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# EMISSIONS TRADING IN PRACTICE:

## A HANDBOOK ON DESIGN AND IMPLEMENTATION

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In collaboration with:

Motu

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| | |
|---|---|
| **AAU** | Assigned Amount Unit |
| **APCR** | Allowance Price Containment Reserve |
| **ARB** | Air Resources Board (California) |
| **BAU** | Business as usual |
| **CCER** | Chinese Certified Emission Reduction |
| **CCR** | Cost Containment Reserve |
| **CCS** | Carbon Capture and Storage |
| **CDM** | Clean Development Mechanism (Kyoto Protocol) |
| **CEM** | Continuous Emissions Monitoring |
| **CER** | Certified Emission Reduction |
| **$CO_2$** | Carbon dioxide |
| **$CO_2e$** | Carbon dioxide equivalent |
| **CPC** | Carbon Price Floor |
| **CPLC** | Carbon Pricing Leadership Coalition |
| **CPM** | Carbon Pricing Mechanism |
| **CPS** | Carbon Price Support |
| **EC** | European Commission (EU) |
| **EDF** | Environmental Defense Fund |
| **EITE** | Emissions-intensive, trade exposed sectors |
| **EPA** | Environmental Protection Agency (United States) |
| **ERU** | Emission Reduction Unit |
| **ETS** | Emissions Trading System |
| **EU** | European Union |
| **EU ETS** | European Union Emissions Trading System |
| **FSB** | Fixed Sector Benchmarking |
| **GDP** | Gross Domestic Product |
| **GHG** | Greenhouse Gas |
| **Gt** | Gigatonne |
| **$GtCO_2e$** | Gigatonne of carbon dioxide equivalent |
| **GWP** | Global Warming Potential |
| **IAP2** | International Association for Public Participation |
| **ICAO** | International Civil Aviation Organization |
| **ICAP** | International Carbon Action Partnership |
| **IEA** | International Energy Agency |
| **IPCC** | Intergovernmental Panel on Climate Change |
| **JCM** | Joint Crediting Mechanism (Japan) |
| **JI** | Joint Implementation (Kyoto Protocol) |
| **$ktCO_2e$** | Kilotonne of carbon dioxide equivalent |
| **LRF** | Linear Reduction Factor |
| **MRV** | Monitoring, Reporting and Verification |
| **MSR** | Market Stability Reserve |
| **Mt** | Megatonne |
| **$MtCO_2e$** | Megatonne of Carbon Dioxide equivalent |
| **MW** | Megawatt |
| **NDC** | Nationally Determined Contributions |
| **NDRC** | National Development and Reform Commission (China) |
| **NZ-AAU** | New Zealand-originated Assigned Amount Unit |
| **NZ ETS** | New Zealand Emissions Trading Scheme |
| **NZU** | New Zealand Units |
| **OBA** | Output-Based Allocation |
| **OECD** | Organisation for Economic Co-operation and Development |
| **PBL** | *Planbureau voor de Leefomgeving* (Netherlands Environmental Assessment Agency) |
| **PMR** | Partnership for Market Readiness |
| **REDD** | Reducing Emissions from Deforestation and Forest Degradation |
| **REDD+** | REDD plus Conservation, Sustainable Management of Forests, and Enhancement of Forest Carbon Stocks |
| **RGGI** | Regional Greenhouse Gas Initiative |
| **t** | Tonne (= metric ton, in the United States) |
| **$tCO_2$** | Tonne of carbon dioxide |
| **$tCO_2e$** | Tonne of carbon dioxide equivalent |
| **UK** | United Kingdom |
| **UN** | United Nations |
| **UNFCCC** | United Nations Framework Convention on Climate Change |
| **U.S.** | United States |
| **WCI** | Western Climate Initiative |

# SYNTHESIS – EMISSIONS TRADING: BRINGING IT ALL TOGETHER

Currently, about 40 national jurisdictions and over 20 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. Together, carbon pricing instruments cover about half of the emissions in these jurisdictions, which translates to about 7 gigatonnes[1] of carbon dioxide equivalent ($GtCO_2e$) or about 12 percent of global emissions.[2] An increasing number of these jurisdictions are approaching carbon pricing through the design and implementation of Emissions Trading Systems (ETS). As of 2016, ETSs were operating across four continents in 35 countries, 13 states or provinces, and seven cities, covering 40 percent of global GDP, and additional systems were under development.[3]

Moreover, as the world moves on from the climate agreement negotiated in Paris, attention is turning from the identification of emissions reduction trajectories—in the form of Nationally Determined Contributions (NDCs)—to crucial questions about how these emissions reductions are to be delivered and reported within the future international accounting framework. The experience to date shows that, if well designed, emissions trading can be an effective, credible, and transparent tool for helping to achieve low-cost emissions reductions in ways that mobilize private sector actors, attract investment, and encourage international cooperation.

However, 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 an ETS 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, including from the European Union, several provinces and cities in China, California and Québec, the Northeastern United States, Alberta, New Zealand, Kazakhstan, the Republic of Korea, Tokyo, and Saitama.[4]

1 A tonne is known as a metric ton in the United States.
2 World Bank (2015)
3 ICAP (2016i)
4 As of 2016, ETSs in force include the European Union Emissions Trading System (EU ETS), the Swiss Emissions Trading System, the California Cap-and-Trade Program, the U.S. Regional Greenhouse Gas Initiative (covering Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont), the Québec Cap-and-Trade System, the Kazakhstan Emissions Trading Scheme, the New Zealand Emissions Trading Scheme, , the Korean Emissions Trading Scheme, and Japan's Saitama Target Setting Emissions Trading System and Tokyo Cap-and-Trade Program. In addition, the Alberta's Specified Gas Emitters Regulation (SGER) sets a facility-level emissions intensity target (as opposed to an absolute cap). A range of regional pilot ETS are in force in China, with a view to absorb these in an overall Chinese cap-and-trade system by 2017. A further 15 jurisdictions are currently considering implementing ETSs (see *www.icapcarbonaction.com/en/ets-map* for up-to-date information on all operating and planned ETSs)

# WHY EMISSIONS TRADING?

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 pre-industrial levels, action will be needed on multiple fronts, including:

- Decarbonizing the production of electricity;
- Massive electrification (to increase reliance on clean electricity) and, where this is not possible, switching to cleaner fuels;
- Improving energy and resource efficiency, and reducing waste in all sectors; and
- Preserving existing and increasing the number of natural carbon sinks in forests and other vegetation and soils.[5]

This will require a shift in investment patterns and behaviors, and innovation in technologies, infrastructure, financing, and practice. Policies will be needed that achieve this change in ways that reflect local circumstances, create new economic opportunities, and support citizens' wellbeing.

For many jurisdictions, GHG carbon pricing is emerging as a key driver of this transformation. By aligning profits with low-emissions 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 toward 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. A growing number of firms and investors are advocating carbon pricing policies from government,[6] 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.

5 For further discussion of the role of climate change mitigation in supporting economic development, see Fay et al. (2015).
6 Recent examples of engagement of private-public coalitions advocating carbon pricing include: World Bank (2014), supported by over 1,000 companies and investors along with national and subnational jurisdictions, an open letter to governments and the United Nations from six major oil companies calling for an international framework for carbon pricing systems (UNFCCC, 2015a): and the launch of the Carbon Pricing Leadership Coalition 2015, whose government and private sector participants are committed to building the evidence base for effective carbon pricing (see Carbon Pricing Leadership Coalition, 2015).

# EMISSIONS TRADING OR CARBON TAX?

Two kinds of market instruments can deliver an explicit price on carbon:[7] emissions trading and carbon taxes. They have much in common. Both emissions trading and carbon taxes aim to internalize the costs carbon emissions impose on society by placing a price on these emissions that can:

3. Change the behavior of producers, consumers, and investors so as to reduce emissions, but in a way that provides flexibility on who takes action, what action they take, and when they take that action;
4. Stimulate innovation in technology and practice;
5. Generate environmental, health, economic, and social co-benefits; and
6. Provide government revenue that can be used to reduce other taxes or support public spending on climate action or in other areas.

The key distinction is that with a carbon tax the government sets the price and allows the market to determine the quantity of emissions, whereas with emissions trading the government sets the quantity of emissions and allows the market to determine the price. Hybrid systems, which combine elements of both approaches, also exist in different forms, for example, an ETS with a price floor and ceiling, or tax schemes that accept emissions reduction units to lower the tax liabilities.

In practice, the fact that emissions trading provides reasonable confidence about the future level of emissions has served to make it an attractive policy option for many governments. In addition, empirical evidence suggests that the strategic use of free allocation of emissions allowances to manage the distributional and leakage effects of emissions trading has made it easier to secure political support. Last but not least, ETSs can be linked to other ETSs or to offset mechanisms, enabling international cooperation on carbon pricing through larger, more robust markets.

Regardless of which instrument is selected for pricing carbon, a common set of principles can be applied to guide effective design. These principles are presented in Box S.1.

BOX S.1 **The FASTER Principles for Successful Carbon Pricing**

The FASTER Principles for Successful Carbon Pricing[a] were developed jointly by the World Bank and the Organisation for Economic Co-operation and Development (OECD), based on the practical experience of different jurisdictions with implementing carbon taxes and emissions trading systems. The FASTER Principles are the following:

- **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 nonclimate policies;
- **Stability and Predictability:** Implement carbon prices, within a stable policy framework, that give a consistent, credible, and strong investment signal, whose intensity 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 emissions reduction; and
- **Reliability and Environmental Integrity:** Allow for a measurable reduction in environmentally harmful behavior.

a World Bank and OECD (2015).

# HOW DOES AN ETS WORK?

Under an ETS, the relevant authority imposes a limit (cap) on the total emissions in one or more sectors of the economy, and issues a number of tradable allowances that does not exceed the level of the cap. Each allowance corresponds to one unit of emissions (typically one tonne).[8]

The regulated participants in an ETS are required to surrender one allowance for every unit of emissions for which they are accountable. They may initially either receive freely or buy allowances from the government, and participants and others

7 A host of other policies exist that aim to provide an incentive for emissions reductions. Often, the implied carbon price associated with these policies can be calculated, the so-called "implicit carbon price." However, the focus of this discussion is on *explicit* carbon prices created through either an ETS or carbon taxes.

8 Allowances are typically issued in units of tonnes carbon dioxide, or tonnes of carbon dioxide equivalent ($CO_2e$). The latter includes carbon dioxide as well as other GHGs (e.g., methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, sulphur hexafluoride, and nitrogen trifluoride) on the basis of their relative global warming potential (GWP).

can also choose to trade allowances or bank them for future use. They may also be able to use eligible units from other sources, such as domestic offset credits (from sectors outside the cap), international offset mechanisms, or other ETSs.

The cap on allowances and the establishment of a market to trade them result in a price for allowances, creating an incentive to reduce emissions. A more stringent cap translates into lower allowance supply, so—all other things being equal—the allowance price will tend to be higher, creating a stronger incentive. The ability to trade on the market also results in price convergence and a uniform price signal, which in turn favors lower-emission goods and services. Setting the cap in advance provides a long-term market signal so participants can plan and invest accordingly.

Allowances can be allocated for free—based on some combination of past emissions, output and/or performance standards—or sold, typically at auction. The latter supports transparent price formation and generates revenue for the government, which can be used for a variety of purposes, among others, to fund climate action, support innovation, or help low-income households. Additional mechanisms can be used to support price predictability, cost containment, and effective market operation.

The environmental integrity of the system is ensured through requirements for emissions monitoring, reporting and verification (MRV) and the enforcement of penalties for noncompliance. This is facilitated by the use of registries into which allowances are issued with unique serial numbers and that enable allowances to be tracked as they are traded between different participants and canceled. Market oversight provisions safeguard the broader integrity of trading activity.

Different jurisdictions can choose to link their ETS directly or indirectly through mutual recognition of allowances or other units, such as offset credits. Linking broadens access to least-cost mitigation, attracts resources for further mitigation, supports market liquidity, and enables political cooperation on carbon pricing.

# LAYING THE FOUNDATION FOR AN ETS

## Setting ETS objectives

An ETS is a policy tool and it can be designed to achieve a range of outcomes—environmental, economic, and social. Before proceeding to ETS design, a jurisdiction must decide how much the system should contribute to the emissions reductions that it wants to achieve globally and domestically, the rate at which to decarbonize its own economy, what level of cost is acceptable, how costs and benefits will be distributed, whether revenue shall be generated by selling or auctioning allowances and how those proceeds will be used, and how the ETS and its co-benefits will contribute to economic transformation and sustainable development. It will be easier to come to a decision on the adoption of an ETS and determine the specifics of ETS design and implementation once there is broad public acceptance of the jurisdiction's need to reduce GHG emissions—at least to a level below business as usual (BAU)—in the long term.

## Tailoring an ETS to local circumstances

There are many opportunities to tailor an ETS to reflect the jurisdiction's specific circumstances and needs. Relevant aspects include: local priorities; the motivation for choosing an ETS relative to alternative policy instruments; the jurisdiction's current and evolving emissions profile; the existing regulatory environment and confidence in market mechanisms; the size, concentration, growth, and volatility of the economy; trade and competitiveness concerns; institutional strengths and weaknesses; and relationships with potential linking partners.

## Managing policy interactions

All ETSs are developed within a broader policy and legal framework, including other climate change policies. This will lead to important interactions that will often require careful attention. Additional policies in sectors covered by the cap can counteract, distort, or duplicate the impact of an ETS. For example, other abatement policies such as renewable energy and energy efficiency policies may lead to emissions reductions in ETS sectors at costs above the ETS's carbon price, meaning that the ETS will not deliver least-cost mitigation as a whole. On the other hand, those policies can also complement or even enhance the effectiveness of an ETS by creating additional GHG mitigation opportunities or removing non-price barriers to reducing emissions. The role that an ETS is expected to play within a broader climate change policy package will often be an important determinant of its design.

# ETS DESIGN IN 10 STEPS

This handbook sets out a 10-step process for designing an ETS (see Figure S.1). Each step involves a series of decisions or actions that will shape major features of the system (see Box S.2). 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 these steps is more likely to be iterative rather than linear.

## BOX S.2 Checklist for the 10 Steps of ETS Design

### Step 1: 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

### Step 2: Set the cap

- ✓ Create a robust foundation of data to determine the cap
- ✓ Determine the level and type of cap
- ✓ Choose time periods for cap setting and provide a long-term cap trajectory

### Step 3: Distribute allowances

- ✓ Match allocation methods to policy objectives
- ✓ Define eligibility and method for free allocation and balance with auctions over time
- ✓ Define treatment of entrants, closures, and removals

### Step 4: Consider the use of offsets

- ✓ Decide whether to accept offsets from uncovered sources and sectors within and/or outside the jurisdiction
- ✓ Choose eligible sectors, gases, and activities
- ✓ Weigh costs of establishing an own offset program vs. making use of an existing program
- ✓ Decide on limits on the use of offsets
- ✓ Establish a system for monitoring, reporting, verification, and governance

### Step 5: Decide on temporal flexibility

- ✓ Set rules for banking allowances
- ✓ Set rules for borrowing allowances and early allocation
- ✓ Set the length of reporting and compliance periods

### Step 6: Address price predictability and cost containment

- ✓ Establish the rationale for, and risks associated with, market intervention
- ✓ Choose whether or not to intervene to address low prices, high prices, or both
- ✓ Choose the appropriate instrument for market intervention
- ✓ Decide on governance framework

### 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 units

### Step 8: 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

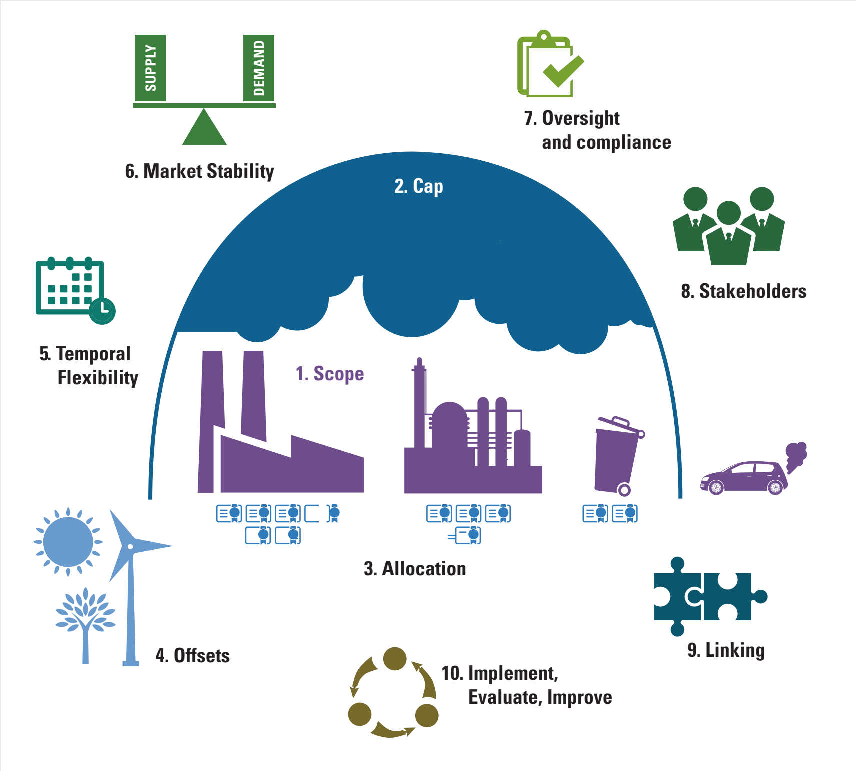
### Step 9: Consider linking

- ✓ Determine linking objectives and strategy
- ✓ Identify linkage partners
- ✓ Determine the type of link
- ✓ Align 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
- ✓ Evaluate the ETS to support review

FIGURE S.1 **ETS Design In 10 Steps**




*Author:* ICAP

## STEP 1: 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

The scope of an ETS refers to the geographic area, sectors, emissions sources, and GHGs 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 a carbon price, and effort sharing between the covered and uncovered sectors to meet economy-wide emissions reduction targets.

In determining ETS scope, there are important differences across sectors and emissions sources. Key considerations include the jurisdiction's emissions profile (and its expected evolution) and what this implies for the potential for emissions reductions. The ability and cost of monitoring and regulating across emissions sources and at different points in the supply chain will also be important; this will be influenced in part by existing regulatory structures and policies. Finally, consideration should also 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, which enhances market liquidity. However, a broader system may impose greater regulatory burdens on small and diffuse emissions sources that 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" upstream on suppliers of fossil fuels 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 up to seven gases. While some jurisdictions have placed the point of regulation for emissions from fuel combustion upstream to reduce administrative costs (e.g., fuels in California, Québec, and New Zealand), others have opted for downstream options for alignment with existing regulatory or reporting systems (e.g., EU, California, and Québec for large point sources), or for hybrid options because energy prices are regulated and carbon price signals otherwise would not be passed through the supply chain (e.g., Korean ETS and pilot ETSs in China).*

## STEP 2: Set the cap

- ✓ Create a robust foundation of data to determine the cap
- ✓ Determine the level and type of cap
- ✓ Choose time periods for cap setting and provide a long-term cap trajectory

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

Setting the cap requires 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 consideration of how other current or planned policies could influence ETS outcomes.

The cap should be aligned with the jurisdiction's overall mitigation target. In setting the cap, policy makers need to manage trade-offs between emissions reduction ambition and system costs, aligning cap ambition with target ambition, and assigning mitigation responsibility across capped and uncapped sectors. Absolute caps set targets for each compliance period in tonnes of emissions reductions, although flexibility can be provided by banking provisions, allowance reserves, offset credits, linking, and periodic reviews that may result in cap adjustments. Intensity(-based) caps prescribe the number of allowances to be issued per measure of output (e.g., GDP or kilowatt-hour of electricity), which allows them to adjust automatically to fluctuations in economic output, but provides less certainty over emissions outcomes. Absolute and intensity caps can be equally stringent with respect to their expected results, but can also produce different outcomes when actual output deviates significantly from projections. ETSs with absolute caps are more common. Jurisdictions that choose intensity caps will have a smaller body of knowledge and experience to draw on, particularly if there is an interest in program components such as linking and offsets.

*LESSONS LEARNED: A cap is only as good as the 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 contain costs (see Step 6). Developing intensity caps introduces some additional technical and administrative challenges. In practice, partly because of a concern about high prices, initial caps in many existing ETSs have been set at levels that (in conjunction with other design features) have resulted in prices significantly lower than expected, which can cause its own set of problems (see Step 6). To support effective market operation and build confidence and support among market participants, a long-term cap trajectory should be combined with transparent, rules-based processes for possible modifications to the cap and advance notice of future changes.*

## STEP 3: Distribute allowances

- ✓ Match allocation methods to policy objectives
- ✓ Define eligibility and method for free allocation and balance with auctions over time
- ✓ Define treatment of entrants, closures, and removals

Whereas the cap determines the emissions impact of an ETS, allowance allocation is an important determinant of its distributional impacts. It can also influence the efficiency of the system and therefore merits careful attention.

The government can distribute allowances through free allocation, auctioning, or some combination of the two, as well as award allowances for removals. Free allocation methods vary according to whether they are based on entities' historical emissions—referred to as grandparenting—or based on an industry-specific benchmark; and depending 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 pay for cuts in distortionary taxes, support spending on public programs (including other forms of climate action), or be returned to households directly.

*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 (e.g., managing the transition into the ETS, preserving incentives for cost-effective abatement) should be transparently stated upfront, and subsequent decisions on particular 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. The risk of leakage in emissions-intensive, trade-exposed (EITE) sectors has been a major concern in ETS design and implementation, and is likely to remain a core consideration in the short to medium-term, even though empirical evidence on leakage is limited. This issue will also decline in importance if and when carbon pricing is adopted more widely or eventually even becomes harmonized globally. Auctioning has typically been introduced on a limited scale initially, but with the intention to let it gradually displace free allocation. 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 initial years. Using auction revenue strategically can be a powerful selling point for proceeding with an ETS.*

## STEP 4: Consider the use of offsets

- ✓ Decide whether to accept offsets from uncovered sources and sectors within and/or outside the jurisdiction
- ✓ Choose eligible sectors, gases, and activities
- ✓ Weigh costs of establishing an own offset program vs. making use of an existing program
- ✓ Decide on limits on the use of offsets
- ✓ Establish a system for monitoring, reporting, verification, and governance

An ETS can allow "offsets"—credits for emissions reductions in uncovered sources and sectors—to be used by covered entities to meet compliance obligations under the cap. This expands the supply of emissions units (although this can be counter-balanced with a reduction in allowance supply to maintain the overall cap) and can significantly reduce ETS compliance costs.

Offsets can come from a variety of sources: entities from uncovered sectors within the jurisdiction (e.g., depending on the system, transport, forestry, or agriculture); uncovered entities outside the jurisdiction's borders; and early (pre-ETS) reductions. Allowing offsets can support learning and engagement among uncovered sources, facilitate investment flows into other sectors where financial support is needed to stimulate low-carbon development, and often also yield co-benefits.

By lowering allowance prices and creating a new political constituency for the ETS among the offset sellers, offsets may allow policy makers to set a more ambitious cap and may support policy stability. For a given cap, accepting offsets will lower prices, if there is eligible low-cost abatement potential available outside the system. Emissions by covered sources will rise, but global emissions should not. The quality of MRV of offsets needs to match that of the ETS to ensure environmental equivalence of offsets and allowances (see Step 7). This can be challenging because, unlike ETS allowances issued in relation to a cap, offsets are credited relative to BAU, using benchmarks or counterfactual baselines. Unless this is done carefully, without conservative assumptions and rigorous monitoring and reporting, there is a risk that at least some offset activities may not be additional to BAU and result in emissions shifts rather than reductions (leakage). In addition, especially in relation to carbon sequestration activities, there is a risk that reductions may not be permanent. Therefore, the use of offsets has to be considered carefully in order not to risk the environmental integrity of the ETS. There is also a concern that extensive use of offsets and the reduction in abatement in the capped sectors increases the risk of the locking in of emissions-intensive infrastructure.

*LESSONS LEARNED: Offsets provide a powerful tool for containing cost, expanding mitigation incentives beyond the cap, and generating co-benefits. Establishing an operational domestic offset mechanism to produce a pipeline of units requires institution and capacity building, and involves considerable time, effort, and cost. Another aspect to consider is whether any credits generated are only expected to be eligible in the domestic scheme or whether there is an intention that they may be used outside the jurisdiction's boundaries. Valuable experience has been gained with international offsets under the Kyoto Protocol's Clean Development Mechanism (CDM) and Joint Implementation (JI) as well as other project crediting mechanisms. Some offset types and methodologies have been proven to lack environmental integrity, and the future evolution of international offset mechanisms is unclear at present. Most ETSs accept only some types of offsets and limit how many can be used. Applying internationally established methodologies, adapted for local circumstances, can help ensure environmental integrity and accelerate the development of a new domestic offset mechanism, if desired. While offsets have typically been generated at the level of individual* *"projects" (e.g., facilities), jurisdictional or sectoral programs prospectively offer the potential to lower transaction costs while maintaining or enhancing environmental integrity.*

## STEP 5: Decide on temporal flexibility

- ✓ Set rules for banking allowances
- ✓ Set rules for borrowing allowances and early allocation
- ✓ Set the length of reporting and compliance periods

One of the attractions of an ETS is that it can provide some flexibility for entities as to when they wish to reduce emissions. However, this flexibility in timing must be balanced against the certainty of achieving reductions. Key policy decisions in this regard include setting the length of reporting and compliance periods and enabling participants to bank (carry over) or borrow allowances across compliance periods.

Longer compliance periods can offer companies greater flexibility around the timing of investments in emissions abatement, potentially lowering costs significantly. However, excessively long compliance periods can create incentives to delay action and investment in reducing emissions, which might increase costs. Limiting compliance periods, typically to 1–3 years, ensures early mitigation and market activity, which may be important to demonstrate early progress toward emissions reduction targets. Borrowing is effectively equivalent to longer compliance periods and raises similar considerations.

Many existing ETSs allow for allowance banking, which encourages earlier reductions and helps smoothen costs (and allowance prices) across compliance periods. There may, however, be reasons to limit banking if there is high uncertainty about the future of the ETS. In such cases, banking restrictions might be needed to avoid negative impacts on the future supply and environmental integrity of allowances—for instance, during a pilot that may differ significantly from the ETS that is to follow. The transition process should also account for the existence of banked allowances.

*LESSONS LEARNED: Temporal flexibility in an ETS is critical to managing costs and price volatility but should be balanced. Banking between commitment periods is usually encouraged because besides helping entities manage costs and (typically) reducing volatility, it brings forward emissions reductions. It also creates a constituency with a vested interest in the success of the ETS and in one with more stringent caps, as this will increase the value of their banked allowances. Borrowing also has advantages but creates risks; in particular regulators may find it difficult to monitor the creditworthiness of the borrowers.*

## STEP 6: Address price predictability and cost containment

- ✓ Establish the rationale for, and risks associated with, market intervention
- ✓ Choose whether or not to intervene to address low prices, high prices, or both
- ✓ Choose the appropriate instrument for market intervention
- ✓ Decide on governance framework

In an ETS, time-varying market prices provide the signals that will allow firms to achieve a given quantity of emissions at least cost. Just as in many commodity markets, it may be hard to predict longer-term ETS prices accurately, because they depend on variations in economic activity, volatility and variability in fuel markets, uncertain marginal abatement cost estimates, and potential policy changes. Persistently low prices in an ETS could arise because mitigation turns out to be easier than expected, because other climate and energy policies also contribute to lower emissions and therefore reduced demand for allowances, or because of a recession that lowers economic activity and thus emissions; the reverse could be true for high prices. Policy uncertainty and other market or regulatory failures could depress demand for banking, inhibiting the formation of long-term credible carbon prices.

ETS design can reduce this potential volatility and uncertainty about prices. Design options can vary according to whether they adjust the quantity of allowances or place constraints on the price, and the extent of discretion they give policy makers. These design parameters aim to make prices predictable enough to support investment in mitigation and new technologies, and guide a gradual transition toward a low-carbon economy while avoiding costs that are politically or socially unacceptable.

*LESSONS LEARNED: Prior to ETS implementation, the concerns of policy makers have typically focused on the possibility of high prices. However, in some of the ETSs currently in operation, low prices have actually become a greater source of concern. There is growing recognition that appropriate market management approaches can help sustain prices to promote investment and maintain auction revenue, control costs, and ensure mitigation is consistent with long-term goals. A range of different approaches are being trialled: allowance reserves are becoming a more common tool to contain costs and manage prices while limiting emissions; and introducing a price floor at auction can help secure the value of mitigation investments by ETS participants and offsets providers.*

## 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 units

Like other climate policies, an ETS needs a rigorous approach to enforcement of participants' obligations and to government oversight of the system. Lacking 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.

It can be useful to start implementing effective systems for MRV of GHG emissions early in the process of ETS development to support later compliance assessment. This includes legal and administrative considerations around identification of regulated entities and development of detailed methodologies and guidance for emissions monitoring. An initial stand-alone period of MRV or a pilot phase can enable capacity building before implementing a full-scale ETS. Emissions reporting can use existing data collection activities for energy production, fuel characteristics, energy use, 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 initial phase while third-party verifiers are building their own capacities 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 on 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 confidential and commercially sensitive information. Underregulation of the trading market may allow for fraud and manipulation, while overregulation 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: 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 both enduring public and political support and practical collaboration across government and market players based on shared understanding, trust, and capability. The manner and, in particular, the transparency with which ETS policy makers engage with others in government and external stakeholders will determine the long-term viability of the system. Where possible, engagement should start at the beginning of ETS planning and continue throughout the process of design, authorization, and implementation.

In relation to both external stakeholders and other branches of government, communication about an ETS needs to be clear, consistent, and coordinated, and the government has 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 the specialized technical expertise and administrative capacity to develop and operate an ETS. ETS participants and market service providers hold specialized operational knowledge that can help policy makers design an effective system, but they also need to build sufficient capacity to participate in the system. Investing time and resources in capacity building will generate valuable returns.

*LESSONS LEARNED: Government decision making on an ETS 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 5-10 years of engagement and capacity building on climate change market mechanisms to enable informed and broadly accepted policy making on an ETS. Tapping stakeholder expertise will improve ETS design and help gain trust, understanding, and acceptance. Cultivating ETS champions can help broaden support for an ETS. How the government communicates the "story" of the ETS in the local context will be vital to gaining popular support. Because the process of decision making on ETS design can carry over across election or other political cycles, it is important to consider from the outset the likely timing and impact of political changes and the potential to secure enduring broad political support for an ETS or a clear public mandate for action.*

## STEP 9: Consider linking

- ✓ Determine linking objectives and strategy
- ✓ Identify linkage partners
- ✓ Determine the type of link
- ✓ Align key program design features
- ✓ Form and govern the link

Linking occurs when an ETS allows regulated entities to use units (allowances or credits) issued under another jurisdiction's system as valid currency for compliance, 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, thereby lowering the aggregate costs of meeting emissions targets. It can also improve market liquidity, help address leakage and competitiveness concerns, and facilitate international cooperation on climate policy.

Linking can also incur risks. It reduces jurisdictions' control over domestic prices and mitigation effort (including the potential loss of local co-benefits) and limits their autonomy over ETS design features. It also holds the potential for financial transfers out of the jurisdiction.

While full linkage may bring greater economic benefits, restricted linking (typically allowing only a certain percentage or amount of foreign units to be used for compliance, or restricting trades to only one direction) may be easier to design and control, and may help address some of the potential disadvantages associated with linking. Another form of restricted linking would be to assign different values to units deriving from different systems. This could reward more advanced systems, and provide less advanced systems with an "on-ramp" toward more fully participating in a linked system.

*LESSONS LEARNED:Although current experience with linking remains limited, it is clear that linking typically requires clear agreement on acceptable levels of ambition in each jurisdiction, and the ability to negotiate changes in ambition over time. In successful links to date, partners have generally had strong existing relationships, which facilitated the initial negotiation and governance of links. Key design features need to be harmonized to ensure environmental integrity and price stability when linking; additional design features may need to be harmonized for political reasons. This harmonization will take time and may be phased in. Poorly managed links can have unintended consequences. Jurisdictions should prepare early for linking, but link strategically and only when suitable. Some small systems, such as Québec's, were designed from the outset to link to other markets or join another ETS.*

## STEP 10: Implement, evaluate, and improve

- ✓ Decide on the timing and process of ETS implementation
- ✓ Decide on the process and scope for reviews
- ✓ Evaluate the ETS to support review

Moving from design to operation of an ETS requires government regulators and market participants to assume new roles and responsibilities, embed new systems and institutions, and launch a functional trading market. Gradual introduction of an ETS can help if existing institutions are weak and confidence in use of ETS is low; it allows "learning by doing." Key options are launching an ETS pilot and phasing of sector coverage, ambition, and the degree of government intervention in the market.

Circumstances will change and experience will generate learning about the ETS. Key drivers of allowance allocation, such as equity considerations, potential for leakage, and concerns about poor market function, will evolve. Regular reviews of ETS performance supported by rigorous, independent evaluation will enable continuous improvement and adaptation. But change should not be an end in itself, and where it becomes necessary, it should always be balanced against the benefits of policy stability.

*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 once the ETS is fully launched. Phasing in an ETS can ease the burden on institutions and sectors without obvious adverse effects. Providing a predictable review process and schedule can reduce policy uncertainty, a major barrier to low-emissions investment, but additional unanticipated changes may be unavoidable. Evaluating an ETS as input for a review can be challenging; data are often limited and external drivers of economic activity and emissions make it hard to discern the effects of the ETS from that of other policies or macroeconomic developments. Evaluation processes can be enhanced by starting data collection before commencement of the system, making entities' data public where possible, and encouraging external evaluations. Good governance and stakeholder engagement processes are key to successful implementation.*

# APPLYING THE 10 STEPS OF ETS DESIGN IN PRACTICE

The 10 steps of ETS design proposed in the handbook are interdependent, and the choices made at each step will have important repercussions for the appropriate decisions during other steps. As noted at the start of this chapter, in practice, the process of ETS design will be iterative rather than linear. Figure S.2 illustrates key design interactions across the steps.

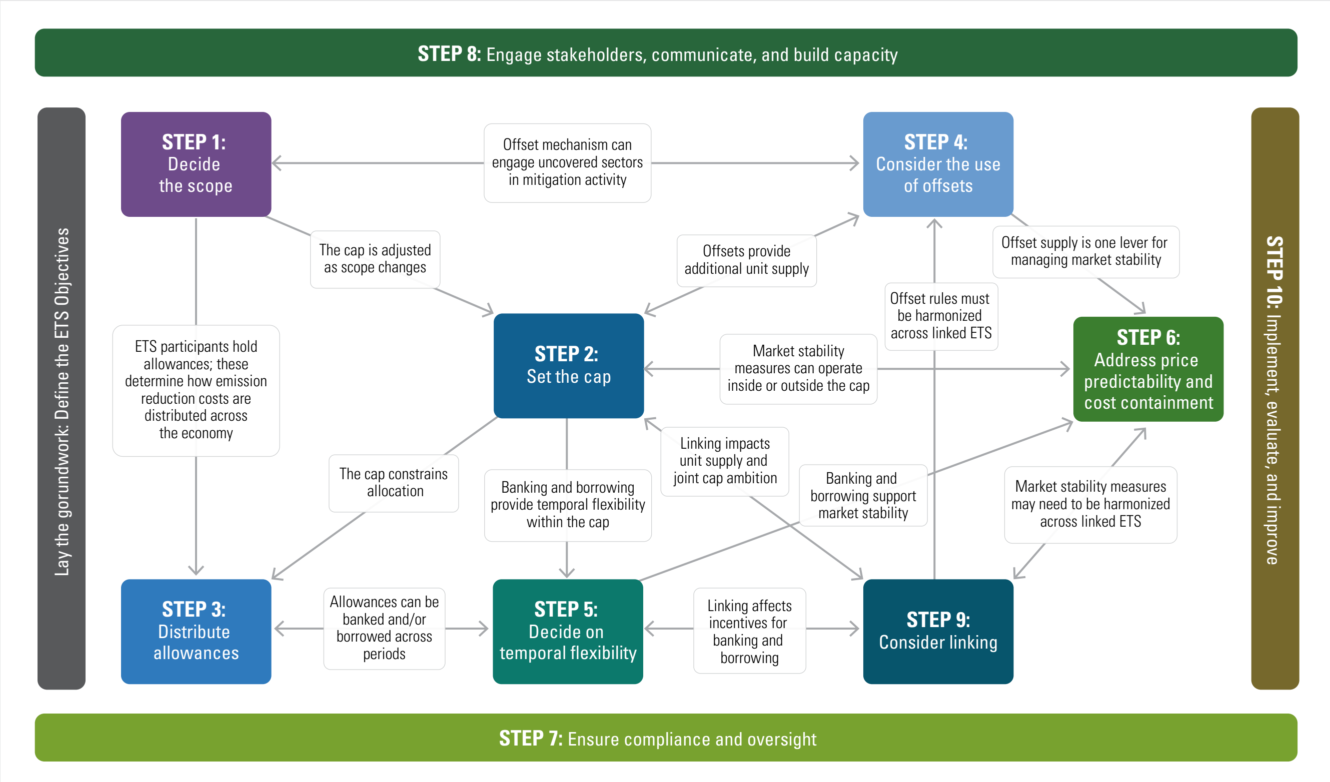
The point of entry to the process of ETS design is laying the groundwork by setting ETS objectives and beginning engagement, communications, and capacity building with government and external stakeholders.

Across the remaining steps, a series of initial high-level decisions serve as "keystones" of ETS design, defining its fundamental shape and direction. These can be broadly grouped as follows:

- A first set of decisions about which sectors to cover (Step 1), where to place the points of regulation for covered sectors (Step 1), and whether the system may link with others in the near or longer term, and the system design features that facilitate this (Step 9);
- A second set of decisions concerns the form and ambition of the cap, both initially and over time (Step 2), and its relationship to other sources of unit supply (Steps 4 and 9);
- In turn, these two sets of decisions influence the development of the allocation plan (Step 3) and mechanisms supporting market stability—price predictability, cost containment, and market management (Step 6); and
- A final important keystone decision is whether to start with a pilot, or plan for direct implementation, potentially with phased introduction of sectors or certain design features over time (Step 10).

Detailed decisions and actions across all 10 steps can then be considered iteratively in the context of these keystone decisions.

FIGURE S.2 **ETS Design Interdependencies**




# SHAPING THE FUTURE OF ETS DESIGN

The fundamental concept of emissions trading is as simple as it is powerful. While a large number of decisions have to be made to set up an effective ETS, the practical experience gained over the first decade of GHG emissions trading can be distilled into five basic guidelines for effective ETS design:

- Be informed globally, but design locally;
- Build a strong foundation of data and institutions;
- Learn by doing and provide predictable processes for adjustment;
- Adapt the ETS to changing circumstances; and
- Bring people with you.

The next decade of emissions trading experience lies in the hands of the decision makers, policy practitioners, and stakeholders who rise to the challenge of developing an ETS in their specific geographic and socioeconomic context. 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-emissions development.

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# BEFORE YOU BEGIN

Emissions Trading Systems (ETSs) are being implemented in various forms to limit and cost-effectively reduce GHG emissions around the world—from California and Québec to China, from Kazakhstan to the Republic of Korea, from New York to New Zealand, and in the European Union (EU). These experiences build on the flexibility mechanisms of the Kyoto Protocol and on a longer track record in using similar instruments for reducing other pollutants, such as in the United States for sulfur dioxide and nitrous oxides in the 1990s.[9]

The goal of this handbook is to draw on these experiences to assist with the design, implementation, and operation of an effective and credible ETS.

# UNDERSTANDING EMISSIONS TRADING

## Why emissions trading?

The attractiveness of an ETS is powerful: it limits total emissions while enabling emissions reductions to be realized at the lowest possible cost.[10] In this way, it can channel entrepreneurial activities and help move economies toward a low-carbon, high-efficiency future. Emissions trading is ideally suited for pollutants such as GHGs that are pervasive and where the timing and point of emissions does not significantly affect the primary environmental impact of concern, climate change.

## How does an ETS work?[11]

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.[12] Each allowance typically corresponds to one tonne of emissions.[13]

The regulated participants in an ETS are typically required to surrender one allowance for every tonne of emissions for which they are accountable. Participants that hold allowances 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 emissions units from other sources, such as domestic or international offsets mechanisms or other ETSs.

The cap on allowances and establishment of a market to trade them generate a uniform price on allowances (the "carbon price"). This provides an incentive to reduce emissions, as long as the cost of reducing emissions is lower than this price. The result is a price signal that favors lower-emission goods and services. A more stringent cap means less allowance supply, higher prices, and a stronger incentive to reduce emissions. Setting the cap in advance provides a long-term market signal so participants can plan and invest accordingly.

Allowances can be allocated for free—based on some combination of historical emissions, output, and/or performance standards—or auctioned. The latter generates revenue for the government, which can pay for cuts in distortionary taxes, support spending on public programs (including other forms of climate action), or be returned to affected stakeholders directly. Additional mechanisms can be used to support price predictability, cost containment, and effective market operation.

The environmental integrity of the system is ensured through requirements for emissions MRV, and the enforcement of penalties for noncompliance. All of these are 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 or social responsibility purposes. Market oversight provisions safeguard the integrity of trading activity.

Different jurisdictions can choose to link their ETS directly or indirectly through mutual recognition of allowances and other emissions reduction units. Linking broadens access to least-cost mitigation, supports market liquidity, increases price predictability, and enables political cooperation on carbon pricing.[14]

## ETS design in 10 steps

This handbook sets out a 10-step process for designing an ETS (see Box 0.1). Each step involves a series of decisions or actions that will shape major features of the system. However,

9 The three "flexibility mechanisms" of the Kyoto Protocol are Joint Implementation (JI, Article 6), the Clean Development Mechanism (CDM, Article 12), and international emissions trading (Article 17).

10 Hardin (1968) discusses the overall implications of open-access resources. For the specifics around assigning property rights, see Coase (1960). Glaeser et al. (2001) interpret the implications and limitations, including the crucial importance of transaction costs, something Coase himself identified years earlier (Coase, 1937). Among practical policy instruments, emissions trading is the one that most directly implements a Coasian solution. Medema (2014) has a more recent survey of the early reception of Coase's insights.

11 For more on the economic logic behind the workings of emissions trading, see section 5 on "Emissions Trading and Economics: A Primer," at the end of this chapter.

12 Alberta's Specified Gas Emitters Regulation (SGER) sets a facility-level emissions intensity target (as opposed to an absolute cap).

13 Allowances can be issued in units of tonnes (= U.S. metric tons) of carbon dioxide, or tonnes of carbon dioxide equivalent. The latter includes carbon dioxide as well as other GHGs (e.g., 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 corresponds to a different weight of GHGs, as in RGGI, where an allowance corresponds to a short ton.

14 The International Carbon Action Partnership (ICAP) has developed a series of ETS briefs that provide a basic introduction to emissions trading and its benefits. These briefs are available at: https://icapcarbonaction.com/en/icap-ets-briefs.

BOX 0.1 **Designing, Implementing, and Operating an ETS in 10 Steps**

Step 1: Decide the scope

Step 2: Set the cap

Step 3: Distribute allowances

Step 4: Consider the use of offsets

Step 5: Decide on temporal flexibility

Step 6: Address price predictability and cost containment

Step 7: Ensure compliance and oversight

Step 8: Engage stakeholders, communicate, and build capacities

Step 9: Consider linking

Step 10: Implement, evaluate, and improve

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 these steps will not necessarily be linear.

## 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.[15] It was implemented in earnest during the phasedown of leaded gasoline in the country during the 1980s, leading to an eventual phaseout.[16] The U.S. 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.[17] Soon thereafter, the focus shifted toward climate, and some countries began experimenting with GHG emissions trading. The 1997 Kyoto Protocol established provisions ffor the trading of emissions/emissions reductions among its parties. In 2005, the EU and Norway established domestic ETSs and Japan instituted a voluntary trading program as a means to help implement their Kyoto commitments. Some large companies have also gained experience with internal ETSs.[18] GHG trading has spread since then, and jurisdictions have used a variety of designs and approaches (see Table 0.1). As of 2015, jurisdictions with an ETS in operation made up 40 percent of GDP (see Figure 0.1). The Paris Agreement of December 2015 affirms the role of voluntary mitigation cooperation between countries, together with provisions to ensure its environmental integrity, and sends an important signal that is likely to accelerate establishment and linkage of ETS (see Box 0.2).

TABLE 0.1 **GHG ETS Milestones**

| | |
|---|---|
| **1997** | Kyoto Protocol signed<br>Emissions Reduction Market System (Chicago area)<br>New South Wales (NSW) Voluntary ETS |
| **2002** | United Kingdom ETS (voluntary)<br>Tokyo ETS (voluntary) (Japan) |
| **2003** | Chicago Climate Exchange (voluntary) (United States)<br>NSW Greenhouse Gas Reduction Scheme (GGAS) (Australia) |
| **2005** | Kyoto Protocol comes into force<br>European Union ETS (EU ETS)<br>Norway ETS<br>Japan Voluntary ETS |
| **2007** | Norway, Iceland, and Liechtenstein join EU ETS<br>Alberta's Specified Gas Emitters Regulation (SGER) (facility-level emissions intensity target) |
| **2008** | Switzerland ETS<br>New Zealand ETS<br>Japan Experimental ETS |
| **2009** | Regional Greenhouse Gas Initiative (RGGI) (Northeast and Mid-Atlantic U.S. states) |
| **2010** | Tokyo Metropolitan Government ETS (Japan) |
| **2011** | Saitama ETS (Japan) |
| **2012** | Australia ETS |
| **2013** | Kazakhstan ETS<br>California ETS (United States)<br>Québec ETS (Canada)<br>China ETS pilots (cities of Beijing, Guangdong, Shanghai, Shenzhen, Tianjin) |
| **2014** | China ETS pilots (provinces of Hubei and Chongqing) |
| **2015** | Republic of Korea ETS<br>Paris Agreement adopted |

15 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 et al. (2003).

16 For more on the phasedown of leaded gasoline, see Kerr and Maré (1998), Kerr and Newell (2003), and Newell and Rogers (2003).

17 Schmalensee and Stavins (2013) give a good history.

18 Company-level trading systems have helped ease the transition to country-level systems. As of September 2014, 150 companies disclosed that they have an internal carbon price. BP's system, which lasted from 1999 until 2002, when the U.K. trading system went into effect, was the first system of its kind and covered all BP operations across the globe (Akhurst et al., 2003; Victor and House, 2006). In two years, the system cut GHG emissions by 10 percent. A similar system was implemented by Royal Dutch Shell between 2000 and 2002, covering 22 sites, accounting for around one-third of its emissions.

BOX 0.2 **TECHNICAL NOTE: What the Paris Agreement Means for Markets**[a]

The Paris Agreement, adopted by 195 nations in December 2015 under the auspices of the United Nations Framework Convention on Climate Change (UNFCCC), recognizes the role of carbon markets through its provisions on transferring mitigation outcomes among Parties. The Article stipulates that Parties to the Agreement can voluntarily transfer mitigation outcomes toward the achievement of their nationally determined contributions (NDC) in order to "allow higher ambition … and to promote sustainable development and environmental integrity" (Article 6.1). Specifically, such "cooperative approaches" may include:[b]

1. Transfer "internationally transferred mitigation outcomes" (ITMO), under Articles 6.2 and 6.3, resulting from countries' domestic mitigation actions.
2. Transfer mitigation outcomes generated through a mechanism that operates under the authority of the Conference of the Parties (COP) and "contribute(s) to the mitigation of greenhouse gas emissions and support sustainable development," under Article 6.4. This new mechanism (which some have called "Sustainable Development Mechanism" (SDM)) must "deliver an overall mitigation in global emissions," and a share of proceeds from this mechanism will be used to assist developing countries in adapting to the impacts of climate change.

For both types of approaches, clear provisions to avoid "double counting" are specified, which is a foundational requirement to ensure the environmental integrity of carbon markets. The Agreement also highlights the role that tropical forests play in stabilizing climate (Article 5), and is thus likely to thus help boost programs reducing emissions from deforestation and forest degradation, including potentially through market approaches.

Under the decision accompanying the Agreement, "the important role for providing incentives for emissions reduction activities, including tools such as domestic policies and carbon pricing" was explicitly recognized (paragraph 137). Parties also agreed to develop guidance to ensure the avoidance of double counting (paragraph 37) as well as the rules, modalities, and procedures for the SDM (paragraphs 38–39).

In the meantime, jurisdictions are likely to continue work on domestic emissions trading, thereby generating knowledge, standards, and practical experience which will be critical to the development of guidance under the UNFCCC. This may in turn facilitate future linkages and international trading.

a For an in-depth analysis of carbon market provisions in the Paris Agreement see Marcu (2016).
b UNFCCC (2015b).

Important lessons can also be drawn from detailed policy proposals that were developed but not implemented (as in the case of the U.S. federal-level proposals), or implemented and then repealed (Australia).

# DETERMINING OBJECTIVES FOR THE ETS

An important first step in designing an ETS is to identify the policy objectives. An ETS is a policy tool and it can be designed to support a range of policy objectives—environmental, economic, and social—in addition to the primary objective of limiting GHG emissions. Before proceeding to ETS design, each jurisdiction may wish to consider how much the system should contribute to the emissions reductions that it wants to achieve, the rate at which to decarbonize its own economy, what level of cost is acceptable, how the system will interact with other policies, how to distribute costs and benefits, whether revenue will be generated and how it will be used, and how the ETS and its co-benefits will contribute to economic transformation and sustainable development. It will be easier to come to a decision on the adoption of an ETS, and determine the specifics of ETS design and implementation, once there is broad acceptance of the jurisdiction's need to reduce GHG emissions—at least below business as usual (BAU)—in the long term.

Some of the objectives frequently stated for adoption of an ETS are described in more detail below.

## Reducing GHG 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 rises and avoid the worst impacts of climate change. This is recognized as an integral part of global sustainable development. Governments at all levels have set targets for reducing their GHG emissions over time, either on an absolute or intensity basis.

In this context, carbon pricing can play a key role. In particular, 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.[19] In turn, these lower costs open up the opportunity to take more ambitious action.

19 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 the section on Complementary Policies below.

FIGURE 0.1 **Emissions Trading Around the World**


*Source:* ICAP 2016i.

## Driving economic transformation and sustainable development

To achieve a low-carbon economic transformation, action will be needed on four fronts:

- Decarbonizing the production of electricity;
- Massive electrification (to increase reliance on clean electricity) and, where not possible, alternative measures such as switching to cleaner fuels;
- Improving efficiency and reducing waste in all sectors; and
- Preserving and increasing the number of natural carbon sinks through improved management of forests and other vegetation and soils.

This will require a shift in investment patterns and behaviors, and innovation in technologies, infrastructure, financing, and practice. Policies will be needed that achieve this change in ways that reflect local circumstances, create new economic opportunities, and support the wellbeing of citizens.

For many jurisdictions, carbon pricing is emerging as a key driver of this transformation.[20] 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 (see Box 0.3). A carbon price 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. Emissions fall without firms being told by government

20 Dechezleprêtre et al. (2011) find that climate policies have taken a leading role in driving innovation in climate mitigation technologies, as measured by patents. Martin et al. (2011) find that firms are responding to climate policy in the EU by spending more internally on R&D, particularly as they receive fewer credits for free during allocation.

**BOX 0.3 TECHNICAL NOTE: Incentives for Innovation**

Potential innovators do not take into account 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 governments support the R&D 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 starts to be deployed, the subsidies can be lowered again.

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 challenge with this approach is to try and limit the support given to technologies that ultimately prove to be socially unproductive.

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.[a] German feed-in-tariffs have a similar effect, subsidizing large-scale renewables deployment, alongside the European Union ETS.[b]

a See Acemoglu et al. (2012), who show that optimal climate policy involves both a carbon price and research subsidies. See also van Benthem et al. (2008), who look specifically at the case of solar subsidies in California.
b See Wagner et al. (2015) as an example of how renewables relate to climate policy more broadly.

how to act. 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.[21]

## Reducing air pollution, improving health, and providing other co-benefits

High GHG emissions often go hand-in-hand with high levels of other pollutants, as well as traffic congestion, loss of forests, and other socially negative impacts. For example:

- **Improving local air quality** has been among the most important considerations in establishing an ETS in California and China alike. 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 GHG emissions by 2050 relative to 2005 levels could lead to a 20-40 percent reduction in premature deaths over the same time period.[22]
- **Preserving local environments** can be similarly important, in particular when forests and land-use change are either included in the ETS or linked via emissions reduction credits ("offsets"). 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.
- **Other co-benefits** include, among others, increased energy security from a more diverse fuel mix, induced technological change, the creation of green jobs, and lower traffic congestion and accidents from reduced use of passenger vehicles.[23]

## Raising revenue

The government can distribute allowances through free allocation, auctioning, or a combination of the two. Auctioning generates government revenue, which can be used for a variety of purposes, including to fund climate action or to help low-income households. The exact allocation of funds will depend on political decisions and local circumstances, which are often outside the purview of ETS designers.[24]

21 Recent examples of engagement of private-public coalitions advocating 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 pricing systems (see UNFCCC, 2015a); and 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).

22 Bollen et al. (2009) surveys 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 20–40 percent in 2050. Under this scenario the benefits in China were valued at 4.5 percent of GDP. Parry et al. (2014) finds that domestic environmental benefits exceed the $CO_2$ mitigation costs, even leaving aside climate benefits.

23 The IPCC Fourth Assessment Report (2007), section 4.5.3, provides a good discussion on the various co-benefits of climate change mitigations policies. See, for instance, Jochem and Madlener (2003) for an in-depth analysis of the nonenvironmental benefits of climate change policies, including innovation and employment.

24 ARB (2015a) gives an overview of how auction proceeds are used in the California ETS. Goulder (2013) analyzes the interaction between climate change policies and the tax system, concluding that, if well designed, climate policies can produce double dividend—both reduce GHG emissions and lower the costs of the tax systems.

Auctioning has typically been introduced on a small scale in the first instance but with the intention to let it gradually displace free allocation over time. Using auction revenue strategically can be a powerful selling point for proceeding with an ETS.

# KEYS TO EFFECTIVE ETS DESIGN

Once objectives have been determined, policymakers may wish to decide a set of criteria consistent with those objectives against which to assess ETS design option. Policymakers will need to strike an appropriate balance between a range of criteria that will determine the ultimate success of any ETS. Some of the commonly used criteria are discussed below.[25]

- **Contribution to mitigation.** Environmental effectiveness 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 and the cap is being enforced. Minimizing 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 keep abatement costs low given a particular emissions reduction 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 delivering least-cost abatement across covered sectors can also be influenced by how well the ETS is integrated with other policies (e.g., energy) affecting emissions in those sectors.
- **Predictability.** The more predictable the system, the smoother will be its operation and the closer to socially optimal the investments and resulting 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.
- **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 to plan ahead.
- **Administrative cost-effectiveness.** Administrative costs are most directly impacted 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.
- **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 pre-existing regulatory context; the size, growth rate and composition of the economy; the emissions and abatement opportunity profile of the economy; the ambition of policymakers; and the capacity and strength of relevant institutions.
- **Compatibility with other jurisdictions.** Consistent ETS design features across jurisdictions allow for a coordinated climate policy architecture, most directly in the form of linking that allows emissions units from other systems as valid compliance instruments within an ETS.
- **Fairness.** 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.

25 See section 5.2 in Government of Australia (2008b) for a similar set of assessment criteria used in Australia's ETS design. For alternative criteria, see: California Market Advisory Committee (2007), U.S. EPA (2003), Goffman et al. (1998), and Weishaar (2014), among many others.

# CONSIDERING INTERACTIONS BETWEEN AN ETS AND OTHER POLICIES

The design and introduction of an ETS will invariably take place in a context in which there are an array of other climate and energy policies, as well as other public policies that will either support or run counter to mitigation objectives.

When designing an ETS, it is important to conduct a systematic assessment of potential policy interactions with a focus on five key areas:

- Positioning the ETS relative to other policies;
- Understanding policy interactions that will affect the outcomes achieved by the ETS;
- Understanding how the ETS may influence the attainment of other policy objectives;
- Understanding where new complementary policies may be needed; and
- Maintaining policy alignment over time.

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

To support an assessment of this sort, policy mapping tools and approaches can be helpful. While the most obvious policies to include in such a mapping exercise are other policies focused on climate change mitigation or energy (see Box 0.4) it may also be helpful to include policies relating to environmental issues, market regulation, finance sector regulation, tax, trade, foreign policy, research and innovation, economic development, social welfare, and education. [26,27]

## Positioning the ETS relative to other policies

It is important to (i) clarify how the ETS will contribute to achieving the climate policy objectives of the jurisdiction, relative to other current or planned policies, and (ii) position the ETS strategically within the broader policy portfolio. Doing so can help build public support for the system and is of crucial importance in navigating through different ETS design options. This requires clarity on both the emissions mitigation outcomes of an ETS and the use of potential revenues from an ETS.

Jurisdictions have taken different approaches to positioning their ETS relative to other policies. For example, the EU ETS was introduced to help meet EU-wide mitigation targets cost-effectively by introducing a common carbon price signal across member states for electricity generation and energy-intensive industries, leaving other sectors to targeted policies at the EU- or member states-level. The overarching GHG emissions targets and the respective caps for the EU ETS are an integral part of a broader set of objectives determined at the EU level, which also include energy efficiency and renewable energy. The EU ETS is, however, also operated in the framework of a complex array of member states climate and energy policies, based on national priorities and traditions. While the targets are set at the EU level, member states have a clearly defined competence to formulate their own energy mix, ensure security of supply, and determine how they will achieve these targets.

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 have its primary impact on those parts of the economy that could not be reached by targeted regulation, while serving as a backstop ensuring that emissions targets would still be met if the other measures proved less effective than hoped (see Step 2 for further discussion of California's positioning of its ETS).

By contrast, New Zealand selected an ETS as its primary mitigation instrument, emphasizing that its ETS offered an equitable approach by covering all sectors and gases over time, and enabled linkages to international markets, which would support meeting its international commitments at least cost.

## Understanding policy interactions that will affect the outcomes achieved by the ETS

Other policies can also affect the mitigation ambition, carbon price, and distributional effects of an ETS.

In some cases, the impacts of other policies on an ETS may be negative or duplicative, particularly if they are not reflected appropriately in the design of the cap of the ETS or other provisions. Avoiding undesirable repercussions is most likely to be a challenge in relation to energy-sector policies and regulations, especially those addressing energy efficiency, low-carbon energy, and technology innovation. If these policies

26 For a summary on these major alternative policy instruments, see Chapters 3.8 and 15 in IPCC (2014) and Sterner and Corria (2012). See also PMR (2015a), p. 22 for a similar breakdown of policy instruments for reducing emissions.

27 Hood (2013) provides a comprehensive list of questions to assist in mapping the potential interactions between carbon pricing and existing energy policies while OECD (2015) provides a comprehensive overview on low-carbon policy alignment.

BOX 0.4 **TECHNICAL NOTE: Other Climate Policy Instruments**

Taxes set a price on carbon emitted, without a firm emissions limit. Taxes, along with emissions trading (together called "market-based approaches"), are widely regarded as the most cost-effective policies to reduce emissions (see "Regulating prices versus quantities," section 5, for a discussion of the similarities and differences between and ETS and carbon taxes).

Standards and other "command and control" regulation typically set uniform rules that new and/or existing emitting facilities must follow, in regard to levels/rates of GHG emissions and/or co-pollutants, technologies used in production, energy efficiency, or the end product itself. Standards 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 mechanisms that enable obligations to be met in a more flexible way (e.g., U.S. Renewable Portfolio Standards for renewable electricity generation with tradable credits across systems or India's Perform, Achieve, and Trade (PAT) system for energy efficiency). Such combinations of standards and flexibility mechanisms have similarities to an ETS, except that the quantitative target is based on a different measure (e.g., 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, and 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. However, giving subsidies to entities within high-emitting industries can perversely increase their output.[a]

Information and education programs include raising awareness about the emissions impacts of 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 just such steps.

a For example, Tsao et al. (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 damage the cost effectiveness of the latter (see Fischer and Preonas (2010), who draw a similar conclusion).

lead to emission reductions in ETS sectors at costs above the ETS price, then this allows emissions from other sectors under the cap to rise: the ETS will not deliver short-term, least-cost mitigation. Alternatively, if an ETS forces greater emission reductions than would happen under co-existing policies, the latter will 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.

However, a significant part of these effects can often be avoided or justified if:

- Policy interactions are analyzed carefully and the outcome of complementary policies are reflected in the different design features of the ETS (cap setting, price stabilization mechanisms, etc.) so that the different policies support each other as much as possible; and
- The goals of complementary policies beyond short-term emission mitigation are clearly defined. These might include longer-term objectives that go beyond the time horizon of the foresight of an ETS such as technology innovation, encouraging deployment of particular mitigation options to lower their long-term costs, or other strategic objectives such as improved air quality or the security of energy supply.

Other policies can also positively reinforce the impact of an ETS price signal. To the extent that non-ETS policies 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 disproportionate or regressive impacts of carbon pricing, remedy principal-agent problems, or reduce other non-price barriers to mitigation, they can enhance the positive impact of an ETS.[28]

## Understanding how the ETS may influence the attainment of other policy objectives

Aside from considering the impact of other policies on the effectiveness of an ETS, it can also be helpful to consider how the implementation of an ETS might

28 For further discussion on developing an effective package of carbon pricing and complementary policies, refer to Matthes (2010), Hood (2013), and Schmalensee and Stavins (2015).

affect other policies. For example, an ETS that prices emissions from the forestry sector might also provide co-benefits from greater biodiversity, by creating a further financial incentive for landowners to enter into long-term forest protection covenants.

