processes in the EU ETS.
359 European Commission 2020f.

Box 10-7 details the review processes of RGGI, whose design has looked to implement more flexibility in the review system through ongoing evaluation and periodic reviews.

Box 10-7 Case study: Comprehensive review of RGGI

The Regional Greenhouse Gas Initiative (RGGI) system was designed as a "living system," meaning that the system regulations and the MoU among participating states provides for periodic comprehensive system review and program evaluation.

The original RGGI MoU called for a comprehensive 2012 review. Over the course of two years, the review process considered five primary issues: program success, program impacts, additional reductions, imports and carbon leakage, and offsets. In addition to the empirical analyses undertaken by numerous outside organizations, the review incorporated extensive regional stakeholder participation. The participating states held 12 stakeholder meetings, webinars, and learning sessions for the regulated and nonregulated communities, environmental nonprofits, consumers, and industry advocates.

The two major findings of the review were that there was an excess supply of allowances and that the cost control mechanisms in place at the time were ineffective. As a result, the number of allowances was reduced from 165 million to 91 million, and a Cost Containment Reserve (CCR) was also created.[360] Some other minor adjustments were made concerning offsets, reserve price, and the retirement of unsold allowances. The amendments to the program were captured in an update to the Model Rule and through changes to the RGGI Regional CO_2 Allowance Budget. These documents then served as the basis for participating states in their respective statutory and regulatory processes to update their respective CO_2 Budget Trading Program regulations. The 2012 Model Rule amendments included a statement committing participating RGGI states to conduct ongoing program evaluation to continually improve RGGI and to begin another comprehensive program review no later than 2016.

The second review program review commenced in late 2015 and was completed in late 2017, resulting in the 2017 Model Rule. Program reviews were conducted through a series of nine stakeholder meetings and substantive economic analysis. The review process considered six primary issues: potential changes to the RGGI cap, incorporating and improving RGGI flexibility mechanisms, RGGI regulated sources, complying with the Clean Power Plan, broadening the RGGI market, and improving the RGGI CO_2 Allowance Auctions and Tracking System. The resulting 2017 Model Rule outlines major program elements that will guide the program between 2020 and 2030. A key element is an additional 30 percent cap reduction between 2020 and 2030, more than 65 percent below the RGGI cap set in 2009. Other key elements include the creation of an Emissions Containment Reserve (ECR), modifications to the CCR and adjustments to cap to account for excess unsold allowances that were banked up to 2020.[361] The 2017 Model Rule amendments also include a statement committing participating RGGI states to conduct ongoing program evaluation to continually improve RGGI and to begin another comprehensive program review no later than 2021.

Targeted reviews

Targeted reviews are complementary to comprehensive reviews. They tend to be more administrative or technical in nature and can be either scheduled or unscheduled. Targeted reviews focus on a specific aspect of the ETS, for instance the operation of a PSAM or offset system, or the appropriateness of allocation methods, in contrast to comprehensive reviews, which look at the system at a higher level. For both types of review there are clear guidelines as to how the reviews are conducted.

- **Scheduled reviews** of an ETS let policymakers assess basic functionality and make any necessary changes to the system design to improve that functionality. Early reviews, in particular, provide a good chance to engage with stakeholders, learn from their experiences, and build understanding and acceptance of emissions trading. Yet they also have their limits — the limited amount of data available may not be sufficient to draw robust conclusions about the functionality of the system. In many cases, early perceptions of effectiveness are therefore unlikely to be an appropriate basis to make fundamental changes to the design of an ETS.
- **Unscheduled reviews** may arise in response to unexpected or unpredictable developments, including cases such as the following:
  - an urgent problem is leading entities to face noncompliance despite their best efforts;
  - laws or regulations are found to be in conflict; or

360 RGGI 2013b.
361 RGGI 2017c.

- there appears to be a loophole in the regulations that market actors are exploiting.

In contrast to comprehensive reviews, technical or administrative issues can be managed largely through processes run by officials and regulators. These reviews will benefit strongly from input by stakeholders, who can provide practical insights on challenges and potential solutions.

