pmr PARTNERSHIP FOR MARKET READINESS

icap International Carbon Action Partnership

EMISSIONS TRADING IN PRACTICE:

A HANDBOOK ON DESIGN AND IMPLEMENTATION

SYNTHESIS

WORLD BANK GROUP

1818 H Street NW, Washington, DC 20433
Telephone: 202-473-1000; Internet: www.worldbank.org

1 2 3 4 19 18 17 16

Design: Corporate Visions, Inc.

PARTNERSHIP FOR MARKET READINESS

International Carbon Action Partnership

SYNTHESIS

EMISSIONS TRADING: BRINGING IT ALL TOGETHER

In collaboration with:

Motu

EDF ENVIRONMENTAL DEFENSE FUND® Finding the ways that work

vivideconomics

LIST OF ACRONYMS

BAU	Business as usual
CDM	Clean Development Mechanism (Kyoto Protocol)
CO_2e	Carbon dioxide equivalent
CPLC	Carbon Pricing Leadership Coalition
EDF	Environmental Defense Fund
EITE	Emissions-intensive, trade exposed sectors
ETS	Emissions Trading System
EU	European Union
EU ETS	European Union Emissions Trading System
GDP	Gross Domestic Product
GHG	Greenhouse Gas
$GtCO_2e$	Gigatonne of carbon dioxide equivalent
GWP	Global Warming Potential
ICAP	International Carbon Action Partnership
JI	Joint Implementation (Kyoto Protocol)
MRV	Monitoring, Reporting and Verification
NDC	Nationally Determined Contributions
OECD	Organisation for Economic Co-operation and Development
PMR	Partnership for Market Readiness
tCO_2e	Tonne of carbon dioxide equivalent
UNFCCC	United Nations Framework Convention on Climate Change

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 (2016).

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, 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, 2015); 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:

1. 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;
2. Stimulate innovation in technology and practice;
3. Generate environmental, health, economic, and social co-benefits; and
4. 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 can also choose to trade allowances or bank them for future use. They may also be able to use eligible units from other sources,

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 of 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).

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 degree of delegation of market oversight

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

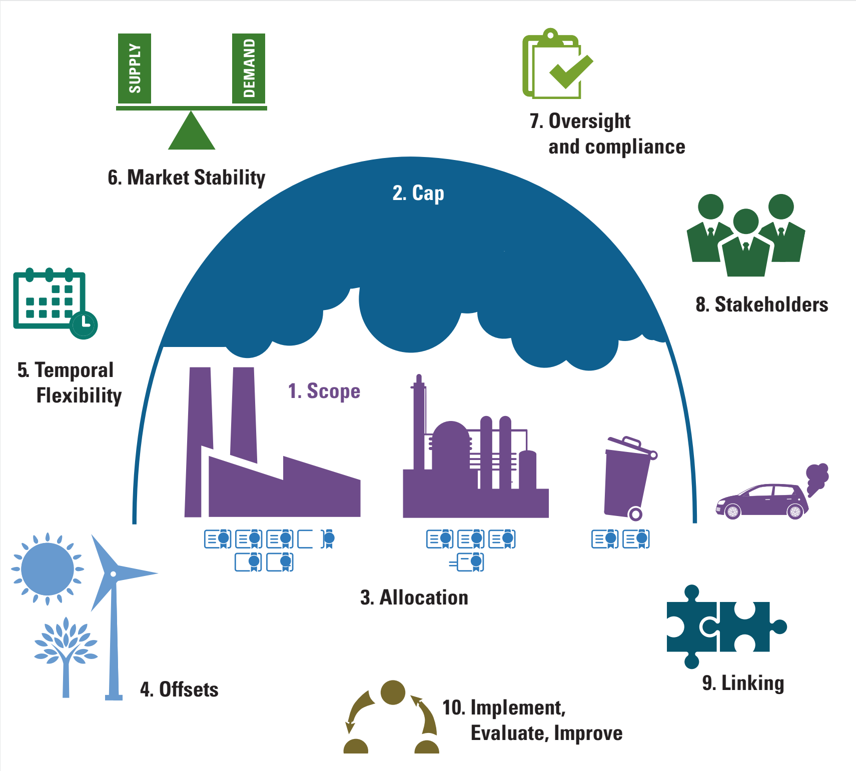
Step 9: Consider linking

- ✓ 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**



Source: 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 counterbalanced 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 ready. 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.