Other considerations relate to economic or social development. The combination of higher energy prices and increased incentives for efficiency and innovation could have both positive and negative impacts on a government's objectives for economic growth, fairness and distribution of welfare, international competitiveness, or technological development and industrial policy. On the one hand, the promotion of energy efficiency facilitated by an ETS may support policy objectives related to energy security. On the other hand, the potentially regressive impacts of carbon pricing on low-income households and small- and medium-sized enterprises could run counter to other policies supporting their advancement.

Finally, the revenues raised from any allowance auctions can be used to promote other policy objectives by, for example, reducing distortionary taxes or providing funds to identified policies and programs in line with policy objectives.

## Understanding where complementary policies might be needed

Besides considering the interactions, in both directions, between an ETS and existing policies, the introduction of an ETS may also prompt policymakers to consider what complementary policies may be needed to increase the effectiveness of the ETS or meet related policy objectives, as discussed in Table 0.2. New additional policies may be considered for a number of reasons:

- As a broad price instrument, an ETS cannot necessarily be used to guarantee specific strategic outcomes in covered sectors. The government may thus 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. If these policies are applied in uncovered sectors they can help increase emissions reductions and also reduce leakage from the covered sectors.
- In addition, even for sectors covered by an ETS, various market and regulatory barriers can prevent the diffusion of cost-effective technologies and practices.[29] 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.[30] 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.
- In the longer term, complementary measures can pave the way for additional emissions reductions, even if applied to sectors (fully) 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, in the form of increased knowledge and other societal benefits. This may well provide a justification for additional policy action to create incentives for private investment in R&D for clean energy and other abatement technologies.

The advantages and disadvantages of considering complementary measures are summarized in Table 0.2.

TABLE 0.2 **Advantages and Disadvantages of Complementary Measures**

| | + Advantages | - Disadvantages |
|---|---|---|
| Covered sectors | + Can help to overcome high transactions costs and other barriers to adopting energy efficiency and other low-emissions technologies<br>+ Possible additional GHG emissions reductions in the long-run due to targeted technological innovation, enabling stricter future ETS caps<br>+ Easier to target where emissions occur and, thus, decrease hotspots of local (air) pollutants and provide other local co-benefits | - Typically less cost-effective to achieve short term targets than ETS[a]<br>- Can reduce price under the ETS and, thus, lead to weaker emissions reductions signals in other sectors under the cap if the cap is not adjusted to account for this |
| | ± No additional aggregate carbon mitigation benefits in the short run for the same level of the cap | |
| Uncovered sectors | + Emissions reductions in sectors or sources not otherwise included in the ETS<br>+ Lower potential leakage from covered sectors | - Typically less cost-effective than including sectors or sources under the cap |

a Over the medium to long term a policy mix is likely required to achieve cost-effective net zero emissions targets.

29 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 ETS.

30 See Jaffe and Stavins (1994), Scott (1997), and Schleich and Gruber (2008).

## Maintaining policy alignment over time

In addition to 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, Hood (2013) recommends that policymakers initiate regular energy policy and carbon pricing policy reviews, and establish institutional setups that facilitate policy coordination, especially between climate and energy policymakers.

# 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 the following three steps:

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

## Increasing marginal abatement cost curves

Different abatement opportunities have different costs per tonne of abatement achieved. As a result, they require different carbon prices in order to be profitable to undertake. Some abatement technologies are cheap and, indeed, according to some analyses, some reductions 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. By contrast, other abatement technologies are more difficult to implement—and, thus, more expensive.

Putting these abatement opportunities in order 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 tonne of reductions rises with emission reductions as more expensive opportunities are pursued.

The same logic applies to companies and 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. 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.

## 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 (depending on the structure of capital stocks, the recent stage in the modernization cycle, etc.). Low-Cost Inc., on the other hand, has several cheap carbon-reducing ideas that it has not yet adopted (see Figure 0.2).

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

The simplest way to achieve the limit may be to set a uniform standard (see Figure 0.3): both companies are required to limit their emissions to the same amount (of 50 units apiece). While Low-Cost Inc. will find it relatively easy (and cheap) to comply, 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 covered 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.

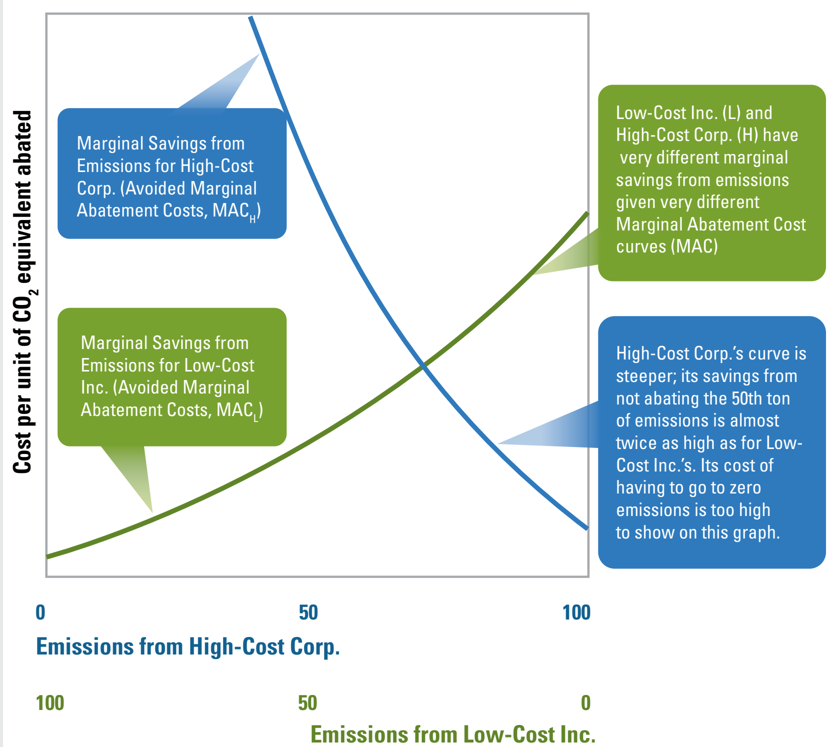
Next comes trade (see Figure 0.4). Regardless of how allowances are distributed, the initial allocation process is unlikely to have resulted in the allocation that establishes the least cost (i.e., most "cost-effective") distribution of emissions across the two companies. For example, in a case in which 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 some—at a price.

The resulting price 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 reductions 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 units and 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 units) that it needs to cover its emissions. The result is that the same total level of emissions is achieved—but at a lower total cost for both companies as well as for the system as a whole.

FIGURE 0.2 **Example of Two Firms with Different Abatement Costs**




*Note:* Two firms with different "abatement" (emissions 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.

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 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 a political and distributional perspective, they do not change the overall effectiveness of the cap. Regardless of how a fixed number of allowances are distributed, total emissions will not exceed the limit.

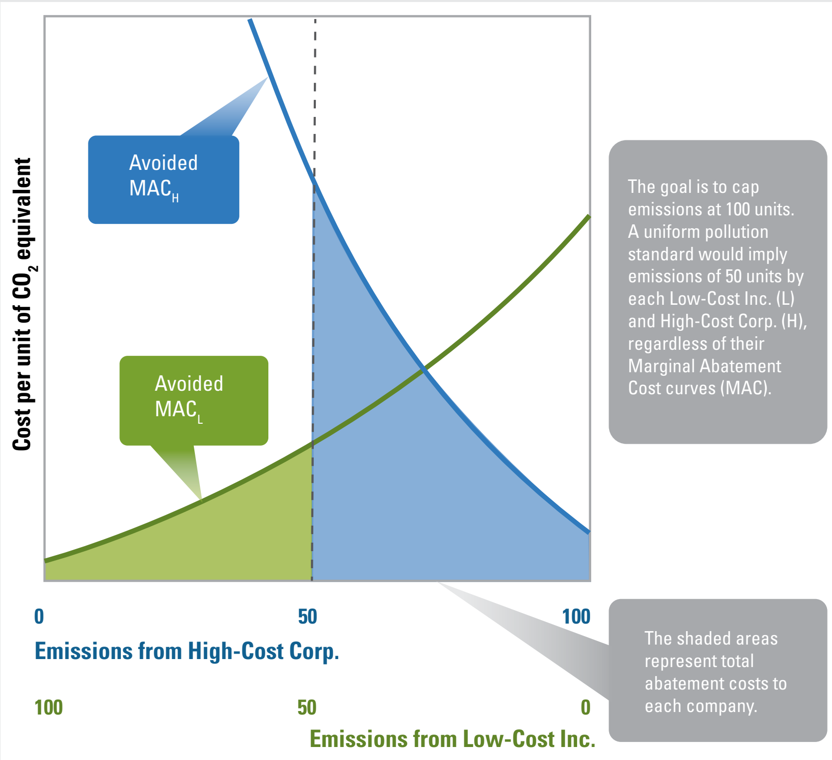
## Regulating prices versus quantities

Emissions trading is only one policy instrument available to combat climate change. The most direct alternative is to tax GHG emissions. Economists disagree on whether a carbon tax or an emissions trading system is a better policy instrument and in practice the optimal choice is likely to depend on the specific circumstance.

A cap-and-trade system, in its purest form, ensures 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 societal benefits, either approach could be designed to achieve the same outcome, as shown in Figure 0.5.

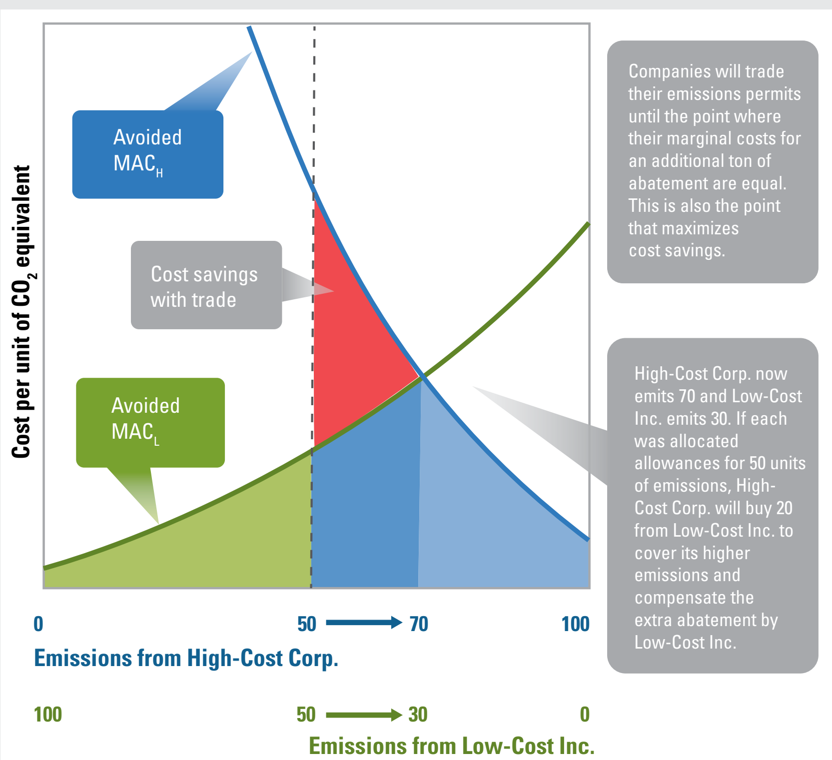
However, the world is uncertain: there is imperfect knowledge regarding both the marginal abatement cost curve and the marginal societal benefits curve. As a result, an ETS and a tax—even if designed to be equivalent in expectation—will likely have different outcomes. Which one is preferred (on

**FIGURE 0.3 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, together accounting for a total of 100.

**FIGURE 0.4 Comparing Trade to an Allocation Prescribing Equal Emissions by Each Company**

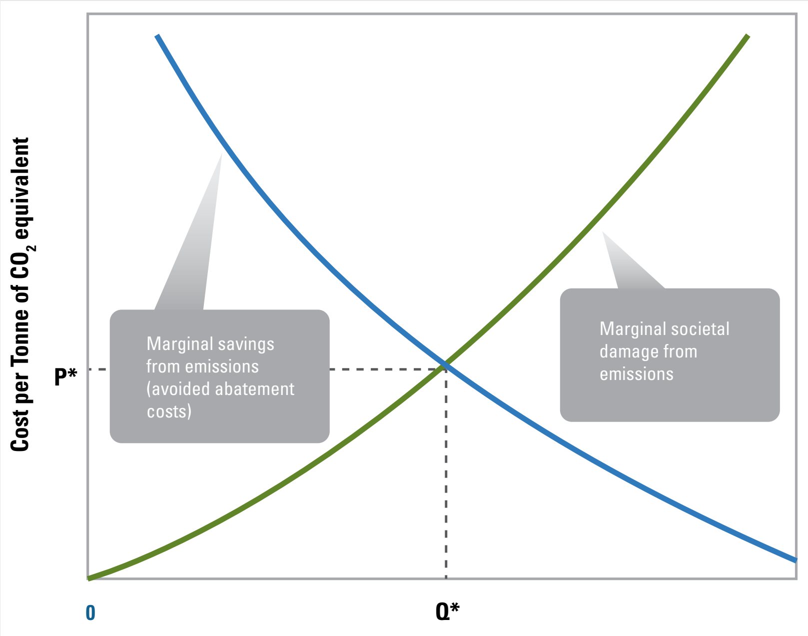



economic efficiency grounds) will depend on the relative importance of minimizing marginal costs (favoring a carbon tax) or being certain over environmental outcomes (favoring a cap-and-trade system).[31] The political feasibility of either approach will also differ across different contexts.

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 cost-effectively reducing GHG emissions.

31 Under a cap, if marginal abatement costs are higher than expected, the market price for one tonne 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.

FIGURE 0.5 **Damages and Savings from Emissions and Mitigation Efforts**




*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∗.

# QUICK QUIZ

## Conceptual Questions

- How does an ETS work?
- What is the difference between an ETS and a carbon tax?

## Application Questions

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

# STEP 1: DECIDE THE SCOPE

# AT A GLANCE

- ✓ 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

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

There are a number of arguments in favor of making the scope of an ETS as large as possible. A wide scope means the ETS encompasses a greater portion of the covered region's emissions—this provides more certainty on the attainment of jurisdiction wide emissions targets, helps lower compliance costs for entities, reduces competitiveness impacts among covered sectors, and may improve the operation of the allowance market.

On the other hand, an ETS with a wide scope can involve high administrative costs because so many entities are involved. Applying thresholds to exclude small emitters, and placing the "point of regulation" upstream, as discussed in detail in this chapter, can help manage this trade-off. In the context of deep decarbonization targets, the expansion of an ETS to sectors with comparably high marginal abatement costs can also trigger significant distributional effects and thus should be considered carefully.

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

- ▲ **Which sectors and gases should be included?** In general, it is preferable to include a sector or gas that accounts for significant emissions, provided those emissions can be easily monitored. Often, the areas worth including are those where there is otherwise insufficient financial incentive to reduce emissions and where co-benefits may be realized from achieving emissions reductions.
- ▲ **At what point should regulation be introduced?** Emissions should be regulated at a point where they can be monitored and their compliance enforced, and where the regulated entity has some ability to influence emissions either directly or by passing through costs. Sometimes the accountable entity, that is, the "point of regulation," will be *downstream*, at the facility or entity at which emissions are released into the atmosphere. This case often sends the most direct price signal. However, it can also imply significant transaction costs, although these can be reduced if some regulatory infrastructure already exists at these points in the value chain, such as existing emissions monitoring and reporting requirements for other air pollutants. However, if the covered entities can be expected to pass on the cost of compliance down the value chain in the form of higher product prices, emissions may instead be better regulated *upstream,* where the fuel that causes them is first commercialized. Upstream regulation may be attractive in increasing coverage, and reducing transaction and compliance costs, but a concern may be that it will be less effective at generating a behavioral response.
- ▲ **Should there be emissions thresholds to avoid including too many small entities?** Such thresholds are more necessary when emissions are regulated downstream. While they reduce/remove compliance costs for smaller entities as well as bureaucracy and enforcement costs, they can also reduce their environmental effectiveness and cause competitive distortions between entities on either side of the threshold. Any threshold needs to be calibrated to take into account jurisdiction-specific factors. Opt-in provisions can offer some flexibility.
- ▲ **Where should the reporting obligation be placed?** A more aggregated unit, such as a company, may reduce transaction costs but can be challenging if there are many sites where multiple companies interact or partial ownership of facilities is prevalent.

This chapter considers (i) the sources of emissions and types of GHGs that might be covered by an ETS and (ii) how their regulation might be effected. Section 1 introduces the issue. Section 2 considers some of the general design questions that policy makers need to address in this regard. Section 3 examines some of the specific issues that are likely to arise when considering the coverage of certain emissions sources.

# 1. Introduction

A number of factors point toward extending the scope of the ETS as broadly as possible. The advantages of a broad coverage include:

- **Certainty on predefined emissions target:** By ensuring coverage is broad (i.e., more emissions are encompassed by the ETS cap), policy makers can be more confident that a predefined emissions target will be met.
- **Lower compliance costs for individual sectors:** Including a larger number of sectors increases the potential to achieve cost-effective emissions reductions because there is a wider array of abatement costs, thereby increasing the probability of entities being able to achieve gains from trading (see "Before You Begin").
- **Competitiveness impacts:** A broad coverage reduces the likelihood of competitiveness or distributional impacts that may arise if one sector or type of emitter is included but another is not. Such intersectoral competitiveness impacts are most likely between products which can be easily substituted. For example, steel and aluminum may be substituted as building materials and gas and oil could be substituted for electricity. Substitutions may also arise because of technology change—for example, electrification of transport, development of the wood pellet industry, etc. 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 while another is not are undesirable and distortive.
- **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 a more stable price and reduces the potential for any one entity to gain market power.[32]

However, there are three key reasons to narrow coverage:

- **Transaction and administrative costs:** Technical and administrative barriers can make a broad scope infeasible—particularly if the logistics and cost of monitoring emissions differ across sectors and sources. The benefits of broad coverage may be outweighed by administrative or other MRV costs faced by the covered entities and the regulator.
- **Distributional challenges:** Including sectors with comparably high marginal abatement costs in an ETS can trigger distributional effects because compliance costs may end up being borne disproportionately by some entities, especially in cases where different sectors can achieve different degrees of cost pass-through.
- **Emissions leakage:** If some jurisdictions regulate emissions but others do not, there is a risk of production relocation or changes in investment patterns to unregulated jurisdictions.[33] This can have undesirable economic, environmental, and political consequences. Tools do exist to address such leakage concerns, but if a sector is thought to be particularly susceptible to leakage, one option is to exclude it from the scope of the ETS. A further discussion on leakage, including on how to establish support for sectors susceptible to it, is provided in Step 3.

Policy makers must balance the benefits of broader coverage against the additional administrative effort and transaction costs, but also the practical availability of alternative or complementary policy mechanisms. Design features such as using thresholds to exclude small emitters and placing the "point of regulation" upstream on suppliers of energy can help manage this trade-off.

Hence, there are four key questions that policy makers need to consider when determining the scope of the ETS:

- What sectors or emissions sources will the program cover?
- What should be the points of regulation in those sectors?
- What is the minimum level of emissions below which emissions should not be regulated?
- With whom does the compliance responsibility lie: with companies or installations, or a combination of both?

These issues are discussed in more detail in section 2, while section 3 provides more detail on key considerations relating to the inclusion of individual sectors within an ETS.

# 2. Scope Design

This section discusses factors policy makers must consider when deciding on the scope of an ETS:

- Sector and gas coverage;
- Point of regulation;
- Threshold; and
- Level of reporting obligation.

32 Geographic extension of the ETS through linking can also lessen competitiveness impacts and improve market operation (see Step 9).

33 A detailed discussion of leakage issues is given in PMR (2015g).

## 2.1 Sector and gas coverage

There are important differences across sectors and emissions sources that affect the extent to which specific sectors and emissions sources are worth covering. Whether it is beneficial to include a specific sector depends on the proportion of emissions it accounts for. In many industrialized countries, for instance, land use or waste account for only 5 to 10 percent of GHG output, while power and industry account for 40 or 50 percent. While some sectors may seem to have more low-cost mitigation options than others, this is hard to predict. That difficulty is one of the major justifications for using carbon pricing: it unlocks private information and 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 zero net emissions. If short-term mitigation opportunities seem to be expensive and scarce, the sector may be targeted for research and development to unlock future abatement potential.

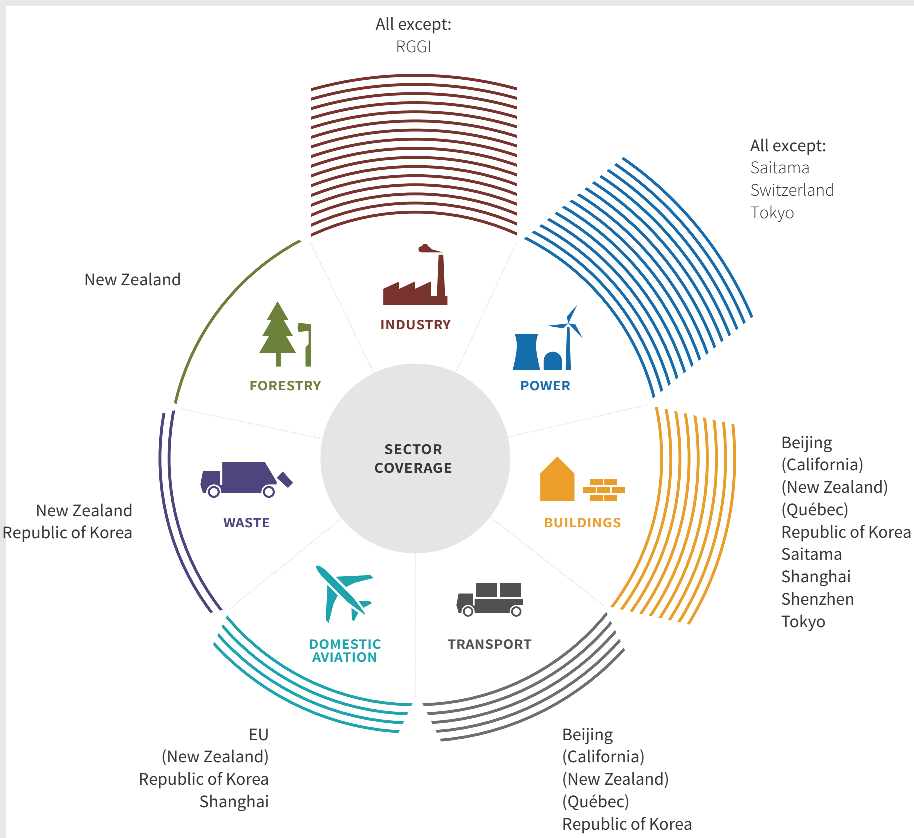
For an ETS to be effective, it must be possible to measure and monitor emissions with low uncertainties and at reasonable cost. Covering sectors dominated by a small number of large emitters can provide high benefits relative to administrative effort. The small number of large emitters can be included and thresholds used to exclude small, diffuse, or remote sources.

By contrast, covering sectors composed of many small, diffuse, or remote emissions sources may involve high administrative costs relative to benefits. The transport sector is a typical example—tracking the emissions from each vehicle and holding individual vehicle owners accountable is not feasible. Upstream regulation is thus often used for transport emissions, if policy makers decide to include it in an ETS at all.

Co-benefits can also play an important role in the political calculus when determining sectoral coverage. Although the GHG benefits from emissions reductions are completely independent of the location of reductions and largely independent of their timing, many co-benefits are location-specific.

Figure 1.1 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 (e.g., from cement and steel production) and emissions from fossil fuel combustion in industry. Coverage of emissions associated with building use is relatively common, while transport and domestic aviation are less so. The number of schemes covering emissions from waste or activities in the forestry sector is the smallest.

FIGURE 1.1 **Sector Coverage in Existing ETSs**




*Source:* ICAP 2016i.
*Note:* Systems in brackets indicates upstream coverage.

In "upstream" energy systems, decisions on scope are made by type of fuel rather than final output sector. For example, when natural gas is covered, it is covered wherever it is used in the economy. Further practical considerations on how to include a source in an ETS—whether electricity generation, industrial fuel use and process emissions, transport, waste- or land use-related activities—are discussed in section 3.

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

TABLE 1.1 **Gas Coverage in Existing ETSs**

| | $CO_2$ | $CH_4$ | $N_2O$ | HFCs | PFCs | $SF_6$ | $NF_3$ |
|---|---|---|---|---|---|---|---|
| EU | ■ | | ■ | | ■ | | |
| Alberta | ■ | ■ | ■ | ■ | ■ | ■ | |
| Switzerland | ■ | | ■ | | ■ | | |
| NZ | ■ | ■ | ■ | ■ | ■ | ■ | |
| RGGI | ■ | | | | | | |
| Tokyo | ■ | | | | | | |
| California | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Kazakhstan | ■ | | | | | | |
| Québec | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Beijing | ■ | | | | | | |
| Guangdong | ■ | | | | | | |
| Shanghai | ■ | | | | | | |
| Shenzhen | ■ | | | | | | |
| Tianjin | ■ | | | | | | |
| Chongqing | ■ | ■ | ■ | ■ | ■ | ■ | |
| Hubei | ■ | | | | | | |
| Republic of Korea | ■ | ■ | ■ | ■ | ■ | ■ | |

certainty. However, depending on the local emissions profile, these benefits may be exceeded by the corresponding administrative cost. Table 1.1 shows the range of choices made by current ETSs in terms of gas coverage.

Globally, carbon dioxide makes up by far the largest portion of GHGs and all ETSs include this gas. Many schemes include some other gases as well. As methane sometimes represents a significant portion of domestic emissions (for example, from landfills, fossil fuel extraction, and agriculture), coverage of these gases may be important to consider, especially in developing countries.

If GHGs other than $CO_2$ are covered, their emissions need to be expressed as carbon dioxide equivalent ($CO_2e$). The Intergovernmental Panel on Climate Change (IPCC) provides information on the conversion metric used in all systems to date, global warming potential (GWP).[34] Some GHGs have a much higher GWP compared to $CO_2$. As noted by the IPCC, the fact that different gases have different impacts at different times means that value judgments must be made when choosing conversion rates (see Step 5 for more discussion of short- versus long-lived climate pollutants).

## *2.2 Point of regulation*

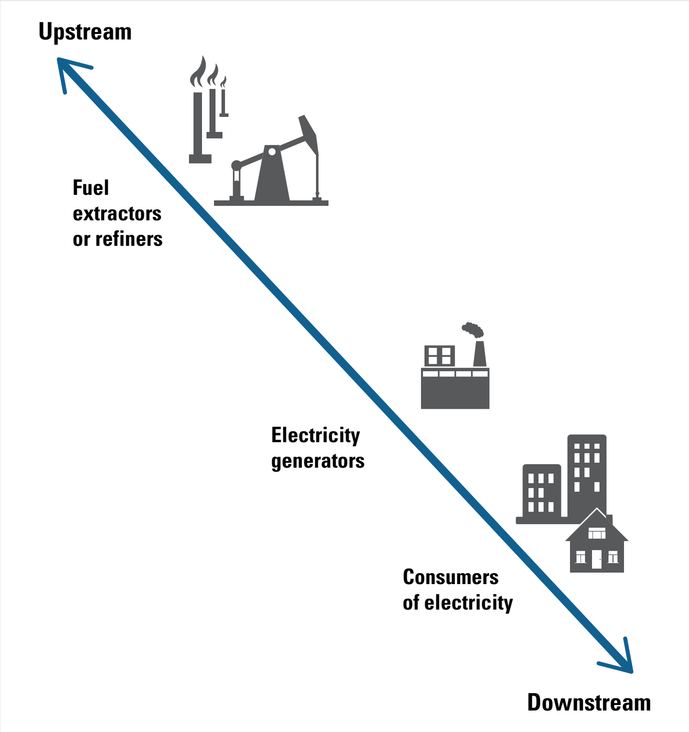
Once policy makers decide to include a sector or source of emissions in an ETS, a critical design feature concerns the point at which those emissions are regulated.

Emissions must be regulated at points where they can be precisely monitored and where compliance can be enforced. For the ETS to be effective in changing behavior, the point of regulation must be able to influence emissions, either directly or by passing through a price. For a number of emissions sources—especially those involving fossil fuel use—emissions could be regulated at multiple points (see Figure 1.2). The two main points of regulation for emissions from fossil fuel combustion are:

- **Upstream:** Where the source of emissions (typically a fossil fuel) is first commercialized by extractors, refiners, or importers. For example, in the California ETS, the point of regulation is where the fossil fuel that will be combusted and thus causes GHG emissions *enters commerce*. In practice, these are terminal racks and large refineries where oil and gas are physically transferred. The owners of these facilities pass the costs reflecting the embedded $CO_2$ through to the consumer in the form of slightly higher fuel product prices.
- **Downstream:** Where the GHGs are physically released into the atmosphere. This is the approach adopted by the EU ETS. In the case of emissions associated with electricity

34 IPCC (2014).

FIGURE 1.2 **From Upstream to Downstream**




*Source:* Adapted from U.S. EPA 2003.

BOX 1.1 **CASE STUDY: Upstream Regulation in New Zealand**

New Zealand has chosen a system that is as far upstream as possible for GHG regulation. Fossil fuels, whether for transport, electricity, or direct energy use, are regulated at the point of production or import. In total, the government enforces compliance for only 102 firms, yet covers 100 percent of $CO_2$ emissions from fossil fuel use.[a] The upstream approach has allowed for administrative simplicity while ensuring comprehensive coverage.

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 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.[b, c]

a New Zealand Emissions Unit Register (2016).
b Eleven firms as of November 2015. These are so-called "schedule 4" participants. Three were already participants because of other emissions sources. New Zealand Emissions Unit Register (2016). Schedule 4 also includes all post-1989 foresters.
c Kerr and Duscha (2014).

generation, a further choice can be made—emissions can instead or also be regulated at the point at which the electricity is consumed.

The advantages of upstream regulation are:

- **Administrative costs tend to be lower:** Often there are far fewer entities involved in the extraction and commercialization of a fossil fuel than in its final consumption, and those entities are more used to managing regulations. This in part reduces transaction costs. For example, California's ETS applies to 85 percent of the state's emissions by covering around 350 entities. New Zealand's regulation, as discussed in Box 1.1, succeeds in covering 100 percent of fossil fuel emissions by regulating just 102 firms. By contrast, the EU ETS applies to only 45 percent of emissions with over 11,500 entities covered.[35]
- **Coverage across sectors tends to be higher and thresholds within sectors are usually avoided:** Linked to the above point, upstream regulation does not require the thresholds often necessary in downstream systems in order to avoid very high transaction costs (discussed in section 2.3). Such thresholds reduce coverage, can result in intra-sectoral emissions leakage, and may reduce the cost effectiveness of the ETS. These problems can be avoided by adopting upstream regulation.[36]

On the other hand, downstream regulation may be preferred if:

- **Downstream data and compliance mechanisms already exist:** Existing permitting and licensing regulation may require downstream users to provide 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 a downstream approach to regulation.[37] In some cases, institutional capability to monitor and enforce compliance may be stronger at a downstream level. This is particularly true when there are a small number of large emitters.
- **There is low potential for cost pass-through:** The effectiveness of upstream regulation in incentivizing

35 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).
36 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).
37 European Council (1996). Directive 96/61/EC.

emissions reductions relies on the additional costs being passed through into the price that is faced downstream. If this is not considered likely, potentially because of market power at the upstream part of the value chain, then downstream regulation may be preferred.[38]

- **"Visibility" of regulation is considered important:** While cost pass-through from upstream to downstream users should mean that the latter face the same economic incentives to reduce their emissions as the former, organizational and behavioral factors suggest that regulating at the point of emissions may be more effective in incentivizing entities to reduce emissions (see Box 1.2).
- **The method of allowance allocation requires downstream data:** If company or installation-level data are required for the free allocation of units to be implemented (see Step 3)—in particular for "grandparenting" purposes—the administrative cost savings that could be achieved by upstream regulation will be reduced in the first years of the ETS.

Emissions from fossil fuel combustion can be monitored accurately upstream and downstream. For other sources of emissions, changing the point of regulation may alter the accuracy of monitoring because different data will be available; this reduces efficiency.

## *2.3 Thresholds*

In order to minimize administrative and MRV costs while maximizing the number of sectors covered in an ETS, policy makers have tended to introduce thresholds on ETS participation. These establish that entities below a certain "size" (defined as GHG emissions per year, energy consumption level, production level, imports, or capacity) are not subject to the ETS requirements. Thresholds can significantly reduce the number of covered entities without losing much of the covered emissions and mitigation opportunities. They constitute a particularly important feature when emissions from fuel combustion are regulated downstream.

What the best threshold is depends on each jurisdiction's context and specific mitigation goals, as well as upon sector-specific issues. The capacity of firms to manage ETS compliance and the government's capacity to enforce compliance are the primary factors. Others include mitigation options available to local entities of different scales, and size distribution of entities. The latter affects how many entities, and hence emissions, are included and excluded with different thresholds and may also affect the risk of production leakage from covered to uncovered entities.

38 Kim and Lim (2014).

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 totality, a significant proportion of emissions are covered.
- **Capabilities of firms and regulators:** If small firms have limited financial and human capacity and the additional costs of the ETS may influence their decision to operate—and these problems cannot be overcome through

1. SCOPE

### BOX 1.2 **TECHNICAL NOTE: Regulation and Behavioral Impacts**

Regulating energy use at the point of emissions is sometimes seen as more effective in incentivizing decision makers to reduce emissions and has been a common choice in practice. Sources face the exact same incentives in economic terms to reduce their emissions whether the cost is faced directly, per tonne of $CO_2$ emitted, or indirectly, as increased fuel prices. Visibility of the regulation—"saliency"—to managers is particularly important. Some ETS regulators aim to achieve productivity benefits from more careful management of energy use. This requires active engagement of managers and may therefore be achieved more easily with regulation at the point of emission.

Other performance metrics faced by managers may be important considerations, too. In nonmarket economies and where installations are owned by governments, the contracts and performance evaluations of managers may be critical in determining responses to carbon prices.

It is possible to address behavioral, noneconomic concerns through other means. Direct engagement and technical advice, or mandatory reporting and emissions reduction plans, 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 was to require industrial facilities (for example, refineries, cement kilns, and food processors) to do energy-efficiency audits and invest in any Net Present Value (NPV)-positive projects. The policy was designed to induce facilities receiving updated output-based allocation to invest in reductions even if they do not face net costs under the state's ETS. The value of direct regulator signals in terms of institutional incentives varies by culture and organizational form.

free allocation of units—then a more generous (higher) threshold may be preferred.[39]

- **Likelihood of intersectoral leakage:** A threshold above which entities are subject to a carbon price and below which they are not, may distort competition between the two groups. It may thus be worthwhile to try to find a threshold that is consistent with the competitive dynamics within the sector.
- **Possibility of market distortions as a result of thresholds:** 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.

## 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 a unit for each tonne of emissions. Some of the main options are:

- A company;
- A company at a specific plant site, or for a specific; production line or process; and
- A specific plant site or installation (that could contain several processes and/or companies).

The choice depends on which entities can be held legally liable and where data are 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 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 to particular companies can be difficult. These problems may be particularly pronounced, for example, in highly integrated chemical production sites, where several companies or subsidiaries may run numerous production processes and where—in order to improve the overall efficiency of production—different processes may constantly exchange energy (in the form of waste heat, waste gas, cooling capacity, power, etc.) or products (e.g., hydrogen, preproducts, and hydrocarbons.).

39 Betz et al. (2010) find that partial coverage, by excluding firms below a threshold, can reduce social costs, while maintaining emissions reductions, compared to blanket coverage.

In Kazakhstan, the Republic of Korea, and in the Chinese pilot ETSs, the regulated entity is the company. In the case of the Chinese pilots, 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 were focused on individual installations. Adopting the same approach for the EU ETS meant that it was possible to combine the procedures for regulating air pollution and emissions trading.[40] It was also consistent with the desire to place the liability at the point where technical mitigation could be achieved.

## 2.5 Summary

Table 1.2 summarizes the key considerations regarding each of the four aspects of scope design discussed above.

**TABLE 1.2 Decisions on Scope**

| | | |
|---|---|---|
| **Sectors/ gases covered** | More | Fewer |
| | ▲ Greater opportunity for low-cost reductions<br>▲ Avoids risk of leakage between sectors<br>▲ Greater control over achieving a target | ▲ Lower administrative and transaction costs<br>▲ Less risk of leakage between jurisdictions |
| **Point of regulation for energy** | Upstream | Downstream |
| | ▲ Cheaper and simpler to administer and monitor<br>▲ Greater coverage with fewer points of regulation<br>▲ Avoids risk of leakage between and within sectors | ▲ Can build on existing regulatory frameworks<br>▲ Can provide incentives to electricity users in systems with regulated prices<br>▲ Possible behavioral benefit of regulating at the point of emission |
| **Threshold level** | Low | High |
| | ▲ Greater opportunity for low-cost reductions<br>▲ Avoids risk of leakage between firms above and below the threshold | ▲ Lower administrative costs<br>▲ Protects smaller firms where administrative and transaction costs might be prohibitive |
| **Level of reporting obligation** | Installation | Company |
| | ▲ Preferable where many companies are likely to be operating at the same installation<br>▲ Ownership transfers of installations between companies are easier to administer | ▲ Lower administrative costs when reporting required by aggregated units such as at the company level<br>▲ More flexibility for company as it does not have to report for each installation individually |

40 EC (2000).

# 3. Scope Considerations in Practice

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

## *3.1 Electricity generation*

There are three possible points of regulation in the electricity supply chain:

1. **At fuel source:** Used in the New Zealand ETS, this involves directly covering all fuels that are used in electricity generation at their source (production, import, or distribution) as points of regulation. This option can allow high-quality, comprehensive monitoring of actual emissions provided all producers and importers can be identified and regulated. By monitoring fuel, it is possible to monitor emissions in the electricity sector as well as in other sectors using those fuels (see Step 7). For this approach to succeed, it is important to cover all fuel sources to prevent market distortions. 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.
2. **Generators:** Used in, for instance, the EU, California, Kazakhstan, and the Beijing ETS, this option involves less overall regulation and administrative cost in some energy supply chains 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.
3. **Electricity consumers:** Used in, for example, Beijing, Tokyo, and Saitama, 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 on large energy users to avoid high administrative costs. It also tends to be used in cases where emissions costs would otherwise not be reflected in electricity prices or where the jurisdiction is unable to regulate generators because electricity generation occurs outside the jurisdiction (see Box 1.3).

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 level can influence which of these approaches is most attractive.

BOX 1.3 **CASE STUDY: Electricity Imports in the California ETS**

As a high share of California's electricity is imported from neighboring states, policy makers decided to include emissions from electricity generated outside of California in the scope of the California Global Warming Solutions Act, also known as AB 32, which authorized the adoption of a Cap-and-Trade Program by the California Air Resources Board (ARB), and directed ARB 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 it—at least for the amount consumed in California. When emissions associated with electricity delivered are unknown (for instance, when there is no existing power purchase agreement (PPA)), importers are allowed to claim the region's "default emissions factor," which is roughly equivalent to the emissions of an older gas-fired power plant.

If electricity suppliers are permitted to pass through cost increases to consumers, options 1 and 2 incentivize 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. In these cases, it can therefore be valuable to provide incentives for emissions reductions through both reducing the carbon intensity of generation and, separately, reducing the overall consumption of electricity. Several systems (for example, the Chinese pilots and Korea), therefore, combine option 2 with option 3 in order to provide an otherwise lacking incentive to reduce electricity consumption.[41] In these cases, combining the regulation of generators (so long as any free allowances are allocated appropriately (see Step 3)) with coverage of "indirect" emissions by electricity users strengthens the emissions reduction incentive of the ETS—although it still may not promote efficient dispatch across generators with different emissions factors.

41 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 uses only Option 3.

BOX 1.4 **CASE STUDY: Tokyo ETS and the Commercial Building Sector**

In the Tokyo ETS, landlords have a compliance obligation for their buildings' indirect emissions and, in addition, tenants that are large emitters (> 5,000 $m^2$ area or > 6 million Kwh electricity) are required to submit an annual reduction plan. The system is based on a long history of dialogue between the Tokyo Municipal government, owners, and tenants.

Large reductions in electricity use, during extreme regional electricity shortages following the 2011 earthquake, may have led to long-term behavioral change as well as more efficient lighting and heating in the building sector.[a] Companies in Tokyo have found that once reducing emissions was recognized as a goal, it became easier to reach consensus on investments in energy-saving technology through implementation of the ETS and better cooperation between landlords and tenants.

a TMG (2015).

Using an ETS to reduce electricity consumption by end users may need to be complemented by other measures to address related barriers to emissions reductions. For example, requirements for electricity reduction plans by landlords, combined with regulation of electricity consumers in Tokyo and Saitama has in part overcome split incentive problems in the commercial building sector (see Box 1.4).

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 to directly reduce peak demand.

## 3.2 Industry

### 3.2.1 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 and buildings typically feature a combination of some large sources and many small sources. If a downstream point of regulation is chosen, thresholds will often need to be used to keep administrative costs manageable. Carefully choosing between downstream companies and installations to become a legal entity is also important. If an upstream point of regulation is chosen, these issues are largely avoided.

### 3.2.2 Industrial processes

With the exception of the Regional Greenhouse Gas Initiative (RGGI), all systems cover 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.

For process emissions from cement, aluminum, and steel, there is no real choice for point of obligation—emissions can be monitored only 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 manufacture can also create process emissions. Where small industrial facilities are emissions sources, they are sometimes exempted to avoid excessive administrative costs.

A final source of industrial process emissions are those from Fluorinated Greenhouse Gases (F-gases). While these gases account for a relatively small proportion of total GHG emissions, their high GWP makes them an important contributor to climate change. Emissions of these gases from industrial facilities are included in a number of ETSs (see Table 1.1).

## 3.3 Transport

Globally, transport accounts for about 14 percent of GHG emissions. Despite this, as Table 1.1 shows, a majority of ETSs do not cover transport emissions.

The perceived 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 change to the amount vehicle owners drive. However, for nonessential travel, price responsiveness may be greater, while 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, electric vehicles, biofuel and low-emissions options for transporting freight—these alternatives in turn depend on longer-term infrastructure developments. The effectiveness of carbon pricing in stimulating this abatement will therefore depend on other transport policies (see the discussion of complementary and competing policies in "Before You Begin").

Existing policies can be another reason to exclude (road) transport emissions from the scope of an ETS. In the EU, ambitious vehicle emissions standards, high fuel taxes, and other regulations have a much stronger effect on transport sector emissions than an increase in fuel prices commensurate with the EU ETS carbon price would. Thus, including vehicle emissions in the cap would not have much, if any, impact on promoting cost-effective abatement. Other jurisdictions (for example California) have included transport in the ETS as a backstop for emissions 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 most likely 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.

By contrast, in the Republic of Korea and also in three of the Chinese pilots (Shenzhen, Chongqing, and Tianjin) emissions associated with the vehicles owned by covered entities (based on firms' reports of fuel purchases) 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 does carry 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.

When the transport sector is included, the treatment of biofuels deserves special attention. On the one hand, the use of biofuels could result in lower net emissions when the carbon sequestration from producing the feedstock is considered. On the other hand, the production of biofuels may lead to indirect land use changes (e.g., tropical deforestation) that actually increase net emissions.

In cases where all fuel use is regulated upstream, domestic aviation and shipping are automatically covered. This is the case in New Zealand. In sectors where downstream regulation is adopted, the inclusion of aviation is a more active choice. Shanghai 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 the emissions. Box 1.5 describes the experience of regulating aviation emissions in the EU ETS, which includes intra-European flights but not flights outside EU air space.

### BOX 1.5 CASE STUDY: EU Measures to Regulate Aviation Emissions

In 2008, the EU included both flights within the EU and international flights to and from non-EU ETS countries in the EU ETS Directive. All such flights would have to surrender allowances under the EU ETS, with airlines facing a fine of €100 per tonne of $CO_2$ emitted if failing to do so. Persistent offenders faced the possibility of bans from EU airports.

When the directive came into effect in 2012, the inclusion of international flights faced strong opposition from both developed and emerging economies, including the US, China, India, and Russia. 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.[a]

These measures included:

- Banning their airlines from participating in the scheme, a move that Chinese authorities made later in 2012;
- Filing a formal complaint with the International Civil Aviation Organization (ICAO);
- Imposing levies or charges on EU airlines as a countermeasure;
- Halting talks with EU carriers on new routes; and
- Asking the WTO to rule on the legality of the EU's move.

In 2013, the General Assembly of ICAO agreed to develop a global scheme for reducing emissions from aviation based on market-based measures. Such measures were to be finalized in 2016 and implemented by 2020.[b] In response, the EU limited the scope of its ETS to flights within Europe until at least the outcome of the 2016 ICAO meeting.[c]

a International Centre for Trade and Sustainable Development (2012).
b Campos and Petsonk (2013).
c EC (2016b).

## 3.4 Waste

The waste sector is infrequently covered by ETS. It is a relatively small source of emissions in most of the jurisdictions that have currently adopted ETSs, additional mitigation options are very limited (in part because of existing regulation around waste disposal), and there is a large number of small sources. To date, only the ETSs in the Republic of Korea and New Zealand feature design elements that cover parts of the waste sector.[42]

While these factors may also be relevant in other countries, the emissions and potential for mitigation may be much larger in emerging countries. Significant emissions and abatement potential may be associated with both waste incinerators and landfills—further abatement may result from reducing the production of waste. Additional co-benefits may be derived from reductions in other forms of pollution associated with better overall waste management.

A challenging issue for landfill methane is that emissions arise over long periods of time 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 perfectly aligned with actual emissions. That approach would also provide no incentive to reduce emissions from waste *already in* the landfill. Thus, the best approach is one that not only provides for improved technology and affects emissions from existing waste, but also provides a unique emissions factor for delivered waste.

## 3.5 Land use-related activities

Agriculture, forestry, and other land use are together responsible for 21 percent of emissions globally. Across regions, 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.

### 3.5.1 Forestry

To date, most ETSs have not covered the forestry sector, thus leaving it as a potential source of offsets (see Step 4). This is due to the comparatively low mitigation potential of forestry in many of the countries that have established an ETS. Forestry is also an administratively more complex sector to include in an ETS: often a large number of potential entities are involved and an efficient tracking system over the lifetime of a forest is needed to monitor both sequestration (uptake), as forests grow, and emissions in the case of harvest. Proper monitoring, to ensure appropriate incentives, requires a broad range of site-specific information.

However, as jurisdictions with significant emissions from the forestry and land use sectors consider the introduction of an ETS, the benefits from including the forestry sector could be high. The example of New Zealand (see Box 1.6) shows that it is possible to include emissions from deforestation.

42 Australia's former ETS also covered the waste sector.

**BOX 1.6 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 (NZ ETS) if they deforest their land.[a] Deforestation is deemed to occur if they clear more than two hectares of pre-1990 plantation forest and convert it to a nonforest use or do not meet minimum replanting or regeneration requirements. They are obliged to either surrender emissions units 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 offsetting their estimated emissions by planting an equivalent new forest on nonforest 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 of planted forests began in the early 2000s in response to the perceived increased profitability of some forms of pastoral farming (particularly dairy farming).[b] The anticipated introduction of the NZ ETS saw many forest owners bring their deforestation intentions forward to avoid liability. This resulted in large areas of deforestation occurring between 2004 and 2008. It had been expected that the scale of deforestation would fall after the introduction of the NZ ETS in 2008. However, the unit price has been in steady decline since 2008 and more deforestation has occurred than previously expected. The restriction of international units from the NZ ETS in June 2015 has led to a steady increase in the unit price and this is expected to reduce deforestation. More recently, with high dairy prices and very low carbon prices (see Box 9.3 in "Step 9"), deforestation has resumed—including on land harvested in 2008–11 but not quickly replanted.

a New Zealand Ministry for Primary Industries (2015).

b 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.

### *3.5.2 Agriculture*

No ETS covers agriculture's "biological" emissions, primarily nitrous oxide from both fertilizer and livestock, and methane from ruminant animals. The only agriculture-related emissions covered are:

- Farm electricity use, where electricity generation is covered and emissions costs are passed through to electricity prices (except for Chinese pilots and the Republic of Korea)
- Farm energy use, such as combustion of liquid fuels for agricultural machinery, where emissions from these fuels are regulated upstream (such as in California, Québec, and New Zealand).

There are four reasons agriculture tends to be excluded from existing ETSs:

1. Agricultural emissions represent only a small share of total emissions in most jurisdictions that currently have 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 tend to be more limited in this sector and are often poorly understood; and
4. Existing policy in some jurisdictions may focus on increasing agricultural output, which may be at odds with the impact of emission pricing.

To date, New Zealand is the only country that has attempted to cover agricultural non-$CO_2$ emissions. As indicated in Box 1.7, it has only designed a system that would operate at the *processor* level—and hence cannot incentivize individual farmer mitigation measures (other than reduced nitrogen fertilizer use).

**BOX 1.7 CASE STUDY: New Zealand and Agricultural Emissions**

Unusually for a developed country, in 2012, methane and nitrous oxide made up 46 percent of gross emissions in New Zealand. The country's ETS was intended to be an "all sources, all gases" system but it has struggled to include methane and nitrous oxide from agriculture. Although legislation was in place to include these emissions starting in 2015, their entry into the ETS was recently suspended indefinitely.

The original legislation would have made meat and milk processors and fertilizer manufacturers the points of obligation, not the farms. This system would only have provided weak, indirect incentives for farmers to reduce the emissions intensity of their production, as it would not have been assessed.[a]

The ideal scale for implementation is at the level of the individual farm, as this provides incentives for a wider range of mitigation options. However, this creates challenges in terms of monitoring and compliance, and in terms of how to distribute allowances to avoid severe distributional consequences for some farming families. In addition, understanding of mitigation options, both within the livestock sector and through the transition to production of alternative low-emissions nutrition sources, is still weak.

a Kerr and Sweet (2008).

## QUICK QUIZ

**Conceptual Questions**

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

**Application Questions**

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

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# STEP 2: SET THE CAP

# AT A GLANCE

✓ Create a robust foundation of data to determine the cap
✓ Determine the level and type of cap
✓ Choose time periods for cap setting and provide a long-term cap trajectory

The ETS cap is the maximum quantity of allowances issued by the government over a defined period of time, which in turn limits how much covered sources can add to global emissions. An "allowance," supplied by the government, allows the holder to emit one tonne (= one metric 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 trading market, each allowance has value (the so-called "carbon" price). The "tighter" or "more ambitious" the cap—that is, the lower the absolute number of allowances issued—the greater is the scarcity of allowances and, thus, the higher will be their price, all else being equal.

The fundamental consideration underlying the ambition of the cap is how far and how quickly the jurisdiction wants to reduce emissions within the capped43 sectors while contributing to global mitigation. This consideration, in turn, breaks down into three key issues that policy makers should consider:

- **Trade-offs between emissions reduction ambition and system costs:** Additional cap ambition implies additional costs on those covered by the cap. System compliance costs should not be so high as to cause disproportionate harm to domestic competitiveness and welfare in the context of the broader commitment to addressing climate change and achieving other ETS policy goals. The level of cap ambition will generally also need to be perceived as environmentally credible and fair by relevant stakeholders, in order to gain (and maintain) political acceptability. International linking and trading partners are likely to judge the system's cap ambition in relation to the level of mitigation effort and price in comparable jurisdictions.
- **Aligning cap ambition with target ambition:** An ETS is typically one of several instruments that may be used in reaching an overarching, economy-wide emissions reduction target. The ambition of the ETS cap should align with this overarching strategy.
- **Share of mitigation responsibility borne by capped and uncapped sectors:** The decision on how much responsibility for mitigation to assign to sectors under the cap should take into account the relative capacity of capped versus uncapped sectors to reduce emissions.

There are two types of cap: (i) an absolute cap, which provides upfront certainty to both regulators and market participants on the maximum quantity of emissions allowances that are available to the regulated entities; and (ii) an intensity cap, which prescribes the number of allowances issued per unit of output or input. The choice of cap type will depend on the nature of the overarching economy-wide target; how concerned policy makers are about constraining future emissions-intensive activities; the range of uncertainties on future economic growth (for example, in fast growing and structurally changing economies); data availability; and priorities for facilitating compatibility with any systems to which they may wish to link.

A range of data can help policy makers make informed decisions on the type and ambition of the cap, including historical emissions data; emissions projections under a baseline; estimates of technical and economic potential to reduce emissions in covered sectors; and the role and impacts of existing policies and barriers to mitigation.

Policy makers will also need to consider legal issues and administrative processes relevant to cap setting, including designating the appropriate government authority with responsibility for administering and, in some cases, also setting the level of the cap as well as the merits of establishing an independent body to provide advice on setting or updating the cap.

Setting the cap requires:

- **Designating allowances to be issued:** An ETS issues domestic allowances in units (e.g., tonnes) of GHG, either $CO_2$ or $CO_2$ equivalent ($CO_2e$). In addition, policy makers need to decide whether to recognize external units for compliance, and whether to limit their use in the system.
- **Choosing time periods for setting the cap:** Caps may be defined on an annual or multiple-year basis. The cap period will usually correspond to a commitment period or ETS phase, during which other program design features are also specified.

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

Policy makers face three common challenges when setting the cap. First, they need to consider whether and how to accommodate changes during the cap period, such as system shocks that may destabilize the market, changes to the number of covered sectors, and firm entry or exit. Second, they must ensure that methods for allocating allowances, whether for free or through auctioning, are consistent with the cap and do not inflate the cap. Finally, they must balance the trade-off between providing certainty on the cap's trajectory to establish a long-term price signal against the need to preserve flexibility for adjustments (see Step 10).

The ETS cap establishes the maximum quantity of allowances issued by the government over a defined period of time, which in turn drives an ETS's total contribution to domestic and international emissions 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.

This chapter first explains how an ETS cap is defined. Section 2 discusses the fundamental aspects policy makers must address when setting the cap: its ambition and type. Data requirements are detailed in section 3, followed by administrative and legal options in section 4. The process for setting the cap is discussed in section 5. The chapter concludes with a discussion of three common challenges associated with setting the cap.

# 1. Defining an ETS Cap

The ETS cap limits how much capped sources within capped sectors can contribute to global emissions. An "allowance," supplied by the government, permits the holder to emit one tonne of emissions[44] under the cap in compliance with the rules established by the program. Because the ETS limits the total number of allowances and establishes a trading market, each allowance has value (the carbon price). Parties regulated by an ETS and other market participants trade emissions allowances depending on the value they attach to the right to emit one tonne of emissions.

There are two methods for defining caps. The first, setting an absolute cap on the quantity of emissions, which is fixed upfront, is the most common. The second method is to use an emissions intensity metric. This prescribes the number of allowances issued per unit of input or output, such as unit of GDP, kilowatt-hour of electricity, or tonne of raw material. Under an intensity approach, the absolute amount of emissions allowed under the cap increases or decreases as a function of the input or output.[45] Both of these options are considered in the overview of this chapter.

The ETS cap is a fundamental determinant of the system's ambition to reduce emissions. However, a range of other ETS design elements will also influence the total amount that capped sources are able to emit under the rules of the program in any particular year:

- The approach taken to regulate activities in the uncapped sectors and the potential for tradable offsets (see Step 4);
- The rules determining the extent to which allowances can be borrowed or banked (see Step 5);
- The existence of a price stability mechanism and the impact this has on the supply of allowances, particularly whether such a mechanism can override the cap (see Step 6); and
- The rules governing a potential link with other ETSs and resulting unit flows (see Step 9).

Given these various features, maximum emissions within the capped sources 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 defining and setting the cap should be made in conjunction with decisions on other design aspects. Moreover, it should be underlined that some design issues related to cap setting not only affect the general ambition level but also the share of emissions reductions that take place within the system and the balance of costs between linked jurisdictions and over time.

Engaging with stakeholders can be a crucial element of the cap setting process. Stakeholders may include ETS participants, groups that may be affected by the carbon price, researchers who can help model the impacts of different choices, potential linkage partners, and broader trade partners. These groups can be essential to gathering data, building public confidence in modeling results, and gaining support for the ETS at large. This is discussed fully in Step 8.



44 Or other specified amount of emissions.

45 For example, some of the Chinese pilot ETSs use intensity-based caps.

# 2. Fundamental Decisions to Address When Setting the Cap

Setting the cap requires decisions on two fundamental issues: the extent of emissions reductions that will be sought and the type of cap (absolute or intensity) that will be used to achieve this. This section highlights the issues involved in setting the cap as part of the system's overall ambition. It then discusses the advantages and disadvantages of the two types of caps introduced above.

## *2.1 Cap ambition*

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

1. Trade-offs between emissions reduction ambition and system costs;
2. Aligning cap ambition with target ambition;
3. Share of mitigation responsibility borne by capped and uncapped sectors; and
4. Potentially, the intended share of domestic emissions abatement efforts.

### *2.1.1 Trade-off between emissions reduction ambition and system costs*

The fundamental objective of any ETS is to deliver a desired level of emissions reductions cost-effectively and efficiently. Box 2.1 discusses three metrics that can be used to assess how ambitious an ETS is in this regard: quantity and speed of emission reductions, allowance price, and total cost.

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 the total expected cost. Inherently, 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 3), national income, and welfare.[46] International linking and trading partners might judge the system's ambition in relation to the level and cost of mitigation effort and price in other, comparable jurisdictions.

A jurisdiction may choose to maintain the overall ambition of its ETS cap on a net global basis but moderate domestic compliance costs, by giving ETS participants access to units outside the capped sectors, through offsets (see Step 4 and

46 However, depending on the way in which revenues raised from an ETS are redistributed and the specific country context, GDP and/or welfare may actually rise.

BOX 2.1 **TECHNICAL NOTE: Determining the Level of ETS Ambition**

Three metrics may be used to define program ambition with regard to GHG reductions:[a]

1. **Quantity and speed of emissions reductions.** The primary goal of an ETS is to limit and 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 as well as global mitigation objectives for limiting temperature rises and reducing global emissions (e.g., as agreed under the UNFCCC).
2. **Allowance price.** In theory, the allowance price reflects the marginal cost of emitting a tonne of $CO_2$ or equivalent GHG in a particular ETS. It thus depends on the overall quantity of emission reductions achieved up to that point and the cost associated with the last increment of reductions. The allowance price indicates the magnitude of the incentive that the ETS is providing to reduce emissions by one more tonne.[b] The allowance price may also be compared to estimates of the "social cost of carbon," which seeks to reflect the full cost to society of each tonne of $CO_2$ emitted.
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.[c, d, e]

a For a further discussion of all three, see Aldy and Pizer (2014). In addition, the PMR (2015a) provides a practical step-by-step guide for assessing the level of ambition in emissions reduction pathways.
b Similar price levels do not necessarily imply similar ambition, depending on the emissions profile of the participants to the ETS.
c Another caveat to using allowance prices as the sole criterion is the simple example of how the prevailing ETS price would increase the more ineffective an ETS design is. For example, if the introduction of market rules prevented efficient exchange of allowances, the price would increase. That increase, however, clearly does not reflect an increased level of ambition; it simply reflects a less efficient market design. Conversely, laxer enforcement standards could decrease the price. The same conclusion applies here.
d This approach, however, only gives information on the expenditure side of the economic result of an ETS, but disregards the "returns" side: one should keep in mind the objective to achieve decarbonization scenarios where profits are equal to or even outweigh losses (termed GDP-neutral and GDP-positive scenarios respectively).
e For an illustration at macro level of such scenarios, see for instance IEA's "bridge scenario" in WEO 2015.

linking (see Step 9). Similarly, if marginal abatement costs are low, ETS participants could be enabled to sell units through linking. The latter does not alter the overall ambition of the ETS cap on a net global basis but it does lead to higher domestic carbon prices and more domestic reductions. In either case, the jurisdiction needs to decide how much they wish to direct ETS-related mitigation investment to achieve reductions within capped (vs. uncapped) sources within their borders as well as across their own jurisdiction (rather than globally), in order to drive down emissions within their domestic economy and generate local co-benefits.

The decisions on the trade-offs between ambition and cost may change over time. In the early stages of an ETS, the government may place a higher priority on getting the fundamental ETS architecture in place, building support for the system, and getting started with trading, rather than achieving an ambitious level of mitigation at potentially high cost. Applying a relatively higher and, thus, less stringent cap 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. Over time, as the infrastructure is established, market participants become more familiar with the ETS regulations, and other jurisdictions adopt similar pricing approaches, the emissions reduction ambition may rise. Moreover, starting with a less ambitious cap that becomes more stringent over time can also create incentives for long-term low-carbon investment decisions while enabling a gradual adjustment to carbon pricing in the short term. However, there may be some risk that this will "lock in" low ambition into the system. These risks include continued investment in emissions-intensive assets and an inability to tighten the cap further into the scheme, as a result of political constraints. To prevent this, policy makers may wish to consider incorporating a tighter future cap into the system when designing it. This can help ensure the ETS delivers long-term abatement.