New Zealand has two types of reviews: mandatory and discretionary. It uses the latter to flexibly review aspects of the ETS should the need arise between mandatory reviews as a type of unscheduled review. Box 10-8 describes the review process in the New Zealand ETS.

Box 10-8 Case study: Review processes in the New Zealand ETS

The New Zealand ETS has undergone several reviews, with different processes applied at different points in time. The 2008 legislation establishing the New Zealand ETS (NZ ETS) provided for two types of review processes:[362]

- a *mandatory* review conducted by an independent panel appointed by the Climate Change Minister, before the end of each international commitment or five-year period. The results of these reviews would be made publicly available; and
- a *discretionary* review of ETS operation and effectiveness that could be initiated by the Climate Change minister at any time and conducted through any means.

The passage of the NZ ETS legislation was immediately followed by a change of government; the new government launched a discretionary review of the NZ ETS in December 2008. The review was carried out by a special, cross-party Parliamentary select committee with the objective of revisiting New Zealand's climate change policy objectives and deciding whether to proceed with an ETS. After this review, the new government chose to retain the NZ ETS with substantial amendments[363] to moderate its expected impact on the economy.

The first mandatory NZ ETS review was conducted in 2011 by a panel of seven nongovernmental experts under the government's terms of reference. It included a six-week consultation period with public submissions and the preparation of expert reports. The panel publicly released an in-depth review report that the government took into consideration in its 2012 proposal for amendments to the NZ ETS.[364] The government ultimately chose to accept some — but not all — of the panel's recommendations. The process helped influence the government's decisions and build public understanding of the system.

In its 2012 legislative amendments, the government changed the NZ ETS review process. Reviews are now optional at the discretion of the minister, no guidance is provided on the scope of the terms of reference, and there is no requirement to use an independent panel. If no panel is involved, the minister must consult with stakeholders and representatives of Maori/iwi (indigenous people) who are likely to have an interest. This change reflected the perception that the initial review provisions were resource intensive and resulted in a very lengthy process. The new review provisions reflect a trade-off between less onerous responsibilities for government and less certainty about the review process for stakeholders.

The second review of the NZ ETS was undertaken in 2015–2016, following the government's July 2015 announcement of New Zealand's post-2020 target. The review began with the government releasing a discussion document for broad public consultation, along with several supporting documents. The review was conducted in two stages. The first looked at immediate reforms of the transitional measures, and resulted in the phase out of the 1-for-2 policy, a measure that allowed non-forestry participants in the NZ ETS to surrender one unit for every two tons of emissions (a 50 percent surrender obligation in 2016).[365] The second stage focused on the broader design and operation to the NZ ETS and its alignment with New Zealand's Paris Agreement commitments. Agriculture was excluded from the scope of the review. Results showed that the NZ ETS had been ineffective in driving domestic abatement. The review resulted in a series of decisions to reform the system, to enable unit supply to be better managed, to set a cap on emissions in line with national budgets, to restrict international credits, to introduce auctioning and a cost containment reserve, to begin the phase-out of free allocation, to simplify forestry accounting, and to improve the technical operation of the system. Following further public consultation, the decisions were confirmed in 2018–2019 and came into force with the passing ratification of the Climate Change Response (Emissions Trading Reform) Amendment Bill in mid-June 2020 and the commencement of unit auctioning in early 2021. →

362 New Zealand Government 2011.
363 New Zealand Ministry for the Environment 2009.
364 New Zealand Ministry for the Environment 2017.
365 New Zealand Government 2015.

10.3.3 GATHERING DATA FOR REVIEWS AND EVALUATIONS

When designing an ETS, policymakers must also consider the data needs for completing reviews and evaluations, as well as options for gathering it.

Data requirements

Much of the relevant data for conducting reviews and evaluations is already collected for other purposes; for example, energy prices and use, firm activity, impact assessments (economic and environmental), revenue and profits, wages and employment, product prices, patents, and weather or land use. Other data will be generated by MRV and compliance systems, the registry recording trades, and through the allowance allocation processes.

