This discussion paper was prepared for the World Bank Group by Juerg Fuessler and Martin Herren of the *INFRAS* consulting group. The paper benefitted from the guidance of Wendy E. Hughes and Bianca Ingrid Sylvester and from helpful comments provided by Christophe de Gouvello (Senior Energy Specialist, GEEDR), Michael A. Toman (Research Manager, DECEE), and Johannes Heister (Senior Environmental Specialist, GENDR), and the World Bank Group’s ’Climate and Carbon Finance Unit’. The publication process was led by Mandkhai Bayarsaikhan and the paper was edited by Daria Steigman.
About the Networked Carbon Markets Initiative

The World Bank Group’s Networked Carbon Markets (NCM) initiative is developing the services and institutions needed to enable a connected international carbon market that is liquid and delivers climate-smart financing more efficiently.

Around the world, countries are developing ways to put a price on carbon to fight climate change. Nearly 40 nations and more than 20 sub-national jurisdictions are participating or preparing to participate in emissions trading systems. Additional countries are considering such climate mitigation efforts as crediting mechanisms and market-based instruments (e.g., tradable renewable energy standards, energy efficiency certificates, and carbon tax systems). These domestic initiatives are crucial to lowering greenhouse gas emissions; however, this bottom-up development of climate mitigation efforts has led to regulatory fragmentation and heterogeneity across jurisdictions.

The NCM initiative responds to the fact that governments are designing and implementing climate mitigation efforts in ways that best suit their individual contexts. While these unilateral efforts are to be commended, the resulting regulatory fragmentation has made it increasingly complex to track progress, compare achievements, and connect efforts across jurisdictions. In response, the NCM initiative aims to develop a framework for enhancing transparency, comparability, and fungibility of heterogeneous climate mitigation efforts. The NCM initiative complements the World Bank Group’s ongoing low-carbon development activities and its efforts to promote carbon pricing as critical to achieving climate mitigation on a large scale in an effective and cost-efficient way.

To achieve this effort will require addressing the various barriers that currently make it difficult to link carbon markets. These barriers include the lack of common standards and rules in the design of market systems as well as the lack of an agreed-upon process to assess climate change mitigation value across heterogeneous markets. The end goal of the NCM initiative is thus to determine trading ratios for carbon units and a mechanism to support carbon market-related functions. This is intended to facilitate connectivity of carbon pricing systems through “Networking” such that these systems will have liquidity, be able to scale, and set the foundation for stable carbon prices.

Three possible components under consideration to support NCM initiative include the following.

1. Carbon Asset Assessment Framework

This framework aims to determine the climate change mitigation value of carbon assets in the international market. Current initiatives that assess climate mitigation efforts can be organized by the risks and contributions that they capture. These include a program’s carbon integrity risk; a jurisdiction’s policy/regulatory risk; and a jurisdiction’s relative contribution to the global climate mitigation effort. The NCM initiative understands that these efforts could benefit from an overarching, coordinating framework that establishes a common language, common concepts, and general principles; common methodologies to collect and interpret data; and tools to help guide users of such information.

2. International Carbon Asset Reserve

The World Bank Group is exploring institutional structures to support a network of carbon markets and to help in addressing market risks and failures. One possible structure is a pooled reserve of carbon assets, or International Carbon Asset Reserve (ICAR), which could provide a source of liquidity or play a market-maker function. While the form, scope, and functions of an ICAR are still being explored, it is intended that such an international (or inter-jurisdictional) instrument is intended to complement and support, rather than replace, jurisdiction-level market stabilization instruments. The ICAR builds on the idea that carbon markets and the mitigation of their inherent risks can be made more efficient by increased connectivity and the pooling of risk mitigation measures on an international level.
3. **International Settlement Platform**

The World Bank Group is exploring the idea of an international settlement platform to track cross-border trades and possible clearinghouse functions.

Networking domestic efforts can help countries achieve their climate mitigation objectives in a more cost-effective way. When different carbon pricing systems are connected, they create a larger, potentially more liquid, market. The larger the market, the more the price of carbon is resilient to volatility. In addition, by connecting with different carbon pricing systems, countries can tap into other abatement options; this can also help to reduce costs. The cost and efficiency benefits that result from networking may, therefore, enable countries to increase the ambition of their climate mitigation efforts.

**Networked Carbon Markets Knowledge Series**

The World Bank Group’s Climate and Carbon Finance Unit has launched a Networked Carbon Markets (NCM) knowledge series in order to contribute to the technical and analytical foundations of the NCM initiative. The objective of this series is to inform ongoing discussion among key stakeholders within international financial institutions, governments, think tanks, and nongovernmental organizations. The papers published as part of the series will present recent findings from the initiative’s analytical work. It is expected that the proposed concepts and components will evolve based on consultations and discussions with stakeholders.