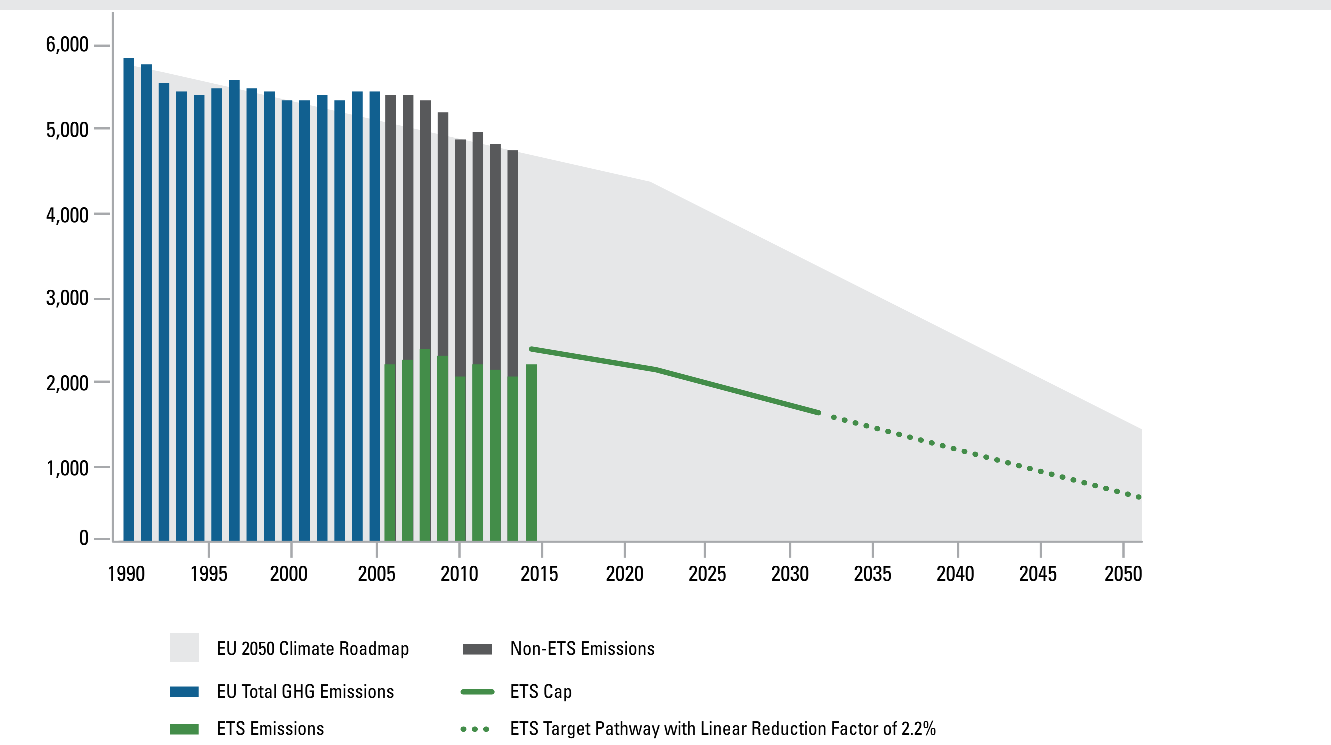
A wide range of information can be collected to inform modeling and assessment of the costs and production impacts of differing levels of ambition in different future economic scenarios. This is discussed further in section 2.3.



### *2.1.2 Aligning cap ambition with target ambition*

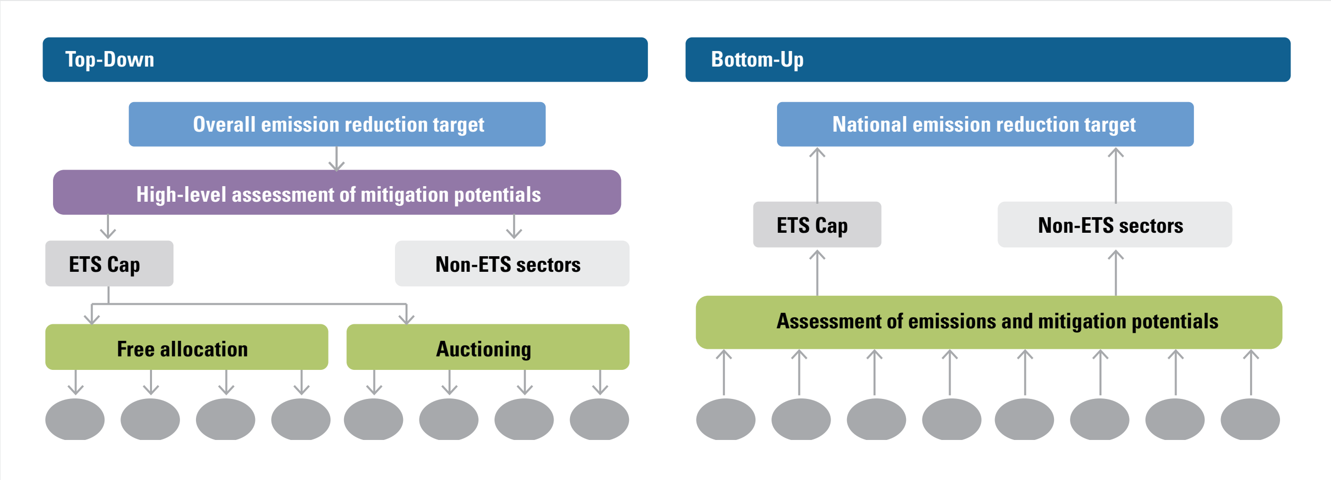
In many cases, an ETS will be considered as one of the key policy instruments to reach an overarching economy-wide emissions reduction ambition (Figure 2.1 shows how the EU ETS targets relate to economy-wide targets). Experience suggests it may also be politically more acceptable to set a

FIGURE 2.1 **EU Emissions Reduction Targets, and Role of the EU ETS**




*Source:* ICAP, 2015a.
*Note:* The green line indicates the progressively declining cap, with a linear reduction factor of 1.74 percent until 2020, and a proposed factor of 2.2 percent beyond 2020.

FIGURE 2.2 **Top-Down and Bottom-Up Approaches to Cap Setting**




*Author:* ICAP

more ambitious cap when there already is an overarching commitment in place to reduce emissions.

In view of this, when deciding on the ambition of the ETS cap, it is important to consider the cap in the context of the overarching, economy-wide ambition. Three options are available to policy makers (two of which are illustrated in Figure 2.2):

1. **A top-down approach:** The government sets the cap based on its overall emissions reduction objectives and a high-level assessment of mitigation potential and costs across capped 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. This approach is, of course, not available in cases where an economy-wide ambition has not been agreed upon. The broader the scope of the ETS is planned, the more attractive top-down approaches are.
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 emissions reduction potential for each. The overall cap is then determined by aggregating the emissions reduction potential for those sectors, subsectors, or participants. The benefit of a bottom-up approach is that it takes into account the specific circumstances of participants and sectors. However, there are some downsides to the bottom-up approach: it requires high-quality, disaggregated data; it may not capture interaction or portfolio effects or broader macroeconomic considerations; and the ambition of the resulting cap may not align with the jurisdiction's broader mitigation targets. If the scope of the ETS, for whatever reason, is more of a partial nature, the bottom-up elements of the cap setting will be even more important.
3. **A hybrid approach:** This 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 capped sectors to top-down mitigation objectives. Many of the ETSs with a more limited scope use these hybrid approaches.[47]

### *2.1.3 Share of mitigation effort borne by capped and uncapped sectors*

Linked to the discussion above, in cases where an economy-wide emissions reduction target exists, determining the ambition for sectors within an ETS with a limited scope has important consequences for the intended mitigation from uncapped sectors. The government should consider the equity, efficiency, and political implications of decisions on the share of mitigation responsibility borne by capped and uncapped sectors. The decision on how much mitigation responsibility to assign to capped sectors should take into account the relative capacity of capped and uncapped sectors to reduce emissions.

If marginal abatement costs are relatively low within uncapped sectors, firms could be permitted to access these lower-cost units through domestic offsets. This is discussed further in Step 4.

As a practical example, alongside decisions on the cap for the third phase of the EU ETS (2013–20), policy makers issued

47 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.

an Effort Sharing Decision that expressly defined the level of mitigation responsibility allocated to uncapped sectors across member states in order to achieve EU-wide mitigation commitments. To achieve the goal of reducing the region's emissions to a level of 14 percent below the 2005 emissions level (equivalent to 20 percent below the 1990 level), capped sectors needed to achieve a 21 percent reduction with respect to the 2005 level, and uncapped sectors needed to achieve a 10 percent reduction with respect to the 2005 level. Greater mitigation effort was required from capped sectors because of the expected lower mitigation costs in power generation (one of the capped sectors)[48] and the effects from complementary policies to strengthen the use of renewable energy sources for a fully ETS-regulated electricity sector. The interaction of ETS with other policies is more fully discussed in the chapter "Before You Begin".

### 2.1.4 Overview of cap setting approaches

Table 2.1 provides a more detailed account of the caps chosen by different jurisdictions and how they relate to economy-wide targets.

## 2.2 Type of cap: absolute or intensity

Four important considerations can influence whether a jurisdiction may prefer an absolute or intensity-based cap:

- Alignment between the ETS cap and overarching mitigation target;
- The extent and nature of uncertainty in the input/output metric that might be used for the intensity cap;
- Data considerations; and
- Whether or not the jurisdiction wishes to link with another ETS and the design of that ETS.

Each of these considerations is discussed below.

### 2.2.1 Alignment of cap structure and the structure of overarching targets

Alignment between the overall emissions reduction target for the economy and the emissions reduction target for the ETS is generally preferable—in other words, an absolute emissions reduction target for the economy as a whole will correspond more easily with an absolute cap, and an economy-wide emissions intensity target may do so with an emissions intensity cap. In particular, structural alignment between caps and targets will make it much easier to understand and communicate to stakeholders how the ETS is contributing to attainment of the overarching mitigation targets (the cases of the EU and California were discussed in section 2.1.3).

However, while such alignment may be easier, it is not essential. In particular, a common misconception is that an absolute cap cannot be used in cases where absolute emissions are expected to grow, and that an intensity cap should be used instead. However, both intensity and absolute caps can be designed to accommodate "growth targets" that allow for absolute emissions to increase for a period of time while reducing the rate of increase below BAU, thereby producing a global emissions benefit. For example, under a "slow, stop, reverse" trajectory, an absolute cap could allow initial growth in absolute emissions (but at a slower rate than under BAU) and then transition to driving reductions in absolute emissions.[49]

Therefore, a jurisdiction's choice of ETS cap structure is not dictated by that of its broader mitigation targets or growth potential. Yet the nature of the overarching targets might play a role in the structural specification of the target. If an ETS will be used to achieve far-reaching decarbonization within a few decades for mature economies with relatively moderate potential for growth, absolute caps will provide a more robust framework than in the context of emerging, fast growing economies that aim for an emissions trajectory of peak and decline.

### 2.2.2 Relationship between cap structure and ETS ambition under output uncertainty

Broadly, the stringency of an ETS depends on the ambition of its cap rather than the structure of its cap. Both absolute and intensity caps can be designed to deliver ambitious mitigation outcomes. However, when a key driver of emissions deviates significantly from projections, even if set with comparable intentions, absolute and intensity caps (expressed relative to that driver) could produce very different mitigation and cost outcomes.[50]

If output is *higher* than projected, then an absolute cap will achieve more mitigation (and correspondingly higher total cost) than an intensity cap, which will allow emissions to rise. As a result, if output grows faster than expected, absolute caps place the risk on compliance cost while intensity caps place the risk on emissions outcomes. By contrast, if output is *lower* than projected, an intensity cap will force more mitigation at higher cost than an absolute cap, and an absolute cap will be relatively less binding on emissions. Further

48 EC (2013); EC (2009).

49 The "slow, stop, reverse" trajectory is discussed in Ellerman and Sue Wing (2003).

50 While, in principle, an intensity-based cap may be set by reference to many intensity metrics (see section 2.2.3), for the sake of simplicity, in this example we assume that the intensity metric is output.

**TABLE 2.1 Economy-Wide Emission Reduction Targets and ETS Caps in Existing ETSs**

| ETS system | Economy-wide targets for jurisdiction/ETS coverage of jurisdiction's GHG emissions (as of 2015) | ETS cap (in millions of allowances) |
|---|---|---|
| EU ETS [a]<br>Phase I (2005–07) | Reduce emissions to levels 8% below 1990 levels over 2008–12 | Cap based on aggregation of National Allocation Plans of each EU Member State |
| Phase II (2008–12) | | Same as above |
| Phase III (2013–20) | Reduce emissions to levels 20% below 1990 levels by 2020<br>*ETS coverage*: 45% | Single, EU-wide cap for stationary sources<br>2013: 2,084, cap for stationary sources, declines 1.74%/year, expanded to cover CCS installations, production of petrochemicals, ammonia, nonferrous metals, gypsum and aluminum, nitric adipic and glyoxylic acid; aviation sector cap: 210 |
| Phase IV (2021–30) | Reduce emissions to levels 40% below 1990 levels by 2030 | European Commission proposes to decline the cap for stationary sources by 2.2% annually |
| New Zealand [b,c] | Reduce emissions to 1990 levels over 2008–12<br>Reduce emissions by 5% relative to 1990 levels by 2020 (unconditional), 11% by 2030 (conditional), and 50% by 2050 (unconditional)<br>*ETS coverage*: 52% | 2008–15: operated under the Kyoto cap with no domestic ETS cap |
| RGGI [d,e] | Not applicable<br>*ETS coverage*: 5.5% of U.S. emissions<br>45% reduction in $CO_2$ from covered sources below 2005 levels by 2020 | 2009: originally stabilized at 149.7 (165 M short tons)<br>2014: 82.6 (91 M short tons), the cap was amended in the 2012 program reform; cap declines linearly by 2.5%. To account for banked allowances, RGGI has a total interim adjustment for 2014–20 of 139.5 million $CO_2$ allowances. |
| Tokyo [f,g] | Reduce emissions by 25% relative to 2000 levels by 2020, 30% reduction relative to 2000 levels by 2030.<br>*ETS coverage*: 20% | 2010–14: cap is set at the facility level and aggregated to a Tokyo-wide cap that reduces emissions by 6–8%/fiscal year below base year (average of any 3-year period from 2002–07)<br>2015–19: 15–17% below base year |
| Saitama [h] | Reduce emissions by 25% relative to 1990 levels by 2020<br>*ETS coverage*: 18% | 2011–14: cap is set at the facility level and aggregated to a Saitama-wide cap that reduces emissions 6–8% below base year (average of 3 years from 2002–07)<br>2015–19: 15–20% below base year |
| California [i, j] | Reach 1990 level emissions by 2020<br>*ETS coverage*: 85% | 2013: 162.8<br>2014: 159.7, cap declined linearly approx. 2%<br>2015: 394.5, expanded to distributors of transportation, natural gas and other fuels; cap declines linearly approx. 3%/year from 2015 to 2020 |
| Québec [l] | Reduce emissions by 20% relative to 1990 levels by 2020<br>*ETS coverage*: 85% | 2013-2014: 23.2 (per year)<br>2015: 65.3, expanded to distribution and importation of fuels in the transport and building sectors, cap declines linearly at 3.2% through 2020 |
| Kazakhstan [k] | Reduce emissions by 15% relative to 1990 levels by 2020 and 25% relative to 1990 by 2050<br>*ETS coverage*: 50% | 2013: 147.2, plus a reserve of 20.6<br>2014: 155.4<br>2015: 153 |
| Switzerland [m, n] | Reduce emissions by 20% relative to 1990 levels by 2020, 35% by 2025, 50% by 2030, and 70-85% by 2050 (targets for 2025 and 2030 are subject to approval by parliament, target for 2050 is an indicative goal)<br>*ETS coverage*: 11% | 2013: 5.63, cap declines linearly by 1.74% a year through 2020<br>2015: 5.44 |
| Republic of Korea | Reduce emissions by 30% relative to modeled BAU by 2020 (4% below 2005 levels).<br>Reduce emissions 37% below BAU (22% below 2012 levels) by 2030<br>*ETS coverage*: 66% | 2015: 573, the cap declines by about 2% through 2017 |

*Source:* EDF et al.

*Note:* CCS = Carbon Capture and Storage; BAU = Business as Usual; RGGI = Regional Greenhouse Gas Initiative; GHG = Greenhouse Gas.

a ICAP, 2016b.
b New Zealand Emission Unit Register, "About the Kyoto Protocol" (n.d.); retrieved from http://www.eur.govt.nz/about-us/about-the-kyoto-protocol.
c Government of New Zealand, "New Zealand's Emissions Reduction Targets." (Last updated July 7, 2015). Retrieved from http://www.climatechange.govt.nz/reducing-our-emissions/targets.html.
d Regional Greenhouse Gas Initiative (RGGI), "The RGGI CO2 Cap," accessed 29 January 2016.
e EDF, CDC and IETA, 2015g.
f Tokyo Bureau of Environment, 2010.
g ICAP, 2016d.
h ICAP, 2016c.
i ICAP, 2015a.
j California Air Resources Board, 2010c, and 17 CCR §95841 Table 6-1; available at http://www.arb.ca.gov/cc/capandtrade/finalregorder.pdf.
k ICAP, 2015a.
l ICAP, 2016a.
m ICAP, 2015b.
n Federal Office for the Environment, Switzerland, 2015.

considerations of the optimal type of cap, whether absolute or intensity, under output and emissions uncertainty, are discussed in Box 2.2. It shows that intensity caps do not provide a comprehensive solution to reducing uncertainty regarding the mitigation and cost burden under an ETS, for example:[51]

- Intensity approaches do not address uncertainty in the rate of emissions per unit of output. The rate of emissions per unit of output can also vary with GDP or in response to other drivers.
- The degree of correlation between emissions and output can vary significantly by country, by sector, and over time, especially during the course of development.
- Intensity approaches also introduce additional technical and administrative challenges. Intensity targets require data collection and reporting on output as well as emissions, which can introduce further complexity, error margins, and time lags in determining emissions outcomes.

### *2.2.3 Data considerations when choosing intensity metrics*

Intensity approaches reduce the need for policy makers to develop output projections in order to predict the cost of compliance with the cap. However, they impose the need to explicitly select appropriate intensity metrics. Intensity metrics can relate to economic and/or commodity outputs. The appropriate choice of metrics will vary according to sector coverage, 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, such as average performance standards or best-practice emissions benchmarks, in other contexts has highlighted a number of 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 manufacture, 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.

If, however, substitution of commodities is seen as a significant source of emissions abatement (aluminum vs. steel, cement vs. other building materials, etc.), the use of metrics related to commodities is obviously not suitable as a basis to define the cap for certain sectors 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

51 Jotzo and Pezzey (2007); Herzog et al. (2006); Wing et al. (2006); and Pizer (2005).

#### BOX 2.2 **TECHNICAL NOTE: Intensity versus Absolute Caps under Output and Emissions Uncertainty**

In the context of setting national emissions targets, Sue Wing et al. (2009) studied the conditions under which absolute and intensity caps on the basis of emissions per unit of GDP would deliver upon expectations for the level of the mitigation burden and cost to meet the target, and minimize their volatility. Based on an assessment of hypothetical targets using historical emissions and GDP, their analysis suggested that the optimal choice between absolute and intensity approaches for each country would vary according to:

- The stringency of the target;
- The degree of correlation between emissions and GDP; and
- The extent of volatility in both emissions and GDP.

Their analysis also suggested that the optimal cap structure for delivering the anticipated mitigation effort and cost may differ from that for reducing the volatility of mitigation burden and cost.

Jotzo and Pezzey (2007) modeled the impacts of economy-wide absolute targets, standard intensity targets (with one-to-one indexation), and “optimal intensity” targets (with variable indexation) on global mitigation and welfare for a range of developed and developing countries under a hypothetical treaty. They found that the extent to which intensity targets helped neutralize emissions uncertainty around future GDP varied by country, with the strongest benefits received by countries with a strong correlation between emissions and GDP, where uncertainty around GDP is high relative to other uncertainties, or countries that are strongly risk-averse. Larger countries also benefit more from reducing risk. Overall, allowing variable target indexation to GDP (at levels greater or less than one-to-one, tailored according to national circumstances) produced a more ambitious global emissions outcome while increasing global welfare by reducing perceived emission risk from changes in GDP.

to specific firms or sectors, simpler reference levels could be used, particularly if the output metric is GDP.

Box 2.3 provides practical examples of how intensity approaches have been applied in two ETSs.

### 2.2.4 Linking

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 cap structure. 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 U.S. Clean Power Plan (see Box 2.3), trading between participants in rate-based states (which choose intensity targets) and participants in mass-based states (which choose absolute targets) will not be permitted. Linking is more fully discussed in Step 9.

# 3. Data Requirements

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

1. Historical emissions data;
2. Projections for emissions under a baseline;
3. Technical and economic potential to reduce emissions in capped sectors; and
4. Role of existing policies and barriers to mitigation.

## 3.1 Historical emissions data

Historical emissions data play an important role in cap setting as they provide an informed basis from which to project future emissions (in the absence of a cap). Data at a national level may already be available from national emissions inventories or can be obtained from international organizations. Examples of the latter include the International Energy Agency (IEA),[52] the Emissions Database for Global Atmospheric Research (EDGAR, a joint project of the European Commission Joint Research Centre (JRC) and the Netherlands Environmental Assessment Agency (PBL)),[53] the Carbon Dioxide Information Analysis Center (CDIAC),[54] and the Climate Analysis Indicators Tool developed by the

52 For data collected by the International Energy Agency on energy-related $CO_2$ emissions, refer to IEA (2016a).

53 For EDGAR data on national greenhouse gas emissions, see EDGAR (2016).

54 For CDIAC data on national carbon dioxide emissions, see CDIAC (2015).

**BOX 2.3 CASE STUDY: Practical Experience with Emissions Trading under Intensity Caps**

Experience to date with setting intensity caps in an ETS is limited. Examples from the United Kingdom and the United States are discussed below.

**UK ETS:** The UK ETS predated the EU ETS and operated with an absolute cap from 2001 to 2006. Alongside its ETS, the UK government imposed a Climate Change Levy on energy use. Energy-intensive industrial firms could negotiate a Climate Change Agreement (CCA) under which they committed to either an energy or emissions target in return for a partial exemption from the Levy. Both energy and emission targets could be expressed on an intensity or absolute basis. Most CCA firms chose intensity approaches. These intensity targets implicitly created an intensity cap on the firms as a group. The government allowed CCA firms to achieve their target through an emissions trading linkage to the UK ETS. The government imposed a "gateway" mechanism that allowed CCA firms to purchase units from the UK ETS, but not to sell units into the UK ETS in order to ensure the stringency of the UK ETS cap. Units were traded across the gateway to help CCA participants meet their targets.[a]

**U.S. Clean Power Plan:** In the United States, the Obama Administration's Clean Power Plan was introduced in 2015 to impose nationwide emissions limits on the power sector. Each state was offered the choice between different kinds of emissions reduction targets: rate-based (lbs $CO_2$/MWh) and mass-based, either with or without a new-source complement (short tons of $CO_2$ per year). States were given flexibility as to how to meet their targets. Emissions trading was provided as an option for both rate-based and mass-based approaches, with the former using Emission Rate Credits (ERCs) and the latter using allowances. However, trading was not permitted between rate-based and mass-based participants. To set the target for each state, policy makers identified a target emissions rate for 2030 based on the Best System of Emissions Reduction (BSER) derived from each state's potential for generation efficiency improvements and fuel switching from coal to natural gas or renewables. This was then offered as the state's emission-rate target, or converted to a mass-based target by applying state-specific projections for electricity output. Under the mass-based approach, reductions from energy efficiency improvements would automatically be recognized within the cap. Under the rate-based approach, additional ERCs could be generated through energy efficiency projects. The mass-based approach would be suitable for linking trading activity under the Clean Power Plan with established ETSs such as RGGI, which use absolute targets.[b]

a Herzog et al. (2006); Dahan et al. (2015b).

b The full text of the regulation, as well as fact sheets on the Clean Power Plan, are available from EPA's website (see, for example, U.S. EPA, 2015).

World Resources Institute (WRI).[55] Methodological differences between data sets should be taken into consideration.

When gathering firm-level data on historical and anticipated emissions to establish and project trends, policy makers 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 that allocation will be through grandfathering; and
- When using firm-level historical or projected emissions, policy makers should seek an independent assessment of the firm's information and assess it against international comparators;
- As most of the relevant emissions data will be calculated from energy data, the methodological consistency (including the relevant emissions factors) between data calculations for cap setting and other steps in the ETS chain is of crucial importance.

When historical emissions data are not available or incomplete, it may still be possible to proceed with the setting of a cap but the specific challenges arising from gap filling need to be addressed carefully. However, the experience of Phase I of the EU ETS, as explored in Box 2.4, illustrates some of the problems that can arise.

## 3.2 Projections for emissions under a baseline

The second type of useful information when setting the cap is information on expected emissions without the ETS. This can inform the potential emissions and cost impacts of an ETS under different emissions caps.

55 For the Climate Analysis Indicators Tool from WRI, see WRI (n.d.).

### BOX 2.4 CASE STUDY: Accounting for Uncertainty of Emissions Projections in Cap Setting for Phase I of the EU ETS (2005–07)

The availability of historical emissions data is critical when determining the ETS cap based on projections or growth rate. For example, because the EU lacked reliable data on industry-wide and company-specific emissions of installations under the ETS prior to 2005, the cap was instead based on a bottom-up estimate of the allowances required by each installation. These estimates were based on partly incomplete data, partly inconsistent emissions calculation methodologies, and the data collection allowed partly 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 BAU emissions, by some estimates.[a] When entities found that they could comply fully with the pilot phase obligations without using all their allowances, the price of the remaining allowances fell to zero. This led to important accounting and allocation reforms for Phases II and III of the trading system involving steady moves to a more centralized cap and allocation process based on actual historical emissions data, which were generated by the MRV obligations under the ETS. Given that banking was not possible between Phase I and Phase II, any Phase I overallocation was not carried into future phases.

Grubb and Ferrario (2006) examined four lines of evidence on emissions forecasting in the context of cap setting in Phase I 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. They recommend that future ETSs be designed with full recognition of "irreducible uncertainty and projection inflation" and that priority be given to improving the reliability and accessibility of the data used for setting ETS caps. Such issues have been addressed for future phases of the EU ETS, with more recent research concluding that the National Allocation Plans have resulted in a more efficient cap setting process compared to a single, EU-wide cap.[b]

a Egenhofer (2007); U.S. GAO (2008).
b 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:[56]

- **Trend extrapolation:** Observed historical trends in output (e.g., GDP) and emissions intensity as a function of output are extended into the future to define an emissions pathway.
- **Extended extrapolation:** The extrapolation of historical trends is refined by accounting for potential changes in output and/or emissions intensity.
- **Decomposition projection:** Trends in a small number of key emissions drivers (for example, population, economic growth, energy intensity, and structural change) are assessed to define an emissions pathway.
- **Detailed bottom-up analysis:** Drivers of production and emissions 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 emissions pathway.

Because emissions and economic projections involve a high degree of uncertainty associated with emissions drivers operating independently of the ETS (e.g., volatility in international energy prices, commodity demand, and currency exchange rates), it is useful to develop a range of emissions 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 is important to remember that these projections regularly tend to be overoptimistic about growth assumption and emissions trends.[57]

## 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 technical innovation to mitigate and maximize economic mitigation potential to produce cost-effective abatement.

Technical mitigation potential can be defined as "the amount by which it is possible to reduce GHG emissions or improve energy efficiency by implementing a technology or practice that has already been demonstrated".[58] 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 IPCC,[59] the IEA,[60] the Deep Decarbonization Pathways Project led by the Sustainable Development Solutions Network (SDSN), and the Institute for Sustainable Development and International Relations (IDDRI). 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."[61] Developing marginal abatement cost (MAC) curves for key sectors, both covered and uncovered, can help in the understanding of the economic costs of meeting mitigation targets. However, developing accurate MAC 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 MAC curves is useful, it is not essential to have comprehensive information on MAC 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 price risk and enable the cap to be adjusted as better information on MAC curves becomes available.

## 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 enhancing, duplicating, or negating the impact of an ETS. It will therefore be important to document these policies carefully as a first step to exploring these interaction effects and hence determining the appropriate type and ambition of the cap. In existing ETSs (e.g., EU ETS, RGGI, and California's cap-and-trade program), significant interactions have been observed in particular between ETSs and policies to promote renewable energy and energy efficiency.

For Phases II and III of the EU ETS, these interactions with complementary goals and policies in the framework of the EU's 20-20-20 targets (20 percent emissions reduction, 20

56 PMR (2015a).
57 Matthes and Schafhausen (2007).
58 IPCC (2014).
59 IPCC (2014).
60 For information on IEA's low-carbon energy technology roadmaps, see IEA (2016b).
61 IPCC (2007).

percent of energy from renewable energy sources, and 20 percent of energy-efficiency improvements) were subject to broad modeling exercises that built a robust reference for a cap that considered the additional emissions mitigation from the complementary policies.[62]

# 4. Administrative/Legal Options

An appropriate authority should be given the responsibility for setting the ETS cap. The relevant authority may be a regulatory, legislative, or administrative body, depending on the structures already in place in the specific jurisdiction.

The cap could be legislated for, or the legislation could establish the process for setting the cap. The latter method leaves more time for data collection and analysis, and can facilitate later adjustment of the cap. It could also defer technical cap setting discussions until later—and less political—stages of ETS development.

The approach taken in a range of jurisdictions includes the following:

- For the Phases I and II of the EU ETS, the governance approach for cap setting was left to the member states. In some jurisdictions (e.g., Germany) cap setting was under a full legislative process; in other jurisdictions (e.g., France), it was by administrative orders. Member state 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. From Phase III onward the cap was set by a full European legislative process. The role of administrative bodies at the national and EU levels was and is strictly limited to technical adjustments.
- In the case of the California ETS, state legislation (AB 32) set the requirement that California return to 1990 emissions levels by 2020 and charged the California Air Resources Board (ARB) with developing a Scoping Plan for meeting the 2020 target. The initial Scoping Plan, approved by ARB in 2008, provided for development of an ETS. The cap was set through regulation under a process managed by ARB as the primary implementing agency.[63]
- In Australia, the Carbon Pricing Mechanism (now repealed) required the Climate Change Authority, an independent statutory agency, to make an annual recommendation on what the cap should be in five years' time. The legislator was required to take the Authority's advice and recommendations into account when setting caps and announce these five years in advance. The Clean Energy Act provided a default cap in the event that a cap had not been set.
- In the Republic of 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.

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 enhance the objectivity, transparency, and credibility of the cap setting process. This approach was proposed by Australia for cap setting under its Carbon Pricing Mechanism (see Box 2.8).

# 5. Setting the Cap

Once the fundamental design decisions have been made, informed by the collection of relevant data, and the formal legal and administrative arrangements have been agreed upon, it is possible to set the initial cap. As discussed in this section, this requires:

1. Designating allowances to be allocated under the cap; and
2. Choosing time periods for setting the cap.

## *5.1 Designating domestic allowances*

Every ETS currently in operation issues its own domestic allowances in units of tonnes of GHG, either $CO_2$ or $CO_2e$. All existing ETSs use tonnes, with the exception of RGGI, which uses U.S. short tons. In addition, policy makers also need to decide whether to recognize external units for compliance. Such external units may derive from offset mechanisms (see Step 4) or the ability to buy and sell through linking (see Step 9). The EU ETS, for example, recognizes four different types of units (see Box 2.5).

Not all allowances issued by the government may be subject to the ETS cap. For example, the government may choose to issue allowances 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. Policy

62 See Capros et al. (2008) for further details.
63 ARB (2008).

2. CAP

makers may choose to place quantity limits on the issuance or use of removal allowances. As noted above, the government may also choose to operate market stability mechanisms that issue units beyond the cap in order to provide price protection or hold back allowances for specific purposes (e.g., new entrant allocation in the course of a trading phase or allocation for market stability purposes). These may or may not be made available to the market if not used for the purpose for which they were originally held back. For the latter case, the cap would be implicitly tightened, which is another way to gradually adjust a cap for real emissions 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 (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 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 for fear that this would undermine the fungibility of allowances.

BOX 2.5 **CASE STUDY: Eligible Units in the EU ETS**

The EU ETS allows multiple unit types for compliance. European Union Allowances *(EUAs)* and European Union Aviation Allowances *(EUAAs)* are domestic units. Certified Emission Reductions (CERs) are Kyoto Protocol units, issued to offset projects in developing countries under the Clean Development Mechanism (CDM). Emission Reduction Units *(ERUs)* are also Kyoto Protocol units, originating from other Annex B countries with their own climate mitigation commitment. Each of these units represents 1 tonne of $CO_2$ equivalent.

Although each unit represents the same amount of emissions, the prices for EUAs in the EU ETS are generally higher than those for international credits. In large part, this is due to the quantity limits applied to CERs and ERUs under the EU ETS, which lower their value. In order to maintain an incentive for innovation at home and guard against the possibility of low-quality credits from outside the jurisdiction, the EU has imposed a limit mandating that no more than 50 percent of abatement may be achieved with international credits across Phases II and III. Differentiated limits apply to existing operators, new entrants, operators with significant capacity expansions or covering new gases/sectors, and aircraft operators. In Phase III (2013–20), the EU ETS accepts newly generated CERs only from Least-Developed Countries and does not accept any credits from industrial gas destruction projects (e.g., HFC-23 and $N_2O$). The combination of changes over time in the supply of international credits and regulatory limits on the use of international credits, along with the uncertainty in the long-term value of international credits under the EU ETS, have contributed to fluctuations in the observed price spread in the EU ETS between international credits and EUAs.[a]

a EDF et al. (2015b).

## 5.2 Choosing time periods for cap setting

At the start of an ETS, the government needs to decide whether to define caps on an annual or multiple-year basis, and how far into the future caps will be set in advance. The term "cap period" is used to refer to the number of years for which the cap is fixed in advance under a given set of parameters. This will usually correspond to a commitment period or ETS phase under which other program design features are also specified. The length of cap periods can change over time.

Decisions on cap periods should be coordinated with other aspects of climate change policy and ETS design. For example, changes in the jurisdiction's international climate change contributions and emissions reduction targets will have implications for cap setting. Transitions between cap periods can be scheduled to accommodate milestones like the entrance of new sectors or new participants, or the commencement of linking.

Some systems have developed cap time periods as follows:

- In RGGI, caps were initially set upfront for two periods (2009–14 and 2015–20), with a cap review and adjustment in 2012.
- In California and Québec, annual caps were set upfront for a series of multiple-year compliance periods covering 2013–14, 2015–17, and 2018–20.
- The EU ETS set a new cap prior to each multiyear phase: 2005–07, 2008–12, 2013–20, 2021–30, etc. A unique feature of the EU ETS is that the caps from 2013 onward include a automatic linear reduction factor that defines the annual contraction of the cap.
- The Tokyo ETS also set a new cap prior to each multiyear phase: FY2010–14 and FY2015–19.

- The Waxman-Markey Bill, which was passed by the U.S. House of Representatives in 2009 but not by the Senate, would have established annual caps from 2012 through 2050.
- Most Chinese pilots combined an initial cap on an intensity basis with annual ex post adjustment based on the actual outputs/business volumes of the 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.

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. 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 of the 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.
- How much the carbon 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 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 actual emissions in a recent year, average annual emissions over a recent period, or projected emissions in the starting year, even though projected emissions are inherently uncertain and subject to pressure for revision. The cap ending point is defined in alignment with the jurisdiction's mitigation and cost objectives for capped sectors (which will require projections to be made). A straight line is then often drawn between the starting and ending points, which sets 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.

# 6. Common Challenges

There are at least three challenges that policy makers must consider when setting the cap:

- Accommodating changes during the cap period;
- Ensuring allocation methodologies are consistent with the cap; and
- Providing a long-term price signal.

## *6.1 Accommodating changes during the cap period*

During the cap period, policy makers must accommodate changes in response to system shocks and changes to sectoral composition and participation.

### *6.1.1 Adjusting the cap in response to system shocks*

Under normal operation, an ETS market responds to fluctuations in unit supply and demand through changes in allowance prices, demand for offsets, or banking. When system shocks (such as major changes in fuel prices or economic activity, or *force majeure* events) drive changes in allowance supply or prices that cannot be managed within existing flexibility mechanisms and could destabilize the market, policy makers may need to consider whether to adjust the cap temporarily or permanently. This decision requires a trade-off between the following considerations:

- Adjusting the allowance supply can help preserve prices at a level considered "appropriate" by stakeholders but will also affect the local and/or global emissions outcomes of the ETS. If the ETS is operating under a binding jurisdictional mitigation commitment, then the jurisdiction will have to compensate for any mitigation shortfall under the ETS, which could represent a fiscal risk to the government and may have implications for the mitigation burden shifted to uncapped sectors. If the ETS is not operating under a binding commitment, then increasing or overriding the cap could raise global emissions.
- Providing certainty on overall allowance supply shifts the focus to other price-containment mechanisms (e.g., operation of a reserve within the cap, banking, and/or access to offsets and linking) that do not alter the system's net contribution to global emissions reductions. However, these mechanisms may not be able to accommodate very significant system shocks or may have political ramifications (e.g., increasing wealth transfers to other countries in the case of offsets or linking).

If policy makers do decide to alter supply, then increases in supply can be achieved by issuing more allowances—either from a reserve within the cap or through a price safety valve mechanism that supersedes the cap—or by allowing more offset units into the market. Allowance reserves, in particular, have been employed by a variety of systems, including the EU ETS, Switzerland, Tokyo, Saitama, California, Québec, the Republic of Korea, Kazakhstan, and several of the Chinese ETS pilots. Options to reduce supply include temporarily withholding or permanently canceling allowances, and restricting the import of units from offsets or linking.[64] Temporarily withholding allowances essentially shifts the banking power from participants to the government (See Step 6).

Another system shock could arise with improved data collection that reveals emissions factors need to be recalculated. The Chinese experience shows how important this could be in countries new to climate policy and emissions reporting (see Box 2.6). In this context, an appropriate balance needs to be struck between allowing cap adjustments to reflect data improvements and providing certainty to ETS participants during each period for which the cap is set in advance.

To improve policy certainty and retain the confidence of market participants, policy makers 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 on the basis of unit supply or unit price.[65] Step 6 provides more information about market stability mechanisms. Alternatives to rule-based cap adjustments would be procedural mechanisms that could rely on decisions of specific bodies appointed for these purposes. Such procedural arrangements have been subject to the conceptual and theoretical debate but have not been used for unscheduled cap adjustments for the existing ETSs.

### *6.1.2 Sectoral coverage changes*

As sectors enter or exit an ETS, or as participation thresholds change, an ETS cap will need to be adjusted accordingly. An operational ETS with phased sectoral entry under an absolute cap (e.g., EU ETS, California, Québec) may explicitly provide for step-changes in the cap as new sectors enter. In the California and Québec systems, breaks between cap periods aligned with the entry of new sectors. In the EU ETS, some sectoral scope changes were made at the transitions between cap periods but aviation entered the system mid-stream during the Phase II cap period. After the further enlargement of the EU in 2007 (when Romania and Bulgaria joined), the cap was adjusted for the ETS-regulated sectors in the new member states in the course of Phase I of the EU ETS. In the case of RGGI, the cap was revised downward when one of the participating states—New Jersey—withdrew. In most cases, these kinds of cap changes can be planned in advance and integrated smoothly into cap setting arrangements.

Besides sectoral coverage changes, individual entities within covered sectors can either enter or exit the market during a commitment period. Further information on accommodating new entrants and closures during the cap period may be found in Step 3.

**BOX 2.6 CASE STUDY: Reconstructing Historical Emissions Trends in China**

In 2015, an international research team reported that China's historical emissions from energy and cement production had been overestimated in earlier assessments due to the use of incorrect data and default emissions factors. According to the researchers, over the period from 2000 to 2012, actual energy consumption had been 10 percent higher than reported, but emissions factors for Chinese coal were 40 percent lower on average than the defaults applied. China's cement emissions were found to be 32–45 percent less than earlier estimates, once default clinker-to-cement ratios were revised based on actual production data. As a result of the recalculation, China's 2013 fossil fuel and cement emissions were found to be 12 percent less than in the inventory reported by China to the UNFCCC, and 14 percent less than in the data reported by EDGAR. This difference is material enough to alter assessments of the global carbon budget.[a]

Later in 2015, Chinese energy statistics based on a 2013 economic survey were released that suggested China's annual coal consumption had been underestimated since 2000 and may have been up to 17 percent higher than previously reported.[b]

These studies highlight the potential challenges for ETS cap setting in countries where historical emissions data are less readily available and where improved data collection results in the recalculation of fuel consumption and emissions factors.

a Liu et al. (2015).
b Buckley (2015).

64 The "minimum auction price" in the WCI ETS design is a mechanism imbedded in the regulation that allows, in case of oversupply, the temporary removal from the market of any excess allowances that would result in the market price falling below the minimum auction price. The removed allowances would slowly be reintroduced in the market only once two consecutive auctions close above the minimum price. Therefore, applying a minimum price at auction may be one option to reduce the risk of oversupply. Allowances dedicated to auction will be retained if the market price is under that price. This feature is applied in the Québec/California ETS.

65 Gilbert et al. (2014b).

## 6.2 Ensuring allocation methodologies are compatible with the cap

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 I of the EU ETS where the decision on how many allowances to provide for free became determinative in setting 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, policy makers will need to ensure that the level of free allocation they plan to supply under a given methodology (e.g., on the basis of facilities' historical emissions or emissions benchmarks per unit of production) can be accommodated by the cap they have set.[66]

From a procedural perspective, however, the lesson to be learned is that a deep integration of cap setting and allocation procedures tends to inflate the caps as a result of distributional conflicts about (free) allocation. A clear separation of the cap setting and allocation processes should be seen as the preferable target 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 given in Step 3.

Special considerations arise for cap setting when the point of obligation for surrendering units in regard to one emissions 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, policy makers have assigned unit surrender obligations for both direct emissions at the point of electricity generation and indirect emissions at the point of electricity consumption.[67] 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 has to accommodate the need to surrender two allowances for each unit of emissions from electricity generation: one upstream and one downstream.

## 6.3 Providing a long-term price signal

As described in section 5.2, it is typical for the period over which a cap is set *in advance* to be between two and ten years. At the transition points between cap periods, policy makers have an opportunity to review and make adjustments to the cap as more information on abatement costs, macroeconomic fluctuations, and actions by international trading partners becomes available.

However, enabling periodic cap adjustments can create uncertainty among market participants as to the possible long-term trajectory of the cap and the resulting price signal. This threatens to undermine one of the main benefits of an ETS, namely to provide a price signal that will incentivize low-carbon investments. A recent study, based on a survey of EU ETS participants, found companies perceive policy risks—caused by changes to the EU ETS and other policies and measures related to renewables and fuel taxes—as more challenging to manage in their investment decisions than market risks.[68]

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 rate of change over time with regard to emissions levels and/or carbon prices in alignment with broader long-term mitigation, technology, or economic transformation targets. Options include setting an indicative cap range or a default pathway to guide future decision making while building in flexibility for decision making by future governments. This was the approach taken by the European Commission (see Box 2.7). Achieving cross-party support for a long-term cap trajectory would help further improve policy certainty. Box 2.8 describes the proposed rolling cap mechanism that was discussed in the development of the Australian Carbon Pricing Mechanism (CPM), the cap design in the California ETS, and the model of the LRF in the EU ETS.

Box 2.9 provides an account of how the policy makers managed this challenge when setting the cap for the California ETS. By identifying clear rules and parameters upfront 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 detailed further in Step 10.

66 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.

67 Kim and Lim (2014)

68 Gilbert et al. (2014b).

### BOX 2.7 CASE STUDY: The Linear Reduction Factor for the EU ETS

From 2013 onward, the cap for the EU ETS is defined by the so-called Linear Reduction Factor (LRF). The LRF is a percentage of the emissions that were regulated by the EU ETS in 2010 (which are adjusted for later scope changes, etc.) and marks the annual contraction of the cap following a linear trajectory. For Phase III of the EU ETS, the cap is calculated as the average of the annual cap levels between 2013 and 2020 on this linear trend. The LRF was initially defined at 1.74 percent, will explicitly not expire by the end of the recent phase, and is part of the binding ETS legislation for the periods beyond 2020. In the context of the structural reform of the EU ETS, the LRF is planned to be increased to 2.2 percent from 2021 onward, again explicitly without a date for expiration. Hence, the original concept of the LRF at 1.74 percent implied a legally binding emissions reduction for the capped entities of 70 percent below the 2010 levels by 2050. The adjustment of the LRF to 2.2 percent from 2021 onward leads to a legally binding emissions reduction of approximately 83 percent below the 2010 levels by mid-century. This robust long-term emissions reduction commitment is one of the factors explaining the fact that prices did not fall to zero during the deep surplus crisis of the EU ETS from 2010 onward.

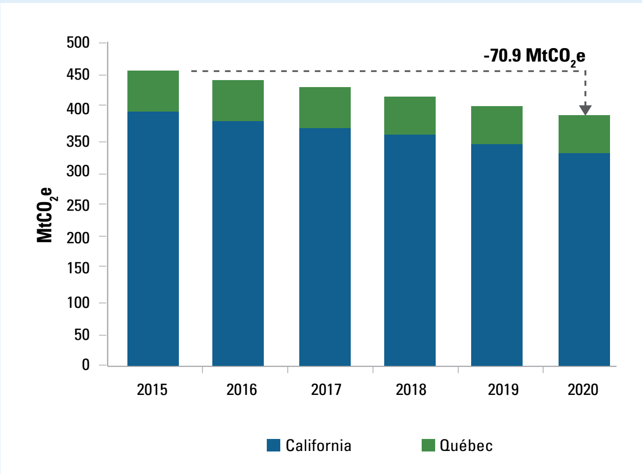
### BOX 2.8 CASE STUDY: Australia's Rolling Cap Mechanism

The Australian ETS applied the concept of a rolling cap mechanism. Under the government's Carbon Pricing Mechanism (CPM), which started operation in 2012 but was repealed in 2014, the initial 3-year fixed-price phase was to be followed by a flexible trading phase that provided for fixed 5-year caps that were to be extended annually by one year by the government, with advice from an independent Climate Change Authority. In the event no decision could be reached, a default cap would align with the government's national emissions reduction target for 2020.[a] Under the government's precursor proposal for the Carbon Pollution Reduction Scheme (CPRS), the cap setting process included the same design of a 5-year fixed cap with rolling annual updates plus the definition of a "gate-way" consisting of a band (upper and lower cap limit) that would guide cap setting for the 10-year period beyond each 5-year cap. This approach was intended to provide some certainty over cap setting for a period of 15 years.[b]

a Government of Australia (2011).
b Government of Australia (2008).

## BOX 2.9 CASE STUDY: Ambition and Cap Design in the California ETS

The California ETS 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 intended as a backstop to reinforce outcomes from a large portfolio of mitigation policies and ensure that mitigation incentives penetrated into the parts of the economy that were not covered by targeted policies. Drawing from assessment of mitigation potential and modelling of economic costs, the state allocated a share of the state-wide emissions reduction responsibility to covered ETS sectors, which account for 85 percent of the state's emissions.




*Author:* ICAP.

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 program design included quarterly auctions, with a price floor that increased over time. The cap extended across three compliance periods (2013–14, 2015–17, and 2018–20). 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. For further supply and price flexibility beyond the cap, participants could use approved offsets to meet up to 8 percent of their obligation and access unlimited units from linked ETS. 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.

When setting the cap and price expectations, officials evaluated the system ambition and costs in other systems, particularly RGGI and the EU ETS, and concluded that their approach compared favorably while supporting the state's emissions reduction goals. Cap setting and allocations based on historical, verified emissions has contributed to establishing a stable and active market. For example, in the three California-only auctions held in 2014, the price for 2014 vintage allowances stayed extremely steady throughout the three auctions, only fluctuating by two cents (US$11.48 to US$11.50) and staying 15 cents above the floor price on average. Between the state-run auctions, daily trade activity on the secondary market has been characterized by stable allowance prices and increased trading volumes. These results indicate California companies have faith in the integrity and strength of the current program and are using the auctions to buy the allowances they need to comply with the regulation.[a]

a Center for Climate and Energy Solutions (2014) and ARB (2010c).

2. CAP

# QUICK QUIZ

## Conceptual Questions

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

## Application Questions

- In your jurisdiction, how much should the ETS contribute toward meeting economy-wide emissions reduction targets?
- Will your jurisdiction need to design a cap that supports linking to another ETS in the near or longer term?

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# STEP 3: DISTRIBUTE ALLOWANCES

# AT A GLANCE

✓ Match allocation methods to policy objectives
✓ Define eligibility and method for free allocation and balance with auctions over time
✓ Define treatment of entrants, closures, and removals

When policy makers place a cap on emissions, they create scarcity that, in turn, generates a "climate rent." This scarcity leads to higher consumer prices for emissions-intensive goods and services, reduces some asset values, and can adversely affect workers. The method of allowance allocation helps determine how this climate rent and these costs are distributed across society. Even if the total costs of an ETS to the economy are small, there can be big winners and losers. Who the winners and losers are will depend on, and can be strategically influenced by, how allowances are distributed.

The choice of allocation methods is also key to how companies react to the ETS. For example, allocation can be pivotal to companies' decisions on production volumes, location of new investments, and how much of carbon prices they pass on to consumers. In these ways, it can therefore also affect the total cost to the economy of the ETS.

When distributing allowances, policy makers will seek to achieve some or all of the following objectives (which are not always mutually compatible):

- **Managing the transition to an ETS:** There are numerous issues involved in transitioning to an ETS that a policy maker may wish to manage through the approach to allowance allocation. Some issues 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. Others relate to risks such as the fact that participants may have a low capacity to trade initially or that, where institutional capability is weak, some companies may resist participation.
- **Reducing the risk of carbon leakage or loss of competitiveness:** These risks present a combination of undesirable environmental, economic, and political outcomes for policy makers. Avoiding these factors is always one of the most controversial and important aspects when considering the design of an ETS.
- **Raising revenue:** The allowances created when an ETS is established are valuable. By selling allowances, often through auctioning, policy makers thus have the potential to generate sometimes significant amounts of public funding.
- **Preserving incentives for cost-effective abatement:** In attempting to achieve any or all of the above objectives, policy makers must ensure that the overall 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.

In many cases, the total value of the allowances will be considerably higher than mitigation costs.[69] 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. It will be time-consuming to get the relevant parties to agree.

There are two fundamental approaches to allocation. The government can sell allowances through an auction, or it can give allowances away for free—either to ETS participants or to other affected parties. As free allowances can be allocated through three main methods, there are four allocation methods in total (auctioning plus three free allocation approaches).

Each of the following methods involves trade-offs against achieving one or more of the objectives mentioned above:

- **Selling allowances in an auction:** Policy makers create a source of public revenue using a method with little chance of market distortion or political input. 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. It also rewards early action. However, auctioning offers weak protection against leakage and does not compensate for losses from stranded assets.
- **Free allocation using a grandparenting approach:**[70] This can provide compensation for stranded assets. In a downstream system, this can be a simple method that can be attractive when managing a transition. As long as the level of allocation is not updated based on the company's emissions, it provides strong incentives for cost-effective reductions. By providing compensation for the risk of

69 Consider an example where baseline emissions are 100 tonnes, the cap is set at 80 tonnes, and the price is $10 per unit. The cost of abatement is always less than $200 (20 units times $10) and may even be well below that, while the value of allowances is $800.

70 Grandparenting is often referred to as grandfathering in the literature.

stranded assets, it can also ease the transition to an ETS but, as a corollary, it also raises the possibility of windfall profits. It provides only weak protection against leakage, can significantly distort the price signal if applied in combination with updating provisions, and does not reward early action.

- **Fixed sector benchmarking with infrequent updating:** The use of sectoral benchmarks can, if designed consistently and carefully, safeguard incentives for cost-effective emissions reductions (including through demand-side abatement). It also rewards early action. However, these benefits can be lost if the benchmarks are not designed carefully, and this process can be time-consuming and data-intensive. It may have mixed results in protecting against leakage, and can still result in windfall profits. The output used to determine the free allowances to covered entities could be either historical or real data, and updating is necessary in the latter case.
- **Free allocation using output-based allocation (OBA) with annual updating:** Company-level allocations can be based either on their own pre-ETS emissions intensities or on sector benchmarks. As in the fixed sector benchmarking approach, either historical or output data can be used to calculate the free allowances for companies and updating is necessary in the latter case. This option strongly protects against leakage and rewards early action. However, it can be administratively complex if sector benchmarks are used, safeguarding the incentives for cost-effective reductions require consistent and careful benchmark designs, incentives for demand-side abatement need to be protected, and care may be required to keep allocations within the cap if levels of free allocation are high overall.

Rather than allocating all emissions by auctioning or giving them away for free, many systems have elected a hybrid approach where entities in some sectors receive some free allowances, but not all. Often this is a way to ensure that those sectors considered to be at genuine risk of emissions 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.

This chapter first examines the four policy objectives considered when allocating allowances. The next section looks at the four methods of allocation—one selling through an auction and three methods of distributing them for free. Hybrid methods of allocation are discussed in section 3 as well as how to identify which sectors may be chosen for assistance. The concluding section discusses new entrants and closures, and removals.

# 1. Objectives When Allocating Allowances

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

- Managing the transition to an ETS;
- Reducing the risk of carbon leakage or loss of competitiveness;
- Raising revenue; and
- Preserving incentives for cost-effective abatement.

This section discusses each of these objectives and highlights some of the important trade-offs that policy makers will need to consider. If it is possible, policy makers 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.

## *1.1 Managing the transition to an ETS*

Policy makers 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, inefficient generation capacity, coal-fired boilers) acquired in the past that generated profits before regulation but that now leave their owners with high emissions that are hard to reduce. They fall in value with the introduction of an ETS. Their operating costs rise and they may become obsolete earlier than anticipated. These losses can be compensated through free allocation.
2. **Recognize early reductions:** An ETS takes time to create. During that process, it is valuable to reward, or at least not penalize, those who 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 historical emissions under a grandparenting approach, or the use of benchmarking approaches from the beginning can help reward early action or prevent delays in emissions 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' wellbeing, particularly that of poorer households. California used free allocation (with conditions) to protect electricity consumers; Australia recycled auction revenue to protect low-income households.

Two risks could arise early in ETS implementation:

- **Companies may have a low capacity to trade initially:** A further 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 of making costly mistakes (for example, by failing to be compliant with obligations, resulting in fines) are common before an ETS is implemented. Again, 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.
- **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.

## 1.2 Reducing risk of carbon leakage or loss of competitiveness

Carbon leakage (also known as emissions leakage) occurs when a mitigation policy, such as an ETS, causes a reduction in emissions in the jurisdiction where it is implemented but inadvertently leads to an increase in emissions in other jurisdictions that do not have equivalent policies in place. This increase in emissions in other jurisdictions arises because the differences in policy can cause shifts in production, through relocation of existing production or new investments, in response to the difference in policy settings.

Products that are "trade-exposed" because the companies that produce them compete directly with foreign producers in either export or import markets are most vulnerable. 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 carbon leakage should be small.

Empirical ex post estimates on the level of leakage are limited but tend to find little evidence of carbon leakage. It is also possible to use economic models to generate ex ante leakage estimates: general equilibrium estimates (economic models that look at impacts across the whole economy) of leakage rates range from 5 to 15 percent while partial equilibrium estimates (sector-specific economic models) project wide ranges, from 0 to 100 percent.[71]

71 PMR (2015g).

The risk of leakage presents a combination of undesirable outcomes for policy makers:

- **Environmental:** Leakage undermines a carbon pricing policy's environmental objective by causing carbon to rise in jurisdictions beyond the reach of the policy.
- **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 emissions reductions.
- **Political:** The risk of loss of jobs and asset values can create significant political challenges.

This confluence of potentially undesirable environmental, economic, and political outcomes means that the issue of leakage is always one of the most controversial and important aspects when considering the design of an ETS. Different forms of free allowance allocation are among the most frequently deployed tools to reduce the actual or perceived risk of leakage. While different mechanisms for free allocation can be effective in addressing carbon leakage, in doing so they often dampen the carbon price signal and hence the incentives for abatement. This trade-off must be managed and is discussed in the methods for free allocation below.

## 1.3 Raising revenue

The allowances created when an ETS is established have value. By selling allowances, usually through auctioning, policy makers have the potential to generate sometimes 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 instance, other policies to decarbonize the domestic economy or to support international action on health, education, or infrastructure; or to reduce government deficits and/or debts. It can also play a valuable role in compensating disadvantaged households who might otherwise be adversely affected by an ETS.

However, raising revenue through the sale of allowances may be in conflict with some of the objectives addressed above; for example, it means that fewer allowances can be given away for free to protect against leakage.

### 1.4 Preserving incentives for cost-effective abatement

In attempting to achieve any or all of the above objectives, policy makers must ensure that the overall objective of the ETS is maintained: ensuring firms and individuals are incentivized to abate emissions in a cost-effective manner. There are three types of abatement incentives that policy makers 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 carbon intensity) will benefit over less efficient ones;
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.
3. **Promoting demand-side abatement:** The method of allocation should allow the price of emissions-intensive goods and services to increase, so that end users 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,[72] but this may not be the best way to achieve other objectives such as managing the transition to an ETS or addressing carbon leakage.

## 2. Methods of Allocation

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

1. Selling allowances in an auction
2. Free allocation using a grandparenting approach
3. Free allocation using fixed sector benchmarking with infrequent output-based updating
4. Free allocation using OBA with annual updating

It can be helpful to break this down first into a decision as to whether to sell allowances through auction (option 1) or provide them for free (options 2–4). 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 could allocate only a share of the allowances.

Table 3.1 summarizes allocation methods used in each ETS to date while Table 3.2 summarizes allocation methods against objectives identified in section 1. This table shows that none of the free allowance allocation approaches score a “yes” against maintaining the incentives for cost-effective abatement. This partly relates to the approach that they take to updating allowance allocation over time, as further discussed in Box 3.1 (a recurrent theme throughout the following sections). In addition, Table 3.3 provides an overview of the data requirements for the different allocation methods.

### 2.1 Auctioning

Auctioning involves the allocation of allowances through a market mechanism, ensuring efficient functioning of the trading market and strong incentives for carbon abatement. It also creates a source of public revenue that can then be distributed to a wide range of potential beneficiaries.

Existing ETSs vary substantially in the extent to which they use auctioning. 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. Some systems (e.g., California and Québec) have framed ETS in part as a revenue-raising instrument from the beginning. In other cases (e.g., EU ETS), the use of auctioning has gradually expanded over time, primarily to the power sector, and it is estimated that up to half of the allowances may be auctioned over Phase III of the EU ETS. By contrast, in some jurisdictions (e.g., most Chinese pilots and the Republic of Korea) virtually no allowances are currently allocated through auctioning, although the Republic of Korea and China’s national ETS 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 could reduce carbon price volatility. Frequent auctions mean that the value 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 both have joint quarterly auctions. The large-scale EU ETS auctions are held several times a week at different trading platforms. The single-round, sealed-bid, uniform-price auction design is the most

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

TABLE 3.1 **Allocation Methods in Existing ETSs**

| ETS | Free Allocation vs. Auction | Free Allocation Recipients | Free Allocation Type |
|---|---|---|---|
| EU (phase I and II) | Mixed, minor share auctioned | Power generators, manufacturing industry | Mixed, large share of grandparenting, increasing share of benchmarking |
| EU (phase III and beyond) | Mixed, large and increasing percentage auctioned | Manufacturing Industry and aviation | Fixed sector benchmarking |
| New Zealand | Mixed, few freely allocated. No auctioning has yet taken place | Emissions-intensive trade exposed (EITE) activities | Output-based; some grandparenting, now ended |
| Switzerland | Mixed | Manufacturing Industry | Fixed sector benchmarking |
| RGGI | 100% auction | None | N/A |
| Tokyo | 100% free allocation | All | Grandparenting based on entity-specific baseline set on any consecutive three years in the period 2002–07. |
| Saitama | 100% free allocation | All | Grandparenting based on entity-specific baseline set on any consecutive three years in the period 2002–07 |
| California | Mixed, increasing percentage auctioned | Electric distribution utilities and natural gas suppliers on behalf of ratepayers; emissions-intensive and trade-exposed industrial activities | OBA—with output and sector-specific emissions-intensity benchmarks, some grandparenting, very few sectors (industry); based on long-term procurement plans (electricity); historical data (natural gas) |
| Québec | Mixed, most auctioned—increasing with time | Emissions-intensive trade exposed (EITE) activities | Output-based benchmarking |
| Kazakhstan | 100% free allocation | All | Grandparenting |
| Republic of Korea | 100% free allocation | All | Grandparenting (for most sectors), benchmarking (for cement, refinery, domestic aviation). |

TABLE 3.2 **Summary of Methods of Allocation against Objectives**

| Method of allocation | Objective | | | |
|---|---|---|---|---|
| | Managing transition to ETS | Reducing risk of carbon leakage | Raising revenue | Preserving incentives for cost-effective abatement |
| Auctioning | No | No | Yes | Yes |
| Grandparenting | Partial | Partial | No | Partial |
| Fixed sector benchmarking | Partial | Partial | No | Partial |
| Output-based allocation (OBA) | Partial | Yes | No | Partial |

TABLE 3.3 **Summary of Data Requirements for Different Methods of Allocation**

| Method of Allocation | Historical emissions | Historical output | Emissions benchmark | Actual output |
|---|---|---|---|---|
| Auctioning | No | No | No | No |
| Grandparenting | Yes | Maybe | No | No |
| Fixed Sector Benchmarking | Maybe | Yes | Yes | No |
| OBA | Maybe | Maybe | Yes | Yes |

*Source:* Maosheng, 2015.

BOX 3.1 **TECHNICAL NOTE: Updating**

As Table 3.1 illustrates, 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 for the degree of these distortions will be 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. In particular:

- Only few ETSs (e.g., the repealed Australian Carbon Pricing Mechanism) foresee a pure lump sum allocation. This provides an undistorted price signal comparable to an auction and does not distort abatement incentives.
- Most of the existing ETSs update the free allocation. This may be done between trading phases (the fixed sector benchmark approaches described in section 2.3) or within a trading phase (the OBA described in section 2.4). This updating can reduce leakage. However 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 allowances allocation not only needs to be reflected as a pure distributional issue but also considered an important design feature with regard to the cost effectiveness of emissions abatement.

commonly used in carbon markets around the world today.[73] Box 3.2 discusses ETS auction design issues in more detail.