However, some studies will require fresh data. These might include administration costs for government and regulated entities, emissions from otherwise similar entities not covered by the cap, interview information on new business practices, investments, revenue generated, and innovations.

To yield robust insights, these data need to be available to authorities and other researchers in a timely way and with adequate documentation. The aggregate data that is generally released publicly is of limited value in addressing key questions of effectiveness and impacts; robust, detailed studies will require data on specific participants.

Data gathering methods

In addition to publicly available data, there are two methods of gathering information for a review or evaluation:

1. **Reporting by firms:** Data on firms' commercial and emissions trading activities are generally kept confidential. Special provision will often need to be made for confidential data to be provided to the entity undertaking the review and/or evaluation. This normally requires that the entity maintain the confidentiality of the data, while using the data to inform its findings. In the EU, data that do not have to be published by law are treated as confidential if the operator marks them as such; if there are requests for disclosure, the operator has the right to prevent disclosure. In some cases, for example in New Zealand, these data can be made available in an anonymized form to trusted researchers (for example in universities and ministries) under strict confidentiality and data security conditions. Data may be available to policymakers from impact assessments developed as part of standard government processes.
2. **Qualitative information:** Surveys, interviews, or consultations with participants and other stakeholders can complement analysis of quantitative data. They can help identify potential causes of perceived poor outcomes and suggest further empirical questions to avoid misinterpretation and enrich interpretation of data and results from its analysis.

10.3.4 MANAGING THE EVOLUTION OF AN ETS

ETS policy will inevitably need to develop over time. Changing an ETS can have implications for prices, asset values, and perceptions and attitudes. Changes can strengthen or undermine predictability, depending on their drivers and on how they are decided and implemented. These implications need to be anticipated and included in the decision-making calculus when considering whether and how to implement change. Table 10-1 shows how ETS policy has evolved over time in five different contexts.

Fundamental changes to an ETS following a comprehensive review may have far-reaching political, legislative, and economic consequences. Given the potential impact of the reviews, the scheduling of reviews is often built into legislation (see Step 7). These processes will be jurisdiction-specific and may follow existing legislative review timelines. Both the EU and New Zealand have reviews built into legislation and have policy departments carrying out their ETS reviews. New Zealand's Climate Change Commission has review responsibility regarding a range of issues that pertain to the NZ ETS.

ETS legislation should establish policy and processes as to how the decision maker, typically the government, will respond to a review. It may specify

- the process for sharing findings of a review with other parts of the government and with stakeholders. For instance, some governments use green paper and white paper processes to socialize and invite comment on potential changes;
- the time frame to announce changes; for example, this could use movements between phases of an ETS as a waypoint to make policy changes; and
- the minimum notice period for major changes.

By establishing a transparent process, policymakers can help both ensure balance and build trust in the quality of decisions. Governance processes will be locally specific and depend on local political culture and existing institutions; however, at a minimum these processes should provide transparency, predictability, and an opportunity for stakeholders to offer input into decision-making.

Table 10-1 Timelines of significant changes in five long-lived systems

Regional Greenhouse Gas Initiative	
Date	Event/Changes Made
2005	MoU to set up a joint cap and trade system signed by the governors of Connecticut, Delaware, Maine, New Hampshire, New Jersey, New York, and Vermont.
	Model Rule outlines the framework for an ETS.
2006	Signatory states publish Model Rule after substantive amendments made in response to public comments.
2007–2008	States codify Model Rule in state-specific legislation and/or regulation.
2008	First auction held.
2009	First compliance period begins.
2011	New Jersey announces intention to withdraw.
2012	First system review: cap reduced to 165 million short tons of CO_2.
	New Jersey withdrawal effective.
2014	Updated Model Rule released after first system review that (1) reduced cap to 91 million short tons of CO_2, (2) introduced CCR, and (3) established interim control period to ensure regulated entities comply with allowance purchases in a feasible manner.
2015	Second system review begins.
2017	2017 Model Rule released after second system review: further reduction of emissions cap, creation of an ECR, and modifications to the CCR.
2019	New Jersey adopts final regulations to rejoin RGGI in 2020.
	Virginia finalizes final regulations to join RGGI in 2020.
2020	Virginia adopts final regulations to join RGGI starting in 2021.
	Pennsylvania adopted draft regulations to join RGGI in 2022.