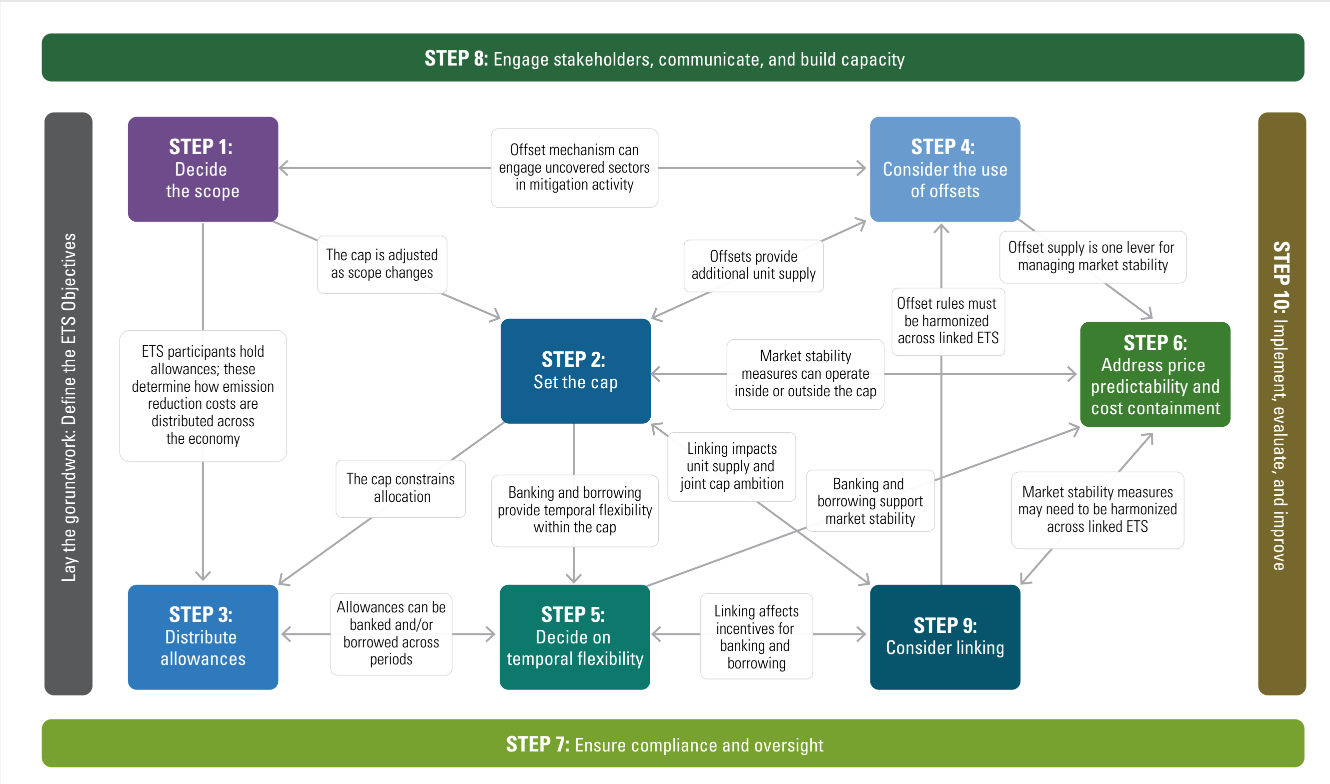
The point of entry to the process of ETS design is laying the groundwork by setting ETS objectives and beginning engagement, communications, and capacity building with government and external stakeholders.

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:

1. Be informed globally, but design locally;
2. Build a strong foundation of data and institutions;
3. Learn by doing and provide predictable processes for adjustment;
4. Adapt the ETS to changing circumstances; and
5. 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.

ACKNOWLEDGMENTS

This Handbook was prepared jointly by a team of experts from Motu Economic and Public Policy Research and Environmental Defense Fund, with significant contribution from Vivid Economics.