### *2.1.1 Advantages*

Auctions have several advantages:

- **Revenue:** Governments can use income raised in an auction to support several objectives:
  - **Support 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, or reduce emissions in uncovered sectors (see Box 3.3 on auctioning use in California and Québec).
  - **Improve overall economic efficiency:** Revenues could support fiscal reform such as reducing other distortionary taxes in order to improve overall efficiency or they could be used to lower government debt.
  - **Address distributional concerns and generate 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.
- **Less political input:** Auctions can be administratively simpler than alternative free allocation approaches. They also reduce the opportunity for industry lobbying in support of specific firms or sectors (although there may still be lobbying for the auction proceeds).
- **Price discovery and market liquidity:** Auctions provide a minimum amount of market liquidity and can facilitate price discovery, especially in cases where liquidity is otherwise limited by significant amounts of banking of allowances (see step 5) by those who receive free allowances.
- **Reduced risk of distortions:** As described further below, different forms of free allowance allocation may distort incentives to undertake cost-effective abatement and may lead to windfall profits. In an auction, all entities pay the full cost of allowances, which should lead to cost-effective abatement, including demand-side abatement, as costs are passed through to consumers and significantly reduce the risk of windfall profits. The auction results in an efficient allocation of emissions 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.

73 Cramton and Kerr (2002) and Betz et al. (2009) discuss detailed choice of auction mechanisms for GHG markets.

### BOX 3.2 TECHNICAL NOTE: Auction Design for ETSs

The issuance of emissions allowances against payment is usually conducted by government through multi-unit auctions, which are, in essence, similar to those conducted in other markets such as stock, bonds, and commodities (e.g., energy, flowers, and fish). In order to ensure efficient allowance allocation, key elements of auction design and implementation—including auction format, schedule and frequency, available volumes, access to auctions, access to information, and management of auctions—are to be considered in light of the impact of auctions on the secondary market; the possibility of market manipulations; and openness and operational costs for all participants, especially small- and medium-compliance participants.[a]

Multi-unit auctions can be either dynamic, involving several bidding rounds between which participants are informed of the demand of others, or sealed, where participants simultaneously submit a single bid without knowing what others are willing to pay. Winners of a multi-unit auction either pay what they are willing to pay (pay as bid) or the auction clearing price (uniform price). Following Lopomo et al. (2011), these various combinations are laid out in the table below.

| Pricing | Bidding: Dynamic | Bidding: Sealed |
|---|---|---|
| Pay as bid | "Descending Clock"<br>▲ Dutch Tulips<br>▲ Sydney Fish Market | "Discriminatory Sealed Bid"<br>▲ U.S. Sulfur dioxide<br>▲ U.S. Treasury bonds (pre-1992) |
| Uniform price | "Ascending Clock"<br>▲ Virginia Nitrogen Oxide | "Uniform Price, Sealed Bid"<br>▲ RGGI<br>▲ EU ETS<br>▲ California and Québec Cap-and-Trade Programs |

Source: Adapted from Lopomo et al., 2011.

Today, most ETSs favor a sealed bid, uniform price auction format for its price discovery, openness, simplicity and nondiscrimination of participants, and prevention against collusive behaviors. However, some scholars have also noted the benefits of enhanced price discovery that clock auctions offer.[b] In determining the frequency of auctions and the auction schedule, the regulator must strike a balance to ensure open access and participation on the one hand and minimize the impact of the auction on the secondary market on the other hand. Frequent auctions may indeed be desirable to ensure a steady flow of allowances into the secondary market at a rate that does not jeopardize market instability. Yet multiple auctions can also increase transaction costs and the risk of low participation. Several auctions are held for EU allowances every week at different trading platforms, whereas Québec and California hold four joint auctions a year.

Another critical guiding principle for auction design is to prevent against fraud and market manipulation. Some jurisdictions have commissioned (independent) market monitors to oversee the conduct of the auction participants, and identify indications of market manipulation and collusion.[c] To ensure transparency, some ETSs require that winning bidders as well as the total allowances bid for are made public. Maximum and minimum bids are also reported, but individual bids are not published (e.g., California).[d] Other ETSs sell the allowances via established exchanges that publish aggregate results of the auctions without disclosing the winning bidders. Reporting to market oversight authorities is, however, mandated (e.g., EU ETS).[e]

a For more information on ETS auction design and implementation see Charpin (2009) which reflects the recommendations made by France's public-private workgroup on the format, operational implementation modalities, and access to the EU ETS phase III auction process.
b Cramton and Kerr (2002); Evans & Peck (2007); Betz et al. (2009). See Kachi and Frerk (2013) for a summary.
c Kachi and Frerk (2013).
d See California's auction summary, ARB (2015h).
e For an example, see EEX (2016).

BOX 3.3 **CASE STUDY: Auction Revenue Use in California and Québec**

California and Québec linked their systems on January 1, 2014. By November 2015, they had held five joint auctions. In total, California's auctions raised approximately US$3.5 billion in revenue for the state through 2015 (ARB 2015). Total auction revenue for California is expected to be about US$15bn by 2020.[a]

Québec has raised revenues of approximately Cad$967 million (about US$700 million). Despite their linked systems and joint auctions, California and Québec have their own approaches and restrictions on what to do with their auction proceeds.

California has strict statutory requirements regarding how auction revenues must be spent. Specifically, three laws passed in 2012 set parameters for the kinds of investments the funds can be used for:

- One law created the Greenhouse Gas Reduction Fund and required that all auction revenue be placed in this fund.[b] When a department is allocated moneys from this fund through the state budget process, it must state how the money will be used, how that use will further the goals of the Global Warming Solutions Act of 2006,[c] which established the system, reduce GHG emissions, and work toward non-GHG-related goals.
- A second law requires that auction revenue be spent on reducing GHG emissions and, where possible, creating jobs, improving air quality, and improving public health.
- A third law requires 25 percent of auction revenue to be used to benefit disadvantaged communities, with 10 percent of revenue to be invested in those communities.[d]

Through the budget process, the California Governor and Legislature have directed funds to various state agencies and diverse programs, including high speed rail, affordable housing in sustainable communities, weatherization, and water energy efficiency.

As to Québec, all auction revenues go to the Québec Green Fund and are dedicated to the fight against climate change by funding measures in Québec's 2013–20 Climate Action Plan.

a Estimate from ARB as quoted in Reuters story, October 2015. By way of comparison, Quebec's five auctions to November 2015 raised around Cad$967 million.
b California Senate Bill (SB) 1018, see Government of California (2005).
c Assembly Bill (AB) 32, see Government of California (2006).
d The second law is AB 1532 (Government of California, 2012a) and the third is SB 535 (government of California, 2012b).

### *2.1.2 Disadvantages*

Auctions also have disadvantages:

- **No direct protection against leakage or compensation for stranded assets.**[74] 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. These costs can be passed on to consumers in sectors that face limited international competition, like (often) electricity. But for sectors exposed to carbon leakage, this could imply significant financial challenges and strong incentives for output (and emissions) to relocate to a jurisdiction where carbon pricing is not as stringent. Measures other than free allocation to counteract this, such as border carbon adjustments, are hotly discussed but may entail significant political and practical barriers to implement—and have not yet been used for any ETS.
- **Concerns over impacts on small firms.** There will also often be concerns that small firms will not be able to easily participate in an auction process, further raising costs. However, an enabling framework for liquid secondary markets could avoid this and the acquisition of smaller numbers of allowances from intermediaries might even entail lower transaction costs than allocation in some cases.

There is an important political dimension to these considerations. The introduction of carbon pricing is usually a politically contentious process with significant vested interests often opposed to policy reform (although this is increasingly balanced by a constituency of business interests and other stakeholder groups calling for carbon pricing). In this context, one of the practical attractions of emissions trading is that the free distribution of allowances can reduce the distributional impacts of carbon pricing on some of those who might be most opposed to its introduction, while still providing policy makers with an assurance that a particular emissions reduction target, as reflected in the cap, will be met.

As a result, many ETSs initially started with a large majority of allowances being allocated for free, using different approaches, yet are often looking to gradually increase the proportion of auctioning over time.

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

## 2.2 Free allocation using grandparenting

There are two key characteristics of allocating allowances for free through grandparenting.

- First, firms receive assistance directly related to their historical emissions (often reduced by some percentage). Allocation could be based on the entity's emissions directly, or on past production or fuel input multiplied by a standard emissions factor.
- Second, the amount received remains independent of future output decisions or decisions to reduce carbon intensity. Prominent examples include the first two phases of the EU ETS, the first phase of the Republic of Korea ETS (for most sectors), and various Chinese ETS pilots.

However, while these characteristics define the pure form of grandparenting, in relation to the second aspect, many grandparenting schemes make periodic adjustments or updates to take account of changes in circumstances from when the initial allocation was made (also see Box 3.1).

It is critical to set the date for data used for grandparenting for all facilities early (the base year upon which allocation is determined) to avoid incentives to drive up emissions to increase allocation, to ensure equitable treatment of facilities, and to minimize lobbying by firms to maximize the benefit to their facilities. Two challenges in this context are:

- **Data availability:** The data may need to be collected and audited specifically for this process and may not be available for earlier years; and
- **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 few allowances—but also probably have fewer "stranded assets" because their investments were made more recently, when the regulation may have been anticipated.

### *2.2.1 Advantages*

The key advantages of grandparenting are:

- **Attractive method of compensating affected industry:** 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, nonupdating 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.
- **Relative simplicity in "downstream" systems:** In a downstream system, grandparenting means that the amount of free allocation is based entirely on a firm's historical emissions. Early MRV will provide these data. Despite the challenges identified above, compared to other methods of free allowances allocation, this is a relatively straightforward approach to undertake allocation. This has made it a popular method in the initial stages of many carbon pricing schemes. Prominent examples include the first two phases of the EU ETS, the first phase of the Republic of Korea ETS (for most sectors) and various Chinese ETS pilots.
- **Maintains abatement incentives:** It does this in two ways:
  - Firms that reduce emissions can sell their surplus allowances, those firms that increase emissions pay the full cost.
  - As with auctioning, grandparenting should, in the absence of any updating provisions (direct updating, plant closure provisions, new entrant allocation, etc.), result in an efficient allocation of emissions rights 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. This should mean that firms will respond to the carbon price in the same way as if they had not received the free allowance allocation. Firms that are not fully trade-exposed will tend to increase their product prices to reflect their higher costs, stimulating demand-side abatement. However, as discussed below, if the ETS includes updating provisions these advantages will diminish (depending on the frequency of updating).
- **Reduces firms' need to trade in the early years:** Unless firms are changing rapidly, their free allocation will be close to their level of emissions.

### *2.2.2 Disadvantages*

However, grandparenting is also associated with several disadvantages:

- **Repeated grandparenting reduces incentives to abate:** While grandparenting should maintain incentives to abate, this can be significantly diluted if applied in combination with updating provisions (as widely implemented for Phase I and II of the EU ETS). In these cases, future allowance allocation will be based on updated emissions levels. This means that firms that reduce emissions (either by reducing 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 emissions abatement from production and investment decisions. It is only likely to be addressed if it is signaled at an early stage that subsequent allocations will not be based on grandparenting, as indeed has been the case in a number of systems.

- **Weak impact on leakage prevention:** Providing assistance through grandparenting should not affect the incentives that firms face under a carbon price. This means that higher costs brought about by the introduction of a carbon price could lead to a reduction in firm output (and a transfer of this output to competitors outside of the jurisdiction).
- **Windfall profits:** With grandparenting, firms are incentivized to reduce emissions to minimize their carbon cost liability. This reduction in emissions may lead to a fall in output and thus an increase in prices. However, this has no impact on the free allowances an entity receives. In other words, firms may benefit from both higher prices and free allowances.[75] This was seen, for instance, for some electricity generators in Phase I and II of the EU ETS.[76] Windfall profits under grandparenting may be highest for the historically high emitters within a sector who have not taken early action; they receive high free allocations and may still have low-cost abatement opportunities. Windfall profits may undermine public confidence in the system, particularly if they persist.
- **Penalizing early action:** Early actions and early movers may face disadvantages if they implemented abatement measures before the period that was selected as the base period for grandparenting.

## 2.3 Free allocation using fixed sector benchmarking

Fixed sector benchmarking combines two features. Firstly, in contrast to grandparenting, the level of assistance is determined by reference to a product or sector level benchmark emissions intensity rather than by reference to the current or historical emissions intensity of each individual firm. Thus, it depends on the firm's historical output level but not its emissions. Secondly, there is only infrequent updating of assistance levels in response to changes in firm output.

This is the approach adopted in Phase III of the EU ETS for the manufacturing industry (see Box 3.4). A series of benchmarks were created for different products under the cap, to the extent feasible. Free allowances received by firms/installations in the sector are in principle calculated by multiplying the installations' historical output level by the benchmark. Once the level of free allowances is set, future changes in installation output have limited impact on the allowances received by each installation (only if capacity is added).

### 2.3.1 Advantages

There are two main advantages to this approach:

- **Severing the link between firms' emissions intensity and allowances received:** Firms that have taken actions 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 a firm's specific emissions, which 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.
- **Demand-side abatement incentives are preserved for nontrade-exposed products:** As with grandparenting, changes in output do not immediately lead to changes in allowances under a fixed sector benchmarking approach. This means firms may have an incentive to reduce output in order to reduce emissions liabilities, and those not competing in international markets can raise prices (with less risk of perceptions of windfall profits) and hence stimulate some demand-side abatement.

### 2.3.2 Disadvantages

The disadvantages of this method are:

- **Calculation of sector 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 multi-output production processes. However, the successful development of benchmarking approaches in the EU indicates that these technical challenges can be overcome. Existing principles and methodologies to set benchmarks, for instance, from the EU or from California, could also be used by other systems as a basis for developing their own.

75 CE Delft and Öko-Institut (2015) present empirical evidence suggesting cost pass-through despite the provision of free allowances in both phases II (grandparenting) and phase III (fixed sector benchmarking) of the EU ETS, for certain industrial sectors.

76 See Sijm et al. (2006).

BOX 3.4 **CASE STUDY: Fixed Sector Benchmarking in Phase III of the EU ETS**

The fixed sector benchmarking allocation approach under the EU ETS Phase III does not regularly update the output basis for allocation. To improve its effectiveness in preventing leakage, the policy has been designed to create a stronger link between allocations and output, which in turn facilitates stronger protection against leakage. Specifically, a historical output level is set, based either on output in 2005–08 or 2009–10 (Decision 2011/278/EU).

Firms producing:

- Less than 10 percent of their historical level in any one year receive no allocations in the subsequent year, effectively acting as a closure threshold;
- Between 10 and 25 percent of the historical level activity receive allocations with a 25 percent weighting in the next year;
- Between 25 and 50 percent of their historical level receive 50 percent of their full allocation in the next year; and
- More than 50 per cent of their historical level receive their full allocation, even if their output exceeds their historical activity level.

In a comparison of production decisions in the EU cement sector between 2011 and 2012, one study indicates that firms might have increased their output levels in 2012 in order to ensure higher allowance allocations in 2013, the first year of Phase III.[a] If cement is considered at risk of carbon leakage, this suggests that the thresholds and allocations are having some effect in terms of preserving output and hence addressing leakage.

However, there are two disadvantages to this approach:

- Because allocations are not directly in proportion to output, there is a possibility for gaming: by setting production at a level just above a threshold, firms can receive allocations that exceed the emissions costs they face—at an output level of 51 per cent of their historical activity level, firms would be entitled to receive 100 percent of their allocation.
- The market can be distorted as firms are incentivized to produce above activity level thresholds. Such perverse incentives could lead to production at an inefficient level.[b]

a Branger et al. (2014).
b Neuhoff et al. (2015)

- **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 emissions cost. While this increase in prices might stimulate some demand-side abatement, as discussed above, it can also lead to firms earning windfall profits from free allowance allocations.
- **Mixed results in mitigating leakage risk:** Fixed sector benchmarking has a dynamic similar to grandparenting; sectors genuinely exposed to international competition could still cut back on production and lose market share to those not facing carbon prices. In other words, it may not be particularly effective at reducing carbon leakage risk. Accordingly, policy makers may adjust the approach to provide stronger incentives for leakage protection, as described in the chapter "Before You Begin."
- **Potential for distortions of the price signal:** If benchmarks are not strictly based on sector or product outputs but instead reflect process, fuel, or other input specifics, price signal distortions may arise that are comparable to those observed with grandparenting in combination with updating provisions.
- **Increases high emissions-intensive firms' need to trade from beginning of the program:** This factor can make the transition into the ETS more difficult.

## *2.4 Free allocation using Output Based Allocation (OBA)*

OBA has two key properties. Firstly, assistance is allocated according to a predetermined emissions intensity. Secondly, when firms increase or decrease their output, the amount of assistance that they receive correspondingly rises or falls, according to the predefined level of intensity. The predefined intensities can be fixed by sector or be based on the firm's own historical emissions intensity.

This model is similar to the fixed sector benchmarking approach if the allowance allocation is determined by a sector benchmark (which could be calculated in exactly the same way as the fixed sector benchmarking approach) multiplied by the firm's output level. However, in contrast to the fixed sector benchmarking approach, if there are subsequent changes in firm output, then, with just a small lag, there is an adjustment in the allowances that the firm receives. A simple worked example is provided in Box 3.5. Variants on this basic model are used in California, Québec, New Zealand, the former system in Australia, some sectors in the Republic of Korea, and some sectors in most of the Chinese pilots.

BOX 3.5 **TECHNICAL NOTE: Impacts of OBA on Incentives to Produce**

Consider a carbon price of $100. As a high-emissions-intensity firm (A) increases output from 1 to 2, its emissions also rise by 1 $tCO_2e$. With no free allocation, this increase in production would cost $100 in terms of liability on top of the direct cost of production. That could leave firm A vulnerable to international competition. With the benchmarked OBA, as output rises, allocation also rises, from 0.7 $tCO_2e$ to 1.4 $tCO_2e$. Firm A's extra emissions liability from increasing production from 1 to 2 units is now only $30.

By contrast, when low-emissions-intensity firm (B) increases output, the extra free allocation it receives (also 0.7 $tCO_2e$ more) is greater than its extra emissions (0.5 $tCO_2e$) and it actually receives a production subsidy of $20 per unit. This illustrates the way benchmarks give low-emissions-intensive 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 an issue of particular concern in a heterogeneous sector where one rate may be applied to a set of different activities and outputs.

| | Unit | Firm | Output | |
|---|---|---|---|---|
| | | | 1 unit | 2 units |
| Firm's 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 = $100) | $tCO_2e$ | A: High | 0.3 | 0.6 |
| | $ | | 30 | 60 |
| | $tCO_2e$ | B: Low | -0.2 | -0.4 |
| | $ | | -20 | -40 |

### *2.4.1 Advantages*

The advantages of OBA are:

- **Maintains incentives to abate emissions intensity:** OBA 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 stronger when OBA is used with fixed sector benchmarks rather than with firm-specific benchmarks (where there may be an implicit or explicit possibility that the firm-specific benchmark will be updated). Sector-specific benchmarks reward early mitigation action and also allow less carbon-intensive firms to gain a competitive advantage through lower carbon costs. Again, these advantages will materialize only if the benchmark design is strictly based on a sector or product output approach, and process, fuel, or other input shifts are fully rewarded.
- **Targets leakage risk strongly:** 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 sector benchmarking schemes, where extra output does not usually lead to additional assistance. This works to maintain or increase output levels despite the pressure of competition from firms that do not face the carbon price. As such, it offers strong leakage protection. The volume preservation feature of OBA is even more attractive if there are opportunities to reduce the carbon intensity of production, which firms will only pursue if they are confident that they will retain high levels of output in the future.

### *2.4.2 Disadvantages*

The disadvantages of this method are:

- **Demand-side abatement incentives may be lessened:** OBA provides a strong incentive to maintain or even increase production levels. In sectors not exposed to international competition, higher levels of output mean that end user prices are lower than they would be under alternative forms of allocation. This can mean that OBA dents incentives for demand-side abatement. The latter will often be a relatively low-cost form of abatement (e.g., using steel, aluminum, and concrete more efficiently in construction) and hence means that the cost of meeting a given emissions reduction target may be unnecessarily high. In sectors exposed to leakage, this may not have material effects on demand-side efficiency as international competition would serve to limit price increases in any case.
- **Calculation of benchmarks and measurement of output:** Benchmarks based on firms' historical emissions intensity require much the same data as grandparenting, although

"output" must also be defined. The establishment of sectoral benchmarks is data-intensive and creates potential for lobbying around the methodology.

- **Possible interaction challenges with the overall cap:** In all forms of free allowance allocation, there is a need to ensure that the number of allowances allocated for free does remain within the cap (e.g., in Phase III of the EU ETS, a cross-sectoral adjustment factor was applied to the initial free allowance allocation of all sectors). This may be more difficult to manage under OBA if overall levels of free allocation are high. If increases in OBA allocation cannot be absorbed within the pool of allowances that would otherwise be auctioned, the overall level of assistance firms are entitled to receive may not be known when a particular phase of the scheme starts. Alternatively, the overall cap on emissions could change, rendering the domestic environmental outcome of the ETS less certain.

# 3. Identifying Sectors to Protect Against Leakage

Rather than allocating all emissions by auctioning or all allowances for free, most systems have elected a hybrid approach whereby some sectors receive free allowances, but not all. This approach is particularly common when free allowance allocation is being used to protect against carbon leakage, but otherwise policy makers want to auction allowances. In this case, there is a need to identify the sectors most likely to be at genuine risk of carbon leakage. Even where sectors are not trade-exposed, and hence less likely to be at risk of leakage, if they have high emissions intensity, they may experience significant stranded assets, which can also be a justification for assistance during the transition to the ETS. This argument becomes more difficult to sustain when an ETS has been operating for a significant period of time.

Policy makers have generally used two main indicators—carbon intensity and trade exposure, either in isolation or combination—to determine exposure to carbon leakage risk and hence eligibility for free allocation:

- **Carbon intensity** captures the impact that carbon pricing has on a particular firm or sector. It can be thought of, for these purposes, as the volume of emissions created per unit of output, revenue, value added, profit, or similar economic metric (the term emissions intensity can be used interchangeably). As carbon leakage is driven by carbon emissions cost differentials between jurisdictions with and without carbon prices, the larger the impact of a given carbon price on sectors or firms, the greater the risk of leakage, all other things being equal.
- **Trade exposure** can be thought of as a proxy for the ability of a firm or sector to pass on costs without significant loss of market share and hence its exposure to carbon prices. Trade, or the potential to trade, is what allows competition between producers in different jurisdictions. Therefore, trade is critical to allowing firms that face different carbon prices to compete. 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.

The two indicators can also be used to separate assistance categories into tiers. Table 3.4 shows the different factors that ETSs have used to identify which sectors might be exposed to the risk of leakage and Box 3.6 provides more information on the approach taken in Australia.

While these criteria have typically been used in determining sectors exposed to carbon leakage, there are a number of important considerations:

- First, in the academic literature, a number of authors have argued that trade intensity, while relevant, is not a standalone driver of carbon leakage and only has an effect when a sector or firm is also carbon-intensive. The same is also true for carbon intensity in cases where trade intensity is not high.
- Second, when considering carbon intensity, it is important to take into account the carbon emissions costs passed through from the supplying sectors, particularly electricity, as well as the direct carbon emissions costs incurred in production.

# 4. Other Issues

## 4.1 New entrants and closures

When deciding on allocation methods, it is important to consider how the system will deal with both new entrants to, and exits from, the market. As noted in "Before You Begin," these can be thought of as special forms of updating provisions.

Under an auction system and with allocations based on benchmarks, 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 current OBA systems, new entrants are treated in broadly the same way as an existing

TABLE 3.4 **Trade Exposure and Emissions Intensity in Different ETSs**

| Scheme (Period) | Criteria | Definitions | Applied at firm or sectoral level? |
|---|---|---|---|
| EU ETS Phase III | Cost increase >30%; or<br>Trade intensity >30% or<br>Cost increase >5% and trade intensity >10%<br>Qualitative assessment for borderline sectors | Cost increase: [(assumed carbon price (€30) × emissions) + (electricity consumption × emissions intensity of production × carbon price (€30))]/GVA)<br>Trade intensity: (imports + exports)/(imports + production) | Sectoral |
| New Zealand | Highly exposed if carbon intensity >1,600 $tCO_2e$ per million New Zealand dollars of revenue and trade exposed<br>Moderately exposed if carbon intensity >800 $tCO_2e$ per million New Zealand dollars of revenue and trade exposed | Carbon intensity is calculated as tonnes of $CO_2e$ per million dollars of revenue metric<br>Trade exposure is qualitative and based on the existence of trans-oceanic trade in the good in question. Electricity is explicitly excluded | Sectoral |
| California | Variously split into high, medium, and low exposure. This was based on a combination of tiers of emissions intensity and trade intensity.<br>Emissions intensity tiers are: High: >5,000 tCO2e per million dollars of value added;<br>Medium: 1,000–4,999 tCO2e per million dollars of value added;<br>Low: 100-999 tCO2e per million dollars of value added;<br>Very low: <100 tCO2e per million dollars of value added.<br>Trade intensity tiers are:<br>High: >19%;<br>Medium: 10–19%;<br>Low: <10%. | Emissions intensity calculated as tonnes of $CO_2e$ per million dollars of value added metric<br>Trade intensity: (imports + exports)/(shipments + imports) | Sectoral |
| Australia (repealed ETS) | Highly exposed if trade exposed and one of the following applies: carbon intensity >2,000 $tCO_2e$ per million Australian dollars of revenue, or >6,000 $tCO_2e$ per million Australian dollars of GVA<br>Moderately exposed if trade exposed and one of the following applies: carbon intensity >1,000 $tCO_2e$ per million Australian dollars of revenue, or >3,000 $tCO_2e$ per million Australian dollars of GVA<br>Trade exposed >10% | Carbon intensity is calculated as tonnes of $CO_2e$ per million dollars of revenue metric or, alternatively, tonnes of $CO_2e$ per million dollars of gross value added<br>Trade exposure based on either a quantitative test: (imports + exports)/production; or a qualitative assessment | Sectoral |

*Author:* Vivid Economics.

source that expands production. When a new entrant reports output, it will receive allowances just like existing firms. The only complication may relate to the calculation of the benchmark intensity metric, unless this is set at a sector-wide level. Similarly, if any firm closes, it produces no output and receives no allowances.

Under grandparenting (and fixed sector benchmarking), these issues are more complex. In terms of closure, while it might be considered fair that once a facility closes down, it should no longer receive free allowances, this may not be consistent with the intention to provide allowances as compensation for the loss of stranded assets. It may also create an artificial incentive to preserve production.[77] 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 entrants' reserve, which is set aside within the cap to provide free allocation to eligible new

77 Ellerman (2008) discusses these issues in the context of Phase I of the EU ETS.

BOX 3.6 **CASE STUDY: Approach to Identifying Activities at Risk of Leakage in Australia**

Australia used an administrative process to determine eligibility of activities. Activity definitions were simple and measurable. Activities needed to pass both an emissions intensity and a trade-exposure test. Firms volunteered activities to be assessed for eligibility. The level of free allocation varied by degree of emissions intensity. Emissions intensity was calculated on the basis of value added.[a] The list of eligible activities was short[b] and total levels of free allocation were low as a percentage of total allowance value.[c]

a New Zealand copied the Australian system, including the latter's much higher electricity emissions factor—in order to harmonize and facilitate future linkage. New Zealand used revenue rather than value added to define emissions intensity.

b In New Zealand, in 2014, only 24 activities received industrial allocations (New Zealand Government, 2015).

c New Zealand, under similar rules, in 2013 allocated 4.8 out of 37 megatonnes of allowances surrendered freely to industrials. New Zealand Environmental Protection Agency (2014).

entrants to the market. In the EU, member states included new entry provisions primarily to avoid leakage of new entrants.

### 4.2 Allocation of allowances for removals

As is discussed in Step 2, a jurisdiction may wish to have arrangements for allocating allowances to sources that might facilitate the removal of emissions from the atmosphere. Potential activities include capture and destruction of industrial gas, carbon capture and storage (CCS), and reforestation. There is a whole range of ways to treat these potential removals but there is a need to align allocation for these activities with the accounting treatment of the related emissions source.

## QUICK QUIZ

**Conceptual Questions**

- What are the key options for distributing allowances?
- What objectives can each distribution option help achieve?

**Application Questions**

- In your jurisdiction, what activities are both strongly trade-exposed (to jurisdictions with no or weak carbon pricing) and emissions-intensive?
- Would your jurisdiction want an ETS to generate additional government revenue that could be used strategically? Given the local confidence in markets, how willing would firms and regulators be to rely on auctions vs. free allocation for distributing allowances?

# STEP 4: CONSIDER THE USE OF OFFSETS

# AT A GLANCE

- ✓ Decide whether to accept offsets from uncovered sources and sectors within and/or outside the jurisdiction
- ✓ Choose eligible sectors, gases, and activities
- ✓ Weigh costs of establishing an own offset program vs. making use of an existing program
- ✓ Decide on limits on the use of offsets
- ✓ Establish a system for monitoring, reporting, verification, and governance

Offsets provide credit for emissions reductions and/or removal by sources not covered by an ETS. Once accepted, offsets are treated as equivalent, for compliance purposes, to allowances within the ETS.

Opening up an ETS to offsets expands the amount of abatement options in the market, as it renders new regions, sectors, and activities eligible to sell emissions reductions. These options may be available at lower cost than abatement opportunities under the cap; allowing the use of offsets for compliance can thus reduce entities' costs of compliance, which can potentially enable greater mitigation ambition for an ETS. Allowing offsets often has economic, social, and environmental co-benefits and can also support low-carbon investment, learning, and engagement among uncovered sources.

At the same time, the acceptance of offsets in an ETS may have several disadvantages. While it will provide greater compliance flexibility for covered sectors, likely lowering allowance prices, it could also reduce low carbon investment in those sectors, at least for some time.78 Offset approaches should be designed and implemented in a manner that ensures the environmental integrity of units. Among some types of offsets, it is also necessary to manage the risk of a reversal of emissions reductions, for example, if forests or other carbon sinks are established but the sequestered carbon is later released back into the atmosphere. The use of offsets may also bring distributional concerns, as finance flows to other sectors or jurisdictions for investment in low-carbon technology and activities, along with the associated co-benefits of emissions reductions.

These concerns mean that much care is required when considering which geographic regions, gases, sectors, and activities to render eligible for offset generation. Qualitative limits on offset use may, for example, be based on criteria of environmental integrity or the region of origin. For offsets 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. It is important to ensure that all offsets are generated following sound methodologies, either using an existing offset program for sourcing reductions domestically or internationally, or by creating a new offset program to achieve a set of specific policy objectives.

Once any qualitative and quantitative limits have been set and acceptable methodologies identified, the offsets can be integrated in the ETS. This involves adopting a process for project registration and credit issuance, and determining liability in case of reversal of emissions reductions.

This step elaborates the role that offsets might play in an ETS. Section 1 explains what offsets are, how they may be sourced, and how they affect emissions in an ETS. Section 2 elaborates some of the advantages of using offsets and potential challenges. Section 3 discusses more in-depth how to design an offset program that can address the potential disadvantages. It sets out an approach to applying *qualitative* limits to the use of offsets—that is, the geographic origin, types of gases, sectors, time periods, and types of activities eligible for offset generation; and *quantitative* limitations that might, in particular, guard against the potential for overly depressing allowance prices. The section further discusses the methodologies underlying offsets, whether applied as part of an existing or a new offset program. Section 4, finally, sets out some of the key elements of effective governance and implementation of offset programs.

78 See, for example, Szolgayová et al. (2014); Koch et al. (2016).

# 1. What Are Offsets?

Offsets represent emissions reductions resulting from actions taken to reduce emissions by sources that are not covered by an ETS, or to increase carbon sequestration. The use of offsets allows for aggregate emissions from covered sources to exceed the cap, but the overall emissions outcome is unchanged as the excess emissions are offset by the emissions reduction credited by the offset. Subject to conditions set out in protocols for crediting such reductions, ETSs may allow the use of offsets for compliance in place of allowances.

Table 4.1 provides a simplified illustration of how an ETS with an offset program functions. Without offsets, entities covered by an ETS cap can emit 100 $MtCO_2e$. The regulator has created an offset program in which uncovered sources currently emitting about 20 $MtCO_2e$ can obtain credit for emissions reductions. Sources under the offset program 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 offset programs to date have been designed to operate, each offset credit represents an emissions reduction equivalent to exactly one allowance.[79] Covered sources can then increase their emissions by 10 $MtCO_2e$ and still comply with the ETS cap. Total emissions remain unchanged through the addition of the offset program, but overall costs have fallen if the abatement costs of sources under the offset program are lower than the abatement costs of sources covered by the ETS. Box 4.1 discusses offset approaches that would achieve a net decrease of emissions.

### BOX 4.1 TECHNICAL NOTE: Achieving a Net Decrease of Emissions through the Use of Offsets

The example in Table 4.1 shows a stylized case where the actual reductions from within the offset program exactly cover the increased emissions in the covered sectors on a 1-for-1 basis. Traditionally, offset mechanisms such as the CDM have been designed in this manner. Because such offsets achieve a zero net gain for the atmosphere, they are typically seen as a means to control costs and provide benefits to uncovered sectors, rather than as a tool to drive mitigation across the economy.

Furthermore, there are also potential issues with the environmental integrity of offsets, meaning that less than one tonne of emissions could actually be reduced via offsets for each tonne of emissions increased in the covered sectors. This could erode the overall level of emissions reductions or potentially shift greater cost to the covered sectors if policy makers adjust the cap on the covered sectors to make up for the lower-quality offsets.

Offset programs can also be designed such that more than one tonne of emissions reduction must be achieved for each tonne that can be credited. In particular, the new mechanism established under the Paris Agreement of December 2015 must "deliver an overall mitigation in global emissions" as well as foster sustainable development (see Box 0.2 in "Before You Begin"). Some proposed sector-wide or jurisdictional crediting programs would require emissions to first fall below a "crediting baseline" lying below historical emissions (or a conservative estimate of BAU), before any reductions could be credited via offsets.[a]

a ARB (2015f).

### TABLE 4.1 A Simple Illustration of Offsetting in an ETS

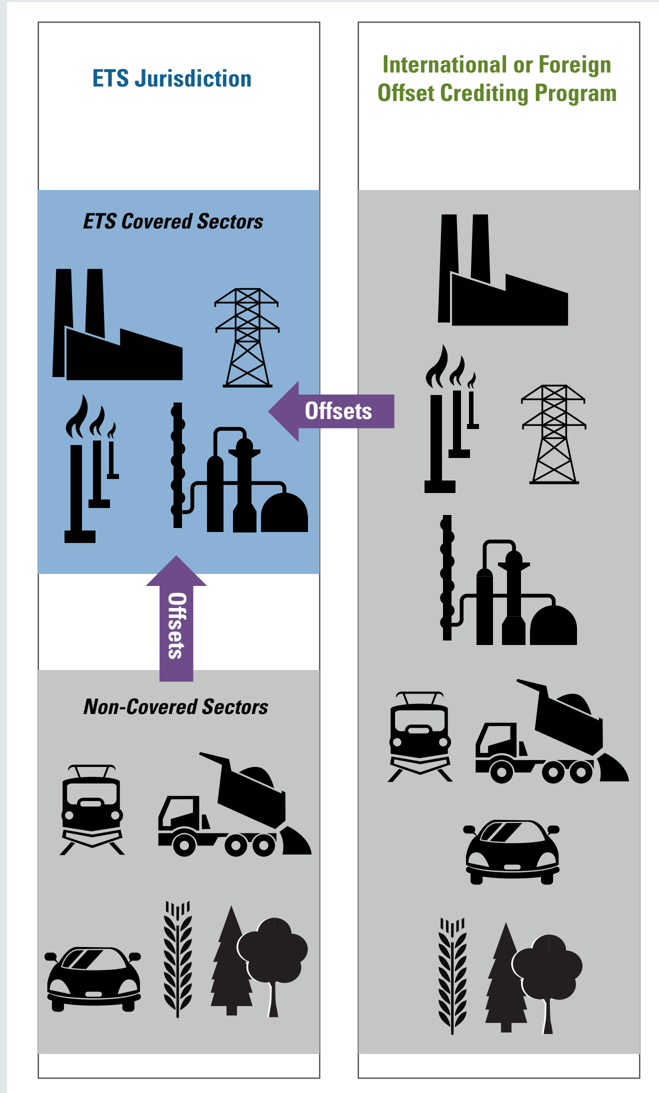
| Sources | No offset program (MtCO2e) | With offset program: Before trading ($MtCO_2e$) | With offset program: After trading ($MtCO_2e$) |
|---|---|---|---|
| Covered emissions | 100 | 100 | 110 (10 transferred from uncovered emissions within offset program) |
| Uncovered emissions within offset program | 200 (with no offset program there is no distinction between these categories) | 20 | 10 |
| Other uncovered emissions | | 180 | 180 |
| Total emissions | 300 | 300 | 300 |

79 Some Parties, however, including France, decided to deliver only 90 percent of the emissions reductions achieved in their territory as carbon credits to the project participants, creating a net benefit for the compliance of the host Party with its international commitments.

An offset program issues carbon credits according to an accounting protocol and has a registry to track and trade the credits.[80] Depending on the ETS, an offset can originate from either within or outside the ETS jurisdiction.

- An **international offset program** is a program that is run by an institution recognized by multiple countries (e.g., a body within an international organization or a non-profit organization). The rules are clearly defined for all participating countries, and the credits are sourced from multiple countries and sold on the international market. The Kyoto Protocol's project-based mechanisms—the Clean Development Mechanism (CDM) is an example of an international offset program (see box 4.2). Article 6 of the Paris Agreement introduces future mechanisms for which rules and guidelines have to be developed.
- A **domestic offset program** is a program that is run at the national or subnational level by a domestic body. The rules are specific to the jurisdiction and developed by the relevant domestic authority, potentially informed by international guidelines. The credits are sourced from projects developed domestically or internationally. Programs in other jurisdictions or countries might link to this ETS and/or its offset program, enabling sales of credits outside the jurisdiction.

FIGURE 4.1 **Sources of Offsets for an ETS**




*Author:* Mehling.

80 See two PMR reports and a USAID report for Kazakhstan for a comprehensive overview on key aspects of offset program design (PMR 2015d; 2015f; and USAID 2014). For an earlier discussion of offset policy issues, also see Olander (2008).

### BOX 4.2 CASE STUDY: The Kyoto Flexibility Mechanisms

Under the Kyoto Protocol, actions to reduce emissions by Annex I countries can be supplemented by three flexibility mechanisms. These were designed to create an interlinked system of tradable units among nations and facilitate transaction of emissions units at the entity level. The three flexible mechanisms are:

- *International emissions trading.* Countries with commitments under the Kyoto Protocol can acquire emissions units called Assigned Amount Units (AAUs) from other countries with commitments under the Protocol and use them to meet a part of their targets (Article 17 of the Kyoto Protocol).
- *The Clean Development Mechanism (CDM).* The CDM allows emissions reduction (or emissions removal) projects in developing countries to earn certified emission reduction (CER) credits, each equivalent to one tonne of $CO_2$. These CERs can be traded and used by Annex I countries to meet part of their emissions reduction targets under the Kyoto Protocol. The mechanism stimulates emissions reductions, while giving Annex I countries some flexibility in how they comply with their emissions reduction targets. The projects must qualify through a public registration and issuance process designed to ensure real, measurable, and verifiable emissions reductions that are additional to what would have occurred without the project. The mechanism is overseen by the CDM Executive Board, answerable ultimately to the countries that have ratified the Kyoto Protocol (Article 12 of the Kyoto Protocol).
- *Joint Implementation (JI).* A country with an emissions reduction or limitation commitment under the Kyoto Protocol may participate in an emissions reduction (or emissions removal) project in any other country with a commitment under the Protocol, and count the resulting emissions units toward meeting its Kyoto target. As with the CDM, all emissions reductions must be real, measurable, verifiable, and additional to what would have occurred without the project. This project-based mechanism is similar to the CDM, but only involves parties with commitments under the Kyoto Protocol, so strictly speaking the credits are not offsets, because they are nested under an overall economy-wide emissions limitation commitment. The credits generated by these JI projects, each equivalent to one tonne of $CO_2$, are denominated Emission Reduction Units (ERUs) and are created by the cancellation of the corresponding number of AAUs from within the selling country's emissions budget. Under JI there are two "tracks" by which projects can apply for approval: party verification and international independent body verification. The mechanism is overseen by the JI Supervisory Committee, which answers ultimately to the countries that have ratified the Kyoto Protocol (Article 6 of the Kyoto Protocol).

The CDM was the first, and remains the largest international offset market. Overall, it has fostered US$130 billion of investment in GHG reducing activities in developing countries. Entities under the EU ETS were able to save up to US$20 billion by buying CERs to meet compliance obligations. A total of 200 GW of renewable energy capacity has been installed through CDM projects.

The size, scope, and operation of the CDM have drawn some criticism. In particular, various parties have questioned the environmental integrity of some CDM projects, such as those generating CERs from the destruction of industrial gases like HFC, which accounted for approximately 70 percent of CERs issued in 2009 and 2010. One important issue has been that CER revenue may have created perverse incentives to increase production of the underlying product to profit from the CERs awarded for its destruction (in the case of HFCs). Motivated by that concern, the EU and New Zealand decided to ban the use of such CERs in their ETS.

Prices on the CDM market have dropped dramatically in recent years, from over US$20 per unit before the 2008 recession to less than US$0.20 per unit in 2014, before recovering to US$0.50/unit in December 2015. The price decline is likely driven by a number of factors, including:

- The drop in demand caused by the financial crisis;
- Overallocation of allowances in the EU ETS, which would otherwise have been a greater source of demand for CERs;
- Japan and New Zealand declining to participate in the second commitment period of the Kyoto Protocol;
- Preannounced limits by some ETSs on the types of CDM projects they will accept credits from, which accelerated the generation of offsets so that they might continue to be eligible; and
- Uncertainty about the future eligibility of credits.

# 2. Using Offsets: Benefits and Challenges

## 2.1 Advantages of using offsets

There may be several advantages to using offsets:

- **Cost containment:** Offsets allow covered entities access to a greater set of cost-effective mitigation opportunities. For example, the forestry, agriculture, transport, housing and waste sectors fall outside of the cap in the cases of most existing ETSs (see Step 1). Nonetheless, these sectors still offer a range of opportunities to reduce emissions or increase carbon sequestration at relatively low costs.[81] By lowering compliance costs and creating a new, supportive political constituency for the ETS in the form of offset project developers, offsets may allow policy makers to set a more ambitious cap and may support policy stability.
- **Generate an abatement incentive in uncovered sectors:** If it is considered infeasible to include certain sectors within an ETS, then an offset mechanism may create an abatement incentive and support investment flows within these sectors.
- **Generate co-benefits in uncovered sectors:** Allowing offsets often has economic, social, and environmental co-benefits, including better air quality, restoration of degraded land, and better watershed management. When this aligns with policy priorities, for instance, in relation to international cooperation or improving livelihoods in rural, agricultural areas, this will be an advantage.
- **Increase capacity for implementing a market-based mechanism in uncovered sectors and other countries:** An offset program can engage new sectors and countries in climate mitigation and lead to innovation and learning about market-based mechanisms. Sectors that would otherwise have struggled to attract financing for mitigation action are provided with a financial incentive to invest in mitigation. When offsets are generated abroad, this learning process can support the adoption of market-based measures in the host countries. Over two-thirds of offsets generated by the 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.[82] Similarly, a domestic offset program can develop capacities outside covered sectors and prepare uncovered entities to enter the ETS.

## 2.2 Challenges of using offsets

A number of potential issues must be addressed when considering the use of offsets to ensure environmental integrity and avoid undesirable impacts:

- **Pressure on allowance prices:** The corollary of cost containment is that offset credits will reduce prices and incentives to reduce emissions in the covered sectors (see Step 6 for a discussion of the problems associated with volatile and low prices). In the EU ETS, the availability of low-cost offsets from the CDM has contributed to low prices and the accumulation of an oversupply of allowances, which policy makers have sought to reduce in an effort to exacerbate scarcity in the system. A typical way to introduce scarcity and ensure that a minimum level of reductions occurs in covered sectors is the imposition of quantitative limits on offsets use although this often involves a trade-off against improved cost effectiveness (see section 4.3). In addition, costs and supply of offsets may be challenging to anticipate and, once information has been collected, any quantitative limits may have to be reviewed.
- **Establishing additionality:** Offsets involve assessing whether the emissions reductions are additional to those that would have materialized without the incentive of being able to sell the credit. This requires the estimation of a baseline or counterfactual scenario. Because regulators cannot accurately estimate baseline emissions of a project, there is a risk that the offsets generated may not represent genuine emissions savings.[83] Various ways to address additionality have been developed in different offset methodologies, including aggregating reductions across a broader set of actors in a jurisdiction to reduce the self-selective nature of the voluntary program.[84]
- **High transaction costs:** The transactions costs associated with the administration of offset programs may be high: often the reason policy makers leave sources uncovered in the first place is that they are small and numerous, or otherwise costly or difficult to administer (see discussion of emissions thresholds and scope considerations for different sectors in Step 1).
- **Reversals:** Some types of offsets generate credits from carbon sequestration projects and programs, helping to establish carbon stocks. However, there is a risk that

81 The U.S. Environmental Protection Agency's economic analysis of the most recent national cap-and-trade proposal in the U.S. Senate 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 U.S. EPA, 2010).

82 CDM Policy Dialogue (2012).

83 A similar "baseline" issue may arise when setting the cap (see Step 2). If this is set up above BAU then any emission reductions would have occurred anyway and the associated allowances do not correspond to emission reductions resulting from the regulation (typically referred to as "hot air").

84 Van Benthem and Kerr (2013).

reductions achieved from these activities at one point in time could later be unintentionally or intentionally reversed and provide only temporary ("nonpermanent") climate benefits. For example, a field that has been converted to no-till cropping may be turned back into conventional tillage, releasing soil carbon. Similarly, a forest planted to sequester carbon may be harvested prematurely or burned, releasing the credited carbon. An offset program needs to address liability for reversals to guarantee that the reductions in emissions for the program persist at least as long as the reductions achieved under the emissions cap (see section 4.2.1). Often, imposition of liability is the best way to align incentives to prevent reversals, but if this is impossible, one option to manage reversal risk is to establish a buffer pool of credits that acts as a general insurance against reversals as well as to pool risks by aggregating activities across a larger region.

- **Leakage and leakage protection:** On the one hand, providing incentives for sources outside the cap to mitigate emissions can reduce leakage (shifts of emissions to uncovered sources if demand for those emissions is not met) by bringing more sectors under a carbon price. At the same time, offsets can generate leakage through shifting activities, market leakage, and investment leakage. *Shifting activities* may occur, for example, in avoided deforestation and forest degradation projects—in a large forest area, paying to protect the forest in one part does not protect other areas, and communities may simply deforest unprotected areas. Leakage through market and investment channels seem less likely to occur. One solution that has been proposed to some of these challenges in the context of international offsets is to scale up the accounting across an entire sector or jurisdiction. Such larger-scale accounting may account for all the emissions—and thus implicitly capture leakage within that sector or jurisdiction.
- **Distributional issues**: Offset programs may give rise to distributional concerns over resource transfers to uncovered sectors, whether domestic or international. As noted above, this transfer of resources and potential co-benefits may align with other policy objectives, but it can be a disadvantage in cases where there is misalignment. There may also be concerns over transferring resources abroad and compromising international competitiveness.
- **Subsidy lock-ins:** If an ETS intends to expand its coverage over time, allowing the generation of offsets before sectors are covered can make it more difficult to subsequently extend the cap. These sectors may resist the change from recieving revenue from abatement activities to incurring a liability for emitting.

# 3. Designing an Offset Program

When designing an approach to using offsets in an ETS, policy makers need to decide the following aspects: the geographic scope of an offset program (see section 3.1); the gases, sectors, and activities to cover (see section 3.2); whether to limit offset use (see section 3.3); and further methodological requirements (see section 3.4).

In deciding the scope of, and any limitations to, the offset program, four goals are likely to be important:[85]

1. Avoiding double counting of emissions reductions and helping ensure additionality by covering only emissions that are not regulated under a cap or reductions that are already being achieved by other mitigation policies;
2. Matching potential supply to expected offset demand;
3. Ensuring compatibility with international systems, particularly those of potential future linking partners if linking is a consideration (see Step 9); and
4. Supporting policy priorities (e.g., cost containment, rewarding early action, and promoting co-benefits and emissions reductions in specific sectors or regions).

## *3.1 Choosing geographic coverage*

An ETS may accept offset credits from within the jurisdiction's boundaries, outside the jurisdiction's borders, or both:

- **Local:** Accepting offsets only from within the jurisdiction, but outside of covered sectors, may be preferable if domestic emissions reductions are a key priority, and may also ease compliance, monitoring and enforcement concerns. Additionally, any co-benefits of mitigation are kept within the jurisdiction. In the Korean ETS, for example, only domestic offset credits are used. Eligible activities include those eligible under the CDM and carbon capture and storage (CCS) implemented after April 14, 2010.
- **Outside jurisdiction:** Accepting offsets from outside the jurisdiction expands potential sources of supply and offers more low-cost abatement opportunities. Domestic offset programs that allow credits from outside the jurisdiction of an ETS have been integrated in subnational ETSs in California and Québec, RGGI, and Saitama. International programs are used by a wide range of ETSs. They may target a wide range of countries (e.g., CDM or the envisaged international sectoral offsets in California), certain regions (e.g., North America, including the Mexico forestry

85 Adopted from Climate Action Reserve et al. (2014), which has wider applicability outside of California.

protocol within the Climate Action Reserve (CAR)), or specific sectors and projects based on bilateral agreements (e.g., Japan's Joint Crediting Mechanism). The decision regarding the scope of outside jurisdiction coverage will largely depend on how policy makers assess the trade-off between enhanced cost effectiveness (which favors a broad geographic scope) and 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 offsets from a particular location (see Step 9).

## 3.2 Choosing gases, sectors, and activities to cover

It will generally be preferable to include particular industries, sectors, gases, or activities when they have:

- Mitigation potential (to ensure that the inclusion of offsets has an impact);
- Low mitigation costs (to promote cost effectiveness and cost containment);
- Low transaction costs (to promote cost containment);
- Low potential for nonadditionality and leakage (to ensure environmental integrity);
- Environmental and social co-benefits in uncovered sectors (to allow these opportunities to be realized); and
- Potential to encourage investment in new technologies (so that the purchase of offsets can provide an appropriate incentive).

To give effect to these considerations, many ETSs place qualitative limits on the type of credits they accept, either by setting specific criteria to ensure environmental integrity and other goals, or by using lists of eligible and noneligible offset types, or both. These typically reflect assessments of co-benefits, distributional implications, as well as additionality, leakage, and reversal risk. Both Europe and New Zealand blocked the use of offsets from nuclear power and large hydroprojects (for political and environmental sustainability reasons) and from industrial gas destruction (because of additionality concerns). Further, the EU has not accepted temporary credits (tCERs) issued under the CDM, thereby excluding credits from 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 arguing that it could not control the risk of reversals outside its borders.

Qualitative limits can also be seen as a positive incentive for the types of projects that are accepted. Projects deemed likely to lead to learning and transformation could be bolstered by becoming eligible offset categories. For example, Shenzhen targets particular clean energy and transport projects as well as ocean carbon sequestration. The EU ETS, since 2013, only accepts 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 taken 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 designed a new system to take advantage of the early action that some participants have had with the CDM. Other goals included ensuring environmental quality, reducing programmatic compliance costs, and producing co-benefits (see Box 4.3).[86]

## 3.3 Quantitative limitations on offset use

A regulator may wish to limit the use of offsets in an ETS if it has policy goals other than increasing the supply of low-cost abatement options. Objectives that warrant quantitative limits may include incentivizing investment in low-carbon technology in covered sectors (which may be undermined if offsets result in too low a price) and realizing mitigation and co-benefits in its own jurisdiction. There may also be concerns over environmental integrity of offsets relative to reductions achieved under an ETS. Relaxing or removing quantitative limits on offsets can also be used as a cost-containment tool (see Step 6). Approaches to limiting units from linked systems, including offset generating systems, are further discussed in Step 9.

Table 4.2 summarizes the quantitative and qualitative limits across different ETSs. 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 covered entity can only use offset credits to cover up to 10 percent of its compliance obligation. If the cap is relatively nonstringent, allowing a relatively small percentage of the compliance obligation to be satisfied with offsets could still represent a high percentage of total reductions achieved. An alternative approach, as used in phase III of the EU ETS, limits use of international offsets to 50 percent of estimated aggregate emissions reductions (1.6 billion tonnes of $CO_2$e). This limit applies to the market as a whole and is not differentiated. Saitama also uses a limit relative to emissions reductions and further differentiates limits by entity, allowing factories to use more offsets for compliance than offices.

86 Margolis et al. (2015).

## BOX 4.3 CASE STUDY: Offset Use in the Chinese ETS Pilots

China was a major provider of offsets under the CDM. This experience helped develop local expertise in carbon markets, which was later valuable in the establishment of the seven Chinese ETS Pilot programs.[a] All seven pilots allow for the use of Chinese Certified Emission Reductions (CCERs), which are domestic units generated under a national offset program administrated by the National Development and Reform Commission (NDRC).

All Chinese ETS pilots set restrictions on the types, origination date, geography, and quantity of offsets that can be used for compliance. These reflect a number of concerns, including those related to preventing double counting and ensuring that CCERs do not flood the market. The table below summarizes the ways in which offsets can be used across the Chinese ETS pilots.

A majority of the methodologies eligible under the CCER program are directly derived from the CDM, although some new methodologies have been approved by the NDRC. CCER projects encompass a wide range of activities with large numbers for wind, solar, hydro, and some large projects aimed at afforestation/reforestation and addressing fugitive emissions. To be eligible for generating CCERs, a project must have started implementation after February 16, 2005, and meet a number of other requirements.[b] The so called "pre-CDM" projects, which are those projects being granted CCERs for emissions reductions produced before their registration under the CDM, currently dominate, but the share of such projects is expected to decline.[c]

| Pilot | Type of Offset Credit | Rules of Use | Geographic Restriction | Temporal Restriction |
|---|---|---|---|---|
| Shenzhen | CCER | No more than 10 percent of allocated allowances | CCERs from projects in the covered entity boundary cannot be used. | CCERs must come from existing or planned renewable and new energy projects, clean transport projects, marine carbon sequestration projects, forestry carbon sequestration projects, or agricultural emissions reduction projects |
| Shanghai | CCER | No more than 5 percent of allocated allowances | CCERs from projects in the covered entity boundary cannot be used | CCERs generated after January 1, 2013 |
| Beijing | CCER; validated emission reductions from energy conservation projects and forestry carbon sequestration projects | No more than 5 percent of allocated allowances | Up to 50 percent of the annual CCER quota may come from projects located outside of Beijing, with priority to projects located in cooperation areas, including Hebei Province and Tianjin City | CCERs must come from projects that began operation after January 1, 2013; excluding CCERs from HFCs, PFCs, $N_2O$, $SF_6$, and hydropower projects |
| Guangdong | CCER | No more than 10 percent of annual verified emissions | At least 70 percent of CCERs should come from projects located in Guangdong Province | At least 50 percent of the reductions from a particular project must be in $CO_2$ and $CH_4$ emissions; excludes CCERs from hydropower, fossil fuel (coal, oil, and gas) power generation, heating, and waste energy projects; excludes CCERs from pre-CDM projects |
| Tianjin | CCER | No more than 10 percent of annual verified emissions | CCERs from Beijing, Tianjin, and Hebei should be given priority. CCERs from projects located in the covered entity boundary of Tianjin and other province and city pilots cannot be used | CCERs must be generated after January 1, 2013, and only from $CO_2$ projects; hydropower projects are not allowed |
| Hubei | CCER | No more than 10 percent of allocated allowances | 100 percent of CCERs should come from projects located in Hubei Province | CCERs can only be from small hydropower projects |
| Chongqing | CCER | No more than 8 percent of annual emissions | N/A | CCERs must be sourced from projects operational after December 31, 2010 (except forestry carbon projects); excludes hydropower projects |

a CDM Policy Dialogue (2012).

b According to the Administrative Measures for the Operation and Management of CCER projects, all projects that were developed after February 16, 2005 and belong to any of the following categories are eligible to apply for registration: Type I: Voluntary emissions reduction projects that were developed using methodologies approved by the national authority; Type II: Projects that were approved as CDM projects by the NDRC but not registered at the UN CDM Executive Board; Type III: Projects that were approved as CDM projects by the NDRC and produced emissions reductions before being registered at the UN CDM Executive Board; and Type IV: Projects that were registered at the UN CDM Executive Board but whose emissions reductions have not been issued.

c PMR (2015b).

### TABLE 4.2 Offset Use in Existing ETSs

| ETS | Type of Offset | Limits |
|---|---|---|
| California | ▲ Compliance Offsets Credits issued by California Air Resources Board (ARB) from a project in the United States or its Territories, Canada, or Mexico, and developed according to a compliance offset protocol approved by ARB.<br>▲ Compliance Offset Credits issued by linked regulatory programs (i.e., Québec)<br>▲ Sector-Based Offset Credits from crediting programs (including REDD) in an eligible developing country or some of its jurisdictions. This will, however, be subject to further regulation. | Offsets limited overall to 8 percent of an entity's compliance. Sector-Based Offset Credits are subject to a sublimit of 2 percent of compliance obligations through 2017, and up to 4 percent between 2018 and 2020. |
| EU | | |
| *Phase I (2005–07)* | No offset eligible | N/A |
| *Phase II (2008–12)* | JI (ERUs) and CDM projects (CERs) | Qualitative limits vary across member states. No credits from land use, land use change and forestry, and nuclear power sectors. Restrictions on hydroprojects > 20 MW. Credits can account for a certain percentage of each country's allocations. Unused credits transferred to Phase III. |
| *Phase III (2013–20)* | JI (ERUs) and CDM projects (CERs) | Qualitative restrictions from Phase II apply. Post-2012 credits restricted to those originating in Least Developed Countries. Credits from industrial gas projects not allowed. Credits issued for emissions reductions in 1st commitment period of Kyoto Protocol only accepted until March 2015. Use of credits in Phase II and III is restricted to 50 percent of overall emissions reductions from 2008—20 (1.6 billion tonnes of $CO_2e$). |
| *Phase IV (2021–28)* | TBD | Proposal to exclude all international credits is under consideration. |
| Kazakhstan | Domestic offsets | No offset program established to date. |
| New Zealand | JI (ERUs), Kyoto Removal Unit (RMUs), CDM (CERs), domestic removal units | Not allowed: CERs and ERUs from nuclear projects; long-term CERs; temporary CERs; CERs and ERUs from HFC-23 and N20 destruction; CERs and ERUs from large-scale hydroelectricity (if in compliance with the World Dam Commission guidelines); |
| | Post 31 May 2015: Only Primary CER units from second commitment period | ERUs, RMUs, CERs from 1st commitment period only accepted until 31 May 2015. |
| Québec | Domestic (North American: Canada and United States) | Offsets (domestic and international) limited to 8 percent of entity's compliance. |
| RGGI | Domestic (projects located in RGGI states and select others) | Up to 3.3 percent of each entity's compliance obligation, although no offsets have been generated by this program to date. |
| Saitama (Japan) | Domestic and national | Unlimited use of offset credits in general. Credits from projects outside Saitama can be used for up to one third (offices) or one half (factories) of a facility's reduction target. |
| Republic of Korea | | |
| *Phase I–II (2015–20)* | Domestic (including domestic CERs) | Limited to activities implemented after April 14, 2010.<br>Limited to 10 percent of each entity's compliance obligation. |
| *Phase III (2021–25)* | Domestic and International | Up to 50 percent of offsets in the ETS can be international. |
| Switzerland | International, from CDM (CERs) and JI (ERUs) | Limited to credits originating in Least Developed Countries or other countries if CDM projects were registered before January 1, 2013, or credits from JI projects for emissions reductions achieved before January 1, 2013.<br>In addition to these criteria, only projects in the following sectors/activities are eligible: use of renewable energy (for hydropower plants only those with an installed production capacity of no more than 20 MW), end user's improved energy efficiency, methane flaring and avoidance of methane emissions at landfills, municipal waste recycling or waste incineration plants, recycling of agricultural waste, waste water treatment or through composting.<br>Installations that already participated in voluntary phase (2008–12): Offsets in 2013–20 limited to 11 percent of five times the average allocated allowances in 2008–12 minus credits used during that period.<br>Installations that entered in mandatory phase as of 2013 as well as newly covered emission sources: 4.5 percent of actual emissions in 2013–20. |
| Tokyo (Japan) | Domestic and national | Unlimited use of offset credits in general. Credits from projects outside Tokyo can be used for up to one third of a facility's reduction obligations. |

## 3.4 Determining appropriate offset methodologies

Regulators also need to determine how offsets are developed and the way in which environmental integrity is safeguarded. This is provided for by the methodologies and MRV requirements of different offset programs, which include processes to assess additionality of projects and baselines against which reductions are credited. Another consideration for regulators is the time frame during which eligible offsets can be generated, especially if the offset program starts before generating sectors are covered by an ETS (see Box 4.3).

Regulators first need to decide whether to make use of international offset programs (such as the CDM and any other future UNFCCC crediting mechanisms, offsets from other ETSs, and/or voluntary market protocols) and, if so, how and how much (section 3.4.1). If these deliberations lead to the decision to set up a domestic offset program, a host of further decisions will need to be made (section 3.4.2). In either case, credited emissions reductions could be sourced from activities within and/or outside the jurisdiction in which the ETS operates.