The first paper in the NCM knowledge series is “Design Options for an International Carbon Asset Reserve,” which was prepared by the INFRAS consulting group. It presents first concepts and insights on an International Carbon Asset Reserve. In particular, it explores how different design options can support a range of networked carbon pricing efforts. The report provides an overview of key risks in carbon markets, highlights the benefits of pooling risks on an aggregated scale, and identifies potential design options and structures for an ICAR. The paper contributes to the wide effort to promote a long-term price on carbon and carbon market stabilization, comparability, and networking.
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# Acronyms

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<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>AFOLU</td>
<td>Agriculture, Forestry and Other Land Use</td>
</tr>
<tr>
<td>CARB</td>
<td>California Air Resources Board</td>
</tr>
<tr>
<td>CDM</td>
<td>Clean Development Mechanism</td>
</tr>
<tr>
<td>CER</td>
<td>certified emissions reduction</td>
</tr>
<tr>
<td>CO₂</td>
<td>carbon dioxide</td>
</tr>
<tr>
<td>ERPA</td>
<td>Emissions Reduction Purchase Agreement</td>
</tr>
<tr>
<td>ETS</td>
<td>Emissions Trading Scheme</td>
</tr>
<tr>
<td>EU</td>
<td>European Union</td>
</tr>
<tr>
<td>GHG</td>
<td>greenhouse gas</td>
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<tr>
<td>ICAR</td>
<td>International Carbon Asset Reserve</td>
</tr>
<tr>
<td>IEA</td>
<td>International Energy Agency</td>
</tr>
<tr>
<td>IEP</td>
<td>International Energy Program</td>
</tr>
<tr>
<td>l-CER</td>
<td>long certified emissions unit</td>
</tr>
<tr>
<td>NGO</td>
<td>non-governmental organization</td>
</tr>
<tr>
<td>RGGI</td>
<td>Regional Greenhouse Gas Initiative</td>
</tr>
<tr>
<td>t-CERs</td>
<td>temporary certified emissions units</td>
</tr>
<tr>
<td>tCO₂e</td>
<td>tons of carbon dioxide equivalent</td>
</tr>
<tr>
<td>VCS</td>
<td>Verified Carbon Standard</td>
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<tr>
<td>WCI</td>
<td>Western Climate Initiative</td>
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</table>
This paper is designed to stimulate a discussion among key stakeholders about an International Carbon Asset Reserve (ICAR). It is not intended as a standalone document but rather as part of a wider effort to promote a long-term price on carbon and carbon market stabilization, comparability, and networking.

The idea of an ICAR, as an instrument to address carbon market related risks, builds on the knowledge that carbon markets and the mitigation of their inherent risks can be made more efficient by increased connectivity and pooling of risk-mitigation efforts. These risks can include carbon price related risks such as the risk of high prices, low prices, and/or volatility in prices. These risks are also non-price related and include the risk of invalidity of issued and allocated carbon units, the risk of non- or underperformance of mitigation activities, and/or the risk of non-permanence of carbon units.

The benefit of pooling efforts to address such carbon market related risks depends on the risk profiles of individual participants and their relative capacities to address these risks individually. The benefits of aggregation also depend on the diversity of carbon units in the pool. By aggregating carbon units that represent a variety of jurisdictions, sectors, and programs, the risks embedded in the pool are lowered.

It is envisioned that participation in the ICAR would be voluntary (opt-in), and differences across individual market designs would be accommodated. Furthermore, it is envisioned that an ICAR would not replace but rather complement and support local risk-mitigation efforts. The ICAR may use several instruments to support domestic measures to address carbon market related risks. Depending on the circumstances and needs of the specific carbon markets, some of the options will be more relevant and work better than others.

This paper provides an overview of key risks in carbon markets in chapter 2. Chapter 3 highlights the benefits of pooling risk mitigation efforts on an aggregate level. Based on this, chapter 4 presents design options for an ICAR and discusses some of the potential elements and characteristics. These options are not meant to be prescriptive or exhaustive; rather, they aim to illustrate the field of potential design options and stimulate the discussion. In addition, while some of the discussed elements and functions of an ICAR could be implemented in the short term, it is assumed that it would become more important in the longer term (i.e., in the context of a post-2020 framework). The paper starts by summarizing the key findings of the research.
Preliminary Findings

The key findings of the paper are summarized below.

1.1. Benefits of Pooling Risk Mitigation Measures

Carbon market related risks can include price related risks such as the risk of high prices, low prices, and/or volatility in prices. Besides the risks directly related to price, carbon market risks can also include the risk of invalidity of issued and allocated carbon units, the risk of non- or underperformance of mitigation activities, and/or the risk of non-permanence of carbon units. As carbon markets mature, their risk profiles may also change.

While many risks may be addressed at the local level, there are other risks that may benefit from pooling at an aggregated level. For example, pooling risk mitigation measures may benefit those jurisdictions with limited capacity to design and operate a price stabilization scheme, which can be time-consuming, difficult, and require numerous capacities and skills. Aggregation may be a simpler option (particularly for smaller jurisdictions) and allow participants to benefit from the know-how and expertise of different carbon markets.