Suzi Kerr and Ruben Lubowski led the teams from Motu Economic and Public Policy Research and Environmental Defense Fund, respectively, which also consisted of Catherine Leining and Leah Murphy (Motu) and Gernot Wagner and Katherine Rittenhouse (EDF). The Vivid Economics team was led by John Ward, and also included Cor Marijs and Paul Sammon.

Michael Mehling (Massachusetts Institute of Technology), Felix Matthes (Öko-Institut), and Duan Maosheng (Tsinghua University) edited the Handbook, and also devoted their time and expertise to provide project guidance.

Pierre Guigon (World Bank), Constanze Haug and William Acworth (ICAP Secretariat) provided substantive inputs and managed the project.

We also wish to acknowledge the following contributing authors: Rob Fowler (Essential Change Advisory Services), Jürg Füssler (INFRAS), Alex Hanafi (EDF), Tang Jin (SinoCarbon), Joojin Kim (EDF), Joshua Margolis (EDF), Clayton Munnings (Resources for the Future), Juan-Pablo Montero (Pontificia Universidad Católica de Chile), Erica Morehouse (EDF), Annie Petsonk (EDF), and Luca Taschini (London School of Economics).

We sincerely thank representatives from ETS jurisdictions who shared their practical insights and knowledge related to designing and implementing ETS through meetings, interviews, and review of the Handbook. These include John Storey-Bishoff (Alberta); Nicole Steinweg (Australia); Edie Chang, Mary-Jane Coombs, Sean Donovan, Jason Gray, Ray Olsson, Rajinder Sahota and Mark Wenzel (California); Wang Shu (China); Maja Dittel, Johannes Enzmann, Hana Huzjak and Dalwon Kim (European Commission); Matti Kahra (Finland); Cécile Goubet, Yue Dong, Maxime Durande, Anais Maillet and Dimitar Nikov (France); Maria Martin (Ireland); Giulia Dramis (Italy); Gulmira Sergazina (Kazakhstan); Hyungsup Lee (Korea); William Lamkin and Will Space (Massachusetts); Erik van Andel (the Netherlands); Lois New (New York); Peter Gorman, Amelia Guy-Meakin, Ted Jamieson, Eva Murray, Matt Paterson, Kate Ryan and Nigel Searles (New Zealand); Dag Svarstad (Norway); Jonathan Beaulieu, Jean-Yves Benoit and Claude Côté (Québec); Hanna-Mari Ahonen (Sweden); Laurence Mortier, Reto Schafer and Sophie Wenger (Switzerland); Masahiro Kimura, Sachiko Nakamura and Yuko Nishida (Tokyo); Ben Rattenbury (United Kingdom); and representatives of the German Federal Ministry for the Environment, Nature Conservation, Building, and Nuclear Safety (BMUB), the German Emissions Trading Authority (DEHSt) and the Spanish Office of Climate Change.

We wish to acknowledge additional input and peer review provided by: Soffia Alarcón Diaz (Mexico), Emilie Alberola (Institute for Climate Economics – I4CE), Danira Baigunakova (Alexander von Humboldt Foundation), Juan Carlos Belausteguigoitia (Centro Mario Molina), Nicolas Bianco (EDF), Hendrik (Derik) Broekhoff (Stockholm Environment Institute), Chris Bush (Energy Innovation), Yong-Sung Cho (Korea University), Suh-Yong Chung (Korea University), Brent Cloete (DNA Economics), Brett Cohen (The Green House), Frank Convery (EDF), Margaret Cress (EDF), Antoine Dechezleprêtre (London School of Economics), Kristin Eberhard (Sightline Institute), Zeren Erik Yasar (Turkey), Carolyn Fischer (Resources for the Future), Hubert Fallmann (Umweltbundesamt), Dirk Forrister (IETA), Meredith Fowlie (University of California, Berkeley), Alexander Golub (EDF and American University), Quentin Grafton (Australian National University), Sonia Hamel (Hamel Environmental Consulting), Anthea Harris (Victorian Government, Australia), Takashi Hongo (Mitsui Global Strategic Studies), Max Horstink (SouthSouthNorth), Yu-Shim Jeong (Korean Foundation for Quality, Republic of Korea), Cui Jing (Baosteel), Nathaniel Keohane (EDF), Seong-il Kim (Seoul National University), Yong-Gun Kim (Korea Environment Institute), Xavier Labandeira (University of Vigo), Sang Youp Lee (Korea Environment Institute), Franz Litz (Great Plains Institute), Andreas Löschel (University of Muenster), Diptiranjan Mahapatra (Adani Institute of Infrastructure Management), Claudio Marcantonini (European University Institute), Andrei Marcu (Centre for European Policy Studies), Ralf Martin (London School of Economics), Brian Murray (Duke University), Michael O'Brien (EDF), Hyungna Oh (Kyung Hee University), Robert Parkhurst (EDF), Billy Pizer (Duke University), Misato Sato (London School of Economics), Jonathan Schrag (EDF), PR Shukla (Indian Institute of Management), Thomas Sterner (EDF, Collège de France and University of Gothenburg), Jan-Willem van de Ven (European Bank for Reconstruction and Development), Stacy VanDeveer (University of New Hampshire), Derek Walker (EDF), Bryony Worthington (EDF), Libo Wu (Fudan University), Matthew Zaragoza-Watkins (EDF), Xiliang Zhang (Tsinghua University).