### 3.4.1 Using existing international offset programs

There are four main scenarios by which an ETS may draw on international offset programs:[87]

- **Full reliance.** International offset programs are responsible for offset generation, oversight and enforcement of process, and review of projects. The ETS regulator chooses which international offset programs to include, and oversees retirement of international units for ETS compliance.
- **Gatekeeping.** As with full reliance, except that the ETS regulator places qualitative and/or quantitative restrictions on the activities generating credits in international offset programs that can be used for domestic compliance.
- **Outsourcing.** Under this approach, responsibility for developing and approving methodologies, or for validation, verification, and accreditation is outsourced to *international* offset programs. However, projects are reviewed and approved domestically and *domestic* institutions are responsible for oversight and enforcement of the program, including issuance of credits.
- **Indirect reliance.** International offset programs provide examples that inform development of a domestic offset program (see section 3.4.2).

This leads to a number of questions that may help policy makers decide on the role that international programs could play:

- What are the short-term objectives of the offset program (cost containment versus preparation for international carbon market)? What are its long-term objectives? Should the offset program attract both domestic and foreign investment? If the policy objective is to maximize low-cost abatement options, it may be preferable to link to a wide-scoping offset mechanism; other policy objectives may warrant qualitative restrictions.
- What is the current situation in terms of institutions, regulations, and technical and operational capacity? The greater the concern over domestic capacity, the more reliance might be placed on international offset programs.
- How aligned are the existing international offset programs with domestic priorities? The greater this alignment, the more attractive options that make greater use of international programs will be.
- How much alignment is desired between the domestic program and international practices? A desire for closer alignment would place a premium on greater integration with international offset programs.
- What level of control is expected over the approval of projects and the issuance of credits? If a strong level of control is desired, this may suggest the establishment of a new offset mechanism.
- How important is the quick delivery of offsets? Making use of established international offset programs is likely to facilitate the generation of offsets more quickly than if a domestic offset program has to be established.
- How important is it to develop domestic capacities around offsetting (including institutional structure, technical skills in general and MRV skills in particular, and establishing a registry)? If this is a priority, a domestic offset program might be preferred.
- What financial resources are available for the planning, design, and implementation phases of the offset program? The development of a domestic offset program will be more expensive than options that make greater use of international programs.



87 PMR (2015f).

### *3.4.2 Creating a new offset program*

In the event that the considerations described above lead to the decision to create a new, domestic offset program, further issues need to be addressed. One of the most important is the design and development of the specific methodologies to credit offset activities, building on more general overall criteria and guidelines that are usually established by the ETS. These can be defined along two dimensions: standardized versus project-by-project assessments, and if some standardization is sought, whether standards are developed as bottom-up or top-down standards.

**Standardized vs. project-by-project methodologies.** A project-by-project-based approach to developing methodologies allows for the conditions of each individual project to be taken into account, and may allow for more precise determination of emissions reductions and additionality. This, however, can be costly, as each project must be evaluated separately and the approval process may rely on subjective assessments, which will reduce the certainty project developers have as to whether their proposed project will be accepted.

By contrast, with standardized methodologies, the approval process for projects is easier, more transparent, and streamlined—evaluators only have to check whether the project meets the defined standards, rather than individually assess additionality, for example. Although this approach induces less subjectivity in the approval process, it may allow for subjectivity in the design of standards. In addition, the upfront cost of designing standards and the cost of updating those standards as needed, may be large.

Table 4.3 lists different elements of methodologies that could be standardized. Elements 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.

**Bottom-up vs. top-down.** Methodologies may be developed via a top-down or bottom-up process, even if the methodologies are later standardized. In a bottom-up approach, individual project developers propose a methodology for their project. If approved, that methodology can then also be used as the basis for a standardized approach to assess emissions reductions from other projects in the same category. A top-down approach leaves the development of methodologies to the offset program. Project developers who want to provide offsets under the program must comply with the standards set in the relevant methodology for their project type. Between the bottom-up and top-down extremes, there is a set of intermediate options that combine elements of each. Table 4.4 gives an overview of differences, examples, and advantages and drawbacks of both approaches. Not all of these approaches are currently used in an ETS context.

TABLE 4.3 **Aspects of Standardization of Methodologies**

| Standardized Approach | Definition | Examples |
|---|---|---|
| Common criteria | Terms or conditions applied across multiple methodologies | "Not mandatory by law"<br>"Does not generate non-carbon related revenue"<br>(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<br>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)<br>(Applied to baseline/additionality determination) | Emissions rate: X tonnes of $CO_2$ per tonne of cement<br>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<br>(Applied to additionality determination) | Market share: < X percent of current sales<br>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 (eg., agricultural methane destruction, solar PV) 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<br>Tools for determination of boiler efficiency |

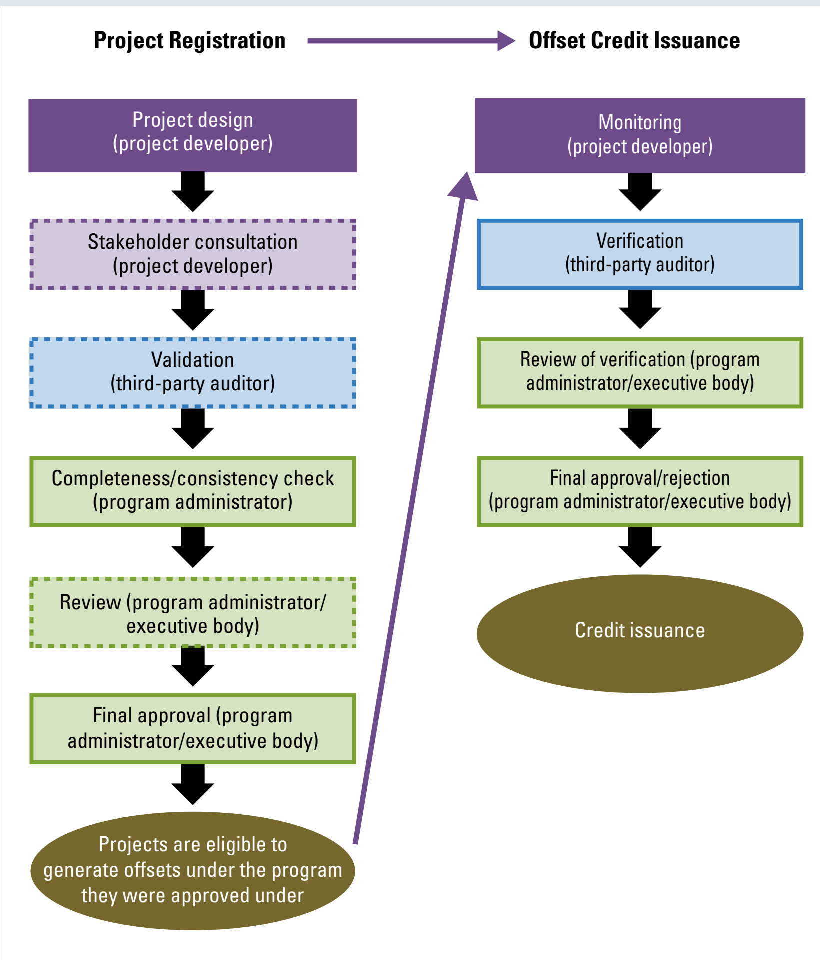
*Source:* PMR, 2015d.

TABLE 4.4 **Bottom-Up vs. Top-Down Approaches to Developing Offset Methodologies**

| | Bottom-up | Top-down |
|---|---|---|
| Typical qualities | Offset program has broader coverage | Offset program has more selective coverage |
| Examples | Clean Development Mechanism<br>Joint Implementation<br>Verified Carbon Standard<br>Gold Standard | California Compliance Offset Program<br>Québec Compliance Offset Program<br>Climate Action Reserve Voluntary Program |
| Pros | Allows for quick start<br>Once developed, may be used by others | Provides more certainty to project developers |
| Cons | Potentially costly for project developers and administrators | Requires more upfront time and public resources to develop |

*Source:* Adapted from PMR, 2015d.

FIGURE 4.2 **General Process for Project Registration and Offset Credit Issuance**




*Source:* Adapted from PMR, 2015d.
*Note:* Dashed lines indicate steps that are skipped by some of the examined offset programs.

# 4. Implementing and Governing an Offset Program

The operationalization of an offset program involves creating a process for project registration and offset credit issuance (section 4.1), handling seller and buyer liability (section 4.2), and determining liability for reversals (section 4.3).

## 4.1 *Project registration and offset credit issuance*

Figure 4.2 depicts a generic process for project registration and offset credit issuance. Dashed lines refer to actions that are included in some, but not all programs. Final project eligibility can be awarded if the project developer has filed a project design that has been through a cycle of validation and checks by third-party auditors and the program administrator. Credit issuance follows once monitoring, verification, and reviews have been completed. Once offsets are created, there will likely also be a process of continued monitoring to identify and address potential invalidation and any reversals (see section 4.2).

## 4.2 *Seller vs. buyer liability*

If the MRV process uncovers that, retrospectively, offset credits have not met the required quality standards or that fraudulent acts have been committed, then there are a number of possible responses. There may be no liability assigned (in which case, the environmental outcome suffers) or, in some cases, a legal procedure may be followed to assign liability. However, often systems establish rules that assign responsibility either to the seller or the buyer:

- With **seller liability,** offset project developers are required to reimburse the regulator if credits submitted for compliance are later found to fall short of quality standards or other mandatory conditions.

- With **buyer liability**, it is the responsibility of the purchaser to ensure that the credits meet quality standards. In this case, covered entities in possession of invalid offset 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—among other things, by selecting less-risky project types, diversifying offset purchases, or buying third-party insurance. For instance, in the California system there are rules by which the regulator can invalidate an offset up to eight years after it is generated and the liability for replacing this offset is placed on the buyer. This strengthens ARB's ability to ensure environmental integrity and promote due diligence under the program. However, the invalidation period can be shortened from eight to three years if the project and documentation submitted to claim the emissions reduction/sequestration is reverified within three years.

If buyer liability is not considered appropriate (i.e., the reasons stated above do not apply), it can be better for the regulator to impose liability on sellers and seek redress in the event of reversals or if 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. This is why some programs favor buyer liability.

Even where buyers are liable for replacing emissions units in case of invalidation or reversals, buyers can shift liability to sellers on a private contractual basis, with commensurate increases in transaction costs. Regulators can also create a tiered system of liability where sellers are primarily liable but, ultimately, if the seller's liability cannot be enforced, buyers become liable.

BOX 4.4 **CASE STUDY: New Zealand Reforestation Offset Protocols**

In New Zealand, owners of forest (native or exotic) are eligible to receive units if the land was afforested from January 1, 1990. Participation is voluntary, and once a landowner joins the system, their land is registered and mapped geospatially. Landowners can only deregister if they surrender all units received. Participants must submit regular emissions returns. The registration of the land is noted on the land title so future purchasers understand the potential liability associated with the land.

To reflect Kyoto Protocol rules, a compulsory liability to surrender allowances for emissions from deforestation of pre-1990 plantation forest was created—as well as other controls that limit deforestation of native forest.

Once land is registered, the participant can receive units for carbon sequestrated in each emissions period. On harvest, emission units must be surrendered to match the carbon lost (accounting assumes instant release to the atmosphere of all above-ground biomass), capped at the number of credits the participant has received. Below-ground biomass is assumed to be released linearly over 10 years.

Monitoring is achieved through a combination of generic look-up tables (by species, region, and age) and a field measurement approach used to create participant-specific tables (for areas of 100 hectares or larger). A self-reporting approach is used—with the possibility of audit. This self-reporting approach is supported by strict legislated enforcement powers, including financial penalties, make-good provisions, and civil and criminal actions.

If carbon in the forest is lost due to natural disturbance (wind, fire, flood), the landowner must surrender emissions units to match the loss. Commercial carbon insurance is available to protect landowners, but is not required.

## *4.3 Liability for reversals*

Questions about liability also arise in the event of reversals. Seller liability may be preferable, particularly if the offset provider can be made a legal participant in the ETS with obligations to monitor and report on their level of carbon storage (see the case of New Zealand in Box 4.4). 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. Other available options include:[88]

- **Buffer approach:** A portion of the credits issued by every project is deposited in a common pool, which acts as a general insurance against natural reversals. The credits in the buffer pool cannot be traded. The amount set aside can be based on a project-specific assessment (e.g., 10 to 60 percent under the Verified Carbon Standard (VCS)), or can be common for all projects.[89]
- **Reserve accounts:** A portion of the credits issued by a given project is put in an account to compensate for possible reversal of that particular project.
- **Commercial insurance or host country guarantee:** Participants may secure additional private insurance

88 See PMR (2015f) as well as Murray et al. (2012).

89 For example, the former Australia Carbon Framing Initiative applied a 5 percent automatic deduction for sequestration activities. The Gold Standard applied a 20 percent deduction.

**BOX 4.5 TECHNICAL NOTE: Offsets and ETS**

Consider these questions when determining whether, how, when, and from whom to allow offsets.

- Which sectors are likely to not be covered by the cap?
  Is there potential to manage the sectors through offsets?
- Is the recognition of offsets from outside the jurisdiction consistent with the goals of ETS?
- How can it be ensured that offsets do not undermine the environmental integrity of the cap?
- What might be the administrative challenges to having eligibility rules?
  What might be the challenges to having additionality and leakage tests?
- Will buyer liability, seller liability, or a combination of both be most feasible for ensuring the quality of offsets?
- Will offsets be unlimited or will they have restrictions?

or public guarantees (e.g., from a host country seeking to support mitigation). 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 developer (in the case of seller liability) compensates for the carbon that is released back into the atmosphere by implementing extra activities, for example, replanting areas where reversals occurred or planting new areas.

# QUICK QUIZ

## Conceptual Questions

- What are the benefits of allowing offsets into your ETS?
- What are the risks from including offsets?

## Application Questions

- What are the primary motivations for including offsets in your system, and how might those affect the type of offsets you accept?
- Does your jurisdiction want to absorb existing CDM units or reward early action by sources that will be covered in your ETS?
- How could your jurisdiction manage the risks of allowing offsets?
- Do you have the administrative capability and mitigation potential among uncovered emissions sources to make it worthwhile to create your own offset program?

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# STEP 5: DECIDE ON TEMPORAL FLEXIBILITY

# AT A GLANCE

✓ Set rules for banking allowances
✓ Set rules for borrowing allowances and early allocation
✓ Set the length of reporting and compliance periods

The ability to incentivize cost-effective emissions reductions is one of the most important advantages of an ETS. One key design aspect is providing entities with temporal flexibility as to when emissions reductions are achieved ("when flexibility"). Temporal flexibility can also reduce price volatility. Moreover, these advantages can be realized, in many cases, without having any significant detrimental effect on the ability to reduce the risks of climate change.

There are three main decision points where policy makers can choose to provide more temporal flexibility:

- By allowing borrowing of allowances from future compliance periods to the current period;
- By allowing banking of allowances from the current compliance period for use in future periods; and
- By deciding on the length of a compliance period.

**Borrowing** provides entities with flexibility in determining their compliance strategy. In particular, it allows those who cannot easily abate immediately the opportunity to make investments that will provide greater abatement in the future. It can also help provide market liquidity in times when allowances might be scarce and prices high. However, allowing borrowing can make it harder to meet short-term targets. In addition, regulators might find it difficult to monitor the creditworthiness of the borrowers—particularly because it is likely that those who will be most eager to borrow will also be the least creditworthy. Critically, allowing borrowing also creates a constituency with an interest in diluting or even removing the ETS in the future. For these reasons, most ETSs have entirely prevented borrowing, only allow it to a limited extent, or have imposed stringent borrowing terms.

**Banking** also provides temporal flexibility. It can help boost low prices as well as create a buffer against future high prices. Crucially, banking brings forward emissions reductions, making it more likely that short-term targets will be met. It also creates a constituency with a vested interest in the success of the ETS and in one with more stringent caps, as this will increase the value of their banked allowances. For these reasons, banking rules are generally more liberal than borrowing rules. Under certain circumstances, banking can reduce price volatility, but in situations where the cap is relatively loose or uncertain, it can actually exacerbate volatility. Restrictions on banking may be most sensible when there is a desire to isolate a pilot phase from subsequent phases, or in the context of reducing the risk of market power in the allowance market.

Within a compliance period, banking and borrowing are generally unlimited, making the **length of the compliance period** an important determinant of temporal flexibility. Longer periods provide the same opportunities and the same risks as greater banking and borrowing do between periods. Many existing ETSs have opted for 1-year compliance periods, or at least some annual compliance requirements; multiyear compliance periods are sometimes accompanied by a requirement for partial or "rolling" 1-year compliance obligations to balance flexibility and risk.

A number of design features determine the extent to which an ETS allows for flexibility over when emissions reductions are realized. This temporal flexibility—sometimes also termed "when flexibility"—is detailed in this step. Section 1 explores the rationale for providing temporal flexibility. Section 2 discusses three determinants of the extent to which an ETS provides temporal flexibility: (i) rules on borrowing, (ii) rules on banking, and (iii) the length of the compliance period. Finally, section 3 summarizes a range of financial instruments that can be facilitated by the provision of temporal flexibility and that can help provide market liquidity, and make it easier for entities to manage risks associated with fluctuating allowance prices.

# 1. Benefits from Temporal Flexibility

The two main reasons policy makers may wish to provide temporal flexibility are:

- It allows for lowering costs through optimization of investments over time; and
- It may reduce price volatility.

At the same time, temporal flexibility by itself is unlikely to have a significant detrimental effect on the environment due to the long timelines of many underlying chemical and physical processes that link GHG emissions to climate change. This section discusses each of these issues in more detail.

## 1.1 Cost optimization over time

Allowing entities to choose when they reduce emissions facilitates cost-effective action on climate change. It does so in two ways:

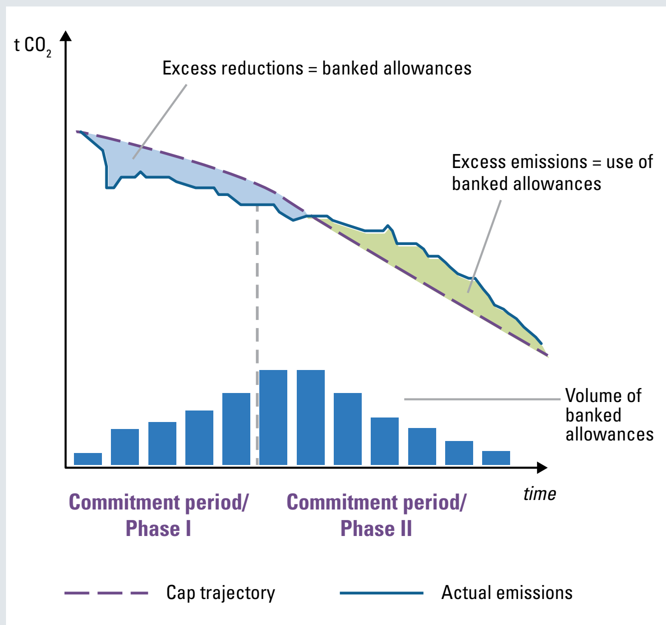
- **By allowing individual entities to abate in the most cost-effective way:** The regulator's timing of emissions limits and associated allowance allocations over time may not match the most cost-effective path for individual regulated entities. The optimal timing for undertaking abatement and installing new equipment will vary with the age of the existing capital stock or plans for expanding/contracting facilities. Allowing flexibility over time 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.[90]
- **By facilitating sectoral and firm-level 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. Permitting flexibility over when emissions reductions are achieved can provide sectors and individual firms with the necessary time to invest in new technology and R&D.

## 1.2 Reducing price volatility

Temporal flexibility can also reduce price volatility, potentially encouraging low-carbon investment (see Step 6).[91] 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, if prices are high, entities may choose to either profit by selling allowances or defer the purchase of allowances, if they are allowed to fulfill any compliance shortfall at a later point in time. This will reduce allowance demand, causing allowance prices to fall. The net result of these self-correcting dynamics is that the trajectory of carbon prices over time is smoother than it otherwise would be (see Figure 5.1).

Under certain circumstances, however, allowing temporal flexibility will be insufficient to address volatility and may even exacerbate it if entities are simultaneously allowed banking or borrowing across the system. Other market management interventions may be needed to ensure price predictability

FIGURE 5.1 **Stylized Model of Banking in an ETS over Time**




*Author:* ICAP.

90 Kling and Rubin (1997) state that banking will lead to cost reduction and, 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 ETS with and without banking. Their analysis shows that allowing participants to bank allowances significantly lowers expected costs.

91 Fell, MacKenzie, and Pizer (2012). Conversely, temporal 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 overcomply and save allowances for later use, when caps will be stricter and probably higher (Dinan and Orszag, 2008; Murray et al., 2009). Fell et al. (2012) also find that allowing temporal flexibility in the form of banking could entail significant cost savings, by incorporating some of the benefits of tax policy—allowing quantity to adjust on a short-term basis.

and provide cost containment in the context of longer-term, system-wide market conditions (see Step 6).

### 1.3 Long- versus short-term impact of GHGs

A further benefit of allowing for some extent of temporal flexibility is that, in many cases, this comes without a significant detrimental effect on environmental performance. In particular, the long-term warming impact of $CO_2$ (the most important GHG) is primarily determined by the cumulative amount emitted; it is relatively insensitive to the emissions pathway in the short term.[92] While delaying abatement by decades would increase temperatures and hence increase climate damages, an increase in emissions now in exchange for fewer emissions in the next few years (or vice versa) will have a negligible impact on the resulting level of climate change.

This is not true for all GHGs, however. Whereas the damage done by $CO_2$ emissions is determined by their cumulative concentration, annual emissions of shorter-lived GHGs, such as methane and aerosols, do have an impact on the speed of warming.[93] Thus, the timing of these emissions even in the short term can be important in determining temperature changes and climate impacts.

## 2. Types of Temporal Flexibility

Given these advantages, almost all ETSs provide some forms of temporal flexibility. Three main mechanisms are available to policy makers:

- Whether to allow entities to explicitly (or implicitly) "borrow" allowances from future compliance periods for surrender within the current compliance period, allowing them to postpone emissions abatement;
- Whether to allow entities to "bank" allowances issued in one compliance period for use in a subsequent compliance period; and

Choosing the length of the compliance period (as within a compliance period there is, ordinarily, considerable flexibility regarding when emissions and abatement activity take place).  In theory, with complete banking and borrowing, and perfect information over long-term emissions limits, a cost-effective abatement pathway emerges where carbon prices increase at a rate of return (e.g., the interest rate) associated with assets that have a similar risk profile.[94] In the case of declining caps, this should produce a more gradually rising price path, compared to a situation with no banking or borrowing. In theory, this provides a clear investment framework where emissions reductions are met at least cost.

However, despite the theoretical attractions of temporal flexibility, for each of these mechanisms, providing complete flexibility also has important disadvantages. In particular, private actors will perceive policy uncertainty and risks as higher, and face a higher cost of capital than society as whole. This will shorten private planning horizons and create incentives to delay abatement more than is desirable from a social perspective. This makes borrowing particularly problematic. This section discusses both the advantages and drawbacks of temporal flexibility in relation to each of the three options noted above. The approach taken by existing ETSs to each of these issues is shown in Table 5.1.

### 2.1 Borrowing between compliance periods

Borrowing allows entities to use allowances they will receive in future compliance periods within the current compliance period. Entities are allowed to emit more today while promising to surrender an equal or greater number of allowances later.

Consistent with the general discussion on providing temporal flexibility identified in section 1, borrowing, in principle, offers a number of advantages. It 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 provide market liquidity in times when allowances might be scarce and prices high.

However, borrowing, in particular, illustrates some of the challenges associated with providing temporal flexibility. As noted above, in the real world, private actors are likely to face incentives to delay costs and behave in a more short-sighted manner relative to the social optimum. In addition, four challenges associated with allowing entities to borrow allowances are: [95]

- **Governments may not be able to assess creditworthiness:** The government may not be well-equipped to assess

92 Allen et al. (2009); Matthews et al. (2009); Zickfeld et al. (2009).
93 Shindell et al. (2012); Shoemaker et al. (2013).

94 If allowances were expected to appreciate faster than other comparable investments, this would create an investment or "arbitrage" opportunity that rational market actors would presumably want to take advantage of by buying and banking allowances for the future. Conversely, if emissions allowances were expected to appreciate more slowly than comparable investments, there should be an incentive to use more of those allowances now rather than holding on to them for later use.
95 Fankhauser and Hepburn (2010); Vivid Economics (2009).

TABLE 5.1 **Temporal Flexibility Provisions in Existing ETSs**

| ETS | Length of commitment period/ Phases | Compliance periods | Banking | Borrowing |
|---|---|---|---|---|
| EU ETS | 2005–07<br>2008–12<br>2013–20<br>2021–30 | Annual | Unlimited banking since 2008 | No (beyond partial 1-year early access)[a] |
| New Zealand | 1-year period | Annual[b] | Unlimited[c] | No |
| RGGI | 2009–11<br>2012–14<br>2015–17 | Three years, aligns with phases | Unlimited[d] | No |
| Tokyo (Japan) | 2010–14<br>2015–19 | Five years, aligns with phases | Unlimited across two phases but not multiple phases[e] | No |
| Waxman-Markey (proposed U.S. Federal)[f] | 1-year period | Annual | Unlimited | Unlimited one year; limited up to five years, with interest[g] |
| California | 2013–14<br>2015–17<br>2018–20 | Aligns with phases + 30 percent annual surrender[h] | Unlimited, with emitter subject to a general holding limit | Limited:<br>▲ In the case of true-up of product-based allocation to match actual production from the previous year<br>▲ In the case of an entity that is new to the program within a compliance period<br>In the case of untimely surrender at a compliance period compliance event, allowed at a 4:1 ratio[i] |
| Kazakhstan | 2013<br>2014–15<br>2016–20 | Annual | Unlimited, beginning in phase 2 | Currently not addressed in the regulation. |
| Québec | 2013–14<br>2015–17<br>2018–20 | Two to three years, aligns with phases | Unlimited, with emitter subject to a general holding limit | No |
| Australia[j] | 1-year period | Annual | Unlimited | < 5 percent of compliance obligation |
| Republic of Korea | 2015–17<br>2018–20<br>2021–25 | Annual | Unlimited | < 10 percent within phases[k] |

*Source:* EDF et al. (2015e); EDF and IETA (2015a); MDDELCC (2014); ICAP (2016e); RGGI (2013); TMG (2012).

*Note:* EU = European Union; RGGI = Regional Greenhouse Gas Initiative.

a It is also technically possible to effectively borrow allowances from a future allocation for one year, in order to meet compliance obligations for the current year. This is because the allocation of allowances takes place in February each year, but the surrender of allowances for the previous year takes place after this date, by the end of April. However, such early access is only permitted within but not across trading periods (i.e., access to phase III allowances for compliance in phase II is not allowed) (EC, 2015b).
b Sector-specific true-up dates in early implementation.
c The NZ ETS allows unlimited banking, except for allowances bought at the price ceiling.
d RGGI states' number of allowances offered at respective auction accounts is lowered if the number of banked allowances rises.
e For example, banking from first to second compliance period is allowed but from first to third it is not.
f The Waxman-Markey Bill proposed a national ETS in the United States. It passed the House of Representatives in 2009 as the American Clean Energy and Security Act of 2009 (H.R. 2454), but never went to a vote in the Senate (U.S. Congress, 2009).
g Unlimited from one year ahead (without interest), up to five years further into the future; is limited to 15 percent of the compliance obligation, and subject to an 8 percent interest rate.
h Every year, units corresponding to at least 30 percent of former year's emissions must be surrendered.
i Borrowing is not allowed except under limited supply scenarios.
j The Australian CPM was repealed in 2014 after a change in government.
k Only within phases, borrowing up to 10 percent of compliance obligation.

the creditworthiness and solvency of firms that borrow allowances. The usual mechanisms, such as the provision of collateral, may be deployed to mitigate this risk, but this adds transaction costs and complexity.

- **Adverse selection of debtor emitters:** The first problem is exacerbated by the fact that the firms that are least solvent are 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.
- **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.[96]
- **Uncertainty over targets:** Depending on the length of the borrowing period, there will be less certainty over whether domestic or international emissions reduction targets will be reached.

In view of these disadvantages, most ETSs have either prevented explicit borrowing, limited it quantitatively (e.g., to 10 percent of compliance within phases in the Republic of Korea), or discouraged it by imposing an exchange rate. The proposed Waxman-Markey bill in the United States had a more sophisticated formulation that established exchange rates for the use of allowances from current versus future compliance periods allocations, depending on how many years into the future allowance vintages were being borrowed from.

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 on which an allowance becomes valid for compliance, see Box 5.1), 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 commitment period. While such mechanisms provide firms with additional flexibility, there is also a risk of a systematic shortfall in abatement if all emitters borrow in this way.

96 Kling and Rubin (1997) found that when firms are given complete freedom to bank and borrow, they produce (and emit) more than is socially optimal in early periods.

BOX 5.1 **TECHNICAL NOTE: Vintaged 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 annual “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 3).

## *2.2 Banking between compliance periods*

Banking explicitly allows covered entities to save unused allowances for use across compliance periods. It enables reductions in emissions today in exchange for increased emissions later.

In line with the general discussion of providing temporal flexibility, allowing banking has a number of advantages. It can facilitate cost-effective abatement by allowing those that wish to abate early the flexibility to do so in preparation 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. Further, if banking is undertaken with respect to GHGs that have shorter-lived warming potential, it can reduce short-term warming pressures, even if longer-term levels of average warming remain unchanged.

However, importantly, and in contrast to borrowing, banking also creates 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.[97]

Given the generally benign effects of banking, the associated rules tend to be more liberal than for borrowing. Policy makers have usually allowed full flexibility on banking across compliance periods within the same commitment period (see Box 5.4 for a recap on the difference between compliance and commitment periods). Across commitment periods, banking has been unlimited in the EU ETS since 2008, and is also

97 Fankhauser and Hepburn (2010).

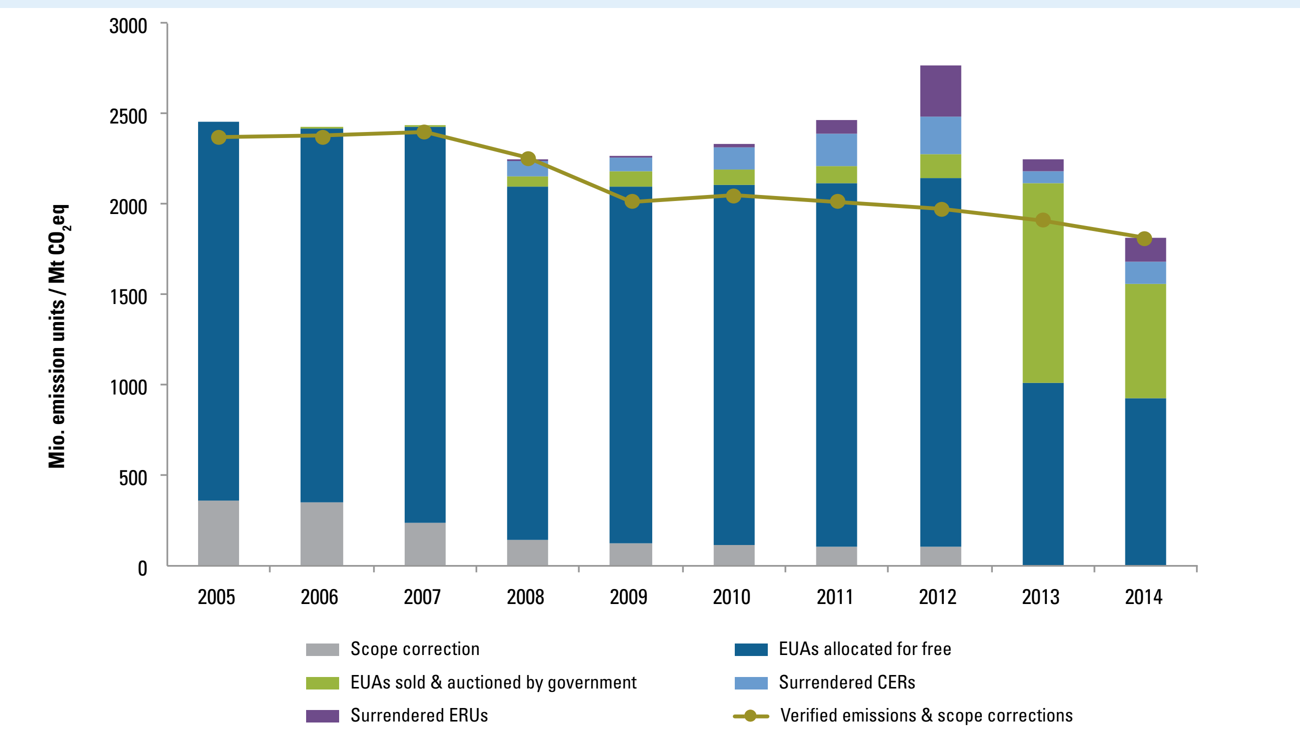
unlimited in the ETS in New Zealand, the Republic of Korea, Québec, California, as well as RGGI, although in some cases it is subject to a general holding limit at the entity level.

However, there can also be disadvantages to banking. For one, unlimited banking can enable excess supply of allowances in one compliance period to be carried over into future compliance periods, potentially perpetuating an underlying imbalance between demand and supply (see also Step 6). Without banking, such an imbalance would be contained within the current compliance period. Also, while allowing banking can often serve to reduce volatility, it can also increase volatility. In particular, banking means that changes in expectations of *future* market conditions can feed back to today's prices, by 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 volatility 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 5.2 describes how this problem arose in the EU ETS.

## BOX 5.2 **CASE STUDY: Banking in Phase II of the EU ETS**

During Phase II 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 III.[a]




*Source:* European Environment Agency (2015).
*Note:* EUA = EU Allowance; ERU = Emission Reduction Unit; CER = Certified Emission Reduction

This experience has emphasized the importance of ensuring market signals are maintained over the longer term. European policy makers have responded by introducing a market stability reserve that aims to maintain a demand-supply balance in order to ensure prices are driven by market fundamentals (See "Step 6").

a Koch et al. (2014); Koch et al. (2015).

In practical terms, there are a number of cases where policy makers have chosen to impose limits on banking:

- **Banking from trial phases:** Prohibiting or limiting banking is a way to isolate a trial phase from the subsequent phase. This creates potential for greater experimentation in the trial phase without necessarily requiring that the allowances from the first phase be recognized as valid in subsequent phases (see Step 10). This approach was adopted in relation to Phase I of the EU ETS. The Chinese pilots have also been designed as experimental markets, with no guarantee that those allowances will have any value once the pilot phases are complete. However, as the EU ETS Phase I experience shows, if there is excess allocation of allowances in the trial phase, prices can quickly fall to zero, as there will be no demand to buy allowances to bank for later use.
- **Delinking from other markets:** Limits on banking may be imposed when an ETS delinks from another or changes its policy on offsets (see Step 4 and Step 9). In 2013 the New Zealand ETS announced that, as of May 31, 2015, international Kyoto units would no longer be accepted for compliance. After this date, firms could no longer use the Kyoto units they had banked.
- **To smooth the transition across commitment periods during which rules for eligibility of allowances may change:** Proposed approaches include limiting the number of banked allowances, requiring banked allowances to be used before a certain time, or establishing a trading ratio that governs how early vintage allowances can be used for compliance in later periods. Establishing an orderly process such that firms do not unexpectedly lose the value of banked allowances if rules change is important to maintain belief in regulators' willingness and ability to ensure a stable framework for investment and trading (see Step 10).[98]
- **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 5.3).

98 The challenges of addressing market transitions in the U.S. $SO_2$ trading program, one of the earliest and most successful examples of the ETS approach, illustrates the importance of this issue for ETS in other contexts (Fraas and Richardson, 2012).

BOX 5.3 **CASE STUDY: Holding and Purchase Limits in California**

The regulations for California's cap-and-trade system impose holding limits and auction purchase limits to prevent participants from acquiring market power.

The regulation limits the number of allowances a market participant can hold at any one time. All covered entities are subject to a purchase limit of 25 percent of allowances sold at auction while for noncovered entities the limit is 4 percent.

The California regulator, ARB, will treat a group of associated entities as a single entity for determining compliance with the purchase and holding limits.

Holding limits are vintage-specific and are set with reference to a "Base" (25MMt $CO_2e$) and the "Annual Allowance Budget," which is equal to the number of allowances issued for the current budget year, as shown in the equation:

**HL(current year) = 0.1∗Base + 0.025∗ (Annual Allowance Budget – Base)**

## 2.3 Length of compliance periods

Another way to provide temporal 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 in some cases commitment periods. However, within a given compliance period, firms can effectively bank or borrow, since they have temporal flexibility for managing emissions and compliance efforts.

Longer compliance periods reduce administrative burdens on regulated entities and also provide the same advantages as those described generally for temporal flexibility. They generate 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 3-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 necessary 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 ensure covered 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. Most existing and proposed ETSs do have some annual compliance requirements. However, except for Kazakhstan, New Zealand, and the Republic of Korea, systems provide flexibility to only comply partially in a given year. ETSs with longer compliance periods include RGGI, California, and Québec, all at three years, and Tokyo, at five years. In addition, in California there is a requirement of partial yearly compliance of at least 30 percent of annual emissions.[99] 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 (see Table 5.1).

BOX 5.4 **TECHNICAL NOTE: Compliance, Reporting, and Commitment Periods**

The length of the *compliance period* establishes the basic time limit for compliance, with longer periods providing greater temporal flexibility for managing emissions and compliance efforts. At the end of each compliance period, covered entities need to surrender the allowances necessary to cover their emissions from that time frame.

The length of the *reporting period* determines at what point entities need to provide information on emissions over a given time frame. This time frame may be shorter than the compliance period.

The compliance period may fall within a longer *commitment period* (called a "phase" or "trading period" in the EU ETS), which is a period that may have its own emissions target, potentially tied to an international commitment or other contribution, and during which allowance allocation and other program features are comparatively fixed. Separate rules may exist for banking and borrowing across compliance versus commitment periods.

## 3. Financial Instruments

Because allowances have a financial value, they can constitute an investment opportunity. As such, in many cases, market participants are not limited to compliance entities, but may also include financial intermediaries in secondary markets. By providing temporal flexibility and holding advance auctions (see Box 5.3), policy makers can facilitate the creation of financial instruments by financial intermediaries that allow entities to better manage the risks associated with fluctuating allowance prices (see Step 6). This can, in turn, improve their ability to take advantage of the flexibility allowed via banking and borrowing.

Four financial instruments (derivatives) that can often be important in carbon markets are detailed in Box 5.5.

99 From ARB's Initial Statement of Reasons, justifying the 3-year compliance period: "A three-year compliance period provides some temporal flexibility by allowing covered 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" (ARB, 2010, II-17). And ARB's justification for partial annual compliance, to address potential adverse selection: "Staff also recognizes that there is a need to require covered entities to submit a portion of its compliance obligation more frequently to ensure they are making progress toward their obligations. Covered 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" (ARB, 2010:II-22).

### BOX 5.5 TECHNICAL NOTE: Financial Products in Secondary Carbon Markets[a]

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:

- **Future contracts** are standardized agreements to buy or sell allowances or offsets in the future at a certain price. A future contract does not necessarily result in physical delivery, but could be satisfied by a payment based on the current market price at the agreed time of maturity.
- **Forward contracts** are similar to futures, but are nonstandardized agreements to buy allowances or offsets in the future for a certain amount. A forward contract usually results in physical delivery or settlement of the underlying asset. There may be details in the forward contract that fit the exact needs of the buyer or seller. As these personalized clauses are not going to be common in the market, these kinds of contracts are 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 particular price at a future date, regardless of the current ("spot") market price at that time.
- **Swaps** are a nonstandardized exchange or series of exchanges (allowances, offsets, cash flows) at a given time or for a set period of time. Common examples are allowance-offset swaps. For example, in some trading systems, a limit has been set on the amount of offsets installations can use for compliance. Since there is often a difference in the price between offsets and allowances themselves, companies that have not yet reached their quota of allowed offsets may sell their allowances and buy offsets, thereby taking advantage of the price difference vis-à-vis companies that may have more offsets than allowances and are already over their quota.

a Kachi and Frerk (2013); Monast et al. (2009); Pew Center on Global Climate Change (2010).

# QUICK QUIZ

## Conceptual Questions

- What are reasons for providing flexibility in the timing of compliance?
- What are the key policy tools for providing temporal flexibility over short, medium, and longer terms?
- What are the main advantages and disadvantages of banking and borrowing respectively?

## Application Questions

- What potential is there to align timeframes for compliance with other administrative processes in your jurisdiction?
- How confident are market actors likely to be in the future of an ETS in your jurisdiction and how can policy design help provide stable signals for investment?

# STEP 6: ADDRESS PRICE PREDICTABILITY AND COST CONTAINMENT

# AT A GLANCE

✓ Establish the rationale for, and risks associated with, market intervention
✓ Choose whether or not to intervene to address low prices, high prices, or both
✓ Choose the appropriate instrument for market intervention
✓ Decide on governance framework

Allowance prices can be volatile as they balance supply, which is largely controlled by policy makers, and demand, which is driven by a complex interaction of economic and firm-level factors.

Price fluctuations are often desirable as they represent the transmission of price signals about abatement costs to market participants. However, what might be considered excessive price variability can occur as a result of exogenous shocks, regulatory uncertainty, and market imperfections. Whether this warrants market intervention by policy makers 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 at least cost 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, unlimited variability may be undesirable as it may deter investment. Policy makers may also wish to contain costs for market participants to ensure political support.

Price variability can be curtailed over the medium-term through a wide variety of market management mechanisms. The governance models for market management that have been implemented and proposed can be characterized in terms of the extent to which they increase *price* certainty (as opposed to the *quantity* certainty that ETSs normally provide) and the extent to which interventions are governed by predetermined rules or are at the discretion of regulatory bodies.

Within this governance framework, policy makers can choose from a menu of interventions that each have their pros and cons, and each likely to be suitable for a particular set of policy objectives and economic context. For any intervention, there is always a risk that it may increase regulatory uncertainty rather than reduce it. This means that any intervention warrants careful design and management to ensure it does not have a counterproductive effect.

This chapter is structured as follows. Section 1 discusses the mechanism of price formation in an ETS. Section 2 sets out the rationale for market intervention and the risks associated with this. Section 3 introduces a series of approaches to managing the allowance market, each along a continuum of the degree to which intervention is based on predetermined rules set by the regulator, and the degree to which the government delegates market oversight to independent institutions.

# 1. Price Formation in ETS

This section explains the ways in which prices are formed in an ETS. Section 1.1 elaborates the key drivers of allowance supply and demand in an ETS. Section 1.2 explains the dynamics of supply-demand balancing in the market and how these dynamics may lead to excessive medium-term price variability, which might run counter to some ETS policy objectives. Section 1.3 introduces the concepts of price *volatility* (short-run variations in allowance prices) and distinguishes it from price *variability* (systemic mid- to long-term price movements).

## 1.1 Supply and demand

Various factors affect the supply and demand of emissions units in an ETS (see Figure 6.1) and, hence, determine allowance prices and how they evolve over time.

### 1.1.1 Supply

The total supply of emissions units depends on:

1. The level of the cap and the associated amount of allowances (allocated freely, through auctions, or through unit reserves) as well as any conditions for the prices at which these are allocated (see Step 2);
2. The availability and cost of offsets (see Step 4);
3. Any supply of allowances and emissions units carried over ("banked") from previous periods or drawn from future periods ("borrowed") (see Step 5); and
4. The availability of units from linked systems (see Step 9).

To a large extent, therefore, supply depends on parameters set by policy makers, be it directly by the level at which the cap is set, or indirectly through the rules set relating to offsets, banking and borrowing, or linking.

### 1.1.2 Demand

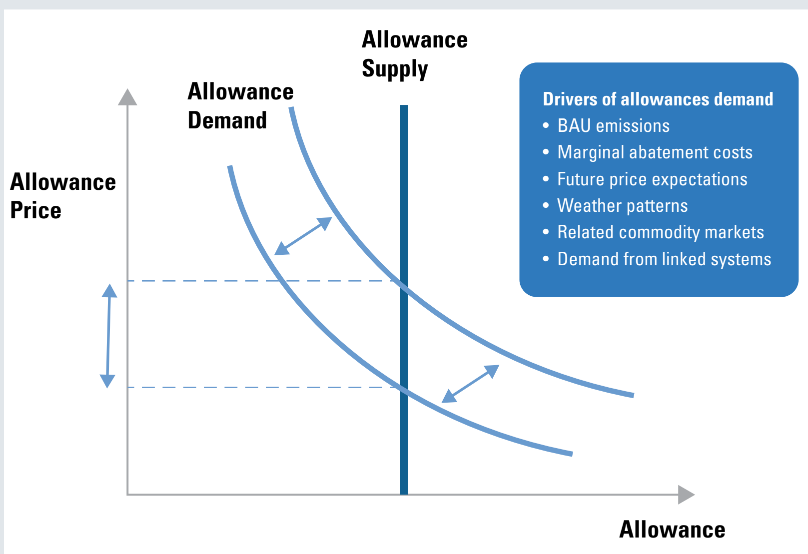
By contrast, the total demand for emissions units in an ETS depends largely on the behavior and characteristics of market participants, and on exogenous shocks unrelated to ETS design features, including:

- The level of emissions under BAU (i.e., no carbon price) relative to the cap;
- The costs of abating emissions within the covered sectors (which are driven by factors such as weather, economic conditions, capital stock, and existing technologies);
- The outcomes of complementary policies (such as renewable energy mandates or fuel economy standards) that reduce emissions within covered sectors;
- Expectations regarding future allowance prices, which determine the demand for banking emissions units for use in future compliance;
- Technological change, including that driven by the expectation of future stringency of the program and future demand for permits; and
- Any external demand for emissions units from linked systems.

## 1.2 Market balancing and the variation of prices over time

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, demand for products will be higher and thus associated emissions will also be higher. This will raise BAU emissions and increase the total amount of abatement necessary to meet a given cap. For a particular set of abatement technologies, holding all else equal, the larger the gap between BAU emissions and the level of the cap, the higher the prices. When the level of BAU emissions is closer to or below the cap, due to a recession or the impact of other

FIGURE 6.1 **ETS Allowance Price Formation**




*Author:* ICAP.
*Note:* BAU = Business As Usual.

6. PRICE STABILITY

policies, prices will be low and, in principle, could even reach zero (particularly if banking is not permitted, see Step 5).

Expectations about the allowance market are also key drivers of price formation. For example, a low interest rate environment will reduce the cost of investing in allowances for the future 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 emissions units associated with current production falls below the number of allowances available in the marketplace (supply), emissions unit prices may still be above zero if there is demand for banking allowances. Expectations of economic and policy conditions also matter because they affect the expected profitability of investments in capital assets and technology R&D that generate returns over a period of time.

While price movements driven by these dynamics reflect the functioning of a market that allows for achieving an efficient abatement pathway, a number of factors can lead to what policy makers may consider "too much" price variability, or otherwise to a need to provide a justification for intervention. Three factors, in particular, may be important:

- **Exogenous shocks:** Significant changes in economic output, and the associated level of emissions, can lead to large and lasting changes in prices. For instance, the financial crisis and subsequent recession was one of the key drivers explaining why allowance prices in the EU ETS fell from more than €20 in 2008 to less than €5 in 2013.
- **Regulatory uncertainty:** Governments will always retain the legitimate ability to change certain key parameters of an ETS or adjust the policy mix that the ETS is a part of. These changes, or anticipation of these changes, can also lead to considerable price changes, as well as uncertainty, which increase the risks of investments in abatement. For example, policy deliberations over postponing ("backloading") the auction of allowances to temporarily tighten the EU ETS's cap led to considerable price movements during the third phase of the program and may have increased the perceived risk from banking allowances.[100]
- **Market imperfections:**[101] A variety of market imperfections may lead to prices being "too" high or "too" low, or otherwise not reflecting all relevant considerations. For instance, ordinarily a low allowance price would be expected to lead to an increase in demand as participants seek to bank allowances now, which they could use for compliance purposes at a later date. This would lead to prices partly self-correcting. However, if market participants have systematically higher discount rates than socially optimum 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. These problems will be aggravated in the event of significant regulatory uncertainty, which could mean market participants are legitimately uncertain about the long-term value of allowances.

Regulated entities can manage price volatility in various ways. Temporal flexibility, regular auctions, offsets and linkage, and derivative trading provide them with ways to smoothen price fluctuations, to the extent that they are part of the ETS design. Opening trade in emissions units to entities that are not obliged to surrender units is important for creating the possibility to manage volatility, as it gives rise to a secondary market with the necessary financial instruments for entities to manage price volatility.

### 1.3 Price volatility and price variability

In some cases, the factors described above will create short-run variation in allowance prices, referred to as price *volatility*. Some of the features embedded in the overall market design—temporal flexibility, regular auctions, broader scope, including offsets and linkage—provide regulated entities with a way to smoothen short-run price fluctuations. In general, any remaining price volatility is unlikely to be a serious concern for policy makers. If the regulatory environment allows for it, market actors have tools to effectively manage volatility in allowance prices via private financial market instruments—options, futures, and other derivatives (see Box 5.5 in Step 5)—just as these tools are used to hedge risks and handle volatility in oil and other commodity markets. Managing the exposure of market actors to price volatility is also one of the key rationales for opening the allowance market to entities other than regulated entities, and creating an enabling framework for a secondary allowance market that can provide the necessary financial instruments.

In other cases, impacts are more persistent and have systemic effects on the market over the medium and longer terms. This is captured by the concept of price *variability*: a divergence between expected and actual prices that persists over the medium to long term. For example, a rapid expansion of economic growth and emissions could cause prices to remain unexpectedly high for a decade. 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-term price changes

100 Koch et al. (2015).
101 Based on a discussion in Neuhoff et al. (2015).

with derivative instruments, which are typically expensive—or not even available—much longer than a year ahead. Similarly, banking of allowances or purchases of future vintages may not be sufficient to buffer a large and persistent unanticipated price rise—and could potentially exacerbate a sustained price decline.

# 2. Market Intervention: Rationale and Risks

The three factors discussed in section 1.2 above—exogenous shocks, regulatory uncertainty, and market imperfections—may provide a justification for market intervention to address relatively persistent, medium- and longer-term price variability. In making this assessment, policy makers will need to take into account what the objectives of the ETS are (see section 2.1) as well as whether the benefits of intervention exceed its risks (see section 2.2).

## 2.1 Common objectives of an ETS

The objectives of an ETS will have a significant bearing on whether or not market intervention should be considered. For example, while low prices are sometimes seen as a reason for concern, they need not be if the objective of an ETS is to attain emissions targets at least cost; in that case, low prices may simply reflect that it is easier than expected to achieve the goal.[102] Low prices may also provide an opportunity and a rationale to increase ambition and make the cap more stringent in the future, as discussed below. Too high prices, by contrast, may be reason for concern, as these may jeopardize the political viability of the ETS.

More generally, the responsiveness of allowance prices to economic conditions may be considered an advantage of an ETS. Because underlying economic activity is a main driver of energy demand and thus emissions, allowance prices tend to be lower during economic recessions and higher during periods of economic growth; this feature may help stimulate economic recovery and maintain political support for an ETS during downturns, while spurring greater emissions reductions during periods of robust growth.

However, policy makers may have other objectives that could justify intervention to limit price variability. Two of the most important are:

- **Providing a predictable climate for investment.** If the objective is to achieve *long-term* decarbonization at least cost and drive structural transformation (see the chapter "Before You Begin") price variability may lead to socially suboptimal investments.[103] Uncertainty generally leads firms to take a "wait and see" approach and delay any long-term investments in low-carbon technology (see also the related discussion on time frames for compliance in Step 5).[104] This provides a rationale for price stabilization measures such as a price floor.
- **Containing costs.** Prices that are too high can undermine the political viability of an ETS, providing a rationale for setting an upper bound on prices. This can help reassure market participants that the ETS is not going to impose costs perceived as excessive.

These goals have been prominent around the implementation of ETS across jurisdictions. Prior to ETS implementation, concerns have typically focused on the possibility of high prices and the options to contain costs. For the ETSs already in operation, however, low prices have turned out to be a bigger concern: it is hard to know in advance how difficult it will be to achieve a specific cap. Persistently low prices may reveal that actual mitigation is much less costly than expected. As a result, policy makers may want some mechanism to increase the ambition of their program over the medium-term, especially if they determine that a high price is desirable to create greater incentives for the adoption of low-carbon technologies, to better reflect and internalize an estimated social cost of carbon,[105] or to meet political objectives.

Over the longer term, policy makers can directly adjust the level of the cap. Questions about the right long-term level of the cap, how often and in what way this should be revisited, and whether this should be made contingent on changing economic conditions, are covered in Step 2 and Step 10.



102 Stavins (2012) discusses the meaning of low prices in an ETS. He argues that low prices do not necessarily reflect a failure within the system. In the case of RGGI, observed low prices are due to the economic downturn combined with the recent developments in the gas sector.

103 See Wood and Jotzo (2011). Dixit and Pindyck (1994) lay the framework to understand how the combination of uncertainty and irreversible investments make firms more cautious in their investment decisions.

104 Martin et al. (2011) find a correlation between the expectation firms hold about the future stringency of the cap and low-carbon innovation, which is robust when including a broad range of control variables.

105 See Grosjean et al. (2014). If the policy maker's primary objective is to establish a specific price (such as an estimated social cost of carbon), a carbon tax may be a more suitable policy instrument (see the discussion of prices vs. quantities in "Before You Begin").

## *2.2 Risks of market interference*

While the discussion above may provide a rationale for intervention to constrain price variability, this needs to be balanced against the possibility that interference in the market may create distortions. The self-regulating responsiveness of the market enables cost-effective abatement to be allocated across the economy and over time. This mechanism may be jeopardized by distortions as a result of unintended effects of policy intervention.

In particular, there is a risk that a further layer of policy intervention and the associated regulatory uncertainty as to how the policy may operate or how the rules might change in the future, could exacerbate rather than alleviate price volatility.[106]

The extent to which price stabilization measures compound regulatory uncertainty may be limited if the measures are well designed and operate in a predictable manner. At a minimum, they should be transparent, have a long time horizon, and have a clear and targeted remit. To the extent that they obviate the need for additional future regulatory changes to achieve policy objectives, they may reduce regulatory uncertainty compared to a counterfactual scenario.

# 3. Managing the Allowance Market

Several policy options are available for managing the allowance market to reduce price variability. These options can be mapped onto the two-dimensional ETS governance space depicted in Figure 6.2, following Grosjean et al. (2014):[107]

- The **horizontal dimension** represents the extent to which an option leads to more price certainty as compared to the classic ETS that provides quantity certainty (see Box 6.1 for a recap of price and quantity certainty in ETS). At either end of the price versus quantity certainty spectrum lie a pure cap-and-trade system (left) and a carbon tax (right). In-between these two extremes, there is a wide range of hybrid schemes such as "hard" and "soft'' price collars.
- The **vertical dimension** represents the extent to which governance of the ETS is delegated away from the jurisdictional government. In a classic ETS, there is no delegation of governance: the government (legislator) implements changes directly through a normal legislative act. Moving down on the continuum of delegation and away from quantity certainty, adjustment rules are introduced. Such rule-based mechanisms are typically predetermined allowance supply adjustments that provide transparency to market participants with respect to potential intervention. The rules can be based on specific triggers (e.g., a minimum price at auction) or a mathematical formula (e.g., linked to trend deviations of economic variables or deployment of renewable energy) to adjust the allowance supply. The rules can be managed by the jurisdictional government or by an independent agency with a predefined mandate. Finally, at the end of the delegation continuum, the government relinquishes most governance decisions to an independent body managing the ETS market. This may imply transferring the control over the cap and/or price to this independent institution. Its legislative basis would clarify its objectives, such as minimizing the cost of achieving a specific emissions reduction target. However, this independent institution would have discretionary power to choose instruments and timing for intervention. This institutional setup is derived from the classical mandate of independent central banks, which enjoy significant discretion over money supply while they are guided by core targets such as price stability, set by government. Historically, this setup was implemented to constrain policy makers and strengthen the long-term credibility of monetary policy.

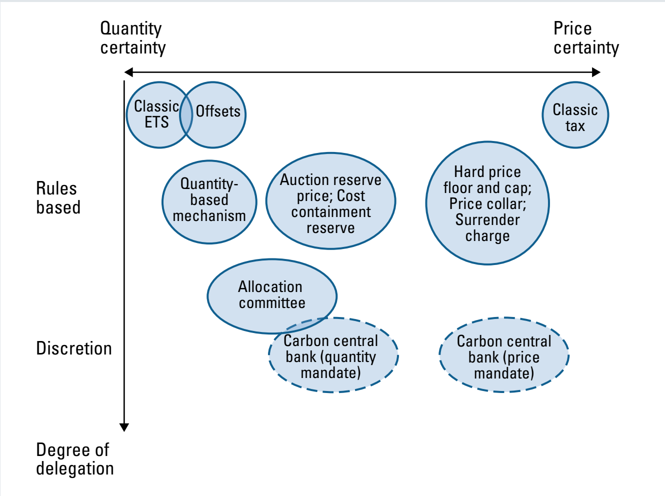
Examples of interventions in this governance space are discussed below. The interventions are:

- Seeking to maintain or increase prices when they reach a low threshold by setting a reserve price at auction (see section 3.1.1), committing to purchase an unlimited or limited number of permits from the market to support prices (hard or soft price floor, section 3.1.2), or imposing a top-up fee or surrender charge (see section 3.1.3);
- Seeking to maintain or lower prices when they reach a high threshold by adjusting limits on use of offsets (see section 3.2.1), selling a limited number of allowances at preset prices from an allowance reserve (see section 3.2.2), or a hard price cap (see section 3.2.3);
- Setting a price corridor as a combination of interventions when prices are both low and high (see section 3.3);
- Deploying a quantity-based mechanism such as a reserve that retains and releases allowances but does not target a specific price range (see section 3.4); and
- Delegating market oversight to a an independent entity (see section 3.5).

106 For a discussion of this issue with regard to recent experience in the EU, see Koch et al. (2015).

107 The ETS governance space is an adaptation of the EU ETS Reform Space in Grosjean et al. (2014).

FIGURE 6.2 **Different Types of Price Predictability and Cost Containment Measures**

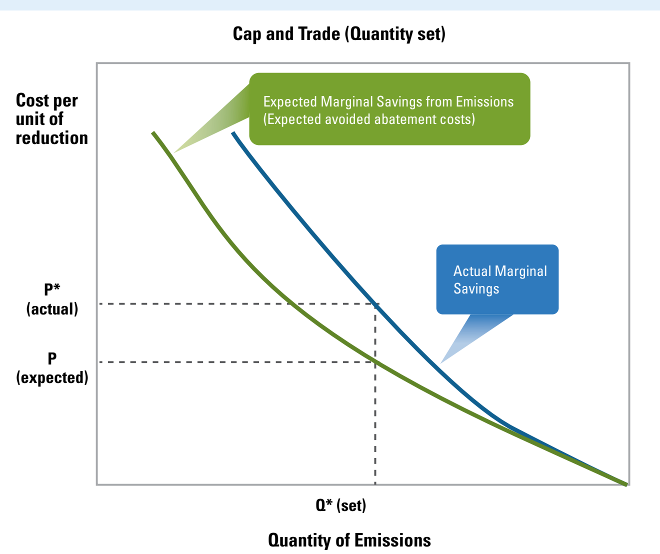



*Source:* Based on Grosjean et al., 2014.

*Note:* A circle with a solid line denotes a governance model that has already been implemented. A dashed circle denotes a governance model that has been proposed but not yet been implemented.

BOX 6.1 **TECHNICAL NOTE: Recap of Price and Quantity Control**

Price and quantity in an ETS are intimately connected. By setting a certain quantity reduction, some certainty about how much that reduction will cost is sacrificed. This is illustrated in the figure below. Under a quantity restriction (a cap), if marginal savings from emissions (i.e., avoided abatement costs) are higher than expected, the market price for GHGs will be higher than expected.




By contrast (but not shown), in a situation in which there are higher-than-expected marginal savings from emissions (i.e., higher avoided abatement costs) when a carbon tax is set, the adjustment will be in the form of fewer emissions reductions than expected.

## 3.1 Responding to low prices

Policy makers can choose between a variety of interventions to address low prices. Three of the main options are: seeking to maintain or increase prices when they reach a low threshold by setting a reserve price at auction (see section 3.1.1); committing to purchase an unlimited or limited number of permits from the market to support prices (hard or soft price floor, section 3.1.2); or imposing a top-up fee or surrender charge (see section 3.1.3).

### 3.1.1 Reserve price at allowance auctions

One option for market intervention is to set a minimum reserve price at allowance auctions. While this sets a minimum price for allowances purchased at auction, it does not necessarily establish a hard, or absolute, floor on the market price. Prices in the secondary market could temporarily fall below the auction reserve price. It therefore sits to the left of hard price floors in the governance space in Figure 6.2.

A price floor at auction is a rule-based delegation, as rules are required to set the reserve price and to reintroduce allowances that are not initially sold. If allowances are simply placed in a reserve and are to be auctioned in future periods, the mechanism is cap-neutral. However, if unsold allowances are at some point permanently retired, then the instrument can play a role in tightening the cap.

In the California auctions, any allowances that are not sold at auction are returned to the Auction Holding Account. These unsold allowances are not reintroduced to auction unless prices are above the floor for two consecutive auctions. At the same time, California requires that the volume of these reintroduced allowances not exceed 25 percent of the total volume offered in a given auction. This is an approach to temporarily tighten the cap in response to an early period of low prices. It has a similar impact as if the market banked the units directly.

### 3.1.2 Hard or soft price floor for allowances

Establishing a hard price floor, another example of rule-based delegation, requires additional mechanisms to ensure that prices in the market cannot drop below a certain level. To this end, the government may commit to buy back as many allowances as needed at a predetermined price. This provides more price certainty than a reserve price at auction and the intervention is therefore located further to the right in the governance space. However, market forces will determine the level of the price when it moves above the price floor, so as an intervention it is to the left of a carbon tax.