European Union Emissions Trading System	
Date	Event/Changes Made
2005	Start of Phase 1.
2008	Start of Phase 2. ETS expanded to include European Economic Area countries (Iceland, Liechtenstein, and Norway[366]). Member States could auction up to 10 percent of allowances.
	Nitrous oxide (N_2O) emissions from production of nitric acid included in scope. Penalty for noncompliance increased to EUR 100/ton.
2008	First revision process of the EU ETS begins.
2009	Directive 2009/29/EC amended the original ETS directive; changes for Phase 3 included (1) a cap set at EU level, decreasing at the linear reduction factor (LRF) of 1.74 percent per year; (2) post-2012 Certified Emission Reductions from the Clean Development Mechanism no longer accepted (except from the LDCs); projects involving the destruction of HFC-23 and N_2O excluded regardless of the host country; (3) higher percentage of auctioned allowances — auctioning became the default allocation mechanism for the power sector; (4) more sectors and gases included in the scope; and (5) free allocation determined by EU-wide, harmonized allocation rule.
2012	Aviation sector included based on Directive 2008/101/EC.
2013	Start of Phase 3. Rules for Phase 3 decided in Directive 2009/29/EC begin to apply.
2014	Structural reform process begins.
	Backloading decision finalized to move 900 million allowances from 2014–2016 auctions to 2019–2020.
	Commission proposed establishing the MSR to reduce the number of excess allowances (total number of allowances in circulation [TNAC]).

366 Norwegian ETS subsumed by EU ETS.

2015	Decision adopted by the European Parliament and EU Council to establish the MSR. Revision process for Phase 4 of the EU ETS begins.
2018	Council of Ministers formally approves the revision of the EU ETS for Phase 4 (2021–2030); changes for Phase 4 include[367] (1) LRF increased to 2.2 percent from 1.74 percent from 2021 onwards; (2) the pace at which surplus allowances are removed from the auctions and placed in the MSR is doubled to 24 percent of the TNAC until 2023; (3) backloaded allowances and unallocated allowances from Phase 3 placed in the MSR; from 2023, allowances in the MSR above the previous years' auction volume will be invalidated; (4) better targeted carbon leakage rules and a gradual phase out of free allocation toward 2030 for less exposed sectors; and (5) funding of low-carbon innovation and energy sector modernization through the newly created Innovation and Modernization Funds.
2019	MSR starts operating. As of August 2020, almost 1.4 billion allowances have been placed in the MSR.[368]
2020	European Commission announces European Green Deal, including proposals to revise and potentially expand the EU ETS.

Québec Cap-and-Trade Program

Date	Event/Changes Made
2008	Québec joins the Western Climate Initiative (WCI).
2011	Regulation respecting a cap and trade system for greenhouse gas emission allowances announced. Amendments made to the regulation to bring the cap and trade system in line with the rules adopted by the WCI.
2012	Amendment to the cap and trade regulation to set operating rules of offset system and to allow for linking with other systems. Annual allowance caps for the 2013–2020 period are established.
2013	Systems first compliance period begins.
2014	Program links with California's.
2014	First joint auction with California.
2015	Second compliance period begins. Upstream fossil fuel distributors, suppliers, and first deliverers of electricity added to the program.
2017	Draft regulations setting the cap trajectory for the period 2021–2030 are published and adopted. Cap trajectory regulations adopted.
2018	California and Québec cap and trade programs link with Ontario. Ontario revokes cap and trade Program, severing link with California and Québec cap and trade programs.
2019	Industrial installations that declare annual emissions of more than 10,000 tCO_2e but less than the threshold of 25,000 tCO_2e can voluntarily register for the cap and trade system.