We wish to thank the following for research assistance: Margaret Cress, Rafael Grillo, Michael O'Brien, and Nicolas Taconet (EDF, USA) and Iurii Banshchikov (ICAP Secretariat). We wish to thank the following for additional editorial assistance: Anna Brinsmade, Daniel Francis, Dana Miller, and Elizabeth Petykowski (EDF), Stephanie Gleissner and Charlotte Unger (ICAP Secretariat), and Inge Pakulski.

We thank our colleagues from the World Bank Group and the ICAP Secretariat who reviewed the report and provided helpful input and feedback: Adrien de Bassompierre, Pauline Maree Kennedy, Tom Kerr, Michael McCormick, Maja Murisic, Grzegorz Peszko, and Bianca Ingrid Sylvester (World Bank), and Alexander Eden, Michel Frerk, Aki Kachi, Lina Li, Marissa Santikarn, Camille Serre, Kateryna Stelmakh, and Kristian Wilkening (ICAP Secretariat). ICAP staff also provided significant research input and illustrations.

ICAP would also like to thank the BMUB for their financial contribution to this report.

REFERENCES

Carbon Pricing Leadership Coalition (CPLC). 2015. "Leadership Coalition." Washington, DC.: The World Bank. Last accessed Feb. 23, 2016. Retrieved from: http://www.carbonpricingleadership.org/leadership-coalition

Fay, M., S. Hallegatte, A. Vogt-Schilb, J. Rozenberg, U. Narloch, and T. Kerr. 2015. *Decarbonizing Development: Three Steps to a Zero-Carbon Future*. Washington, DC: The World Bank.

International Carbon Action Partnership (ICAP). 2016. *Emissions Trading Worldwide: International Carbon Action (ICAP) Status Report 2016*. Berlin, Germany.

World Bank and Organisation for Economic Cooperation and Development (OECD). 2015. *The FASTER Principles for Successful Carbon Pricing: An Approach Based on Initial Experience*. Washington, DC: The World Bank and Paris, France: OECD

World Bank. 2015. *State and Trends of Carbon Pricing 2015*. Washington, DC: The World Bank and Utrecht, Netherlands: Ecofys.

World Bank. 2014. "We Support Putting a Price on Carbon." Washington, DC. Last accessed Feb. 22, 2016. Retrieved from: http://siteresources.worldbank.org/EXTSDNET/Resources/carbon-pricing-supporters-list-UPDATED-110614.pdf

United Nations Framework Convention on Climate Change (UNFCCC). 2015a. "Six Oil Majors Say: We Will Act Faster with Stronger Carbon Pricing." Open Letter to the United Nations and Governments. Bonn, Germany. Last accessed Feb. 22, 2016. Retrieved from: http://newsroom.unfccc.int/unfccc-newsroom/major-oil-companies-letter-to-un

pmr | PARTNERSHIP FOR MARKET READINESS

icap International Carbon Action Partnership

WORLD BANK GROUP