This approach could potentially be quite costly to the government and is therefore not a common feature of ETSs established to date. Under the Beijing pilot program, if the price is lower than 20 yuan per tonne for 10 consecutive days, the government will buy from the market at a fixed price. Shenzhen, Shanghai, Tianjin, Hubei, and Guangdong have similar policies, but without specific operational guidelines.

### *3.1.3 Top-up fee or surrender charge*

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 as a way to raise the cost of using offsets in cases where these are available at prices below the price floor set for allowances.

Under a surrender charge, emitters are required to pay the government a top-up fee 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 tonne of emissions is maintained for ETS participants. In this way, it can deliver a high degree of price certainty, which is reflected by its position on the right-hand side of the governance space. 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 below).

This mechanism has been implemented in the UK power sector (see Box 6.2), 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.

Australia's ETS was designed to include a price floor, as part of a gradually widening price collar. To implement the price floor, the ETS included a minimum auction price domestically and a surrender charge on imports of foreign offset credits that would have presumably entered the market at an even lower price. How to implement this surrender charge raised a number of technical challenges, given the expectation that it would respond quickly to changes in the CER price.[108] When Australia entered into linking negotiations with the EU ETS, it agreed to abandon its price floor as part of the EU's conditions, as this would have decreased its demand for EU allowances (see Step 9).

108 See Australia Department of Climate Change and Energy Efficiency (2011) and Hepburn et al. (2012).

BOX 6.2 **CASE STUDY: Carbon Price Floor to Foster Investment in the UK**

On April 1, 2013, the UK unilaterally introduced a carbon price floor (CPF).[a] The CPF is an attempt to "reduce revenue uncertainty and improve the economics for investment in low-carbon generation."[b] The price floor is achieved by the implementation of Carbon Price Support (CPS), a 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 being an auction price floor, 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. Policy makers intend for the price floor to encourage investment in low-carbon technology by sending a more certain price signal to investors. Entities are regulated at the point where gas passes through the meter or, in the case of LPG, coal, and other solid fossil fuels, at the point of delivery at generating stations.

The CPF is made up of the price of EUAs from the EU ETS and the CPS rate per $tCO_2e$, which is the UK-only additional $tCO_2$ emitted in the power sector. The CPS rates are fixed annually, with the original CPF trajectory to reach £30/$tCO_2$ in 2009 prices by 2020. HM Revenue and Customs expected that the CPF would support £30–40 billion of new investment in low-carbon technology.

The CPS was designed to start at £4.94 per tonne and expected to increase to £7.28 per tonne in 2014–15 and to £9.86 per tonne in 2015–16. The actual value of the CPS would depend on the gaps 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 tonne, in 2009 prices. HM Revenue and Customs expected that this would support £30–40 billion of new in investment in low-carbon technology. On March 19, 2014, however, it was announced that the CPS (the UK-only element of the CPF) rate would not exceed £18 per tonne of carbon dioxide from 2016–17 to 2019–20, even if that means falling short of a target price of £30 per tonne by 2020. The freeze in CPS rates was a result of 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 units for other states in the EU ETS and those in the UK. This led to a concern that the CPS might be damaging the competitiveness of UK industry and leading to undue increases in household energy bills.

a Brauneis et al. (2013); HM Revenue & Customs (2015); HM Revenue & Customs (2014a); HM Treasury and HM Customs (2011).
b HM Treasury and HM Customs (2011)).

## 3.2 Responding to high prices

To tackle undesirably high prices, policy makers can seek to maintain or lower prices when they reach a high threshold by adjusting limits on the use of offsets (see section 3.2.1), selling a limited number of allowances at preset prices from an allowance reserve (see section 3.2.2), or setting a hard price cap (see section 3.2.3).

### 3.2.1 Cost management through limits on offsets

The relaxation of offset limits (by quantity or category of offsets) or the introduction of additional offset volumes held in reserve can increase the supply of units to help contain costs in response to high prices (see Step 4). As such, in the governance space in Figure 6.2, it sits slightly to the right of the classic ETS. An advantage of this approach is that, as long as offsets represent real reductions, it can contain costs without increasing emissions, as would be the case when policy makers simply release additional allowances into the market. Certain types of offsets may also provide important co-benefits, as discussed in Step 4. Offset limits could also be tightened as a way to bolster low prices. However, under certain conditions, adjustments to offset limits may have little impact on prices. For example, increasing the offset limits will have no impact on price if offset supply is not sufficient to meet current potential demand.

The option to relax offset limits to contain prices has been instituted in the Republic of Korea ETS and RGGI. Under the former, the Allocation Committee can change the offset limits at its discretion (see Box 6.6). During the first and second control periods, RGGI had a provision that if average allowance prices over the first 14 months rose to $7 or $10/ton, the limit on offset use would be relaxed from 3.3 percent to 5 percent and 10 percent respectively. In addition, if average prices rose to $10, entities were allowed to use international offset units, including from the CDM. In the first and second control periods, RGGI prices never reached these levels, so these provisions were never activated and, more generally, there was never any demand for offsets. After the revisions to the RGGI system and the introduction of the Cost Containment Reserve (CCR), the RGGI eliminated the previous provisions for expanded use of offsets. The proposed U.S. Waxman-Markey bill also had a provision to relax the limits on international offsets in the event that prices reached the levels of the allowance reserve, and allowing these units to be tendered through reserve auctions.

### 3.2.2 Cost containment with an allowance reserve

In this approach, an allowance reserve is created from allowances that are initially withheld from distribution and/or put up for auction but remain unsold (e.g., because the auction reserve price is not met). These allowances are part of the overall cap, but are only offered for sale when prices exceed 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 (e.g., 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 than it does over the maximum price, and is therefore located further to the left-hand side of the ETS governance space. Probabilistic modeling can help conduct stress tests and estimate the required size of a reserve to keep prices within certain bounds with a particular level of confidence, given best available information.[109]

In the case of California, a percentage of allowances from the cap is set aside each year in order to stock an Allowance Price Containment Reserve (APCR) (see Box 6.3). 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, which establishes a soft price cap, 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.

While these allowance reserves provide cost containment for the entire market, researchers have suggested that regulators could also (or instead) provide limited and targeted assurance to regulated entities that prices would not exceed a certain level.[110] Borrowing a tool from the finance world, regulators could provide "Allowance Reserve Coupons" to regulated entities, granting the right but not the obligation to buy allowances from a reserve at predetermined prices (i.e., a "call" option; see Box 5.5 in Step 5) and such coupons could be tradable.[111] These coupons could be allocated selectively

109 Golub and Keohane (2012).
110 Grüll and Taschini (2011).
111 Anda et al. (2009).

BOX 6.3 **CASE STUDY: California's Allowance Price Containment Reserve**

The Californian APCR is an example of a rule-based mechanism that allows for access to higher-priced allowances. These allowances are available for purchase at quarterly sales, but likely would not be accessed unless auction or secondary market prices exceeded the price at which the APCR allowances were available.[a]

The APCR is made up of a percentage of the total cap through 2020. Specifically, 1 percent of the first compliance period's budget, 4 percent of the second compliance period's budget, and 7 percent of the third compliance period's budget were allocated to the APCR. Allowances placed in the APCR "lose their vintage," meaning that if the APCR were triggered, all of these allowances would be available to contain costs regardless of which budget they originated from.

Allowances from the APCR may be offered for sale, depending on demand, four times a year, six weeks after each quarterly auction. Allowances in the reserve are divided equally into three price tiers. Price levels at each tier increase by 5 percent plus inflation annually. Prices started in 2013 at $40, $45, and $50 respectively. In 2015 the tiers had increased to $45.20, $50.86, and $56.51. To date, however, these prices have not been reached and so the reserve has not been accessed.

In 2015, in response to stakeholder concerns about the potential exhaustion of the APCR, the regulation was amended so that 10 percent of all remaining past unallocated allowances from each vintage year are eligible to be sold through the APCR sales; and 10 percent of all remaining allowances from each future vintage year are also eligible to be sold during an APCR sale. These allowances will only be made available at the highest-price tier level.

Filling the reserve requires removing allowances from the overall allocated budget. To negate the implied increased stringency of the cap, California simultaneously increased the quantity of offsets that could be used for compliance by 4 percent—to a total of 8 percent of each entity's compliance obligation.

a ARB (2013); ARB (2010a).

or auctioned (as with the "put" options discussed in section 3.1.2) to generate government revenue.

### 3.2.3 Hard price cap

A hard price ceiling sets an absolute limit on the price that entities pay to buy allowances.[112] This requires the regulator to commit to selling as many units as the market will demand at the ceiling price. Such a safety valve or hard price cap approach has the downside that, like a tax, it allows emissions to rise above the level of the cap as long as emissions abatement is costlier than the ceiling price. While it ensures a very high degree of price certainty, total emissions cannot be known ex ante. Therefore, the instrument is located to the right of the ETS governance space. In some cases, including Alberta's Specified Gas Emitters Regulation, entities can pay a penalty or other fee to the government instead of submitting allowances. This is an effective price ceiling, which directly substitutes 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.

## 3.3 Price corridor

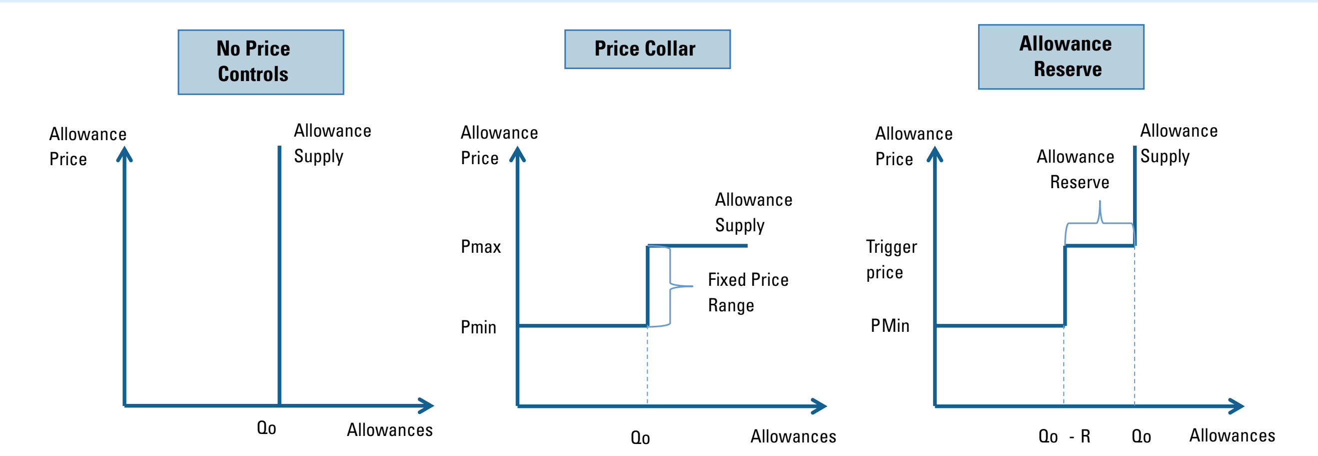
Any of the mechanisms that seek to raise prices when they are low (see section 3.1.1) and that seek to cap prices when they are high (see section 3.2.2) can, in principle, be combined to create a hard or soft price corridor or collar.

Australia's system started with a 3-year fixed price period followed by three years with a price floor and ceiling (corridor). The price *ceiling* was to start at AUD$20 above the international price expected at the beginning of the fixed price period (1 July 2015) and would have risen at 5 percent in real terms annually. The price *floor* was set at AUD $15, rising at 4 percent in real terms annually. The higher growth rate of the ceiling (5 percent) compared to the floor (4 percent) implied that the corridor was set to widen over time. However, as part of the discussions on linking the Australian CPM with the EU ETS, the decision was made to abandon the floor price, although this became moot when the CPM was abolished following a change of government in Australia.

112 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).The latter estimates that with a $50 "trigger" price per tonne of carbon (a hard price ceiling of $50), the expected $3 trillion loss associated with reaching the 1990 level of emissions becomes a $150 billion gain.

BOX 6.4 **TECHNICAL NOTE: Price Ranges Under a Price Collar Versus Allowance Reserve**

The Figure below illustrates the allowance supply curve with a price collar, as compared to a situation where there is no price control and there is an allowance reserve (discussed in 3.2.2). Without price controls, allowance supply is perfectly inelastic and fixed at Qo. With a price collar, supply is perfectly elastic at the minimum price (Pmin), up to point Qo, as the regulator commits to restricting supply at levels that guarantee Pmin. At Pmax, the regulator commits to supply sufficient allowances (as shown by the perfectly elastic supply curve) to maintain that market price. This results in a fixed price range. Similarly, an allowance reserve can restrict supply to guarantee Pmin. However, a reserve by design only has a limited number of allowances and if demand exceeds the size of the reserve (at Qo) after it starts releasing allowances in the market at the trigger price, supply is perfectly inelastic again. As such, it cannot guarantee a maximum price, which is the key difference between a price collar and an allowance reserve.




*Note:* For another helpful iteration of this illustration see Murray et al. (2009).

## 3.4 *Quantity-based mechanism*

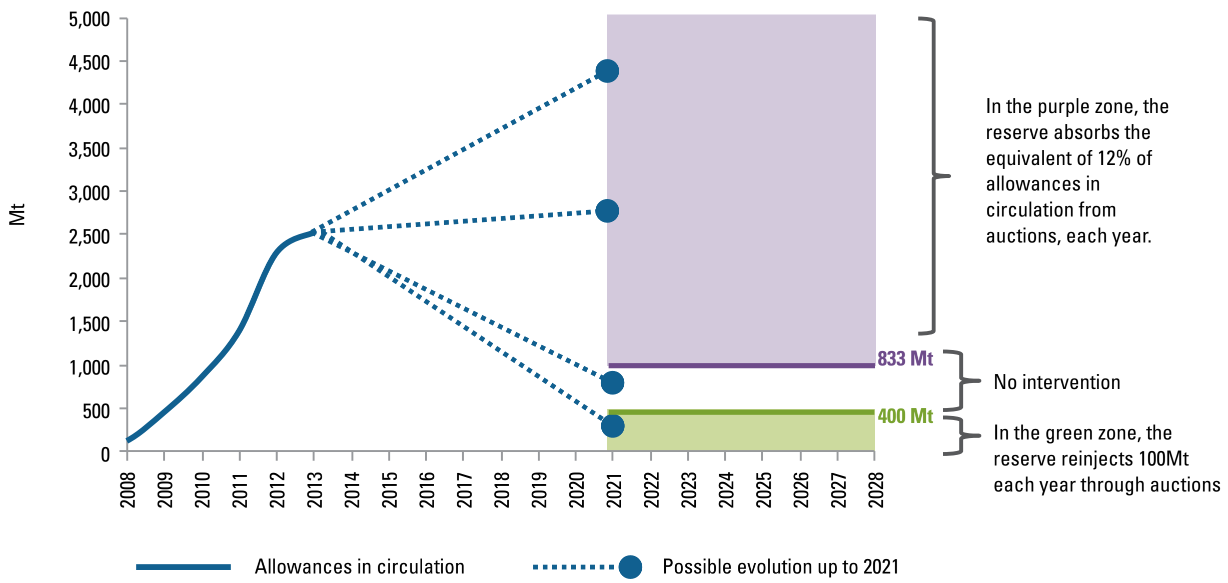
Quantity collars aim to restrict the number of allowances that are in circulation. Given a fixed cap, a quantity-triggered reserve can respond to external shocks by adding or subtracting allowances from a reserve and releasing them into the market, based on predefined triggers, including the quantity of surplus or banked allowances.[113] As such, this type of mechanism is positioned on the left-hand side of the governance space.

The Market Stability Reserve (MSR) under the EU ETS can be characterized as a rule-based approach that is triggered based on the quantity of allowances. The MSR is designed to adjust the annual number of allowances auctioned in the market in certain years, based on predefined rules regarding the level of the allowance surplus (see Box 6.5). The MSR aims to maintain a certain supply-demand balance to keep the carbon price signal at levels necessary to achieve the long-term decarbonization target in a cost-effective manner (European Commission, 2014). The MSR will be implemented in 2018 and be operational from January 1st 2019.



113 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. (2014a) for a review).

BOX 6.5 **CASE STUDY: The EU ETS Market Stability Reserve**




*Source:* Trotignon et al. (2014).

In 2015, EU policy makers adopted the Market Stability Reserve (MSR), which will be established in 2018 and operate from January 1, 2019. The MSR aims to "address the current surplus of allowances," and "improve the system's resilience to major shocks by adjusting the supply of allowances to be auctioned."[a]

The MSR would function by triggering adjustments to annual auction volumes in situations where the total number of allowances in circulation is outside a certain predefined range (see Figure above).[b] Allowances may be removed from auction volumes and added to the MSR if the surplus in the market is larger than a predefined threshold, or removed from the MSR and added to current auction volumes if the surplus is lower than a predefined threshold. Additionally, if the allowance price is over three times the average price of allowances during the two preceding years for six consecutive months, 100 million allowances will be released from the reserve.

The MSR is intended to address the imbalance between allowance supply, which is currently fixed, and demand, which changes with a number of economic and other drivers.[c]

a EC (2015d).
b EC (2014)
c Ibid.

## 3.5 Delegation

Finally, there have been proposals for delegating the management of the allowance market to an independent carbon authority or a carbon central bank; these proposals are positioned on the lower half of the governance space. Examples of this type of delegation and proposed delegation include:

- The United States Congress Lieberman-Warner legislative proposal (S. 2191) suggested the creation of a Carbon Market Efficiency Board. The Board's proposed mandate was to achieve some price level that balanced emissions reductions and economic growth (Manson, 2009).
- The Republic of Korea ETS 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 (see Box 6.6). In a number of predetermined situations, the Allocation Committee is authorized, but not required, to intervene in the market. Similarly, in any of these situations, the Allowance Committee may take a number of actions including but not limited to releasing allowances from a reserve.
- A number of Chinese Pilots have established allocation committees that can directly intervene in the market under certain circumstances.
- Researchers have proposed various models for delegation to independent bodies akin to central banks 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 allowance cap.

### BOX 6.6 CASE STUDY: Price Predictability in the Republic of Korea ETS

The provisions for price predictability in the Republic of Korea ETS combine automatic and discretionary approaches.[a]

There is an allowance reserve, which serves as a mechanism to manage price variability but also provides allowances to new entrants, as well as to firms that have earned early action credits.

In a number of predetermined situations, 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 market price for allowances has been at least three times the 2-year average, for at least six consecutive months;[b]
- The market price for allowances has been at least two times the 2-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 2-year average.

The actions the Committee may take in response to these conditions include:

- Allocate up to 25 percent more allowances from the reserve;
- Set a limit on allowance retention (between 70 and 150 percent of the compliance year's allowances);
- Increase or decrease the limit on borrowing;
- Increase or decrease the limit on offsets; or
- Temporarily set a price ceiling or floor.

a ICAP (2016f).

b This trigger is effectively the same as that used in the EU ETS, as stated in Article 29a of the EU ETS Directive. Specifically, if the allowance price is more than three times the average price of allowances during the two preceding years on the European carbon market, then either member states will be allowed to bring forward auctions or up to 25 percent of the remaining allowances in the New Entrants Reserve can be auctioned.

## 3.6 *Summary of options*

Table 6.1 presents a summary of the pros and cons of the various interventions.

**TABLE 6.1 Pros and Cons of Approaches to Market Management**

| Approach to manage market | Pros | Cons |
|---|---|---|
| Offset limit relaxation/ tightening | Relatively simple to implement, no financial burden for regulator; does not compromise environmental integrity globally (assuming high-quality offsets). | Price bounds not guaranteed; affects emissions limit within capped sector or system (in case of international units); can lead to abrupt price changes if not anticipated. |
| Auction floor price ("reserve price") | Relatively simple to implement; reduces investment uncertainty; ensures positive price and government revenue even if emissions demand below cap; can tighten cap depending on reintroduction of unsold volumes. | Does not guarantee minimum price in market if there is no demand for auctions. |
| Government purchases units from market to maintain floor | Relatively simple to implement; can tighten cap if volumes not reintroduced. | Financial burden to regulator; budget may be insufficient to guarantee price ceiling. |
| Top-up fees | Simple to implement if fee does not fluctuate with price; provides hard floor on carbon price faced by entities subject to fee. | Difficult to implement if fee adjusts with price; inhibits efficiency of system as a whole if implemented only partially. |
| Allowance reserve (soft price cap through limited supply from unit reserve) | Provides greater certainty on prices while limiting uncertainty on emissions (since emissions cannot increase by more than limited amount of units released from reserve); release can fail to increase in emissions if reserve is filled with offsets or external units. | Price ceiling only partially guaranteed; potential incentives for market manipulation. |
| Hard price cap through unlimited supply at fixed price | Guarantees price ceiling for market participants; relatively simple to implement. | Environmental target can be compromised without limit; potential incentives for market manipulation. |
| Regulator offers call/put options with fixed cap | No financial burden for regulator if options fairly auctioned; emissions limit maintained (or cap tightened) if units sold from limited reserve. | Price bounds only partially guaranteed; could introduce added complexity and administrative burden for regulator. |
| Price corridor | Relatively simple to implement; guaranteed price floor and ceiling. | Combined cons of price ceiling and floor. |
| Quantity-based mechanism | Avoids political debates on where the price should be set. | May increase policy complexity and uncertainty. |
| Delegation | Could enhance compatibility of ETS with other energy and climate policies, monitor the interactions with international markets, and allow flexibility to balance ensuring target quantities with allowance prices. | May be politically challenging to implement and lack democratic legitimacy. |

*Source:* Table adapted from Grüll and Taschini, 2011, and Gilbert et al., 2014a.

# QUICK QUIZ

## Conceptual Questions

- What factors determine the supply of and demand for emissions units and corresponding prices?
- What causes uncertainty over prices and what are the consequences?
- What are the rationales for managing low prices, high prices, and other market indicators, and what are some approaches for doing each of these?

## Application Questions

- What are your priorities for ensuring price predictability on the low and/or high ends, and for other goals of market management?
- What approaches might provide sufficient certainty over prices, emissions, and other market indicators?
- Are you considering linking your system in the future, and how might this affect your preferred approaches?

# STEP 7: ENSURE COMPLIANCE AND OVERSIGHT

# AT A GLANCE

- ✓ 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 units

An 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 system ensures emissions covered by the ETS are measured accurately and reported consistently. Effective market oversight can enable the market to run efficiently and promote trust between market participants.

A prerequisite for effective compliance is the identification of all entities regulated by the system, compiled by the regulator based on firms' self-nomination or through its own assessment. This can be made easier by leveraging existing regulatory relationships, but governments will probably also need to develop a specific process to identify new regulated entities, as the population of firms changes over time.

Effective systems for monitoring, reporting and verification (MRV) of emissions and other necessary data (e.g., in the context of allocation approaches such as benchmarking or output-based allocation) are at the heart of ensuring the environmental integrity of an ETS. Different protocols for monitoring emissions have been used in different systems, but default emissions factors are often used to keep costs low while generating an unbiased emissions estimate. Reporting arrangements need to be transparent and can build on existing data collected on energy production, fuel characteristics, energy use patterns, industrial output, and transport. Independent verification of emissions reports is often considered essential to the credibility of an ETS. Further collection, monitoring, reporting, and verification of activity data (e.g., tonnes of clinker or steel produced) allow for cross-checks and provide flexibility to adopt different approaches to allowance allocation. The (typical) importance of independent verification demands that the process for accrediting independent verifiers also be robust. 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. The rigor of the verification process may depend on the existing regulatory culture, although most jurisdictions have favored a more stringent regime, sometimes with a commitment that the government itself covers the verification costs of entities.

Registries—databases that record and monitor the creation, trading, and surrender of all units within a 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 definition 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 emissions units with robust price information. To this end, the registry may provide sufficiently granular data on emissions, allowance allocation and surrender, and compliance while ensuring that appropriate standards of confidentiality and security are maintained.

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 that can be reinforced by public disclosure of ETS performance, a binding system of penalties is still needed.

Finally, regulators also need to provide oversight of both the primary and secondary markets for units. Market regulation determines who can participate, what is traded, where transactions take place, as well as other rules relating to market integrity, volatility, and prevention of 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.

This step considers the requirements and options for regulators to oversee and enforce compliance of regulated entities with ETS requirements. While different options are available depending 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. The chapter is structured around six important elements of designing and implementing an approach to compliance and oversight in an ETS, each elaborated in the following sections:

1. Identifying and Managing Legal;
2. Managing the Reporting Cycle;
3. Managing the Performance of Verifiers;
4. Developing an ETS Registry.
5. Designing an enforcement approach; and
6. Oversight of the market for ETS

# 1. Identifying and Managing Legal Entities

As discussed in Step 1, a wide range of options is available for determining the scope of covered sectors and the points of obligation in an ETS. Decisions on these aspects 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 (section 1.1), assessing the nature of existing or new regulatory relationships with regulated entities (section 1.2), and updating the list of regulated entities over time (section 1.3).

### *1.1 Identifying the regulated legal entities*

There are different approaches to identifying the regulated entities within an ETS. It may be an individual company, a specific production line or process, or a specific plant site (housing several processes and/or companies, see Step 1). Once this decision has been made, 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 alternatively be based on a regulator's own research. Once an approach has been decided, an appropriate list of those entities regulated by the ETS will need to be drawn up.

### *1.2 Leveraging existing relationships with regulated entities*

Regulators often have existing relationships with entities newly regulated under an ETS, which they can build on when setting up the ETS compliance cycle. For example, fossil fuel power stations may have reporting obligations on emissions from sulphur dioxide, nitrous oxide, and other pollutants. These (legal) arrangements may provide a base from which permitting arrangements can be developed as they 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 permits to operate. Other helpful relationships may exist between government statistics services and regulated entities, and/or between government departments and industry associations. But where existing relationships with regulated entities are insufficient to ensure compliance with the ETS, new or expanded rules will become necessary. Depending on the jurisdictional context, such rules may be based on existing powers granted to the ETS regulator, or may necessitate new legislation.

### *1.3 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.

# 2. Managing the Reporting Cycle

An ETS requires effective MRV.[114] *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). As an illustrative example, Figure 7.1 details the EU ETS MRV cycle.

114 For more information on creating programs for the MRV of GHG emissions, please refer to Singh & Bacher (2015).

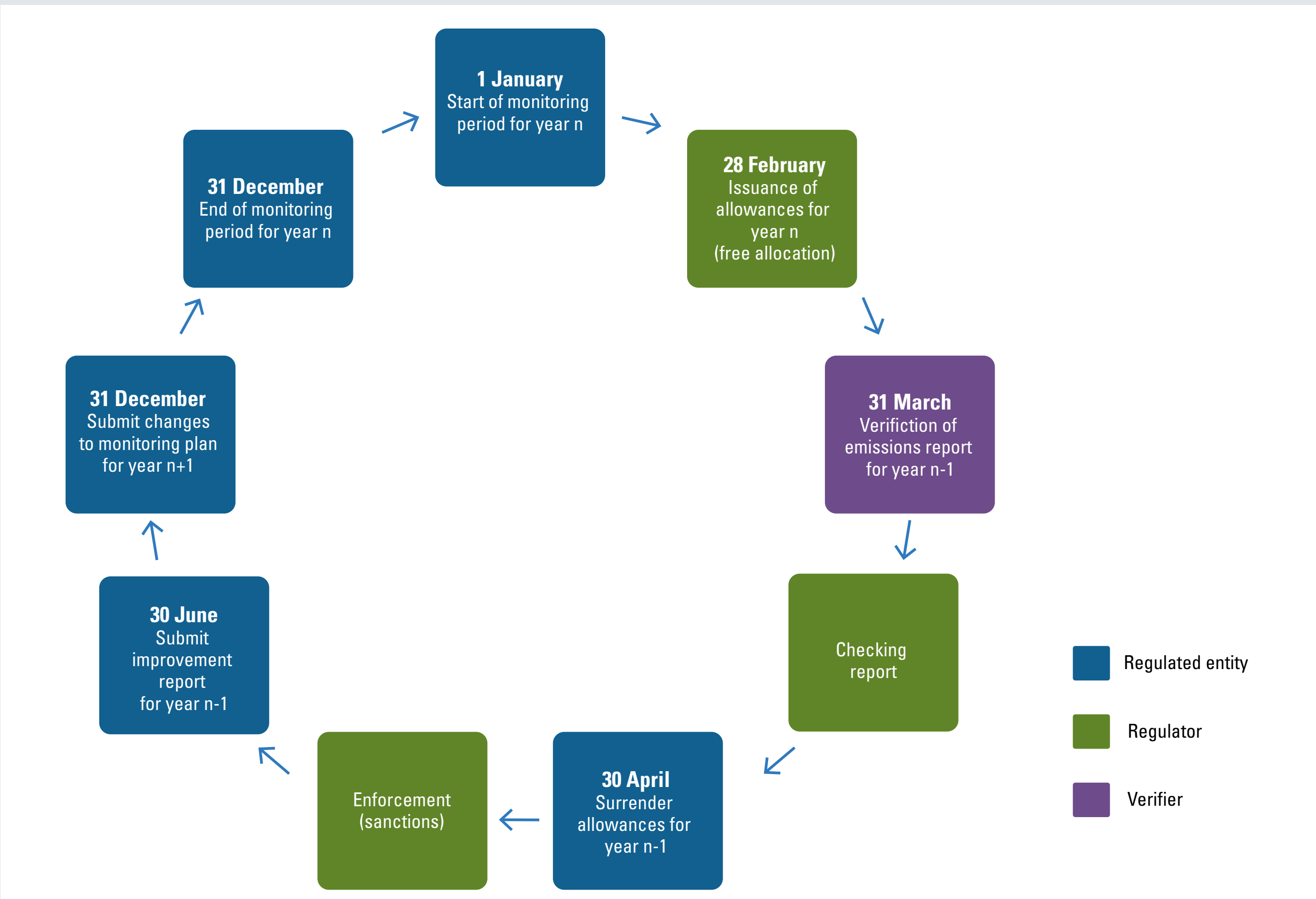
A regulator must provide the following key elements of an MRV system, in line with the relevant legislative regimes in the jurisdiction:

- Methodologies for accounting and quantification of emissions and other necessary data (e.g., in the context of allocation approaches such as benchmarking or output-based allocation);
- Guidance on monitoring methodologies;
- Templates for reports;
- Rules for the use of verifiers; and
- Details on the exchange and management of data.

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 covered entities, for example, by 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[115] can also be used for the MRV requirements under the ETS, lowering compliance costs.

Guidance on establishing monitoring requirements is provided in section 2.1; on establishing reporting requirements in section 2.2; and on establishing verification requirements in section 2.3. Additional procedural considerations are discussed in section 2.4.

FIGURE 7.1 **MRV in the EU ETS**




*Source:* ECRAN (2014).

115 Such as SAP (Systems, Applications, and Products in Data Processing).

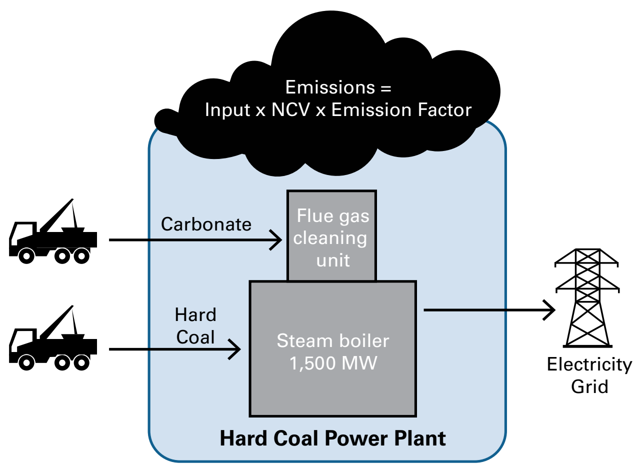
## 2.1 Establishing monitoring requirements

The ETS regulator should define the specific monitoring requirements for all emissions sources included in the scope of the system.

Monitoring guidelines must be available for each sector covered by the ETS. These can draw on a wide library of detailed methodologies, product and activity descriptions, emissions factors, calculation models, and relevant assumptions,[116] although in some cases they will need to be tailored to the specific context of the ETS. Table 7.1 gives a brief overview of the approach to monitoring (and reporting and verification) in countries with established ETSs.

The variety of approaches to monitoring across countries illustrates that different monitoring requirements will work best for different sectors and different GHGs. One approach to monitoring is to prescribe a conservative default method that

**BOX 7.1 TECHNICAL NOTE: Simplified Example of Annual Emissions Monitoring (Calculation) in a Hard Coal Power Plant**




| | Inputs | Heating Value (NVC) | Emissions Factor | Emissions |
|---|---|---|---|---|
| | t | Energy GJ/t | $tCO_2/GJ$ | $tCO_2$ |
| **Hard Coal** | 1,087,387 (truck scale) | 25.5 (sample analysis) | 0.095 (sample analysis) | 2,634,195 |
| **Carbonate** | 10,321 (truck scale) | – | 0.44 (standard factor) | 4,541 |
| **Total** | | | | **2,638,736** |

*Source:* Adapted from BMUB/FutureCamp.

This drawing shows a simplified example of the standard methodology to monitor and calculate combustion emissions from a hard coal fired power plant. Here, emissions are calculated by means of activity data for the inputs coal and carbonate multiplied by emissions factors. As the energy content of coal varies, an adjustment must be made for fuel quantity multiplied by the net calorific value (NCV). The amount of hard coal and carbonate is measured via a truck weigh station; for the major emissions source, the steam boiler, the 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.

116 ICAP (2016g) provides links on its website to monitoring approaches used around the world.

TABLE 7.1 **MRV approaches in existing ETSs**

| | Applicability requirements | Monitoring methodologies | Verification required for | Reporting software/ platform |
|---|---|---|---|---|
| EU ETS | Threshold: capacity threshold for combustion activities: rated thermal input > 20MW. Emissions threshold for aviation, excluding air transport operators that operate flights with annual emissions below 10,000 tCO2.<br>Source categories: Specific source categories irrespective of emissions levels (e.g., production of aluminum, ammonia, and coke, refining and mineral oil).<br>Production capacity threshold: By industry, e.g., manufacture of glass: melting capacity that exceeds 20 t/day. | For $CO_2$: calculation (standard methodology, mass balance), direct measurement, fallback approaches, or combinations of approaches can be used.<br>For $N_2O$, direct measurement is required.<br>A tier system sets requirements for data quality and accuracy. | Emissions Report | Excel templates (European Commission); others by member states, e.g., FMS (Germany) |
| California | Emissions threshold: All facilities with annual emissions ≥ 25,000 t $CO_2$e.<br>Source categories: Some source categories irrespective of emissions levels (e.g., cement production, lime manufacturing, petroleum refineries).<br>Embedded emissions: Suppliers of petroleum products, natural gas and natural gas liquids, and $CO_2$, if annual emissions that would result from consumption of products produced and sold are ≥ 10,000 t $CO_2$e. | Both calculation and measurement may be used with specific tier requirements.<br>Continuous Emissions Monitoring (CEM) is required for certain activities. | Monitoring Plan and Emissions Report | "Cal e-GGRT" |
| Québec | Emissions threshold: All facilities with annual emissions > 10,000 t of $CO_2$e per year. | 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. | Monitoring Plan and Emissions Report (but only for installations with emissions > 25,000 metric tons of $CO_2$e per year) | |
| South Korea | Emissions threshold: On installation level > 25,000 t $CO_2$e per year.<br>On entity level > 125,000 t $CO_2$e per year.<br>Installations with 15,000–25,000 t$CO_2$e per year remain under Target Management Scheme. | Calculation with different uncertainty and data requirements. For some installations, CEM is required. | Monitoring Plan (annual) and Emissions Report | National Greenhouse Gas Management System (NGMS) |
| New Zealand | Energy threshold:<br>Liquid fossil fuels: Owning more than 50,000 liters per year of obligation fuel, to be removed for home consumption or refinery.<br>Stationary energy: Includes importing and mining coal in excess of 2,000 t/year, natural gas in excess of 10,000 liters per year, combusting oil, crude oil, waste oil, and refining petroleum.<br>Source categories: Industrial processes, forestry, and others. | 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.<br>Majority of activities have to use calculation as standard methodology. However, use of CEM is an explicit possibility in the context of "combustion of used oil, waste oil, used tires, or municipal waste." | Emissions Report, but only if participants use a unique emissions factor | |
| RGGI | Capacity threshold: Electricity generators with capacity ≥ 25 MWe | Operators of coal-fired units and units combusting any other type of solid fuels have to use CEM.<br>Operators of gas- and oil-fired units may use alternative methods, calculating emissions via daily fuel records, periodic fuel sampling to identify carbon content in %. | Emissions Report (no Monitoring Plan required) | RGGI uses data reported to the U.S. EPA Clean Air Markets Division database in accordance with state $CO_2$ Budget Trading Program regulations.<br>RGGI COATS |

*continued on next page*

TABLE 7.1 **MRV approaches in existing ETSs** *(continued)*

| | Applicability requirements | Monitoring methodologies | Verification required for | Reporting software/ platform |
|---|---|---|---|---|
| Tokyo | Energy threshold:<br>All facilities with fuel/heat/electricity consumption >1,500 kl ($m^3$)a of crude oil equivalent (COE).<br>Emissions thresholds: For non-energy $CO_2$ as well as other GHGs, all entities with annual emissions ≥ 3,000 $tCO_2e$ and the company has at least 21 employees.<br>Transport capacity threshold: Entities with a certain transport capacity (e.g., at least 300 railroad cars or 200 buses). | Primarily, monitoring is based on calculation using direct measurement of activity data or by using receipts. | Emissions Report<br>(No Monitoring Plan required, but reduction plan) | |

*Author:* ICAP.
a Around 58 TJ or 16 GWh.

is relatively easy to apply (and verify), and then require larger participants to monitor more accurately (see Box 7.1). This tries to seek a balance between a desire to minimize overrewarding those who monitor poorly with a desire not to unnecessarily penalize small sources that may not be able to afford or just lack the capability for more accurate methods. Box 7.2 presents an illustrative example on emissions monitoring requirements for a Lime Kiln included in the EU ETS.

The regulator needs to balance a desire for accurate and robust data while limiting the potential for gaming. Especially in the early phases of an ETS, when time series of consistently monitored and reported data are lacking, the uncertainties about site-specific factors 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 emissions factor calculation, may reduce these risks (see Box 7.3).

## 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 5 for more details on the frequency of compliance requirements), typically providing sufficient time after the end of the compliance period for reports to be prepared. The regulator can design an efficient reporting process by:[117]

- Providing regulated entities with clear guidance on 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);[118]
- Standardizing emissions reports to ensure consistency over time and across reporters;
- Aligning timing of emissions reports with existing business cycles and compliance timeframes; and
- Creating electronic reporting formats to cut down on processing time and transcription errors, e.g., through web-based reporting platforms that can reduce time demands, easily manage large volumes of data, automatically check for errors, and bolster security. [119]

When establishing reporting requirements, it is important to consider the ETS context. Many jurisdictions already collect inputs to the calculations used for emissions reporting, such as energy production, 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 the ETS reporting requirements are practical and effective.

Allowance allocation may require similar or other data than ETS compliance, depending on the form of allowance allocation (see Step 3 for information about the types of allocation and associated data requirements). Besides emission data, many ETSs require the collection, monitoring, reporting, and verification of activity data (e.g., tonnes of clinker or steel produced). Even if these are not needed for allowance allocation initially (for instance, if allowance allocation is done through grandparenting), the collection of these data from the outset

117 Prada (2009).

118 Singh & Bacher (2015).
119 Ibid.

### BOX 7.2 TECHNICAL NOTE: Monitoring Emissions from a Lime Kiln

When Croatia joined the European Union in 2013, GHG emitting installations in the power sector and in industry had to ascertain whether they 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 t of lime. As one of the obligations resulting from Croatia's inclusion in the EU ETS, the operator of the lime kiln had to design a monitoring plan outlining how GHG emissions would be monitored, and that plan had to be approved by the competent authority. At the time, however, the operator of the plant had never been required to monitor and report on greenhouse gas emissions.

For the EU ETS, instructions on how to meet these obligations are laid out in the Monitoring and Reporting Regulation and associated guidance documents. As the operator learned, these specify that monitoring parameters such as activity data and calculation factors have to meet certain quality requirements, so-called "tiers". For cost effectiveness reasons, minimum tiers are based on the amount of greenhouse gases emitted, with less rigorous requirements imposed on smaller emitters. Because the plant emitted between 50,000 and 500,000 $tCO_2$ on average each year, it was considered a medium-sized emitter (a "Category B Installation"), which impacted the chosen monitoring method as described below.

When producing dolomitic lime, CO2 is emitted during the chemical reaction that converts the raw material—dolomitic limestone, consisting of calcium and magnesium carbonate—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 Monitoring and Reporting Regulation, both the process and the combustion emissions have to be monitored and included in an annual emission report.

To determine emissions, the regulation describes 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 book keeping. Another option under the regulation is continuous emission monitoring based on sensor probes that measure $CO_2$ concentrations and volumetric flows in the flue gas stream, but the required investment was considered too costly for the lime manufacturing plant, whose operator opted for the standard calculation method instead.

To determine process emissions, the operator had a choice of focusing either on the quantity of limestone input or the amount of lime output, multiplied with their respective emission factors and a conversion factor reflecting the proportion of unconverted limestone in the final product. The operator chose the second method—basing the calculation of emissions on the output of lime produced—because appropriate metering equipment was already installed. 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 the measurement uncertainty. The operator was able to demonstrate that the requirement for tier 3 (± 2.5% 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 with the emission factor of the fuel type and an oxidation factor indicating the amount of unburnt carbon. Due to the medium size of the installation, the use of standard factors as established by the national inventory was allowed, thereby avoiding the costs for sampling and laboratory analyses.

Although use of default calculation values—meaning a lower tier in terms of data quality—would have been permissible, the operator chose to use laboratory analyses for determining the emission and conversion factors for process emissions. This was easy to implement, as such analyses were already well-established at the plant for the purpose of product quality control.

**Calculating Emissions: An Example**

Under the Monitoring and Reporting Regulation, process emissions are calculated using the following formula:

$$Em = AD * EF * CFF$$

Where *Em* stands for emissions (in t $CO_2$), *AD* for activity data, *EF* for emission factor and *CF* for conversion factor.

Production data showed that the plant had produced 63,875.25 tonnes of lime in 2013. On average, the emission factor was determined to be 0.91 t $CO_2$/t and the conversion factor of dolomitic limestone to dolomitic lime in the plant's kiln was found to be 0.96. Applying the above formula yielded total process emissions of 55,801 $tCO_2$ for 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 t $CO^2$/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 Monitoring and Reporting Regulation sets out the following formula:

$$Em = AD * EF * OF$$

Where *Em* stands for emissions (in t $CO_2$), *AD* for activity data, *EF* for emission factor and *OF* for oxidation factor.

*continued on next page*

BOX 7.2 **TECHNICAL NOTE: Monitoring Emissions from a Lime Kiln** *(continued)*

Activity data of fuels is expressed with 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 emissions stemming from natural gas combusted in the plant were 13,534 $tCO_2$ in 2013. Adding these combustion emissions to the process emissions calculated earlier showed that the plant had altogether emitted 69,335 $tCO_2$ in 2013.

Authors: Mehling and Fallmann.

BOX 7.3 **TECHNICAL NOTE: Default Emissions 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 emissions sources unless a participant prefers to obtain a “Unique Emissions Factor” through direct measurement. Another example is Switzerland where mandatory default factors have to be used for various types of coal. The default factors were assessed in corporation with industry to make sure they reflect actual emission values.

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 emissions 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 through the default factor, entities will not have an incentive 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.

can facilitate a shift to alternative allocation approaches such as benchmarking or output-based allocation in the future.

## *2.3 Establishing verification requirements*

Regulated entities have an incentive to underreport total emissions in order to pay less for compliance, and in some situations also to overreport emissions in order to receive greater allocation of free allowances. Aside from robust monitoring and reporting provisions, it is therefore 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.[120] Quality assurance used by regulators comes in three forms: self-certification, review by program administrators, and third-party verification. These different options are highlighted in Table 7.2.

TABLE 7.2 **Quality Assurance Options**

| Approach | Definition |
|---|---|
| Self-certification | Formal assertion by the reporting entity of the accuracy of regulated entity’s emissions report |
| Review by program administrators | External review undertaken by the program administrator |
| Third-party verification | Reviewed by a qualified third party |

*Source:* Based on table 13 in Singh and Bacher, 2015.

120 IPCC (2000).

Whatever approach is chosen for quality assurance, it 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 all of these quality assurance 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 3 discusses the different options for regulating such verifiers.

Given the complexity and site-specificity of many emissions reports, some jurisdictions (including California, Québec, and the Republic of Korea) extend the need for verification to the monitoring plans that lay down the site- or company-specific methodologies for measuring, calculating, and reporting data, and are subject to approval by the regulatory authority.

### 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 by implementing MRV systems in stages, starting with major emissions 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, and should thus be carefully managed by the regulator. To allow covered entities to adapt to the new regulatory requirements, some jurisdictions (including the Republic of Korea) have used mandatory emissions reporting prior to imposing constraints on emissions. The Republic of Korea established its MRV requirements before the formal launch of the ETS, which facilitated the system's introduction (for more details, see Box 10.1 in Step 10). Early collection of data can also be useful for cap setting and for distributing allowances (see Step 2 and Step 3 respectively).
- **Case-by-case technical decisions.** Where guidance is inconclusive, the regulator will need to make decisions on a case-by-case basis. This process of interpretation and technical decision making can be supported by a technical panel or advisory committee.
- **Managing disclosure of sensitive data.** Much of the data monitored and collected during emissions reporting is considered confidential and commercially valuable by businesses. It is therefore critical for the ETS regulator to guarantee the security of the information provided by the regulated entities so that information flows are not hindered by these concerns. 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.[121] It is important to consult regulated entities on what information will be made publicly available before the system starts (see also Step 8).

## 3. Managing the Performance of Verifiers

As discussed in section 2, MRV in most ETSs require the use of third-party verifiers. This section discusses the process of accrediting third-party verifiers (section 3.1), and balancing risks and costs in the verification process (section 3.2).

### 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 local or accessible international accreditation body.[122] This is useful in providing an independent assessment of the verifier's technical competence in emissions accounting and 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 set by 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).[123]

Regulators may choose to establish guidelines on verification for the verifiers to follow. 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

121 Singh et al. (2015)
122 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."
123 ISO (2006); ISO (2007); ISO (2011).

regulator to carefully monitor and manage their performance, particularly in early stages of the ETS. In the Chinese pilot ETS, for instance, some verification reports are double-checked by experts or other verifiers appointed by the regulators and, in case of poor quality of the verification report, the verifiers will be asked to revise the report. In addition, regulators may stipulate a period of time after which accreditation must be renewed.

### *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 reporting system. This normally requires that the verifier makes use of detailed guidelines and standards specified by the ETS regulator, including checklists and risk registers to establish the levels of compliance with the requirements. On this basis, verifiers must use their own professional judgment to understand the regulated entity's key risks of noncompliance, assess compliance with the program requirements, and conduct 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 a number of options that a regulator might consider if there are concerns that this might create excessive transaction costs, 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 reviews and audits 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.

However, while these approaches 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, as applied in the Chinese ETS pilots, is to maintain the more rigorous procedures but for the government to fund the verification process.[124]

124 SinoCarbon (2014).

## 4. Developing an ETS Registry

Regulators must ensure that covered entities surrender the correct amount of eligible units by the relevant compliance date. To keep track of transactions in the market and the units that have been surrendered, an ETS requires a registry where transfers of units are recorded and monitored. At the end of each compliance period, regulated entities can then transfer (or surrender) units via the registry to the ETS regulator to meet their emissions liability for the period. Section 4.1 discusses the process of setting up a registry. Section 4.2 discusses prevention of fraud.

### *4.1 Setting up a registry*

Registries are IT databases that assign a unique serial number to each unit and track those serial numbers from their issuance onward. This includes information on who has been issued allowances, who holds those allowances as well as other units, and when and from where units are surrendered or canceled. Market participants sign up to the registry and create an account where their units are stored.

Establishing an ETS registry involves the following steps:

- **Creating the legal framework for a registry.**[125] 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 implementing this framework. It must indicate any interactions it may have with other areas of law—such as property, tax and accounting, insolvency, and financial legislation—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[126] and the allocation of responsibilities to all the bodies involved. These responsibilities should be identified and addressed at an early stage to avoid later disputes.
- **Setting up the institutional framework for administering a registry.**[127] 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. It should establish cooperation procedures between

125 For more information on creating the legal framework for registries, please refer to Zaman (2015).

126 It is important to decide on the legal nature of emissions units, 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 Zaman (2015).

127 For more information on creating the institutional framework for registries, please refer to Dinguirard and Brookfield (2015).

the registry administrator and relevant authorities (e.g., market oversight and regulation, justice, etc.)

- **Specifying the functional and technical requirements of a registry.**[128] 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.

## 4.2 Preventing fraud

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. In the event that fraud is discovered, quickly reacting to the events and the appropriate strengthening of systems can help minimize long-lasting damage.

The incidents in the EU ETS, discussed in Box 7.4, highlight both the fraud risks that ETSs are exposed to, as well as the lessons learned from these experiences.

## 4.3 Providing market information

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 allowance markets with robust price information. To this end, the registry may provide sufficiently granular data on emissions, allowance allocation and surrender, and compliance, while ensuring that appropriate standards of confidentiality and security are maintained.

128 For more information on creating the technical infrastructure for registries, please refer to Dinguirard (2015).

### BOX 7.4 CASE STUDY: Fraud and the Evolution of the EU ETS Registry

For the first two phases of the EU ETS, each EU member state had its own registry system, while a Community Independent Transaction Log (CITL) was used for checking and recording transactions of units between accounts. During Phase II, the national registries were also connected to the International Transaction Log, which accounts for the credits under the Kyoto Protocol.

The EU ETS suffered a number of cases of fraud and cyber-attacks against the registry accounts:

- **Phishing**. Phishing refers to 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 bogus e-mail requesting details to access their accounts. In November 2010, there was a similar case involving a cement producer's account in Romania's EU ETS registry.
- **Hacking**. Several million EUAs were stolen from national registries of five member states—Austria, Romania, the Czech Republic, Greece, and Italy—in January 2011. In response, the Commission completely suspended transfers of allowances in all member states until it could verify and improve registry security. The registries progressively reopened and spot trading started again later in 2011. Thanks to early allocation, this did not cause problems regarding compliance for emissions in 2010.

In response to these activities, the EU ETS established an EU-wide registry system in 2012, and the European Union Transaction Log replaced the CITL. A unified registry system, instead of one registry per member state, has made it easier to control transactions and prevent fraud. Some of the specific new registry security measures include:[a]

- **Enhanced control for account opening.** This consists of stronger and harmonized Know-Your-Customer checks;
- **Enhanced transactions security.** Consists of a range of security measures including a 26-hour delay at initiation of a transfer, a trusted account list, and better authentication methods for carrying out transactions.
- **Strengthened registry oversight.** Includes administrator power to suspend registry access and block transfers.
- **Enhanced protection of the good faith acquirer.** Includes serial numbers of allowances that are only accessible by administrators and irrevocability of transfers.

a Kossoy and Guigon (2012).

## 5. Designing an Enforcement Approach

Effective compliance primarily relies on establishing processes that are transparent and well communicated. If information about compliance is easy to understand, accurate, complete, and accessible, 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 8).

However, while well-designed processes will increase compliance rates, full compliance must be assured through a credible enforcement regime with appropriate penalties. The regulator needs to ensure it has the ability to enforce penalties and that, if penalties are not paid or met, it can invoke powers to investigate or prosecute with fines or other civil or criminal sanctions. For example, in New Zealand, the law gives the regulator extensive prosecution provisions for noncompliance that can result in significant financial and criminal sanctions.[129]

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 units 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 that provide fraudulent information or reveal confidential information.[130]

Penalties, which are often used in combination, may include:

- **"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 size of the noncompliance, for example, per tonne of missed emissions. 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 units from 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, and credit records.[131]

Table 7.3 shows details of penalties for noncompliance with unit surrender obligations applied across different jurisdictions, including penalties outside of the ETS in the Chinese pilot systems. 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.

129 New Zealand Environmental Protection Authority (2013).
130 SinoCarbon (2014).
131 Information about penalties outside the ETS in the Chinese pilots is noted in Zhou (2015).

TABLE 7.3 **Penalties for Noncompliance with Surrender Obligations in Existing ETSs**

| ETS System | Jurisdiction |
|---|---|
| European Union | A fine per unit of 100 EUR. The name of the non-compliant entity is also published. For the pilot phase from 2005 to 2007, a reduced fine of 40 EUR is applied. |
| New Zealand | A fine per unit of 30 NZD (19 EUR) and a make-good requirement (surrender or cancel allowances to make up for shortfall). The fee may be reduced by up to 100 percent if participant states voluntarily that it failed to surrender the required allowances or made a mistake in its emissions return before the administering agency sends a penalty notice or the participant is visited by an enforcement officer. |
| Switzerland | A fine per unit of 125 CHF (115 EUR) and a make-good requirement (surrender missing allowances and/or international credits in the following year). |
| RGGI | Penalties for noncompliance are set by each state. |
| Tokyo | The following measures may be taken in two stages:<br>*First stage*: The Governor orders the facility to reduce emissions by the amount of the reduction shortage multiplied by 1.3.<br>*Second stage*: Any facility that fails to carry out the order will be publicly named and subject to penalties (up to 500,000 JPY [3,828 EUR and surcharges (1.3 times the shortfall)] |
| California | Under the Cap-and-Trade Regulation, if an entity fails to surrender sufficient instruments to meet its obligation, California imposes a non-enforcement incentive requirement 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, effectively reducing the cap, and three allowances are recirculated through the auction mechanism. If an entity fails to meet this untimely surrender obligation (i.e., 4 times per metric ton missed), California may institute formal enforcement actions, including seeking penalties as defined by statute. This includes statutory penalty provisions setting forth penalty amounts of 1,000-10,000 USD (921-9,204 EUR) per day per violation (i.e., per metric ton that remained unsurrendered) for strict liability, and increasing amounts depending on the level of intent. |
| Kazakhstan | A fine per unit of 11,156 KZT (30 EUR). In the first year of the system, 2013, penalties for noncompliance with unit surrender requirements were waived. |
| Québec | Companies failing to surrender enough allowances to match their emissions have to surrender the *shortfall plus* a 3 for 1 penalty. Furthermore, depending on the infraction, they can face additional charges varying from 3,000–500,000 CAD (1,988-331,250 EUR) and up to 18 months in jail in the case of a natural person, and 10,000–3,000,000 CAD (6,625-1,987,500 EUR) in the case of a legal person. |
| Beijing | A fine per unit of three to five times the market average allowance price in the previous six months. |
| Guangdong | 10,000 CNY (1,414 EUR) to 50,000 CNY (7,069 EUR). Other sanctions include: two times the shortfall is deducted from next year's allocation and the breach is recorded in the company's credit record. |
| Shanghai | A fine of between 50,000-100,000 CNY (7,069-14,138 EUR). Other sanctions include: the breach is recorded in the company's credit record, suspension of ability to access government funds for energy conservation, emissions reduction measures, energy savings assessments and appraisal scheme for one to three years. |
| Shenzhen | A fine per unit of three times the market average allowance price in previous six months. Other sanctions include: the shortfall is deducted from allowance allocation, the breach is recorded in their credit information management account, government funds discontinued, financial aid is prohibited for five years and the breaches are included in the performance evaluation system for state-owned enterprises. |
| Tianjin | No penalties apply. |
| Hubei | A fine per unit of one to three the times the market allowance price, with a maximum penalty of 150,000 CNY (21,207 EUR). Other sanctions include: two times the shortfall is deducted from next year's allocation, the breach is recorded in the company's credit record, suspend ability to access government funds for energy conservation, emissions reduction measures, and the breach is included in the performance evaluation system for state-owned enterprises. |
| Chongqing | A fine per unit of three times of the market average allowance price in the previous month of the allowance shortfall (draft). Other sanctions include: cancellation of all financial funds granted by the government and prohibition of government financial aid for three years; the breach is included in the performance evaluation system for state-owned enterprises and precludes participation in energy saving, environment protection and climate change mitigation evaluation activities for three years. |
| Republic of Korea | A fine per unit of up to three times the average market allowance price of the given compliance year or 100,000 KRW/tonne (78 EUR).<br>In 2015 and 2016, there is a price ceiling of 10,000 KRW (8 EUR). Therefore, the maximum penalty in this time period would be 30,000 KRW (23 EUR). |

*Author:* ICAP.

*Note:* Information about noncompliance penalties in jurisdictions other than China and New Zealand is from the ICAP website, Introduction to ETS, MRV and Enforcement: https://icapcarbonaction.com/en/about-emissions-trading/mvr-and-enforcement. Information about penalties in China pilots are sourced from Zhou (2015).

## 6. Oversight of the market for ETS units

In addition to monitoring, reporting, and verification of emissions—and the associated surrender of units—the market for units also requires oversight.[132] On the one hand, underregulation and a lack of oversight risks fraud and manipulation; on the other hand, overregulation may lead to spiraling transaction costs and stifle innovation.

The scope of ETS market regulation includes:

- *Who* can participate in the market;
- *Who* is responsible for overseeing the market;
- *What* exactly 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 units) and in the secondary market (i.e., any subsequent transactions of units). The secondary market relates to both trades in the actual units (direct "over the counter" (OTC) trades as well as trades through exchanges) and trades in the derivatives of the units such as contracts for future sales of units.[133] The experiences of existing ETSs also show that these oversight rules should be developed from the beginning of any ETS and that compliance should be rigorously monitored. The VAT fraud challenges experienced in the EU illustrate the risks that need to be managed (see Box 7.5).

As in the case of markets dealing in commodities and financial securities, several measures can be taken by regulators at various levels to minimize the risk of market misconduct, prevent systemic risk, and safeguard against manipulation. These include:[134]

- **OTC vs. exchange trading.**[135] 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 clearing house that becomes the central counterparty to the trade), this is not necessarily the case with OTC trading. Regulators are 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.
- **Reporting and disclosure.** In absence of mandatory clearing or exchange trading, trade repositories or a central limit order book (CLOB) 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 units or derivatives that may be held by a market participant or a group of market participants with

132 See Kachi and Frerk (2013) for a brief summary of key elements of market oversight.
133 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.
134 Kachi & Frerk (2013).
135 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.

### BOX 7.5 CASE STUDY: VAT Fraud in the EU ETS[a]

Until 2010, the EU ETS tax regime treated the transfer of a carbon unit as a service that attracted a value added tax, with the tax collected by the seller.

A number of exchanges offered carbon unit spot products (exchange-traded products with physical settlement by way of delivery of a carbon unit within 1–3 days of the transaction date). These products, along with the "real-time" (i.e., within seconds) transfer and settlement capability of EU Registries, allowed multiple transactions (involving the same carbon units changing hands) to be carried out within a short time span. Criminals exploited this to commit VAT carousel fraud: the acquisition of carbon units 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 €5 billion was lost to VAT carousel fraud between June 2008 and December 2009.

a Adapted from Zaman (2015).

business relationships to prevent the possibility that they seek to distort the market. Position limits can be enforced through transparency at the registry level, the central clearinghouse level, or by an exchange.

- **Participation, registry accounts, and licensing requirements.** Regulators have the option to impose restrictions on who can open an account with the registry and who can trade on what markets, and decide whether licenses for these activities are required. They 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.

# QUICK QUIZ

## Conceptual Questions

- Why are compliance and market oversight important for an ETS?

## Application Questions

- In your jurisdiction, are there existing environmental, tax, legal, and market administrative or regulatory processes that could be replicated or used for the ETS?
- What are the benefits of a stand-alone MRV phase ahead of compliance requirements?

# STEP 8: ENGAGE STAKEHOLDERS, COMMUNICATE, AND BUILD CAPACITY

# AT A GLANCE

- ✓ 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 ETS requires both enduring public and political support and practical collaboration across government and market players, based on shared understanding, trust, and capability. ETS impacts can be significant and far-reaching, making ETS development and operation politically sensitive and of interest to a broad array of stakeholders. These include different industries and their trade associations, government agencies, and environmental advocacy groups. Some jurisdictions have found that it took five to ten years of engagement and capacity building on climate change market mechanisms to enable informed and broadly accepted policy making on an ETS.

Stakeholder engagement normally begins by clarifying the key objectives of the stakeholder engagement process and developing a comprehensive map of relevant stakeholders. This mapping exercise can go beyond simply identifying stakeholders to also understanding the profiles of these stakeholders and hence why their engagement should be sought, as well as what the priorities for engagement should be.

A carefully considered engagement strategy will be of enormous value. This chapter will consider the different forms of engagement and which forms of engagement may be most important for different stakeholder profiles. By tapping stakeholder expertise—in particular economic and technological—it will be possible to improve ETS design and help gain trust, understanding, and acceptance.

A communication strategy can be developed, involving the development of tailored messages for different audiences, as well as making use of well-established communication practices, including engagement with the media. Throughout ETS development and operation, a government's communication about an ETS should be clear, consistent, and coordinated, and the government needs to maintain integrity and credibility.

Developing an ETS also requires strategic capacity building. Government decision makers, administrators, and ETS participants need to build the specialized technical expertise and administrative capacity to develop and operate an ETS.

Step 8 guides policy makers through the objectives of engagement in section 1. It then presents an approach to mapping relevant stakeholders in section 2. Section 3 elaborates on the guiding principles and key aspects of engagement strategies. Section 4 looks specifically at the design of a communications strategy. Section 5 outlines the most important aspects of managing the stakeholder engagement process. Section 6 presents an approach to building the capacity of policy makers, regulators, ETS participants, service providers and other stakeholders.