New Zealand Emissions Trading System

Date	Event/Changes Made
2008	Forestry sector enters the ETS with one-time allocation to pre-1990 forestry. One-time allocation granted to fisheries; free allocation granted to emissions-intensive, trade exposed (EITE) facilities with gradual phase-out. System opened to international trading and accepts Kyoto units for compliance.
2009	NZ ETS discretionary review. Changes include (1) 1-for-2 surrender obligations introduced; (2) phase out of EITE free allocation scheduled but deferred to 2016; (3) stationary energy and industrial processes scheduled to enter but deferred to mid-2010; and (4) agriculture deferred to 2015 (originally scheduled for 2013), but subject to reporting obligation.

367 ICAP 2018b.
368 European Commission 2020c.

2010	Liquid fuels sector enters. Stationary energy and industrial processes enter.
2012	NZ ETS first mandatory review. Agriculture entrance into the ETS deferred indefinitely. Fixed price ceiling of 25 NZD introduced. 1-for-2 surrender obligations extended.
2013	Waste sector enters.
2015	ETS stops accepting international Kyoto units for compliance.
2015–2016	NZ ETS Second mandatory review commences. Stage 1 of review ends May 2016; decision to remove the one-for-two surrender obligation. Stage 2 of the review ends in four made-in-principle decisions that require further work and consultation before they are implemented (1) introducing auctioning of units to align the NZ ETS to the country's climate change targets; (2) limiting participants' use of international units when the NZ ETS reopens to international carbon markets; (3) developing a different price ceiling to eventually replace the current fixed price option of 25 NZD; and (4) coordinating decisions on the supply settings in the NZ ETS over a rolling five-year period.
2019	Improvements to the ETS are announced based on Stage 2 of the second mandatory review, including (1) phasing-down industrial allocation from 2021, (2) averaging accounting in the forestry sector, (3) introducing auctioning, and (4) transitioning from a Fixed Price Option to a Cost Containment Reserve. Agreement made with agriculture sector to plan for pricing instrument (or to enter ETS) by 2025.
2020	Climate Change Response (Emissions Trading Reform) Amendment Bill passes through Parliament in mid-June including all amendments determined by the second review.

Korean Emissions Trading System[369]

Date	Event/Changes Made
2010	Framework Act on Low Carbon, Green Growth goes into force, establishing a legal basis for the ETS.
2012	Act on Allocation and Trading of Greenhouse Gas Emissions Allowances goes into force. Mandatory GHG and Energy TMS launched.
2014	Allocation Plan goes into force.
2015	Korean ETS launches (covers power, industry, building, public, waste, and transportation sectors).
2016	Allocation Committee doubles the borrowing limit to 20 percent and an additional 9 million allowances auctioned at a reserve price of USD 14.72. Release of basic National Roadmap for Greenhouse Gas Reductions by 2030. Amendments on Framework Act on Low Carbon, Green Growth.
2018	Second phase starts: expansion of benchmark-based allocation, introduction of 3 percent auctioning, new banking rules, permitted restrictive use of international credits, > 97 percent free allowances, < 3 percent auctioned. Allocation Committee makes 5.5. million allowances available from the MSR.
2019	Allowance auctioning started by the Korea Development Bank and the Industrial Bank of Korea (named as market makers). Reforms for coming third phase announced, including (1) stricter emissions cap, (2) use of auctions, (3) move from basing free allocation on grandparenting to sector-specific benchmarking, and (4) opening the secondary market to noncompliant entities.
2020	Phase 3 Allocation Plan approved; Allocation Plan will take effect in 2021 and run until 2025. →

369 ICAP 2020c.

10.4 QUICK QUIZ

Conceptual Questions

1. How can an ETS balance the need to adapt to learning and changes in circumstances with the desire for predictability for investment?
2. What are common stages in an ETS review process?
3. What factors might mean that ETS policy design needs to evolve over time?

Application Questions

1. What are the advantages and disadvantages of conducting an ETS pilot in your jurisdiction?
2. Would learning by doing through gradual introduction of sectors into your jurisdiction's ETS help build necessary capacities? What do you see as potential drawbacks?
3. How can your jurisdiction collect data and make it available for high-quality evaluation?

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