# 1. Objectives for Engagement

Before mapping key stakeholders and devising engagement strategies, it is helpful to note the main objectives for engagement. These may include:

- **Meet statutory obligations:** Each government is likely to have statutory requirements and standard practices for public engagement on major policy and legislation, and there is a lot of available guidance on public engagement in policy making.[136] Whatever approach is applied to the ETS should be consistent with local requirements. However, it will be important to consider whether any unique aspects of ETS design require a change to standard approaches.[137] For example, extra time may be needed to allow stakeholders to consider complex proposals. Governments may need to make a special effort to reach out to stakeholder groups that are not often involved in policy making and simplify complex technical information.
- **Build understanding and expertise at all sides:** Stakeholders need to learn about an ETS, how it works, and its potential impacts, before they can support it and participate in it. Potential participants in the system will also have access to better information than government about their emissions, mitigation potential and costs, and competitiveness. They may also have valuable institutional knowledge that could positively affect program design. Access to information from multiple, well-informed stakeholders will improve the ETS and is an essential precondition to create effective regulatory bodies.[138]
- **Build credibility and trust:** Long-term goals need to be credible, and rules and enforcement should be clear. ETS participants and other stakeholders are more likely to have confidence in an ETS if they have been provided and been able 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 will ensure that information and data are public, and that conclusions are as transparent as possible. Predictability of 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-GHG technology (see Step 10 for more on the importance of predictability), so engagement on changes can improve acceptability and efficiency.
- **Build acceptance and support:** A sustainable ETS does not require universal support, but it does require enduring social acceptance.[139] This can take the form of a "quiet majority," even if it is overshadowed by a vocal opposing minority.[140] Broad political support will help ensure the long-term viability of the system through political cycles, and also be key to its overall legitimacy as an exercise of public authority. Perceived long-term viability and legitimacy of the ETS will probably also have a positive effect on investment in abatement technologies (see Step 10).

# 2. Stakeholder Mapping

This section presents an approach to stakeholder mapping. It covers the identification of relevant stakeholders in section 2.1 and the elements to be recorded in stakeholder profiles in section 2.2. These profiles can then be used to prioritize stakeholders for engagement, as described in section 2.3. An overview is provided in Figure 8.1.

## *2.1 Identifying stakeholders*

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

- **Government stakeholders** play a key role in ETS design and implementation. They include departments involved directly in ETS design and implementation, departments whose operations will be affected by the ETS, departments whose support is essential, decision makers with legislative functions; as well as national and subnational authorities. Some of the government departments and agencies that will be most heavily involved are those with responsibilities for environment, energy, economic affairs, treasury, accreditation bodies, and market regulation and oversight. Depending on the ETS design and jurisdictional context, other departments that may have an interest include those with responsibility for transport, forestry, agriculture, fisheries, waste, social development, foreign affairs, tax, competition and consumer affairs, justice, competition and industrial policy, and research and statistics. At the political level, a broad range of stakeholders are relevant, particularly if partisan politics are a feature within the jurisdiction;

136 e.g., OECD (2009).

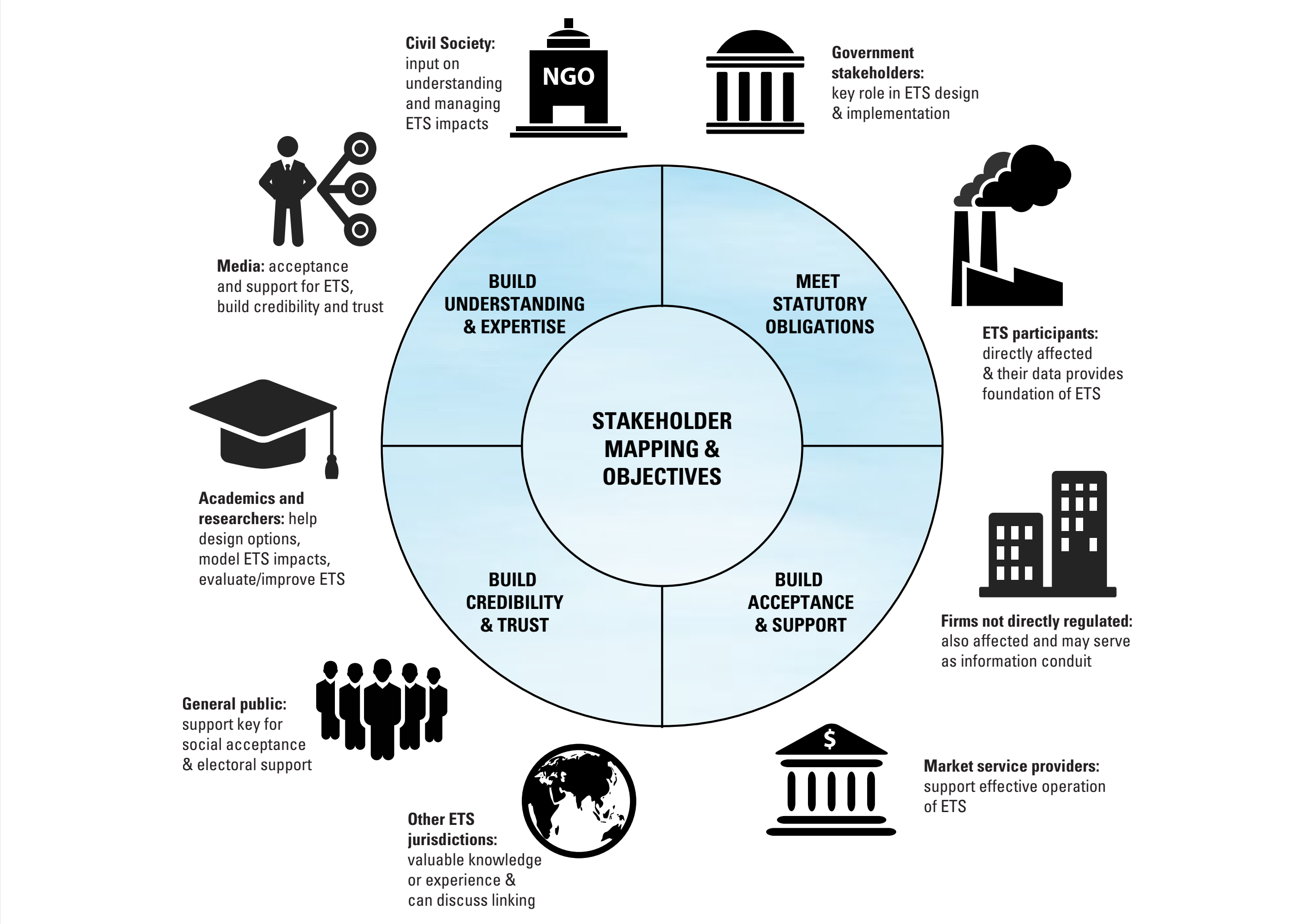
137 During the development of the EU ETS, the German government identified the need to create a new institution for more in-depth stakeholder engagement than would be achieved under standard practice (Matthes, 2013 and Box 8.3).

138 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.

139 Caron-Malenfant and Conraud (2009).

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

FIGURE 8.1 **ETS Stakeholders and Key Considerations in Stakeholder Mapping**




*Author:* ICAP.

- **Regulated entities** are an important group, as they are directly affected and will be fundamental to gaining access to robust information and data on which the operation of an ETS is based. Engagement can be targeted both toward gaining executive commitment to constructive participation in the ETS and securing involvement of operational staff in the design of effective MRV and other systems;
- **Firms affected, but not regulated directly** by the ETS, including manufacturers and suppliers at different points in the supply chain, may also have an interest. Trade and industry associations can play an important role in presenting aggregate views on business interests and in serving as a conduit of information to their membership and to consumers;
- **Market service providers** could include banks, exchanges, and other financial intermediaries such as brokers and trading houses, verifiers and auditors, offset project developers, legal advisors, and verifiers, all offering professional services that can support the effective operation of an ETS;
- **Civil society organizations,** such as environmental, social justice, health and governance NGOs, labor organizations, and consumer groups have an interest in the ETS and could provide valuable input on understanding and managing ETS impacts;
- The **media** are 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 for evaluating and improving ETS design, and can help explain to the public how an ETS works, building credibility and trust;
- The support of the **general public** is key to building the enduring social acceptance and broad political support necessary for a sustainable ETS;

- **Other jurisdictions with an ETS** may be engaged early in the design process to identify and resolve potential barriers to linkage. They may also have valuable experience and knowledge to share. Engagement with other jurisdictions can also include participation in international forums such as the World Bank Partnership for Market Readiness (PMR), International Carbon Action Partnership (ICAP), formal fact-finding missions, and through informal contact; and
- **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 policy making on international mitigation action and trade.

### 2.2 Developing stakeholder profiles

It can be useful to develop stakeholder profiles to create an effective information base for engaging strategically on an ETS.[141] These 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 be able to 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?

### 2.3 Prioritizing engagement

The last step of stakeholder mapping is to prioritize the stakeholders to engage. As human and financial resources for engagement activities are likely to be limited, it is critical to ensure that engagement is targeted at the most important stakeholders. Priority may be assessed, for example, 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, moreover, outreach activities that can be targeted at multiple audiences or can be scaled up and replicated without additional cost—such as a robust online information platform—can help maximize the impact of engagement efforts.

## 3. Designing 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: [142]

- Guiding principles (section 3.1);
- Different forms of engagement (section 3.2);
- Engagement within government (section 3.3); and
- Mobilizing champions outside of government (section 3.4).

### 3.1 Guiding principles

An effective engagement plan should be guided by a number of core principles. These may include the following:

- Clearly define the goals, target audience, and timeline for each engagement activity.
- 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.
- Engage broadly, where possible, so that both majority and minority views can be considered.
- 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.
- Accommodate the needs and capabilities of the target audience (e.g., inviting written submissions, holding public meetings, using media, etc.).

141 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).

142 See Krick et al. (2005) as a useful general resource for developing a comprehensive engagement plan. For corporate perspectives on engagement with both government and nongovernment stakeholders during ETS development, refer to PMR (2015e) and Morris and Baddache (2012).

- 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.
- Coordinate engagement on similar issues across government to avoid duplicative efforts and "consultation fatigue."
- Evaluate and continually improve the effectiveness of engagement activities.[143]

## 3.2 Different forms of engagement

Different forms of engagement are appropriate for different stakeholders, and at different stages of ETS development. Box 8.1. details stakeholder engagement methods in the Tokyo ETS. Box 8.2 provides insight into expert engagement with California's ETS. Box 8.3 outlines Germany's positive experiences with setting up a permanent working group to support ETS engagement.

The International Association for Public Participation (IAP2) has developed a useful framework for considering engagement options in its public participation spectrum (see Figure 8.2).[144] 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 framework can be applied to ETS design and implementation as follows:

- **Inform.** Defined as "*To provide the public with balanced and objective information to assist them in understanding the problem, alternatives, opportunities and/or solutions.*" In the ETS context, this may involve:
  - Producing green/white papers[145] 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 analyses;
  - 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 analyses, alternatives and/or decisions."* 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."* This may involve:
  - Commissioning independent experts to assess ETS design and operation;
  - Enabling substantive dialogue with stakeholders, formally and informally; and
  - Holding multistakeholder 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.*" 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 technical matters, and develop related regulations and guidelines for ETS participants.
- **Empower.** Defined as "*To place final decision making in the hands of the public.*" 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;
  - Where allowed, holding a public referendum on whether to proceed with an ETS;[146] and
  - Delegating authority for technical aspects of allocation plan development to representative sector experts.

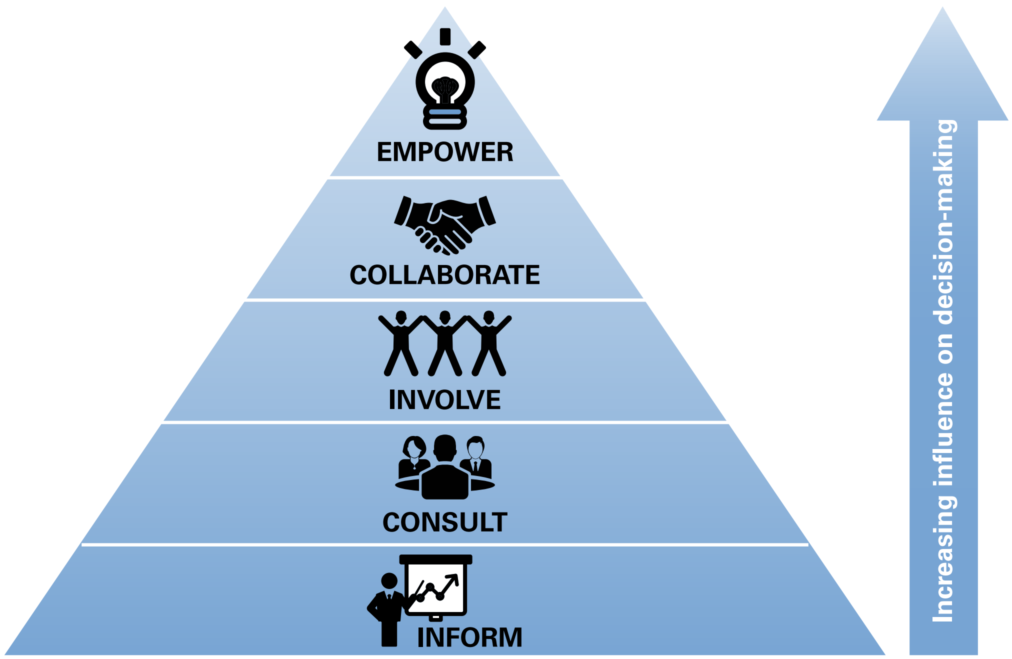
143 These principles represent a synthesis of concepts from multiple sources. For other examples of principles for effective public engagement for policy making, refer to OECD (2009), Krick et al. (2005), and Government of South Australia (2013).

144 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).

145 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.

146 For example, holding a public referendum played a key role in the development of the ETS in California.

FIGURE 8.2 **Role of Stakeholders in ETS Decision Making**




*Source:* ICAP. Adapted from IAP2 (2014).

BOX 8.1 **CASE STUDY: Designing Engagement Methods in 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. The outcome is summarized in the table below.

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

*Source:* Table adapted from PMR (2013).

### BOX 8.2 CASE STUDY: California's Formal Expert Engagement in ETS Design

The design process for the California ETS included regular public meetings from its inception. In total, more than 40 public meetings were held between 2009 and 2012.[a] The California Air Resources Board (ARB) also relied on experts and economic analyses from different committees to inform the design and implementation of the system. These boards brought together experts with different backgrounds to work on specific issues:

- The *Market Advisory Committee (MAC)* was appointed in 2007 to advise on the creation of a market-based mechanism for reducing GHGs, and was comprised of experts who had experience in the creation of other ETSs, including the EU ETS and RGGI.[b]
- 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 comprised of 16 economic, financial, and policy experts, split across different subcommittees—economic impacts, allocation methods, allowance value provision, legal issues, and constraints.[c]
- 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 ARB staff. The Committee worked particularly on the price containment reserve, information sharing, resource shuffling, and linkage with Québec.[d]
- The *Market Simulation Group (MSG)* was established in June 2012 to identify, through simulation analysis, specific concerns with market rules.[e] Risks of market disruption or potential for market manipulation were assessed, especially regarding the allowance price containment reserve. The work of the group was publicly presented and stakeholders were able to comment on it, and its work led to the report *Competitive Supply/Demand Balance and the Potential for Market Manipulation*.[f]

a See ARB (2015c) for archived and scheduled meetings.
b See California Market Advisory Committee (2007) for a description of the role of MAC and the committee's findings.
c See Economic and Allocation Advisory Committee (2010) for the full report of EAAC's recommendations to ARB.
d See ARB (2014) for a description of the role of EMAC.
e ARB (2015b).
f Borenstein and al. (2014).

### BOX 8.3 CASE STUDY: Germany's Experience with the "Working Group Emissions Trading"

Stakeholder outreach in Germany has a long tradition through industry associations. In the context of the EU ETS, this took the form of "Working Group Emissions Trading" (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, distinguishing it from lobbying groups.[a]

The working group operates with its own budget (financed jointly by the Ministry for the Environment and the participating companies) and a joint 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, subworking and plenary group dialogues on a range of technical, political, and cross-cutting issues.

Early and intense consultations on the risks, benefits, and methodologies of the EU ETS proved to be helpful. The timing and sequencing of engagement have also helped make the group more effective. For example, detailed technical discussions only took place after political decisions on overall targets had been made.

The working group has been established as a permanent and continuous stakeholder "process" on all matters related to emissions trading and as a platform for examining the interactions of ETS with other climate change policy instruments and acts.

a Chatham House (2002).

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

## 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, while 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 in engagement with government departments (see also the experience with the New Zealand ETS, Box 8.4). Some principles 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 also be supported by establishing regular channels to communicate progress, share information, and document decisions; and
- **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 8.4 CASE STUDY: Government Coordination in New Zealand ETS Design

An Emissions Trading Group was created to lead the implementation and design of the New Zealand ETS (NZ ETS). 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 nimble group of officials from key departments to collaborate directly on technical ETS design while helping to secure support from their wider departments.

To facilitate cross-departmental coordination and decision making, separate groups of departmental executives and senior officials met regularly to review progress and make decisions. At the political level, the Cabinet designated a subgroup of ministers to lead ETS design and other climate policy development; in some cases they were delegated decision-making authority, although on all major issues full Cabinet agreement was required.

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 been considering 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.

## 3.4 Mobilizing champions outside of government

While the development of an ETS relies heavily on the relationships between government and external stakeholders, it can also be supported by fostering effective relationships *among* external stakeholders. Demonstrable peer support for an ETS can be a powerful influence over other stakeholders.

To achieve this, it is necessary to find stakeholders who can put themselves forward as "champions" of the ETS, notably in the private sector. Stakeholders with previous experience, such as those that have implemented carbon pricing systems within companies or have supported ETS design in other jurisdictions, may be particularly valuable in this regard. For example, in the

**BOX 8.5 CASE STUDY: The U.S. Climate Action Partnership**

The United States Climate Action Partnership, formed in 2007, was a coalition of 22 major companies and five NGOs that came together to "recommend the prompt enactment of national legislation in the United States to slow, stop and reverse the growth of GHG emissions over the shortest period of time reasonably achievable."[a] The partnership included, among others, Ford Motor Company, Alstom, General Electric, and PepsiCo, as well as the Environmental Defense Fund and the World Resources Institute. In its Call for Action, one crucial recommendation was the implementation of a cap-and-trade system.[b]

In 2009, the coalition produced an extensive *Blueprint for Legislative Actions*.[c] This developed the outline for an ETS in the United States—making recommendations on scope, allocation, cost containment measures, and offsets. The Partnership stated that they were "ready to work with the Administration, Congress, and other stakeholders to develop environmentally protective, economically sustainable, and fair climate change legislation."

The U.S. Climate Action Partnership represented a milestone in the discussions around climate change policies in the United States, as it was the first time NGOs and major companies joined together to call for a price on carbon. The *Blueprint* served as a basis for the American Clean Energy and Security Act (referred to as the Waxman-Markey Bill, after its legislative sponsors), which intended to establish an ETS in the United States. Although passed by the House of Representatives in June 2009, the bill did not gain sufficient legislative support to reach a vote in the Senate.

a Meridian Institute (2006).
b United States Climate Action Partnership (2007).
c United States Climate Action Partnership (2009).

development of the American Clean Energy and Security Act (known popularly as the Waxman-Markey Bill), the U.S. Climate Action Partnership brought several leading companies together in a way that allowed them to be important advocates of emissions trading (see Box 8.5). Other champions may include academics and thought leaders in civil society. These were actively involved, for instance, through a consultation process, in the development of New Zealand's ETS (see Box 8.6).

**BOX 8.6 CASE STUDY: Stakeholder Engagement During the Development of the New Zealand ETS**

When designing New Zealand's ETS, the government conducted formal consultations on a detailed ETS design proposal.[a] It sought active involvement of, and collaboration with, stakeholders. This included:

- Inviting external experts—domestic and international—to review its design proposal and subsequently releasing the results to the public;
- Requesting influential thought leaders to join a Climate Change Leadership Forum, which met regularly with ministers and officials, to both provide input into the design and identify how to generate support for the system more broadly;[b] and
- Creating technical advisory groups where stakeholders worked with officials on design elements, such as methodological and accounting frameworks for stationary energy and industrial processes, transport fuels, agriculture, forestry, and waste.[c]

These processes both improved the quality of government decision making and broadened the base of credibility and support for the ETS.

a New Zealand Ministry for the Environment (2007).
b The Forum consisted of several meetings in 2007–08 with private sector participants and representatives of government. For more details on the process, see New Zealand Ministry for the Environment (2010).
c The composition of the advisory groups is available at New Zealand Ministry for the Environment (2011).

# 4. Designing a Communications Strategy

Public perception is a key component of the success of an ETS. The way in which policy makers communicate about an ETS plays a crucial role in building understanding and acceptance.

Communication about an ETS needs to be clear and consistent, and the government should maintain integrity and credibility throughout the process. This will require communication to start early in the design process, so as to build and maintain confidence in the system. It will also require working with technical and communications experts. The following sections offer guidelines for effective communications. Section 4.1 presents tools for tailoring messages to their audience. Section 4.2 presents sound communication practices and procedures. Section 4.3 discusses the importance of engaging the media.

## 4.1 Tailored messages

The categorization of target audiences is important in tailoring the technical content of government communications to meet the needs and capabilities of each audience. It will also help crystallize key messages. Mapping communication needs and key messages against stakeholder groups can be a useful extension of the stakeholder mapping exercise described in section 2. Whereas each stakeholder group's profile must be considered when drafting tailored messages, the following themes could provide a useful foundation:

- The **inherent advantages** of emissions trading lend themselves to a variety of arguments—from its effective contribution toward meeting emissions reduction targets to a focus on flexibility, cost effectiveness, and environmental and economic co-benefits. These may resonate to a different extent with different stakeholders;
- Defining a clear **counterfactual scenario** (e.g., what happens if the government does not proceed with an ETS) can help explain the relative merits of an ETS. If the alternative to ETS is to do nothing to mitigate climate change, the messaging will be very different than if the alternative is a command-and-control approach or other environmental regulation to achieve an accepted mitigation goal;
- **Co-benefits** can be powerful selling points. These might include better air and water quality, improved energy security and efficiency, and increased investment in new technologies. For example, in California, the role of emissions trading in supporting energy security (as a net importer of energy) and industrial strategy (as an exporter of advanced, innovative technologies) was particularly effective; and
- **Correcting misconceptions** proactively can help prevent them from spreading and adversely affecting stakeholder and public perception of an ETS. Table 8.1 presents examples of common misconceptions about emissions trading, taken from past experience in different jurisdictions, and how these may be countered.

TABLE 8.1 **Misconceptions around an ETS and Possible Counterarguments**

| Misconception | Response supporting an ETS |
|---|---|
| An ETS imposes additional costs on the economy. | Such a statement is not necessarily true. By providing an increased signal to be more efficient, a carbon price can actually save an economy money. RGGI, for example, is thought to have produced significant economic benefits despite long periods of low allowances prices. A well-designed ETS may be able to reduce those emissions more cheaply than other policy options. |
| A carbon tax is better than an ETS. | A carbon tax and an ETS each have strategic merits and differences that should be considered by each jurisdiction. Both an ETS and a carbon tax result in a price on emissions that can change behavior. Under an ETS, the government constrains emissions quantity and the market sets the price, whereas under a carbon tax the government sets the price to provide a constant signal and the emissions quantity is not constrained. Both can involve policy uncertainty regarding future ambition and both can provide special measures for managing leakage and competitiveness impacts. When an ETS includes auctioning, it can generate revenue that can be reinvested or returned to the economy, as does a carbon tax. An ETS adapts more readily to changing market conditions than a carbon tax, and allows international cooperation. |
| Emissions trading allows polluters to avoid responsibility for reducing their emissions. | An ETS limits the system's total contribution to net global emissions, and then offers flexibility as to whether participants invest in reducing their own emissions or help reduce someone else's emissions. Participants that choose not to reduce their own emissions bear the full costs of that decision. |
| An ETS will place businesses' competitiveness at risk and send production overseas. | Through mechanisms such as incremental changes in the stringency of the cap, free allocation, and price stability mechanisms, an ETS can avoid or mitigate adverse and disproportionate impacts on emissions-intensive and trade-exposed industry during the transitional period before carbon pricing is more widespread among trade competitors. Importantly, an ETS provides financial advantages to firms that improve their emissions intensity and innovate, which can help improve their competitiveness in the longer term, especially as carbon regulations develop around the world. |
| Free allocation is a subsidy from the government to polluters. | Free allocation, whether permanent or temporary, can help businesses and other affected entities to adapt more smoothly and gradually to carbon pricing, and can reduce perverse leakage effects that raise global emissions and cause job losses. Free allocation under 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 they still retain the economic incentive to reduce their emissions, given the price on GHGs and the possibility of selling excess allowances. |
| Market mechanisms cannot be trusted to solve the problems created by market failures. | An ETS helps remedy the market's failure to price the environmental impacts from emissions when participants make investment decisions. While carbon pricing in an ETS may not solve the whole problem alone, it is a critical component of the solution. As with all forms of regulation, an ETS requires strict monitoring and enforcement to maintain environmental integrity. |

## 4.2 Sound communication practices and procedures

Previous experience with ETS development indicates that sound communication practices and procedures are key to ensure cross-stakeholder understanding and support. These include:

- **Coordinate government communication.** The government's communications around an ETS need to be clear and consistent across departments and political leaders. The content of key messages should be developed with input from the relevant departments and approved by the appropriate authorities. As discussed in section 4.1, the interdepartmental nature and political complexity of ETS design make effective coordination and alignment of communications particularly challenging and important.
- **Address questions proactively.** One practical communications tool is an evolving Frequently Asked Questions (FAQ) document designed to meet the information needs of different types of stakeholders. This can begin with general information about the need for climate change mitigation policy and progressively focus on more detailed aspects of ETS design. A FAQ document can be a living document that is updated more frequently than a formal progress report.[147]
- **Provide regular progress reports.** Providing regular progress reports (e.g., on a quarterly or annual basis) can be a useful tool for keeping stakeholders both inside and outside of government informed. Such reports can provide an update on the operation of the ETS, enhancing transparency and credibility, and providing information of value to policy makers, market participants, researchers, and the media. They also impose a discipline of regularly documenting and publicly reporting key statistics about ETS operation.[148] Step 10 provides more information on system evaluation.
- **Communicate market-sensitive information appropriately.** As with any financial market, carbon markets and price formation are highly sensitive to information regarding supply and demand. In the case of an ETS, supply and demand will be affected by government decisions on key issues like the overall cap, allowance allocation plans, rules for new entrants, and access to units from linking and offsets.[149] The way in which these decisions are communicated is therefore important. The government needs to consider:
  - How and when it will communicate information that will affect market prices can have an impact on market confidence, induce gaming of the system, or interact with other corporate reporting requirements. In particular, there is a need to manage tensions between the public benefits of information disclosure, the commercial interests of ETS participants, and the effective operation of the carbon market. For example, in the case of the EU ETS, researchers found that the release of National Allocation Plans and information on emissions verification affected spot and future prices for Phases I and II. Studies suggested that information was systematically leaked in advance of official announcements, affecting how the market responded.[150]
  - How it weighs the merits of publicly disclosing information specific to individual regulated entities, given any competitiveness issues that may arise as a result of disclosure.
  - How it will manage the release of market-sensitive information held by government regulators, company auditors, and ETS participants. Like other markets, carbon markets can be vulnerable to insider trading.

## 4.3 Media engagement

Building the capacity of the media to understand ETS design and operation, and the confidence of the media in the credibility of government communications about the ETS, will help ensure that accurate information about the system reaches the general public. It will therefore have a major impact on public acceptance of the system and its long-term viability. The guidelines for tailoring messages (discussed above) as well as generally sound communication practices and procedures can help generate this acceptance.

147 For two good examples see the EC (2008b; 2013) and Gouvernement du Québec (2014).

148 For an example of a progress report on the EU ETS, see EC (2015).

149 Market factors that impact prices, as well as policy tools to limit those impacts, are covered in detail in Step 6. For more on the impact of policy changes and related uncertainty on market operation, see Step 10.

150 Lepone et al. (2011).

# 5. Stakeholder Engagement Process Management

Once the stakeholder engagement process is underway, sound management must keep the activities on course. Aside from coordinating the process in line with the engagement strategy, policy makers may specifically consider their approach to risk management (section 5.1), ensuring transparency of engagement outcomes (section 5.2), and evaluation and review (section 5.3).

## 5.1 Risk management

Stakeholder engagement can give rise to risks. Proactively identifying potential risks and responding rapidly to actual risks can help ensure the effectiveness of engagement activities. Type 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.
- **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 8.7 discusses the experiences of California in relation to legal disputes.

## 5.2 Transparency of engagement outcomes

Transparency is an important component of stakeholder engagement. It helps ensure that stakeholders have confidence that their concerns are considered in the design of the ETS. The creation of a platform for discussion is not sufficient: for engagement to be credible, the information obtained from the engagement should be documented clearly and transparently by policy makers. The government should ensure that it is accountable to stakeholders and the general public for its response to this information. For example, the extensive and transparent engagement program as part of the design of Tokyo's ETS contributed to the system's broad acceptance (see Box 8.8).

### BOX 8.7 CASE STUDY: Overcoming Legal Challenges: the Case of the Californian ETS

In California, political disputes led to lawsuits challenging the Cap-and-Trade Program as well as one 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 brought to date, although some cases remain pending. Two of the key legal challenges include:

- **Initial Cap-and-Trade 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.[a] After first requiring further analysis under the California Environmental Quality Act (CEQA), the court ultimately declared the authority of the California Air Resources Board (ARB)'s authority under AB 32 as broad and sufficient to encompass the cap-and-trade approach. While many environmental justice groups retain concerns, equity issues have been further addressed by ensuring that at least 25 percent of all revenue from the Cap-and-Trade Program will benefit low-income, pollution-burdened communities (see Box 3.3 in Step 3 on auction revenue use in California).
- **Offsets Challenge:** In 2012, the Citizens Climate Lobby and Our Children's Earth challenged the use of offsets under California's Cap-and-Trade Program, claiming that ARB had not demonstrated that California offsets protocols represent GHG emissions reductions that would not have occurred in the absence of the offsets credit, as required by AB 32. In 2013, the state trial court ruled in favor of California, offering unequivocal support for the legality of the offsets program. After an appeal by Our Children's Earth, the state appellate court upheld the trial court's ruling.

a 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.

**BOX 8.8 CASE STUDY: The Engagement Process As Part of Design and Implementation of the Tokyo ETS**

The Tokyo ETS emerged after two prior stages of work involving progressive engagement: mandatory reporting and revised reporting.[a] 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 of the facilities to discuss emissions reduction opportunities. As a result, there was a foundation of strong relationships and understanding from which to engage on emissions 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 acted as participants, and the meetings were open to the public. Each meeting attracted over 200 attendees.[b] Stakeholder meetings were held after the initial design of the ETS, but before the detailed program design had been drafted. Through these meetings, the Tokyo Metropolitan government was able to respond to the concerns of the public, and enrich the design of the ETS.

The Tokyo Metropolitan government's stakeholder meetings demonstrated how stakeholder engagement can directly inform the design of an ETS. Companies that had already made reduction efforts were concerned that allowance allocation would not reflect their past efforts.[c] As a result, Top-Level Facility Certification was designed, allowing facilities with the greatest progress in energy saving to apply to be a "top-level facility," resulting in a less onerous obligation under the ETS.[d] 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.

In addition to gaining new design elements through stakeholder engagement, the meetings built trust with stakeholders. The timing of the meetings contributed to their success. For example, the government organized meetings after collecting data on $CO_2$ emissions from 1,300 facilities. This gave it insight into the extent to which reduction efforts had been made before the ETS in the final ETS allocation.[e]

a 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 EDF and IETA (2015h).
b Kimura (2015).
c Kimura (2015).
d EDF and IETA (2015d).
e Kimura (2015).

### 5.3 Evaluation and review

Stakeholder engagement requires evaluation and review. This can follow standard guidelines of evaluation and review of government activities. Good practice includes that facilitators seek immediate feedback after meetings with stakeholders, and that they organize surveys among ETS participants to solicit feedback on the stakeholder engagement process.

# 6. Capacity Building

Design and implementation of an ETS will require capacity building. The following sections cover key capacity-building needs (section 6.1), possible approaches to meeting these (section 6.2), the possibility of introducing pilot or voluntary systems first (section 6.3), and the necessity to evaluate and review capacity-building activities (section 6.4).

### 6.1 Identification of capacity-building needs

"Capacity" can be defined as 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 familiarization with the objectives of an ETS, its design features, and potential impacts.[151] 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 fulfill new functions, such as:
  - Identifying and evaluating ETS design options;
  - Drafting ETS legislation, regulations, and technical guidelines;
  - Administering core ETS functions: cap setting, allocation, MRV, 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.

151 Hausotter & Mehling (2012).

- **Regulated entities** will need the capacity to fulfill their obligations under the ETS for emissions monitoring, reporting, verification, 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 units, managing the accounting and tax implications of ETS obligations, and hedging against new risks and uncertainties.[152]
- **Other market participants** will need the capacity to analyze the implications of government decisions for the marketplace, design facilitative services, and engage in the development of supporting processes and institutions such as offset mechanisms, trading exchanges, and third-party verification of ETS reports.

## 6.2 Methods and tools for capacity building

Following an assessment of the current capacity of relevant stakeholders, the gaps that need to be filled can be identified. A program for ETS capacity building can be designed on the basis of this gap analysis.

Key elements of an ETS capacity-building program may include:

- **Providing basic educational materials** with plain-language information about ETS design, impacts, and obligations;[153]
- **Developing guidelines** and technical documentation through a process of participant input and review, to ensure they are comprehensible and practical;
- **Running ETS simulations** to provide experience with trading and compliance in a controlled setting that tries to be as realistic as possible (see Box 8.9);
- **Holding workshops** that create an opportunity for information sharing;
- **Providing training** to staff who will be involved in ETS-related activities;
- **Engaging researchers** to help develop an ETS design tailored to the local context, based on experiences gained elsewhere; and

152 For case studies on companies' practical experience in preparing for emissions trading, see PMR (2015e).

153 See, for instance, the ICAP ETS Briefs, short leaflets which 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.

### BOX 8.9 TECHNICAL NOTE: ETS Simulations for Capacity Building

A number of jurisdictions have used emissions trading simulations as a tool to engage, train, research, test designs, and experiment. Some ETS simulations have been designed as "games" where participants assume specified roles and enact a trading market or policy negotiation, whereas other simulations operate as models for testing different (policy) scenarios. While some simulations have targeted specific sectors, others have operated within a national or global scope. Many have been focused on capacity building for companies, while others have included regulators, researchers, NGOs, or other types of participants.

Some simulations prepared in a general training context are available online. For example, the U.S. Environmental Protection Agency has an extensive ETS simulation allowing participants to experience an ETS in the role of a manager of an electricity-generating facility.[a] CarbonLab at the University of Queensland, Australia, has developed an emissions management simulation called CarbonGame.[b] Motu Economic and Public Policy Research in New Zealand have developed a trading game that can be applied to emissions or agricultural nutrients.[c]

a U.S.EPA (2016).
b University of Queensland (2016).
c Motu (2012).

- **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 building through information resources, technical training, and country-to-country exchanges.

## 6.3 Learning-by-doing

There may be a place for learning-by-doing through a pilot or voluntary system, while regular reviews and independent evaluation of an ETS will also support learning. These are discussed in Step 10.

## 6.4 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. 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.

## QUICK QUIZ

### Conceptual Questions

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

### Application Questions

- In your jurisdiction, what statutory obligations for public engagement and consultation would apply to ETS development at each stage: design, legal or regulatory process, and implementation?
- 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 external stakeholders?
- Who might be potential “champions” of an ETS, both within and outside of government?

# STEP 9: CONSIDER LINKING

# AT A GLANCE

- ✓ Determine linking objectives and strategy
- ✓ Identify linkage partners
- ✓ Determine the type of link
- ✓ Align key program design features
- ✓ Form and govern the link

Linking occurs when an ETS allows regulated entities to use units (allowances or credits) issued in one or more other systems for compliance purposes. Such links can be one-way, that is, where entities in one ETS can buy units issued from one or more other systems, but not vice versa, or two-way, where both systems recognize the units of the other system. If two or more systems recognize credits from the same offset mechanism, this gives rise to an indirect link.

Linking can be attractive for a number of reasons. It reduces aggregate compliance costs. Allowing two systems to trade emissions allowances increases efficiency in the same way as trade between two companies. The larger the difference in equilibrium allowance prices between the linked systems, the greater the gains from trade. Linking also increases market liquidity and depth. It may also promote price stability, allowing shocks to one part of the ETS to spread across a larger number of participants. If linking partners are also trade partners, the equalization of carbon costs can also reduce the risk of emissions leakage. Finally, linked systems can share some of the responsibility for governing the market and thereby reduce the costs associated with administrative functions.

However, for linkages to work, jurisdictions need to find compromises to align design elements—in particular to guarantee comparable levels of environmental integrity for emissions units; this may require adjustment of certain ETS design features. While linking allows for aggregate gains from trade, if prices significantly differ between jurisdictions, the associated price convergence process can be challenging—either because high price jurisdictions will be concerned that their climate ambition is being diluted, or because low price jurisdictions are concerned by the higher prices they will see. The associated financial flows may also be politically challenging. In addition, although price stability will be greater on average, there is a risk that links transmit large shocks from one system to another, with undesirable effects.

To address these potential disadvantages, jurisdictions may want to carefully choose linking partners, consider potential safeguards such as restricting the extent to which they link, or define conditions under which the link will be terminated. In terms of a linking partner, if there is a concern about the disadvantages of price convergence, and if linking is also regarded as a way to increase liquidity and depth, or reduce leakage, then linking with economically similar jurisdictions may be preferable. If the focus is more on lowering aggregate compliance costs and encouraging cooperation to promote greater mitigation, dissimilar linking partners will be preferred. To date, most links have been between systems in socioeconomically similar jurisdictions, with relatively similar prelinkage allowance prices. Some small jurisdictions' ETSs were designed from the outset to link with a larger market or operate as a multijurisdictional system. Placing restrictions on the extent of linkage will reduce its cost effectiveness, but may be useful if there is a need to trade off some of the advantages of linking against some of its disadvantages, especially around the desire to preserve incentives for domestic emissions reductions and also ensure that linkage supports overall mitigation ambition.

When a decision has been made as to whom to link with and on what terms, in-depth review of respective programs may help further assess alignment of design elements. Linking typically requires clear agreement on acceptable levels of ambition in each jurisdiction, including on the stringency of the cap and certain key design features, such as the nature of the cap or the length of commitment periods. Some other design elements must be aligned to allow effective linkage, including the robustness of MRV and criteria for offset use. Aligning other design elements such as a system's scope and allowance allocation methods may improve the functioning of a link or address political considerations, but this is not strictly necessary. Linking partners may also wish to consider aligning design features that will transmit market signals across links, such as banking, borrowing, and allowance reserves.

When the terms of linkage have been set, jurisdictions can form and govern the link. Whether linkage occurs alongside the launch of an ETS or afterwards may depend on the objectives for linking. Jurisdictions need to choose the legal instrument for governing the link depending on their legal context, as well as the institutions responsible for market oversight and processes for implementing any changes to the link. Further, arrangements should include a contingency plan for delinking.

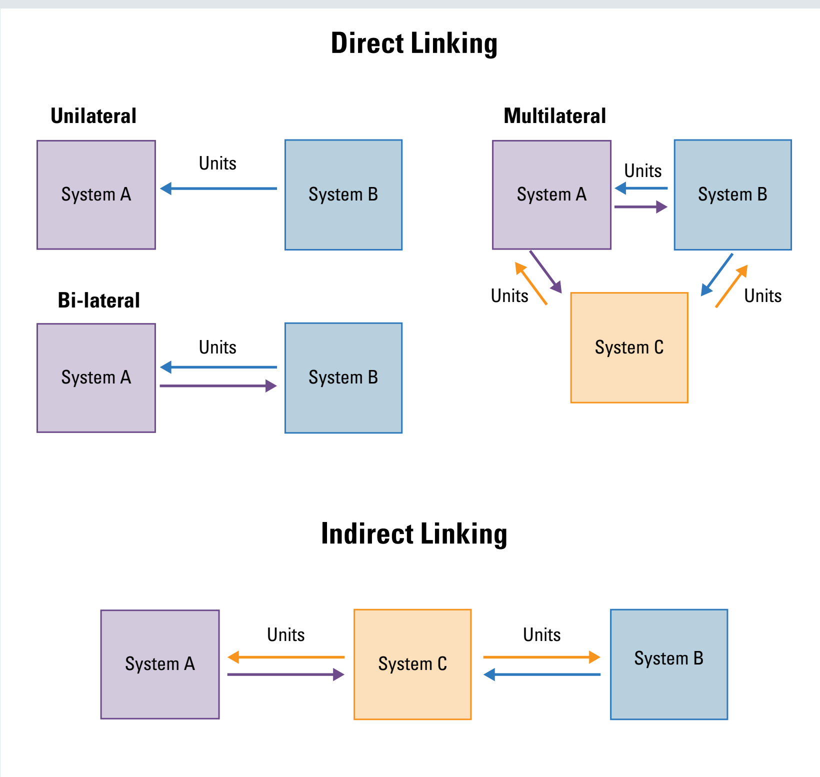
Linking occurs when an ETS allows regulated entities to use units (allowances or credits) issued in a different system for compliance purposes. Section 1 explains the different types of linking. Sections 2 and 3 consider the advantages and disadvantages of linking. Section 4 examines how jurisdictions might look to balance the advantages and disadvantages of linking through both their choice of linking partner and the possibility of limiting the degree of linking. Section 5 considers the extent of design and regulatory alignment required by linking. Section 6 concludes with a discussion on the formation and governance of the link.

# 1. Different Types of Linking

A jurisdiction can consider a number of different types of linking, as shown in Figure 9.1, with some examples of linking ventures to date further summarized in Table 9.1. In principle, three types of linking exist:

- **Two-way**, also termed **bilateral**, and **multilateral** linkages effectively create a unified market for allowances if there are no quantitative limits or other restrictions in place. Allowances originating in one or more markets are eligible for use in the others, and vice versa. An example of two-way linkage is that between California and Québec, which includes joint auctions as an additional layer of integrated operations. 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. A multilateral two-way link, that is, links across multiple systems, is currently being considered in the context of the Western Climate Initiative (WCI).
- **One-way**, or **unilateral**, linkages let emissions units flow only in one direction. One system accepts units from one or more other systems, but not vice versa. Most ETSs have accepted some kind of offsets from outside the system through a one-way link, as discussed in Box 9.4. Direct one-way linkages may also represent the starting point for any ETS that considers linking to another system. Norway first entered into a one-way link with the EU (where Norwegian entities could buy EUAs but not vice versa) as a first step to a two-way link. A similar staged accession was planned for the linkage between the EU and Australia.[154]
- **Indirect linkages** occur when two unlinked systems (A and B) each link to a common, third system (C). Although not formally linked, activity in system A could affect the market in system B and *vice versa*, through their impacts on prices of a common shared partner system, C. Linkages to C could be one- or two-way. An example is New Zealand's ETS, which has been linked indirectly to the EU ETS through their mutual acceptance of CERs from developing countries generated under the CDM.

FIGURE 9.1 **Types of Linkage**




*Source:* Jaffe et al. (2009).

154 In this case, the link was intended to be an indirect one in practice, involving shadow units representing EUAs in the Australian system.

TABLE 9.1 **Linkages (and intended Linkages) between ETSs to date**

| Systems involved | Type of link | Degree of linkage |
|---|---|---|
| California and Québec<br>(Ontario and Manitoba intend to join the system) | Two-way | ▲ Separate caps<br>▲ Similar design features<br>▲ Joint auction and registry system |
| RGGI | Multilateral link among participating states | ▲ Common cap<br>▲ Similar design features<br>▲ Joint auctions<br>▲ Same registry systems |
| Tokyo and Saitama | Two-way | ▲ Separate caps<br>▲ Similar design features<br>▲ Separate allocation mechanisms and registry system |
| EU and Norway | Two-way (began with one-way link with Norway as buyer) | ▲ Common cap<br>▲ Similar design features<br>▲ Separate auctions and registry systems |
| Intended link between Australia and EU | Intended to be one-way (with Australia as buyer) during first phase, evolving to a two-way link | ▲ Separate caps<br>▲ Some design features were in process of alignment |
| EU and Switzerland<br>(not entered into force yet) | Two-way | ▲ Separate caps<br>▲ Similar design features |

In addition, while not a formal link, collaboration among systems may be an important step along the way to full linkage or be considered desirable in itself. By aligning program targets, enforcement mechanisms, or other features, systems can share information and best practice, increase comparability of effort, provide political support, reduce competitiveness and leakage concerns, and simplify administrative procedures for companies operating across the systems. It 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.[155]

# 2. Advantages of Linking

Linkage can provide a number of advantages that help support the objectives of an ETS. This section identifies five of the most important advantages.

## *2.1 Lowering aggregate compliance costs*

Allowing two systems to trade emissions allowances enables efficiency gains in a similar way that trade between two companies does (as described in the chapter "Before You Begin"). The system with higher prices overall will be able to buy allowances from the system with (on net) lower prices, reducing the cost of achieving its cap, while net sellers will be able to emit less but benefit from the increased revenues from exporting allowances. Thus, linkage can reduce costs while keeping total emissions equal, assuming caps in both systems are robust and compliance obligations are enforced (see Box 9.1).

Linkage between ETSs may also be seen as a strategic step toward a more integrated global carbon market and the cost savings that this would bring. As a case in point, the European Commission cites supporting global cooperation through 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 (see Box 9.2).[156] Similarly, one of the goals of the WCI is to foster greater market development for reducing GHG emissions through regional collaboration, including linkage, of subnational jurisdictions in the United States and Canada. Finally, both ICAP and the World Bank are conducting work to enhance linking readiness.[157]

Lowering aggregate compliance costs 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 extending to Ontario, Manitoba, and potentially other states in North America.

155 Burtraw et al. (2013).

156 EC (2015c).

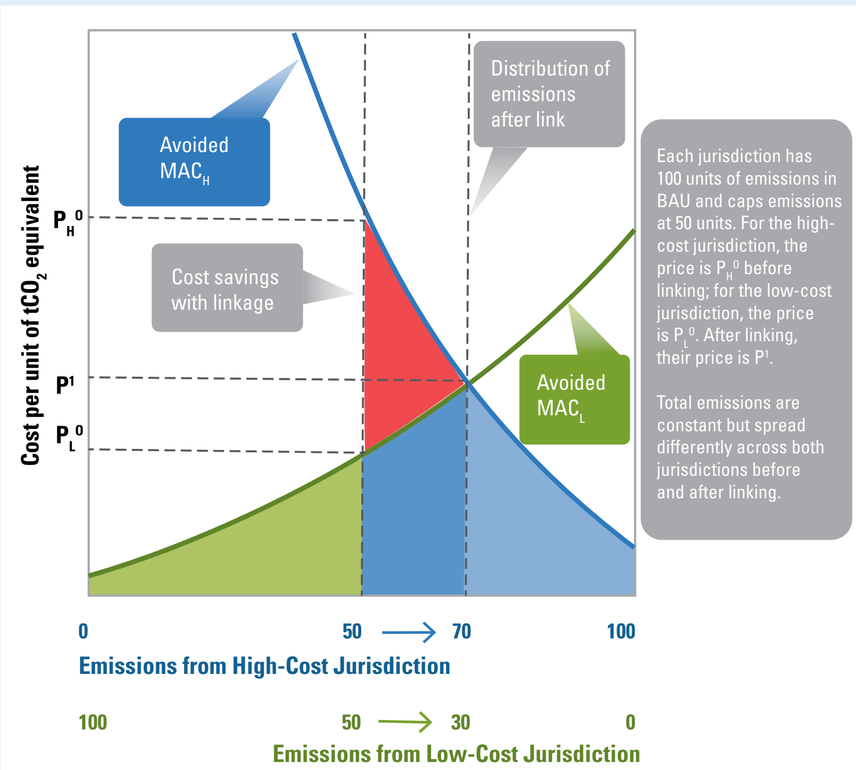
157 ICAP (2016h) and World Bank (2016).

## BOX 9.1 TECHNICAL NOTE: Gains from Trade via Linkage

The greater the differences in marginal abatement costs are across jurisdictions, the greater the potential gains from trade. Take a simple example of two jurisdictions: one with relatively high abatement costs ($MAC_H$), and another with significantly lower costs ($MAC_L$). Total avoided abatement costs from emissions in each jurisdiction without linking are represented by the solid areas in the figure below.

Each jurisdiction has 100 units of emissions in a BAU scenario and caps emissions at 50 units. For the high-cost jurisdiction, the price is $P_H^0$ before linking; for the low-cost jurisdiction, the price is $P_L^0$. After linking, the price stabilizes at $P^1$. Total emissions are constant but distributed differently across both jurisdictions before and after linking. By allowing for trading across jurisdictions—and keeping total emissions the same—the low-cost jurisdiction will now emit less, while the high-cost jurisdiction will emit more, up to the point where marginal abatement costs are equal. The shaded area shows the joint reductions in abatement costs.

### Effects of Linking on Prices and Abatement in High ($MAC_H$) and Low-Abatement Cost Jurisdictions ($MAC_L$)




This suggests that aggregate cost savings from linkage will be higher:

- The greater the differential of allowance prices in the absence of a link,
- The greater the size of the linking partners, and
- The greater the general differences of the two economies.[a]

a Doda and Taschini (2015).

## 2.2 Increasing market liquidity and depth

Linkage can positively affect the functioning of the market by increasing the number and diversity of market participants, improving 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. Greater liquidity and depth can improve market functioning in several ways, among others by:

- Improving the ability of the market to form prices;
- Restricting the potential for market manipulation as a result of buyer or seller power; and
- 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), as well as easier negotiation of trades.

Similarly, linking provides smaller economies that may not in themselves be diverse enough to create a well-functioning ETS with an opportunity to join an ETS. Examples include Cyprus, Liechtenstein, and Malta joining the EU ETS; Québec with California; and the states in RGGI.

BOX 9.2 **CASE STUDY: EU ETS – Leading with Linking**

The member states of the European Union were the first to implement an international ETS for GHGs operating at the level of private entities, and the EU ETS remains the largest to date.[a] It was also a pioneer in developing international linkages.

In Phase I of the EU ETS (2005–07), the Norwegian ETS included a one-way linkage with the EU ETS; Norwegian installations could purchase EU allowances for compliance, but not the other way around. That link was terminated in 2009, when the EU ETS expanded its geographical coverage to include Norway, along with Iceland and Liechtenstein.

The EU has also concluded negotiations to link with Switzerland (date of signature and entry into force of the agreement are open) and had reached an agreement to link with Australia's CPM before the latter system was repealed.

The Directive establishing the EU ETS clarifies some conditions for linkage between the EU ETS and other systems. These include that the other system must be compatible with mandatory enforcement and an absolute emissions cap.[b] In order to be linked to the EU ETS, the other system must meet such requirements or be revised accordingly.

For example, in 2013, in preparation for linkage, Switzerland made significant changes to the design of its ETS to harmonize with the EU system, moving from a voluntary, "opt-in" system that existed as an alternative to paying a carbon tax with about 400 participants to a mandatory ETS system for about 50 larger installations.

a In Phase I, the EU ETS had features of national systems linked under a common framework and forming a common market, although the term "linking" was not used. Since Phase III, it has become a harmonized system with a common cap and EU-wide allocation rules.

b European Council (2009), see paragraphs 40–43 of the Preamble and Article 25 paragraph 1a.

### *2.3 Improving price predictability*

Another advantage of linking is that a larger, deeper market with more diverse participants through linkage can reduce price volatility, as shocks to any one system are spread across the broader linked network. Larger, more diverse systems can better absorb day-to-day, company- or industry-specific shocks, as it is unlikely that all actors in the market will be hit simultaneously with the same economic shock.

### *2.4 Reducing leakage concerns*

Linkage can help reduce concerns about leakage and competitiveness, 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 incentive for shifts in production/emissions (unless covered entities benefits, such as free allocation).

### *2.5 Increasing administrative efficiencies*

Linkage could bring efficiencies and cost savings from joint market operations. This might be particularly relevant for subnational jurisdictions or small countries with greater resource constraints for developing and operating an ETS. For example, California and Québec are conducting joint auctions to reduce program costs and streamline operations. Linkage would also simplify ETS operations and administrative procedures for multinationals and other companies operating across systems if each ETS recognizes the same emissions units and uses similar reporting procedures.

## 3. Disadvantages of Linking

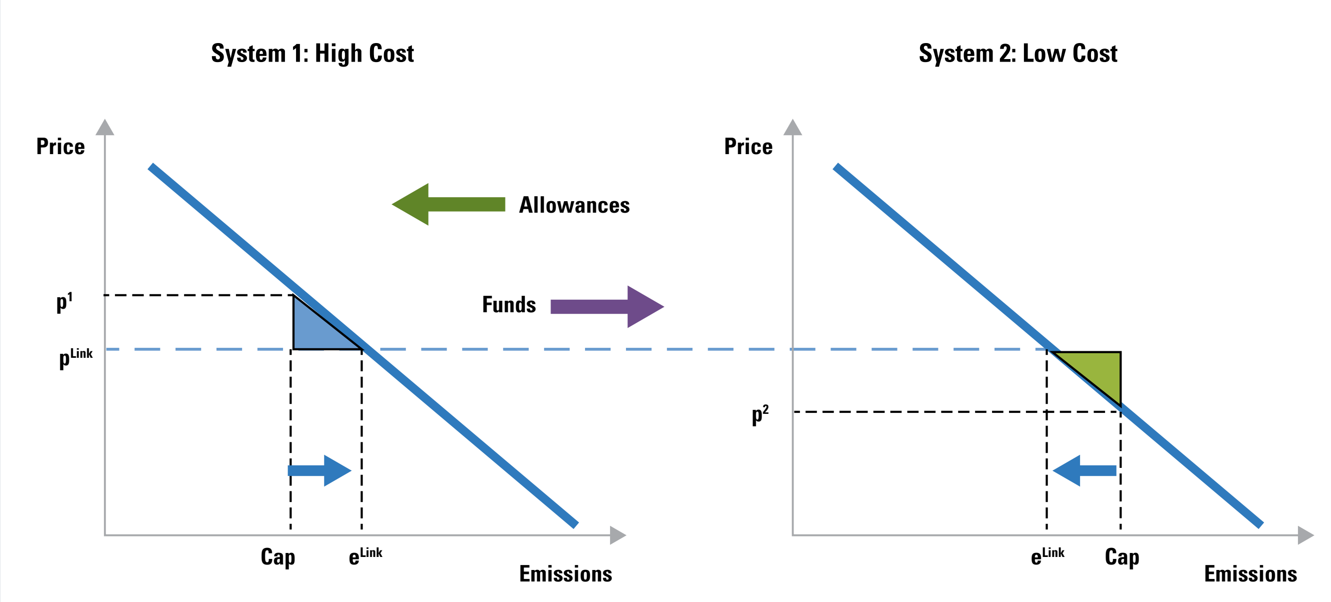
Linking does not only have advantages. This section discusses three key disadvantages of linking that policy makers need to consider.

### *3.1 Challenges from price convergence*

Full linking will lead to price convergence between the linked systems, with the higher costs/higher allowance price jurisdiction seeing a decrease in price and the system with the lower costs/lower allowance prices seeing an increase in prices (see Figure 9.2). Although this reflects the gains from trade generated by linking, it can also cause challenges for both jurisdictions and, most importantly, undermine environmental integrity.

For jurisdictions in which linking leads to lower prices, the link may conflict with the objective of stimulating domestic innovation and/or the deployment of newer and higher-cost technologies and the delivery of co-benefits associated with domestic emissions reductions (see "Before You Begin"). Concerns about the impact of low prices on domestic mitigation incentives have been one of the main reasons for placing limits on the amount of international offsets that can be used for domestic compliance purposes.

FIGURE 9.2 **Effect of Linking on Allowance Prices**




*Source:* Zetterberg (2012).

At the same time, the increase in price in the other jurisdiction may create political challenges for the ETS, although, as noted above, this will be at least partly compensated by the increased revenues that some entities in that jurisdiction will acquire from selling permits. On aggregate, there will be net gains from trade for the selling jurisdiction, but there could still be large distributional and competitiveness implications for companies and individuals in the jurisdiction facing the increase in price, for instance, impacts on low-income households from rising energy costs. Such implications may need to be addressed with additional policy measures.

In addition, price convergence is caused by financial flows between jurisdictions: entities in high-cost/high price jurisdictions buy allowances from low-cost/low price jurisdictions. If these financial flows 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. A related distributional challenge is that auction revenues in high-cost/high revenue jurisdictions will fall, potentially jeopardizing initiatives expected to be funded through those revenues. There may also be legal challenges if the financial flows that the low ambition jurisdiction receives are perceived as a form of "disguised subsidy."

In view of these financial flows, while linkage can enable greater ambition by lowering overall costs, it may also create an incentive for some countries or subnational jurisdictions who expect to be net sellers to create looser caps (or baselines, in the case of emissions reduction crediting systems), so as to sell more allowances internationally. Some buying jurisdictions could be tempted to support this so they will be able to purchase low-cost units and/or may not tighten their caps in light of available cost savings.[158] Conditioning the choice of linkage partners on willingness to take on acceptable levels of program ambition, as discussed below, is thus an important way for both systems to take advantage of potential gains from linkage while guarding against negative environmental impacts.

## 3.2 Imported risks

While linking can improve price predictability, it also means that price shocks from one system may be imported into any system with which it is linked. In other words, while prices may be more stable on average, it is also possible that prices will move dramatically due to external factors. Shocks originating in one system—such as boom-and-bust cycles or ETS policy changes—will affect the linked system. Smaller systems are particularly vulnerable to such "imported risks," as the impact of activity in the larger, linked system will be relatively more significant.

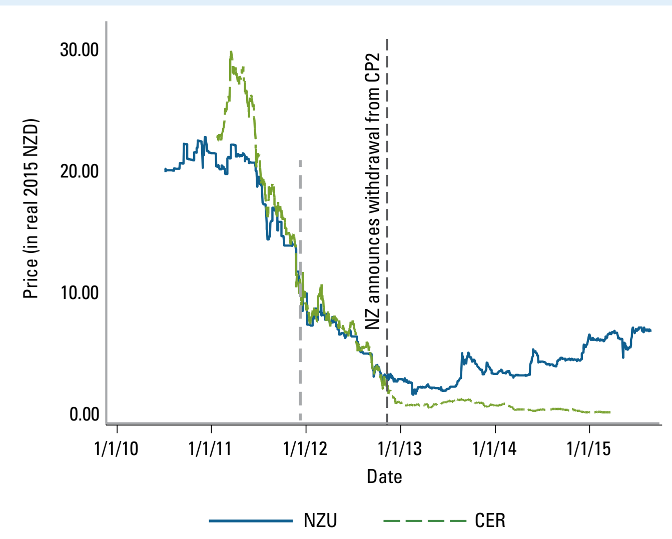
158 Green et al. (2014).

### BOX 9.3 **CASE STUDY: New Zealand and Imported Risk**

New Zealand's ETS (NZ ETS) was designed to link with the Kyoto Protocol, and introduced an unlimited unilateral link to allow purchase of international units. After starting with an allowance price above NZ$20, once CER prices (units from the CDM) began to fall in 2011, the New Zealand Unit (NZU) price matched the CER price and hence fell dramatically. This resulted in negligible incentives for domestic mitigation.

New Zealand regained control of its price only when it announced in 2013 its intention to take a target under the UNFCCC rather than the second Commitment Period of the Kyoto Protocol, restricting the use of international Kyoto units, including CERs, in the NZ ETS 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.




*Source:* OM Financial (2016).

This suggests that although linking might result in prices being more stable on average, they might also change substantially because of external factors, potentially into ranges that clash with other policy priorities (see Box 9.3).

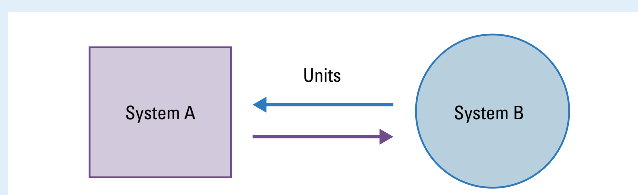
In addition, perceptions of asymmetric market oversight may be a major concern from the perspective of financial regulators, especially in cases where the respective regulations and institutions of a linking partner are considered significantly less robust than the domestic context.

## 3.3 Compromises on ETS design features

While an ETS is developed in light of national circumstances, linking requires a significant degree of alignment of design features to ensure compatibility, especially in cases where a full two-way link is being established. Importantly, each party to the link will need to be satisfied as to the environmental credibility of the units used in the other system, as, after linking, it will also be possible to use these same units for compliance within their respective systems. Jurisdictions may be reluctant to revise ETS design elements to increase compatibility at the expense of domestic circumstances. This aspect is explored in greater detail in section 5. Box 9.4 discusses the concept of networking, which seeks to enable cooperation of carbon markets without requiring alignment of design features.

### BOX 9.4 **TECHNICAL NOTE: Networking Carbon Markets**

Recognizing that aligning policies can be a lengthy and costly process, especially once an ETS is already in place, the concept of "networking" carbon markets has recently been met with increasing interest. Rather than seeking to align systems, "networking" is about facilitating trade of carbon assets by recognizing differences and placing a value on these differences, called the "mitigation value". This would allow more systems to participate in linked carbon markets, even those that are less advanced or less "aligned," while still preserving the environmental integrity of trade. At the core of the networking idea is the need for a reliable analytical framework to better understand the differences between systems, in order compare the relative "mitigation value" of carbon units and facilitate their trade.[a]




*Source:* NCM.
*Note:* Rather than linking schemes that are the same (e.g., linking two squares), networking seeks to link schemes that are different (e.g., linking squares and circles).

a For more information, see the Networked Carbon Markets initiative on the World Bank website: http://www.worldbank.org/en/topic/climatechange/brief/globally-networked-carbon-markets

# 4. Managing the Advantages and Disadvantages of Linking

The discussion above highlighted a series of advantages and disadvantages associated with (different forms of) linking. These are summarized in Table 9.2.

This section discusses two issues that will be important to policy makers in trying to maximize the benefits from linking while avoiding the disadvantages. Specifically, section 4.1 discusses the choice of linking partner, while section 4.2 discusses the options for restricted linking.

## 4.1 Choosing linking partners

While a primary goal will be to ensure environmental integrity is maintained, in choosing linking partners, jurisdictions need to manage a tension between linking with jurisdictions with similar economic characteristics (that 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, at least in part, on the objectives they have for linking.

**TABLE 9.2 Advantages and Disadvantages of Linking**

<table>
<tr><th></th><th>Advantages</th><th>Disadvantages</th></tr>
<tr><td rowspan="2">Economic</td><td>+ Lowers aggregate compliance costs across systems<br>+ Increases market liquidity and depth<br>+ Can reduce leakage and competitiveness concerns<br>+ Can attract external resources for reducing emissions</td><td>- Can increase domestic emissions and reduce environmental and social co-benefits</td></tr>
<tr><td colspan="2">± Can promote price stability, although it can also import price volatility from abroad<br>± Can prompt significant financial transfers<br>± May create administrative efficiencies: prelinkage negotiations and possible program modifications can be costly, while linked systems may lower administrative costs through pooled resources</td></tr>
<tr><td rowspan="2">Political</td><td>+ May strengthen domestic ETS legitimacy and durability through reduced costs and international collaboration<br>+ May increase potential for raising ambition</td><td>- May create domestic political concerns over distributional impacts and resource transfers abroad</td></tr>
<tr><td colspan="2">± Can help shape and build momentum on global climate action, but also decreases independent control over program design and ambition</td></tr>
</table>

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.[159] Linking between trade partners will also be more effective at addressing leakage concerns.

On the other hand, if the economic attributes of a prospective linking partner are different, and these are reflected in an abatement cost differential, the opportunity to realize gains from trade and achieve lower aggregate compliance costs will be greater. Such differences are more likely to prevail between developed and developing country systems, or between economies that have different sectoral structures and hence different abatement opportunities.

This suggests that the choice of linking partners depends on how much weight jurisdictions place on different advantages and disadvantages. 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, 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, dissimilar linking partners may be preferred. The EU ETS linkages with other systems in Europe as well as the Tokyo-Saitama link suggest that, to date, most jurisdictions have opted for linking with systems that have some degree of geographic proximity, existing economic and political ties, and relatively similar economic and abatement cost profiles.[160]

## 4.2 Restricted linking

A further way to manage or trade off the advantages and disadvantages of linking is to allow linking, but to restrict or limit the extent of linkage. This will reduce cost effectiveness compared to full fungibility, but may be useful if there is a need to trade off some of the advantages of linking against some of the disadvantages, especially around the desire to preserve incentives for domestic emissions reductions. It may also make it easier to exit from a linking agreement if conditions change and the linkage is no longer beneficial (e.g. NZ restricted its link to the CDM in 2015, see Box 9.3).

159 This can be seen in the linkages of Norway, Liechtenstein 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 WCI.

160 Ranson and Stavins (2015).

There are three types of quantitative limits that can be applied:[161]

- **Quotas.** Limiting use of external units to a certain percentage of an entity's compliance obligation, or to a certain system-wide aggregate number of units per year, which can then be applied as an entity-level percentage limit. While they would have featured in the proposed Australia-EU link (see Box 9.5), 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 4).
- **Trading ratios ("discounting").** Implementing a conversion factor that dictates the quantity of different types of units that must be surrendered to replace one domestic allowance for compliance purposes. This would discount foreign allowances or offset credits. Trading ratios have not yet been applied in practice by any ETS, although provisions were made for the mechanism in the Waxman-Markey program.
- **Exchange rates.** A special case of trading ratios where these operate symmetrically across systems, akin to an exchange rate for currencies. Thus, if X number of System B's units are needed to substitute for one domestic allowance in System A, then 1/ X number of System A's units will be needed for compliance purposes in the place of one domestic unit within System B.

# 5. Aligning Program Design

One of the key aspects of formal linking is that it requires a degree of consistency between different program features in order to ensure equivalent environmental integrity of units and a well-functioning emissions market. This section provides guidance on harmonization of design elements to allow for linking. Table 9.3 summarizes the design features that need to be aligned. Some design elements absolutely have to be aligned to make linkage work (see section 5.1); alignment of other design elements is optional in principle (see section 5.2), although it may be necessary politically or because linking will in any case lead to the effective transmission of design features across the linked system.[162]

## *5.1 Aligning key design elements*

There are four key design elements that need to be aligned to enable linking. These cover ETS ambition and goals as well as the enabling infrastructure.

The four key design features of the ETS that need to be aligned are the following:

- **Cap stringency.** The cap of a linking partner's ETS must be acceptable to both parties. While there may be greater gains from trade when there are differing degrees of stringency, significant political difficulties are likely to arise from extensive asymmetries. In particular, the country with the higher ambition cap may be concerned about the impact that the resulting fall in price will have on domestic abatement incentives, while the country with the lower ambition cap may be concerned about the increases in allowance prices and hence costs from the link. Moreover, in the extreme case that one ETS has a cap that requires no abatement effort because it is higher than BAU emissions, emissions across the linked systems could be higher than without the link. Emissions in the system with a binding cap would then rise as that system buys emissions units from the other, without a commensurate decline in emissions in the system with the nonbinding cap.
- **Mandatory versus voluntary participation.** Bilateral linking requires systems to align on whether participation is voluntary or mandatory. For example, Switzerland redesigned its ETS from a voluntary opt-in system (coupled with a carbon tax) as part of preparations to link with the EU (see Box 9.2). A voluntary system might, however, seek a buy-only link.
- **Quantity and quality of offsets.** The robustness of rules for offsets must be aligned to harmonize the environmental integrity of units. 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 offset rules on quality is important. As for quantitative limits on offset use, alignment may benefit market functioning as offset limits in one system can be effectively undermined by more lenient offset limits in the other system.

161 Lazarus et al. (2015).

162 See Kachi et al. (2015) for a typology of program elements that are (i) barriers to linking such that harmonization is important; (ii) not necessarily a barrier to linking, but harmonization may improve market operations, and (iii) not necessarily a barrier to linking.

TABLE 9.3 **Importance of Alignment of Different Design Features**

| Step | Feature | Importance of aligning (+ and ++ reflect level of emphasis among analysts) | Alignment could be desirable to address environmental integrity, market operations, or political and competitiveness issues | | |
|---|---|---|---|---|---|
| | | | Environmental integrity | Market operations | Competitiveness/ Perception of fairness |
| 1. Scope | Sector and gas coverage (including opt-in/opt-out provisions) | | | | ✔ |
| | Point of regulation | | | | |
| 2. Cap | Nature of cap (absolute/intensity, mandatory/voluntary) | ++ | ✔ | | ✔ |
| | Acceptable stringency of cap | ++ | ✔ | | ✔ |
| 3. Allocation | Auctioning vs. free allocation | | | | ✔ |
| | Allocations rules (including for new entrants and closures and for trade-exposed industries) | | | | ✔ |
| 4. Offsets | Offset provisions (quantity and quality) | ++ | ✔ | ✔ | ✔ |
| 5. Timeframe | Commitment periods | + | ✔ | ✔ | ✔ |
| | Compliance periods | | | ✔ | |
| | Banking and borrowing | + | ✔ | ✔ | ✔ |
| 6. Market Stability | Stability mechanisms (e.g., price floors/ceilings, reserves) | + | ✔ | ✔ | ✔ |
| 7. Oversight and compliance | Market oversight (including public disclosure of information) | + | | ✔ | |
| | Robustness of MRV | ++ | ✔ | | |
| | Stringency of enforcement | + | ✔ | ✔ | ✔ |
| | Registry design and allowance tracking | | ✔ | ✔ | |

*Source:* Based on material from PMR's Lessons Learned from Linking Emissions Trading Systems: General Principles and Applications; ICAP's Linking Emissions Trading Systems: A Summary of Current Research; EBRD's Carbon Limits; and Thomson Reuters Point Carbon's The Domestic Trading Scheme in Kazakhstan: Phase II, Task 2: Road Maps for Linking Cap and Trade Systems with External Emissions Trading Systems.

- **Cap type.** Linking a system with an absolute cap to a system with an intensity-based cap (indexed to output or GDP, for example) is theoretically possible, but practically very challenging. In particular, intensity targets are often perceived as less stringent than those under an absolute cap (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, a factor that, as discussed in 3.1, can often hold back linking.[163]

Boxes 9.5 and 9.6 provide more detail on the discussions surrounding consistency and convergence of the design of ETS in the case of the link between the Californian and Québec systems as well as the proposed link between the Australian CPM and the EU ETS. They illustrate, in particular, that linking may be easier in cases where it is planned from the outset.

### BOX 9.5 CASE STUDY: Linkage between Australia and the EU

- In August 2012, Australia and the EU agreed to negotiate and finalize a full two-way link. In contrast to the California/Québec case, the EU and Australia ETSs had not been mutually designed with an expectation of linkage to each other. As a result, at the point of announcing the plans to link, it remained to be seen if many design features had to be harmonized fully. The linkage agreement was to be implemented in two stages, in order to analyze, negotiate, and implement any changes to either system that would need to occur in order to facilitate linking. These changes related, in particular, to the removal of the Australian carbon price floor and the reduced use of Kyoto units.
- In the first stage, Australia and the EU announced a one-way link, through which Australian entities would have been able to use EU allowances for compliance at the end of Australia's fixed-price period ending on July 1, 2015. As part of this negotiation, Australia agreed on a further sublimit of 12.5 percent on the use of Kyoto offsets (CERs and ERUs) and land use-related Kyoto units (RMUs). Australia also agreed to drop its price floor.
- The second stage, a bilateral link, was planned to commence on July 1, 2018. This would have made EU and Australian allowances interchangeable, subject to a total limit of 50 percent of Australian companies' compliance obligations being met using international units.
- The change in government in Australia led to the repeal of its Carbon Pricing Mechanism and thus the link with the EU, so it is unknown what further changes to either system might have been required and what design differences might have been allowed.[a]
- For a discussion of the proposed linking of registries, see Box 9.7.

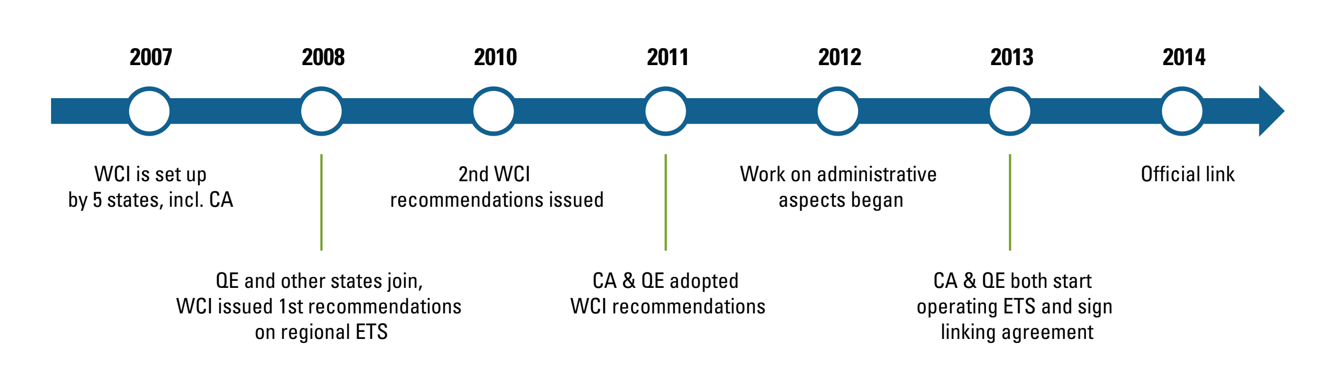
a World Bank (2014).

163 PMR (2014).

### BOX 9.6 CASE STUDY: Linkage between California and Québec

Both California and Québec have committed to reduce their GHG gas emissions by 2020, in part through implementation of an ETS. California has committed to reduce its emissions to 1990 levels, while Québec intends to reduce emissions by 20 percent below 1990 levels. From an early stage in the development of their respective ETSs, both 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 Western Climate Initiative (WCI), a voluntary coalition in which participants drew up plans for a nonbinding, voluntary agreement to reduce their collective regional emissions to a level 15 percent below 2005 levels by 2020. This collective goal lent itself to linkages among partner states and provinces—through collaboration, policy harmonization, or, in the case of California and Québec, full linkage.[a] The WCI recommendations were designed to be "integrated into, or work in conjunction with any future U.S. or Canadian emissions-reduction programs."[b]




*Source:* ICAP.

California and Québec aligned most of their design elements. Before the link was official, they closely compared their regulations, identifying which provisions needed to be exactly the same (or have the same effect) and which could differ. In the end, they decided the provisions that had to be completely harmonized included coverage and arrangements for auctions, floor price, an allowance price containment reserve, banking (with enforced holding limits), and multiyear compliance periods. Issues on which they decided they could differ include offset protocols and recognition of early emissions reductions.

Allowance prices responded promptly but partly in unexpected ways to the establishment of a full link. Québec had been expected to benefit from cheaper allowances, while California had been expected to benefit from a slight increase in demand for California-held allowances, leading to greater in-state reductions.[c, d] In practice, all of Québec's auctions before linking cleared at the floor price, while the price cleared above the floor price at the first joint auction held in November 2014.[e] It is too soon to be definitive about the reasons for these price movements.

a Purdon et al. (2014).
b WCI (2015).
c Purdon et al. (2014).
d Hsia-Kiung et al. (2014).
e MDDELCC (2016).

Three design elements related to enabling infrastructure require alignment:

- **Robustness of MRV systems.** Confidence that monitoring, reporting and verification should be equally robust in both systems is critical to assuring comparability in terms of the environmental integrity of units.
- **Stringency of enforcement.** Authorities that exert comparable levels of enforcement are required to ensure smooth operation of the emissions market. If systems are not able to effectively enforce regulation at a comparable level, the environmental integrity of both linked systems will suffer. Penalties for noncompliance should also be consistent, otherwise noncompliance will happen mainly in the system with less stringent penalties. Market oversight, including the content and timing of public disclosure of information, could also be important to align. The EU and Australia identified oversight provisions as one of the issues to be negotiated (see Box 9.7).
- **Registry and tracking units.** While systems can be theoretically linked without a direct registry connection, ensuring compatible registry systems can greatly facilitate creation of a linked market. The proposed link between Australia and the EU raised issues that systems will have to address when linking registries (see Box 9.7). 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.[164]

### BOX 9.7 CASE STUDY: Intended Australia-EU Linkage – the Role of Registries[a]

Although Australia's CPM was repealed before it ever linked with the EU (see Box 9.5), the two jurisdictions had already begun analyzing many of the implementation details of the proposed link, including the linking of their respective registry systems. The Australian government and the European Commission proposed six principles that any link between their registries should abide by:

- Ensures the fungibility of allowances;
- Ensures environmental integrity;
- Ensures ease of use;
- Is complementary to the efficient operation of both registries for domestic purposes;
- Provides protected access to allowances; and
- Supports the development of international carbon markets.

For the first stage of the link (in which Australian entities could use EU units for compliance, but entities in the EU would not be able to use Australian units), the negotiators proposed an indirect registry link. Under this approach, no units would be directly transferred between registries. Instead, when an EU entity sold to an Australian entity, that unit would be held in an Australian government account in the EU registry and, in parallel an Australian-issued international unit (AIIU) unit would be issued in the Australian registry system to the purchaser. This AIIU would shadow the unit held in the EU, but could be traded or surrendered for compliance in the Australian system. When surrendered, an EU allowance held by the Australian government in the EU registry would then be canceled to avoid double counting. In addition, the AIIU could also be traded back to the EU registry, in which case the relevant AIIU would be canceled and an EU allowance, held in the Australian government's EU account, would be moved to the EU purchaser's registry account. This was expected to help drive price convergence.

a This case study was based on a report by the Commonwealth of Australia and EC (2013).

164 For more information on the ITL, see the UNFCCC's webpage on the subject (UNFCCC, 2014) as well as Wabi et al. (2013), which details the more technical aspects and requirements of the ITL.

## 5.2 Aligning non-essential design features

There is another set of program features that do not necessarily need to be aligned for effective linking, but where alignment could help further address environmental and competitiveness concerns, and help the market operate more efficiently.[165] In these cases, there may be a trade-off between alignment and efficiency, as maintaining diversity in program elements could improve liquidity and be beneficial to market operations. Five elements where alignment could be considered but is not necessary, include:

- **Scope.** Two 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 two systems that cover the same sectors that compete with each other internationally can help address competition and potential leakage issues. For example, the European Commission deemed expanding the coverage of the Swiss ETS to aviation essential for its link with the EU ETS in order to address potential carbon leakage issues.
- **Point of obligation (or "regulation").** While different points of obligation are not necessarily barriers to linking, 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 (e.g., industrial facilities or residential buildings), accounting adjustments would need to be made where electricity is traded across the borders of linkage partners 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, competitive, and distributional challenges for linking. If a system with free allocation links with one that auctions allowances, industries might view their competitors' allocations as 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 9.7). In addition, linking can change the distribution of auction revenues across systems, creating a potential need for agreement on the division of auction proceeds.
- **Commitment periods.** Alignment of time horizons across systems may play a role in reaching agreement on programs' ambition as well as to improve market functioning. Different commitment periods could produce market instability as a result of 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 currently run through 2020 but they are considering extension to 2030 or beyond (see Box 9.6).
- **Compliance periods.** Equivalent compliance periods for entities could facilitate joint program administration. However, different compliance periods could also be beneficial, as they would improve liquidity.

Some design features that do not strictly require alignment might be transmitted across a linked system and therefore need to be considered carefully by policy makers. This transmission occurs in three main areas:

- **Borrowing.** 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 units (or the present-day vintage units they replace) to the second system, even though entities in that system may not borrow for themselves.
- **Banking.** Similarly to borrowing, if a system that restricts banking sells units to another system where greater banking is possible, this will erode the effects of the restriction.
- **Price predictability and cost containment mechanisms.** Linking effectively provides all market actors with access to the most favorable price and quantity management mechanisms anywhere within the system. For example, a price floor in one system will no longer be effective if there are enough allowances below that price in the other system. Similarly, a hard price ceiling in one jurisdiction could compromise the cap for both jurisdictions.[166]



165 The list of design features to harmonize in order to maintain environmental integrity was adapted from Sammut et al. (2014).

166 For example, Australia dropped its price floor as part of its buy-link agreement with the EU, given that EU prices were significantly below the floor and thus would have undermined or complicated the maintenance of the floor. Similarly, Australia set its price ceiling equal to the allowance price in the EU, rendering the role of the ceiling moot.

# 6. Formation and Governance of the Link

If the issues raised in the preceding sections are addressed, it is possible to proceed to formal linking, which will include establishing the required governance arrangements. This involves considering the timing of the link (section 6.1), choosing the linking instrument (section 6.2), identifying institutions to govern the link (section 6.3), and preparing a contingency plan for delinking (section 6.4).

## *6.1 Timing of the link*

Several elements need to be considered in relation to the timing of a link:

- **Early changes.** The history of ETS, notably the EU ETS, suggests that various design features tend to evolve in the early years of a 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 much more difficult to refine the design of an ETS once it has been linked with another.
- **Prealignment.** Timing the implementation of a link depends on the extent to which systems are prealigned. California and Québec engaged in a multiyear collaborative process under the WCI before formally linking, in one step, in 2014. By contrast, the proposed EU and Australia link would have occurred between ETSs that had 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 alignment process.
- **Objectives for linking.** Whether linkage occurs alongside the launch of an ETS or afterwards may depend on the objectives for linking. 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 contain costs, immediate linkage may not be as critical as the level of ambition, and other features in the early stages of the ETS will tend to keep costs low to smooth the transition into the system.

## *6.2 Choosing the linking instrument*

Bilateral linking instruments may include formal treaties, nonbinding agreements, and MOUs, while unilateral links will only require action by one government, as long as the seller authorizes the sale of units. Important questions to ask about a linking instrument include:

- Should the instrument be legally binding or not?
- If a linking instrument is nonbinding, how can it be assured that the regulator of each linking partner has sufficient enforcement scope to address all of the potential issues associated with the linked program?
- How will the instrument be designed to provide sufficient certainty about the link's longevity?
- How will the instrument address the process for collaboration?
- How will design changes, including revisions to the cap and the potential to delink, be addressed in future?
- Which institutions should be established or designated by the instrument to govern the link?

The answers to these questions will depend on the particular legal context in the respective linking jurisdictions. To date, linking via formal treaty has not been implemented, although the EU-Australia link would have been formalized in a treaty and the EU-Switzerland link will use this mechanism. Joining the EU ETS has primarily been accomplished automatically by either joining the EU itself (in the case of Cyprus and Malta) or, in the case of Norway, Liechtenstein, and Iceland, via a decision at the level of the European Economic Area (EEA) to adopt the EU ETS Directive. In the California-Québec linkage, each partners' ability to create a binding linking agreement was limited by their subnational status, notably that of the United States, where treaty making and the ability to create binding agreements between sovereign states is solely reserved to the federal government. Thus, both California and the RGGI states have resorted to nonbinding agreements that nevertheless provide a transparent approach to linkage. California has also entered into a number of MOUs with other governments that are considering or are in the process of developing an ETS (e.g., China and Mexico), as well as with the states of Chiapas (Mexico) and Acre (Brazil) regarding development of REDD+ crediting systems.[167] The process of developing the MOU allows all parties to discuss and lay out transparently what they would like to achieve through a collaborative information-sharing process and gives participants a baseline against which to measure progress.

167 Hsia-Kung and Morehouse (2014).

## 6.3 Establishing institutions to govern a link

Institutions to govern a link may include a provider of market services and a transparent system for design changes:

- **A single provider for market services and oversight.** Both California and Québec (and 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 monitoring the market for fraud or manipulation. By using a single provider for these services, linked systems are able to create administrative efficiencies and reduce costs.[168] Joint auctions can also facilitate harmonization of the carbon price across linked markets.
- **A transparent system for ETS design changes.** New design features that need to be harmonized across linked systems require a transparent process. 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. For example, California and Québec both have regulatory processes that require notice and opportunity for public comments before changes are implemented. They specifically recognize the need to continue harmonizing their ETS design and provide adequate notice of any changes.[169] RGGI, working with a larger collaborative of nine states, relies on a Model Rule that is reviewed every three years.[170] States adopted individual regulations based on the original Model Rule and can update their regulation as the overarching Model Rule changes.

## 6.4 Preparing a contingency plan for delinking

Three issues have to be considered when structuring a linking agreement with an eye to potential delinking in the future:

- **Adjustment of the cap.** If one system delinks from the other, this will affect prices in both systems. Policy makers 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 a more elaborate discussion on responding to evolving circumstances).
- **Treatment of allowances from another system.**[171] If permits from another system can be identified as such and are no longer valid after delinking, any speculation about

168 Kachi et al. (2015).
169 ARB and Government of Québec (2013).
170 RGGI (2014).
171 See Comendant and Taschini (forthcoming), which includes a discussion of how to deal with such "contaminated" allowances.

### BOX 9.8 CASE STUDY: Delinking in RGGI

The Regional Greenhouse Gas Initiative (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 Memorandum of Understanding (MOU) set the overall cap and each state's share of the cap for each 3-year compliance period. In May 2011, Governor Chris Christie announced that New Jersey would withdraw from RGGI ahead of the Second Commitment Period (2012–14). The MOU stated that a state "may, upon 30 days of written notice, withdraw its agreement to [the] MOU and become a Non-Signatory State."[a]

The RGGI cap had to be modified to take into account 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 ton of $CO_2$ for the second compliance period.[b] New Jersey completed the first compliance period before officially withdrawing.

When New Jersey left, it had already sold approximately 300,000 $CO_2$ allowances for 2014 and as RGGI allows unlimited banking and was significantly overallocated 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.[c] 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, delinking 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.

a RGGI (2005).
b RGGI (2016).
c RGGI (2011).

delinkage will cause prices of permits in the linked systems to diverge. The cheaper units will be used as much as possible before delinking and valuable units will be banked.[172]

- **Process for delinking.** Delinking may occur due to a build-up of issues over time or a sudden (political) event. For example, political changes in New Jersey led the state to withdraw from RGGI (see Box 9.8). Under some circumstances (e.g., a temporary enforcement issue), a temporary suspension of a link rather than a complete delink might be desirable. A clear exit strategy will make negotiation on the inevitable changes to adapt to new conditions easier and minimize problems if delinking is necessary. This is especially critical for links between jurisdictions that do not have a close history of interaction on other issues.

# QUICK QUIZ

## Conceptual Questions

- 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?
- What are different ways to link ETS?
- What program design features are likely to require harmonization under a link?

## Application Questions

- How important may linking be for your jurisdiction's ETS?
- What goals might different approaches to linking achieve for your ETS?
- Who would be your preferred linking partners, and why, when, and how might you pursue linking discussions?

172 See Pizer and Yates (2015) for an analysis of the impact of different treatments of banked allowances under delinkage.

# STEP 10: IMPLEMENT, EVALUATE AND IMPROVE

# AT A GLANCE

- ✓ Decide on the timing and process of ETS implementation
- ✓ Decide on the process and scope for reviews
- ✓ Evaluate the ETS to support review

Moving from design to operation of an ETS requires government regulators and market participants to assume new roles and responsibilities, embed new systems and institutions, and launch a functional trading market.

Every ETS has required an extensive preparatory phase to collect data and develop technical regulations, guidelines, and institutions. In addition, some jurisdictions have used explicit pilot periods. These allow all parties to test policies, systems, and institutions; build capacity; and demonstrate effectiveness. This may be particularly valuable if the jurisdiction faces internationally distinctive conditions. 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, policy makers will need to judge the scope and length carefully to obtain a sufficiently representative understanding of the market and policy, while still incurring and imposing costs consistent with a pilot phase.

An alternative or addition is to gradually phase-in some design features of the ETS. This will allow learning-by-doing, easing the burden on institutions and sectors. Some of the key design features that may be phased in include:

- **Coverage:** An ETS might start with a limited number of sectors and thresholds that target the most significant mitigation opportunities, before expanding over time;
- **Cap stringency:** Gradual introduction can allow ambition, and associated costs to participants, to grow more slowly;
- **Free allocation:** Often the proportion of allowances allocated for free starts high and falls over time;
- **Price controls:** The government may wish to provide a higher degree of price control at the outset of an ETS, when the public and financial institutions needed for trading are still at a nascent stage; and
- **Linking:** Linking may be planned for a later stage in ETS development once an ETS is more established.

Circumstances will change and experience will generate learning about the ETS. Reviews of ETS performance—both frequent regular reviews and less frequent systematic reviews—will enable continual improvement and adaptation. These should be complemented by rigorous independent evaluation, and both reviews and evaluations should be facilitated by starting data collection before commencement of the system (as existing data sets and systems are unlikely to be sufficient) and making entities' data public where possible.

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, predictable processes by which ETS changes are communicated and implemented.

This chapter looks at the process of implementation, evaluation, and review. Section 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 2 examines how implementation can be evaluated and reviewed so the necessary adjustments to the system can be made, while also balancing the need for predictability.

# 1. Timing and Process of ETS Implementation

The implementation of an ETS requires a large number of timing and process decisions. Policy makers often choose to commence an ETS with a trial or pilot period to test and confirm the appropriateness of some of these key decisions. For instance, Phase I of the EU ETS served as a sort of trial for this system. China is conducting seven regional pilots that are helping inform the future national system. Kazakhstan similarly had a formal, one-year trial phase.[173] By contrast, California launched its full ETS with no formal pilot or testing phase except for a practice auction, although it too phased in some elements such as coverage of certain sectors and the share of allowances auctioned.[174]

Pre-implementation phases that set out measures to collect data, establish MRV procedures, or create the necessary institutional arrangements can also serve as partial pilots on the way toward ETS implementation without being perceived as a formal ETS pilot. However, incentive structures are important and even highly technical elements of an ETS need to be road-tested. Pretested methodologies and procedures will require further testing in the framework of a fully operational ETS.

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.

## *1.1 Before implementation*

As discussed in Step 8, it is crucial to allocate sufficient time before implementation for:

- Expert advice;
- Data collection;
- Development of ETS regulations and guidelines;
- Designation or establishment of supporting institutions;
- Establishment of registry and trading platforms;
- Capacity building among regulators, ETS participants, trading entities, and other service providers or stakeholders; and
- Public education about the system, possibly including a voluntary trading system and/or ETS simulations for stakeholder engagement and training.

173 See Sergazina and Khakimzhanova (2013).
174 See ARB (2014).

In particular, before compliance or trading begins, it is necessary to ensure there are adequate MRV measures in place. As discussed in Step 8, pre-ETS MRV measures can:

- Improve the quality of data for setting the cap and making choices about distribution of allowances;
- Support capacity building by both participants and regulators as well as legislators; and
- Test government administrative and compliance mechanisms before units must be surrendered.

Both Australia and New Zealand had mandatory reporting in place before ETS obligations. New Zealand phased sectors into the ETS by having one year of voluntary or, for most sectors, 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 country. In the Republic of Korea, the Target Management System has formed the basis for its ETS, as discussed in Box 10.1.

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.

BOX 10.1 **CASE STUDY: Korea's Target Management System**

Korea's Target Management System (TMS) was introduced in 2012. It involved both mandatory reporting and firm-specific emissions reduction targets, applied to the same parties that were expected to be regulated by the Republic of Korea ETS. The TMS smoothed the transition into the ETS by developing the necessary MRV processes. It also helped define the scope and 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 could be reduced, further facilitating the implementation of the Republic of Korea ETS.

## *1.2 Starting with a pilot*

A pilot is a mandatory program that is explicitly framed as a testing or learning period with a specific end date, and for which the regulator clearly signals that the system could significantly change after the pilot ends. This section outlines the objectives of a pilot before discussing their implications for appropriate design.

### 1.2.1 *Objectives of pilots*

Pilots have three main objectives:

- **To test policy, methodologies, systems, and institutions:** Pilots can help identify problems 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;
- **To build capacity in advance of full ETS implementation:** Pilots, in contrast to ETS simulations or voluntary trading (see Step 8), 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 regulatory and advisory capacity through training of ETS consultants, verifiers, and intermediaries, as well as the capacity of regulated entities; and
- **To demonstrate effectiveness:** Pilots may be particularly valuable if the jurisdiction has characteristics that differ from those in other jurisdictions with an existing ETS. In these cases, a pilot can serve to fine-tune ETS design elements and demonstrate overall ETS impact within the jurisdiction. As a result, they can support implementation during subsequent phases, as policy makers can draw on practical experiences, in addition to theoretical models.

### 1.2.2 *Pilot design*

There are several choices policy makers must make when designing the pilot:

- **Length:** When choosing the length of the pilot period, it is important that the time frame chosen be consistent with its objectives. If the principal aim is to collect data, a short pilot period 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, a longer pilot phase may be required. A lag prior to full implementation may also be necessary to make changes to systems.
- **Coverage:** Policy makers 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 fewer sectors or, as in China, have a more limited geographic scope (see Box 10.2). A narrower scope allows key policies and institutions to be tested without imposing the same costs (on both the government and covered entities) as a broader pilot would. However, the pilot may not be representative if it does not cover all market participants.
- **Cap stringency:** Some jurisdictions have decided to impose a less stringent cap in the pilot period, since this will not directly influence the functioning of the market in the long term. However, the benefits gained from experimentation 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.
- **Carryover of units:** A decision also needs to be made whether units from the pilot may be carried over into the full-fledged ETS. However, as discussed in Step 5, restricting banking from a pilot to later phases reduces the risk that undesirable market features in the pilot carry over into the full implementation phase.

### 1.2.3 *Limits of pilots*

While well-designed pilots can achieve many of the objectives outlined above, the lessons they hold for policy makers in terms of effectiveness of ETS design are nevertheless limited. For example, pilots are unlikely to be sufficiently long or ambitious to trigger the large investments that will cause major emissions reductions.

In addition, there are risks associated with ETS pilots in terms of public perception and loss of support if experiments are not viewed as successful. 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 10.3. Clearly communicating and managing expectations regarding a pilot phase will be important to mitigate such risks. In contrast to the EU experience, California chose not to use a pilot phase, but instead went through a long planning process starting with discussions within the WCI.

## BOX 10.2 CASE STUDY: Chinese Regional ETS Pilots

On October 29, 2011, China's National Development and Reform Commission (NDRC) issued 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 by 2020 China's goal of controlling greenhouse gas at a low cost.[a] Among other objectives, the NDRC directed the pilot regions to define the total GHG emissions control target, formulate an allocation plan, establish a local carbon trading supervision system and registry, and establish a trading platform.

This 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 road-test different variants of the proposal in multiple regions that feature different socio-economic circumstances. This learning-by-doing approach allows policy makers 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 and Guangdong.[b] Collectively these areas represent approximately 29 percent of China's 2014 GDP, and have a population of about 256 million. The first pilot (Shenzhen) was launched in June of 2013; the last (Chongqing) was launched a year later. Initially, the pilots were scheduled to run for three years, though some of them may be extended (see below).

### Lessons learned from regional pilots

Through a process of trial-and-error, the local officials charged with developing and running the pilots are looking to craft programs that are tailored to their circumstances. Meanwhile, those developing a national ETS are monitoring the progress and implications of these policy experiments.

NDRC policy makers are thinking carefully about how to segue from the current pilots to a national ETS. While it is possible that the pilots terminate in their current form, it is also plausible that some elements of the individual pilots will be incorporated into a successor, national ETS. Further, local programs may in parallel cover entities that are excluded from a national ETS. In these instances, national and local policy makers may work together to identify program elements necessary to facilitate some degree of interaction and allowance/credit fungibility between the national and regional programs.

a NDRC (2011).
b Zhang et al. (2014).

## BOX 10.3 CASE STUDY: Lessons Learned from Phase I of the EU ETS

The EU included what amounted to a trial phase in its ETS design—Phase I, which ran from 2005 through 2007, and allowed no banking of allowances into Phase II. In this learning-by-doing period, both regulators and covered entities were able to gain experience with emissions trading. As stipulated in Article 30 of the Directive establishing the EU ETS, a full review of the EU ETS was then mandated before the end of Phase I.[a]

The first Phase 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 were of concern to financial controllers/accountants and not just 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 public perceptions of the EU ETS. Based on the experience in Phase I, 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 determine the free allowances for covered entities in their country, through the National Allocation Plans (NAP), tended to overestimate emissions projections, giving regulated entities a higher allocation than needed and leading to low prices. This reduced the incentive to invest and innovate;
- The lack of harmonization across member states in their approach to determining NAPs caused distortion of competition;
- Firms in some sectors receiving free allocation were able to pass through the market value of allowances in the form of higher prices for consumers, leading to windfall profits, with negative distributional impacts; and
- The approval of NAPs was complex, and created a lot of uncertainty about the overall cap of the EU ETS.[b]

The first phase was valuable in that it allowed these issues to be identified and addressed in subsequent phases.[c] In particular, since Phase III, the Commission has centralized both the cap process and the allocation method. Additionally, only sectors considered at risk of carbon leakage receive free allocation of allowances.[d]

a European Council (2003).
b See EC (2008a); reports of all Working Group meetings are contained in Annex 1.
c European Council (2009).
d The power sector receives no free allocation in Phase III as it is considered capable of passing on the cost of carbon to consumers and industry. The rules for Phase III 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 Phase I and II no ex post adjustment was allowed.

## 1.3 Gradual implementation

In addition to, or instead of, a pilot, policy makers may wish to consider gradually implementing aspects of the ETS. In contrast to a pilot, gradual implementation envisages a particular end design of the ETS from the outset, but phases in the introduction of some of the design elements. This section outlines the objectives of such a transition (and hence the benefits it may bring), its elements, and some of the challenges it may pose.

### 1.3.1 Objectives of gradual implementation

Similar to pilots, the objectives of gradual implementation are:

- **To build capacity:** Gradual implementation can allow for capacity building both inside and outside of government, to build confidence in effective ETS operation before obligations apply more broadly or with greater stringency, or more complicated rules are introduced;
- **To test systems:** While gradual implementation is associated with a particular ETS design in the long run, it nonetheless provides an opportunity for early review of the first stages of implementation, and for altering plans for later stages accordingly;
- **To reduce upfront costs associated with 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, policy makers can mitigate some of these risks and complexities. Once each part of an ETS is operating, the costs and capability needed to sustain the system fall significantly; and
- **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.

### 1.3.2 Elements of the transition

Some of the key design features of an ETS where a gradual implementation approach might be adopted include:

- **Coverage:** 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. It can then expand to include additional sectors and/or a larger number of participants over time;
- **Cap stringency:** Gradual introduction 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 gradually be reduced over time;
- **Free allocation:** Levels and methods of free allocation could transition over time. Grandfathering for stranded asset compensation or to prevent emissions 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 3), and so free allocation methods may be reduced, phased out, or shifted to more sophisticated approaches (benchmarking, OBA) over time. If free allocation is reduced, the introduction of large-scale auctions needs careful testing and upscaling;
- **Price controls:** The government may also wish to provide a higher degree of price control at the outset of an ETS, when public and financial institutions needed for trading are at a nascent stage. The system may then transition towards greater liberalization as carbon pricing becomes more geographically widespread, 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 in order to allow time for the market to mature (see Step 6); and
- **Linking:** Some ETSs may launch as linked systems with other jurisdictions from the beginning. However, in other cases, policy makers 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).

### 1.3.3 Challenges associated with gradual implementation

The following challenges are associated with gradual implementation:

- **Reduction in overall ETS impact:** The overall environmental impact of the ETS may be lower if fewer sources are covered initially. There will also be a loss of cost effectiveness compared to the full market. As a result, the overall emissions goals and cap needs to be adjusted to account for lower coverage (see Step 2);

- **Carbon leakage:** Another, 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 it is clear that the uncovered sources will be entering the system in the medium-term. In this case, long-term investment decisions should not be affected;
- **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 Box 1.6 in Step 1);
- **Political expectations:** A high initial cap risks low prices that may harm system credibility and reduce expectations for longer-term prices. Market participants may not be confident that the government will implement more ambitious caps in later stages; and
- **Stakeholders resistant to change:** The initial market design could potentially create stakeholders that will be resistant to subsequent change, making it more difficult to move to the long-term desired design. For example, sectors that are initially excluded may find it easier to continue to resist entry (e.g., the agricultural sector in New Zealand, see Step 1).

The following tables provide a timeline for significant policy changes in five ETSs. The last table (on New Zealand) distinguishes between changes due to phased implementation and those resulting from a review.

### TABLE 10.1 **Timelines of Significant Changes in Five ETS**

**Regional Greenhouse Gas Initiative (RGGI)**

| Date | Event/Changes Made |
|---|---|
| 2005 | MOU 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 | Substantive amendments made to Model Rule in response to public comments. |
| 2007 | RGGI, Inc. was established in July 2007, and Maryland, Massachusetts, and Rhode Island join RGGI. |
| 2007–08 | States codify Model Rule in state-specific legislation and/or regulation. |
| 2008 | First auction held. |
| 2008–10 | Offset protocols developed. |
| 2009 | First compliance period begins. |
| 2011 | New Jersey announces intention to withdraw. |
| 2012 | New Jersey withdrawal effective.<br>Cap reduced to 165 million short tons of $CO_2$. |
| 2013 | Updated Model Rule released after 2012 review: lowers cap; introduces Cost Containment Reserve and interim control period. |
| 2014 | Cap reduced to 91 million short tons of $CO_2$. |

**European Union Emissions Trading System (EU ETS)**

| Date | Event/Changes Made | |
|---|---|---|
| | Sectoral coverage and linking | Allocation |
| 2007<br>(Start Phase I) | Bulgaria and Romania accede to EU; join EU ETS. | |
| | Norway unilaterally links to EU ETS. | |
| 2008<br>(Start Phase II) | ETS expands to include EEA countries (Iceland, Liechtenstein, and Norway [a]). | Member states can auction up to 10 percent of allowances. |
| | $N_2O$ emissions from production of nitric acid included. | Penalty for noncompliance increases to €100/tonne. |
| 2012 | Aviation sector included based on Directive 2008/101/EC. | |
| 2013<br>(Start Phase III) | Rules for Phase III decided in Directive 2009/29/EC.<br>Cap set at EU-level, decreasing linear trend set.<br>Post-2012 CERs from the CDM no longer accepted (except from the LDCs). Projects involving the destruction of HFC-23 and $N_2O$ are excluded, regardless of the host country. | Higher percentage of auctioned allowances; Auctioning becomes default for power sector. |
| | System expanded to include $CO_2$ emissions from petrochemicals, ammonia and aluminum; $N_2O$ emissions from nitric, adipic, and glycolic acid production; and perfluorocarbons (PFCs) from the aluminum sector. | Free allocation determined by EU-wide, harmonized allocation rule. |
| | Croatia accedes to EU; joins EU ETS. | |
| 2014 | Backloading finalized, 900 million allowances moved from 2014–16 auctions to 2019–20. | |
| 2019 | Market Stability Reserve (MSR) to become operational. | |

a Norwegian ETS subsumed by EU ETS.

*continued on next page*

TABLE 10.1 **Timelines of Significant Changes in Five ETS** *(continued)*

| California Cap-and-Trade Program | |
|---|---|
| Date | Event/Changes Made |
| 2009 | Multiple public meetings on various aspects of a (future) California Cap-and-Trade Program. |
| 2010 | First Draft Regulation published, including offset protocols for U.S. Forest Projects, Urban Forest Projects, Destruction of Ozone Depleting Substances, and Livestock Manure Digesters. |
| 2011 | Final Regulation adopted (including four compliance offset protocols). |
| 2012 | Program "initiated." |
| 2013 | First enforceable compliance obligation period starts. |
| 2014 | Program linked to Québec. |
| | Compliance Offset Protocol Mine Methane Capture (MMC) Projects adopted. |
| 2015 | Program expanded to suppliers of transportation fuels and natural gas. |
| | Rice cultivation offset protocol approved; forest offset protocol expanded. |

| Québec Cap-and-Trade Program | |
|---|---|
| Date | Event/Changes Made |
| 2011 | "Regulation respecting a cap-and-trade system for greenhouse gas emission allowances" and amendments to "Regulation respecting mandatory reporting of certain emissions of contaminants into the atmosphere" adopted to bring the latter in line with the rules adopted by the WCI. |
| 2012 | Amendment to Cap-and-Trade Regulation to set the operating rules of Québec's offset system. |
| | Amendment to Cap-and-Trade Regulation allowing the linking of Québec's system to that of California. |
| 2013 | Launch of the System. |
| 2014 | Program linked to California's. |
| 2015 | Upstream fossil fuel suppliers and first deliverers of electricity added to the program. |
| | Québec signs MOU with Ontario and Manitoba expressing the intent to collaborate to link their (planned) systems under the WCI. |

| New Zealand Emissions Trading System (NZ ETS) | | |
|---|---|---|
| Date | Event/Changes made | |
| | Sectoral coverage | Allocation and surrender provisions |
| 2008 | Forestry enters.[a] | One-time allocation to pre-1990 forestry.[a]<br>One-time allocation to fisheries.[a]<br>Free allocation to EITE with planned gradual phaseout.[a]<br>Forestry removals implemented.[a]<br>NZ ETS opens to international trading and accepts Kyoto units for compliance.[a] |
| 2009 NZ ETS Review | Stationary energy and industrial processes scheduled to enter, but deferred to mid-2010.[b]<br>Agriculture deferred to 2015 (originally scheduled for 2013), but subject to reporting obligation.[b] | 1-for-2 surrender obligations introduced.[b]<br>Phaseout of EITE free allocation scheduled, but deferred to 2016.[b] |
| 2010 | Liquid fuels sector enters.[a]<br>Stationary energy and industrial processes enter.[b] | |
| 2012 NZ ETS Review | Agriculture deferred indefinitely.[b] | Fixed-price measure introduced.[b]<br>1-for-2 surrender obligations extended.[b]<br>New Zealand did not take a target under the Kyoto Protocol's second commitment period.[b] |
| 2013 | Waste sector enters.[b] | Auctioning enabled (not implemented).[b] |
| 2015 | | NZ ETS stops accepting international Kyoto units for compliance.[b] |

*Note:* CER = Certified Emission Reduction; CDM = Clean Development Mechanism; EEA = European Economic Area; EITE = Emissions-Intensive Trade-Exposed; WCI = Western Climate Initiative.

a Denotes changes due to phased ETS implementation or planned prior to ETS launch.
b. Denotes changes after ETS review.

# 2. ETS Reviews and Evaluations

This section examines the following elements: the rationale for reviewing an ETS; the types of reviews; data requirements for reviews and evaluations; and processes for responding to a review.

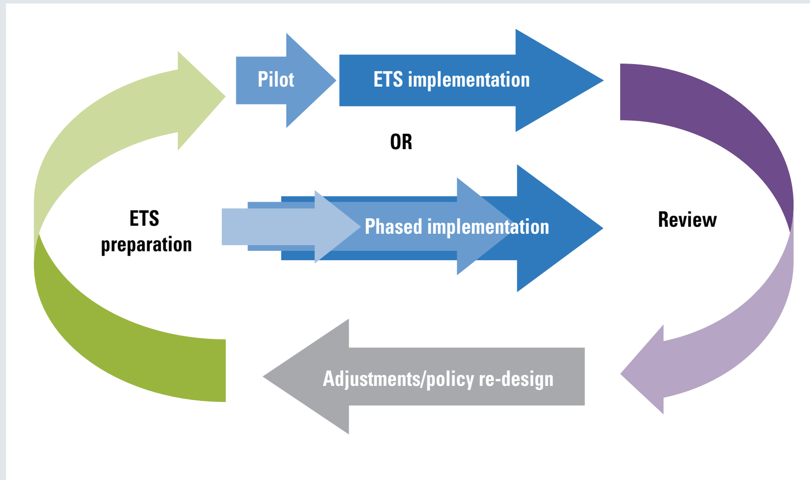
## 2.1 Rationale for reviews

Evaluations and opportunities to review and make changes to the program are crucial parts of an ETS. The most successful systems will be those that have an efficient and politically acceptable process to respond to new information on program performance and to changing local and global circumstances. Figure 10.1 depicts a stylized model of an ETS policy cycle, including the stages of review and subsequent adjustments of the policy.

Reviews are mainly necessary for the following reasons:

- **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 international climate policies:** For example, international policy developments might require an increase in cap ambition, or offer new linking or offset opportunities;
- **Learning from ETS experience:** Issues will arise from lessons learned about emissions trading since the initial design, and will need to be taken into account;
- **Responding to administrative issues:** An ETS is complex and interacts in complex ways with other laws and regulations. Administrative problems may need resolution; and
- **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.

FIGURE 10.1 **Stylized Model of the ETS Policy Cycle**




*Author:* ICAP.

Reviews provide an opportunity to balance the trade-off between predictability and flexibility that is inherent in all aspects of ETS design. Ideally, they need to be "predictably flexible"[175]—a robust and predictable process for evaluation and 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, issuing some units a long way in advance and including provisions for banking can give firms a vested interest in maintaining the ETS and keeping a stable price in the long term (see Step 5). Similarly, as discussed in Step 1, introducing complementary policies can help increase perceived political commitment to the attainment of targets.

## 2.2 Types of reviews

Clearly defined objectives are critical to any effective review. Often it is the emergence of new policy objectives—or the need to create a new balance among them—that can justify a review in the first place, regardless of the effectiveness of the ETS in meeting original goals.

Three main types of review can be distinguished:

1. Comprehensive reviews that amend fundamental aspects of the ETS;
2. Regular reviews that amend administrative or technical aspects; and
3. Evaluations that support both comprehensive and regular reviews.

175 World Bank Institute (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.

### *2.2.1 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. Some of the key issues that might be explored during a comprehensive review include the following:

- Systematic adjustment of the cap to take account of the broader context, including any change in 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;
- Evaluations of how the ETS has performed relative to expectations for allowance prices, compliance costs, and potential for leakage and competitiveness impacts; and
- Analysis of how much the carbon 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 refresh and refine stakeholders' and officials' understanding of how an ETS can most effectively operate, helping protect core features.

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 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.

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 10.4. 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 also within phases. These ad hoc reviews are discussed in the following sections.

### *2.2.2 Regular reviews*

Regular reviews are complementary to comprehensive reviews. They tend to be more administrative or technical in nature and can be scheduled or unscheduled.

- **Scheduled reviews** of an ETS allow policy makers to assess basic functionality and make any necessary changes to the design of the system 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 system as a whole. In many cases, early perceptions of effectiveness are therefore unlikely to be an appropriate basis for informing fundamental changes to the design of an ETS.
- **Unscheduled reviews** are needed where:
  - An urgent problem is leading an entity to face non-compliance, despite its best efforts;
  - Laws or regulations are found to be in conflict; or
  - There appears to be a loophole in regulations that market actors are exploiting.

In contrast to comprehensive reviews, issues that are technical and legal can be managed largely through an administrative process run by officials and regulators. These reviews will benefit strongly from input by stakeholders who can provide practical insights into challenges and potential solutions.

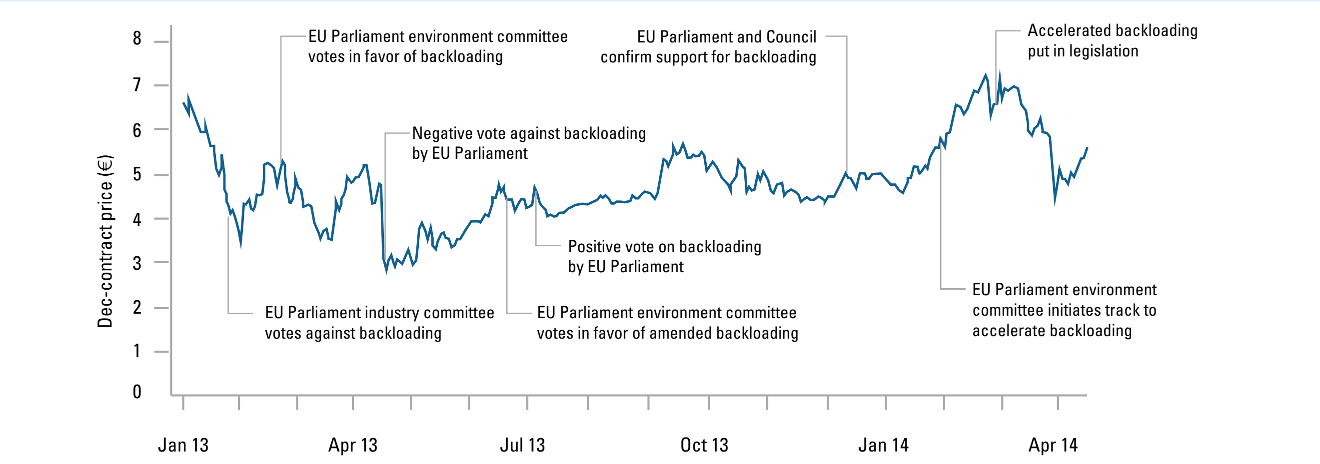
For instance, California regulators use an adaptive management approach to implementation, evaluation, and improvement. As issues arise, necessary actions or policies to improve the effectiveness of the regulation are proposed. These go through a lengthy public consultation process before the California ARB makes any amendments.

### *2.2.3 Evaluations*

Evaluations help inform the comprehensive and regular review processes. They perform three roles:

- To identify program features that are working well;
- To inform redesign of elements that may not be working as well as they could; and
- To more generally assess the future role of emissions trading within the climate policy mix.

BOX 10.4 **CASE STUDY: Structural Reviews of the EU ETS**




*Source:* World Bank (2014).

Three institutions are involved in EU ETS legislation: the Commission, the Council, and the Parliament. The Commission initiates legislative proposals (including new regulations or amendments to existing ones) while the Council and Parliament can suggest amendments to any proposal, and ultimately need to approve any proposal for it to enter into force.[a]

Opportunities for review and reform of the EU ETS process were planned from the outset. Directive 2003/87/EC, establishing the EU ETS, stipulates that: "On the basis of experience of the application of this Directive and of progress achieved in the monitoring of emissions of greenhouse gases and in the light of developments in the international context, the Commission shall draw up a report on the application of this Directive."[b] The Directive specifies which elements of the ETS should be reviewed and what questions the review should answer. It also required the Commission to propose amendments in light of the first review, to be submitted to the Parliament and Council by the end of June 2006.

For its first review, the Commission gathered information through a survey among participants and stakeholders, and, in 2007, commissioned a Working Group consisting of representatives of all interested member states and sectors. This Group discussed scope; compliance and enforcement; further harmonization and increased predictability; and linking with other ETSs.[c] Directive 2009/29/EC amended the original ETS Directive to take into account lessons learned from Phase I through this review. Updates included changes to coverage, cap setting, and allocation.[d]

The EU ETS is currently undergoing a second review, aimed at providing input to changes for Phase IV of the EU ETS (commencing in 2021) and implementing the ETS portion of the 2030 Climate and Energy Framework agreed upon by European heads of state in October 2014. The framework stipulates that ETS sectors will have to reduce their GHG emissions by 43 percent below 2005 levels by 2030. As a result, it is proposed the annual reduction factor for the ETS be increased from 1.74 to 2.2 percent. In addition, changes are proposed to better target the fixed number of freely allocated allowances and to develop two funds to assist firms in mitigating their emissions. This review is being carried out by the European Commission, using extensive consultations with stakeholders and experts.

Outside of these planned reviews and the associated amendments to EU ETS legislation, the EU has also made unplanned changes in response to changing circumstances. For example, in November 2012, the European Commission proposed "Options to Reform the European Carbon Market." This unscheduled review was prompted by the large and growing surplus of allowances, which had arisen largely because of the economic crisis depressing emissions more than anticipated. This has led to lower than expected allowance prices, with a range of associated challenges (see Step 6).

The review resulted in two major interventions. With the first intervention, as a short-term measure to respond to excess supply in the market, the Commission "backloaded" 900 million allowances through an amendment to the Auctioning Regulations. This shifted allowances that were going to be auctioned in 2014–16 to the 2019–20 auctions. The second intervention, to be implemented in 2018 and commence in 2019, is to create a Market Stability Reserve (MSR), which is intended to increase the resilience to major shocks by adjusting the supply of allowances to be auctioned (see Step 6 for more discussion). However, implementation of these amendments has created some uncertainty, which in turn may have contributed to volatile prices, as shown in the figure above.

a EC (2015b).
b European Council (2003), Art. 30.
c EC (2008a).
d See Ellerman et al. (2007) and Ellerman et al. (2010) on review and reform processes in the EU ETS.

Evaluations are important as they help policy makers address questions such as the following:

- **Environmental effectiveness:** Are emissions lower than they would be otherwise?
- **Cost effectiveness:** Are costs acceptable and lower than they would be with alternative policies? and
- **Fairness:** Do some groups, especially vulnerable ones, bear excessive costs?

In order to identify causal relationships, an evaluation of an ETS needs to occur in reference to a "counterfactual" scenario. This is a hypothetical scenario that tries to anticipate what would have happened without the ETS in place or if the ETS had been designed differently. Three different methods can be used to develop these scenarios:[176]

1. **Economy-wide models** (such as computable general equilibrium models) try to create a counterfactual against which real outcomes can be compared, controlling for external factors that are unrelated to the ETS. The actual outcome is compared to a modeled one;
2. **Qualitative interviews and surveys** can be used to elicit stakeholder and expert opinions about ETS impacts that would not have happened without the ETS. The interviewees must try to separate out the ETS's effects and other effects;
3. **Econometric studies** exploit "natural experiments," where behavior by covered entities (or sectors) in the ETS can be compared to their behavior before the ETS or to the behavior of similar firms not covered by the ETS.

Given the challenges of developing a counterfactual, a complementary approach is to evaluate intermediate impacts—changes that would be associated with a well-functioning ETS and that may be more directly observable. Box 10.5 traces the intermediate impacts that might be expected if the ETS is functioning well to the final impacts of concern. For example, the effectiveness of the system in reducing emissions is difficult to assess in isolation but, if allowance prices are low, this could suggest that the ETS is not driving significant emissions reductions or that the cost of reducing emissions is relatively low, allowing for potentially greater ambition. Analysis of intermediate steps can help identify the causes of problems and items for reform.

When considering who should undertake an evaluation, policy makers should adopt the same criteria as for comprehensive reviews. Ideally, researchers in academia or NGOs will be able to make use of data from the evaluation to independently explore their own research questions. Transparent evaluation and consultation with stakeholders, and vigorous academic discussion, will improve the quality of work and facilitate its use to effectively revise the ETS.

176 For a more comprehensive overview of how the different methods can be applied to estimate ETS impacts, refer to Sato, M. et al. (2015).

TABLE 10.2 **Examining Final ETS Impact by Evaluating Intermediate Impacts**

| ETS Features | Intermediate Impacts of ETS (examples only) | Final outcomes of social concern |
|---|---|---|
| Scope<br>Cap<br>Allowance distribution<br>Offsets<br>Compliance periods/banking<br>Price management<br>MRV<br>Governance<br>Linkage | Total and facility-level emissions<br>Compliance rates<br>Carbon prices<br>Price pass-through<br>Company Board attention<br>Electricity dispatch order<br>Clean Innovation<br>Clean investments and infrastructure<br>Well-functioning markets<br>Number and volume of trades in spot and futures<br>Price dispersion<br>Levels of participation in trade<br>Existence of brokers, insurance products, etc.<br>Banking<br>Additionality of offsets<br>Net and gross trades between linked systems | Low Emissions<br>Low leakage<br>Low costs<br>Short term<br>Long term: low-emissions economy<br>Fair distribution of gains and losses |

Amend ETS?

## 2.3 *Gathering data for reviews and evaluations*

When designing an ETS, policy makers must also consider the data needs of reviews and evaluations. This subsection considers the data required and options for gathering the data.

### *2.3.1 Data requirements*

Much of the relevant data for conducting reviews and evaluations is already collected for other purposes: energy prices and use, firm activity, revenue and profits, wages and employment, product prices, patents, weather, land use, etc. Additional data will be generated by MRV and compliance systems, the registry recording transactions, and through the allowance allocation processes.

However, some studies will require fresh data. These might include administration costs for government and covered entities, emissions from otherwise similar entities not covered by the cap, interview information on new business practices, investments, innovations, and the like.

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 are generally released publicly are of limited value in addressing key questions of effectiveness and impacts; robust, detailed studies will require data on specific participants.

### *2.3.2 Methods of gathering data*

In addition to publically available data, there are two methods of gathering information for a review or evaluation:

- **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 reviewing entity will maintain the confidentiality of data, but can still use those 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 accordingly; 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; and
- **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 their analysis.

## *2.4 Processes for responding to a review*

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. A practical example of such a comprehensive change is discussed in Box 10.6.

Fundamental changes to an ETS following a comprehensive review may have far-reaching political and economic consequences. ETS legislation might therefore indicate 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;
- The time frame to announce changes; and
- The minimum amount of advance warning for major changes.

By establishing a transparent process in this way, policy makers can help both ensure balance and build trust in the quality of decisions. Certain governance processes will be locally specific and depend on local political culture and existing institutions. The process used in New Zealand is discussed in Box 10.7.

### BOX 10.5 **CASE STUDY: Comprehensive Review of RGGI**

The RGGI Memorandum of Understanding (MOU) stipulated that a "Comprehensive 2012 Review" would be undertaken, during which amendments could be made to both the MOU and the Model Rule.[a] This review considered five primary issues: program success, program impacts, additional reductions, imports and emissions leakage, and offsets. In addition to the extensive empirical analyses undertaken by numerous outside organizations, the review incorporated extensive 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 consequence, the number of allowances was reduced from 165 million to 91 million.[b] A cost containment reserve was also created, with a trigger price of 4 dollars in 2014, 6 in 2015, 8 in 2016, 10 in 2017, and increasing by 2.5 percent per year after 2016. Some other minor adjustments were made concerning offsets, forests, reserve price, and the retirement of unsold allowances.[c] The amendments to the system were released on February 7, 2013, and entered into effect in 2014.

A new program review commenced in late 2015 and will consider, among others, additional reductions to the cap post-2020.[d]

[a] RGGI (2005).
[b] RGGI (2013).
[c] Ibid.
[d] Ibid.

10. EVALUATION

### BOX 10.6 **CASE STUDY: Review Processes in the New Zealand ETS**

The 2008 legislation establishing the New Zealand ETS (NZ ETS) provided for two types of review processes:[a]

- A *mandatory* review conducted by an independent panel appointed by the Minister, before the end of each international commitment or 5-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 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 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.[b] 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.[c] 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.[d] 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 in review provisions 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.

a New Zealand Government (2008), section 160.
b New Zealand Government (2011).
c Emissions Trading Scheme Review Panel (2011).
d New Zealand Government (2008), section 160.

# QUICK QUIZ

## Conceptual Questions

- How can an ETS balance the need to adapt to learning and changes in circumstances with the desire to ensure predictability for investment?
- What are common stages in an ETS review process?

## Application Questions

- What are the advantages and disadvantages of conducting an ETS pilot in your jurisdiction?
- 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?
- How can your jurisdiction collect data and make it available for high-quality evaluation?

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