Aggregating a diverse pool of carbon units, whose values do not move up and down in perfect synchrony, can also enhance overall risk mitigation efforts. This is because, by aggregating carbon units that represent a variety of jurisdictions, sectors, and programs, the risks embedded in the pool are lowered. The lower the correlation between carbon units, the greater the reduction in risk that can be achieved.

The process of jurisdictions coming together to negotiate on the role and function of an ICAR may bring benefits in itself. For example, the exchange of information on different carbon markets and negotiations on how risks can be efficiently managed in a joint approach may help regulators in different jurisdictions to better understand the different systems and to make their own carbon markets more comparable and robust.

Figure 1.1 illustrates how an ICAR could be compatible with a range of domestic risk mitigation instruments. There are also concepts for the development of insurance solutions for some (offsetting-based) carbon markets. Some carbon markets in the landscape could choose to join an ICAR supporting their domestic (limited) risk-mitigation systems and benefiting from the pooling of risks and related efficiency gains.

1.2. Possible Design Options for an ICAR

Numerous functions, structures, and design options for an ICAR may be considered. The possible design options for an ICAR to support jurisdictions to mitigate the risk of high carbon...
prices, which is the primary focus of this paper, are summarized in Table 1.1.

### 1.3. Role of the Public and Private Sectors

It is envisioned that ICAR would have a public form. On the one hand, private sector entities may be more efficient in their operational processes and may also provide access to larger funds. On the other hand, private sector entities do not have the political mandate to carry out the reserve functions that require delicate balancing of participating jurisdictions' economic and political interests.

### 1.4. Process of Implementation

Given the numerous regulatory and institutional complexities within and among participating carbon markets, a step-wise process appears to be a solid approach to the design and implementation of an ICAR.
Overview of Carbon Market Related Risks

2.1. Price-Related Risks

This section provides an overview of risks related to price levels and the movement of carbon prices in carbon markets. This includes (perceived) risks that are relevant during the build-up and early phases of emissions trading systems and that may limit both government and private-sector support for the introduction of market-based instruments. As carbon markets mature, their risk profiles may change, and this section also examines the price-related risks in developed carbon markets.

A feature of most cap-based carbon market instruments (such as emissions trading systems) is that caps are set ex-ante, before the phase of emissions trading and compliance. In most cases, caps are set in absolute terms (i.e., in allowed tons of CO₂ emissions per year) rather than in relative terms (i.e., in allowed tons of CO₂ emissions per unit of activity, such as the tons of CO₂ per ton of steel produced). Cap setting builds on future projections of a range of variables, including economic development and growth, energy prices, the availability of efficient technologies and low carbon fuels, and the rate of implementation and effectiveness of other policies fostering energy efficiency and renewable energy. These variables are fundamental in driving the balance between supply and demand in carbon markets and, therefore, movements in carbon prices.

Some carbon market regulators want to make sure that carbon prices are high enough to provide sufficient long-term incentives to invest in emissions mitigation technologies. High prices in carbon markets may, however, affect economic growth in certain sectors that are subject to international competition—which some regulators may try to prevent by introducing price-capping mechanisms.

In addition, some regulators may seek to avoid large price variability to ensure a stable environment that allows investors to adequately assess the viability of long-term investments in low carbon technologies.

Price and volatility controls in carbon markets are subject to considerable debate in both policy circles and the scientific community. While some see market intervention as an essential tool to prevent the consequences of large price fluctuations on market functioning (in particular in early phases of carbon markets), others see them as a distortion that may prevent the formation of a clear price signal. This paper does not review this debate but simply recognizes that some jurisdictions have decided to include price containment instruments in their carbon market systems (see appendix A for an overview on existing [single jurisdiction] risk mitigation measures and instruments).

2.1.1. The Risk of High Prices

The risk of high prices for units in a carbon market is one of the main risks mentioned when discussing the introduction of emissions trading systems and other cap-based market mechanisms that impose a limit on carbon emissions in host countries. During the design of allocation rules for trading systems, the perceived risk of high prices, international competitiveness, and uncertainties in emissions projections may lead regulators to refrain from stringent cap setting. This, in turn, may support a tendency to over-allocate emissions to compliance entities in emissions trading systems [see Grubb, Azar, and Persson (2005) for Phase 1 EU-ETS].

Drivers of high prices can include:
- Low allocation of allowances in a (closed) system that has high marginal abatement costs
- Decrease in the supply of units for technical or regulatory reasons, because compliance entities need more units for their own compliance, or as a result of a build-up of speculative positions
- Increase in emissions due to (economic) growth and, therefore, an increase in demand for units

In a domestic market that is not subject to international competition, the introduction of a carbon market instrument affects entities with compliance obligations (“compliance entities”) differently. For example, high carbon prices can lead to higher production costs and lower competitiveness for less-efficient, carbon-intensive compliance entities and lower production costs and/or higher carbon revenues for carbon-efficient compliance entities.

More broadly, higher carbon prices may lead to increased investment in greenhouse gas (GHG) mitigation measures and
subsequent investment opportunities. This may also result in additional revenue streams (earmarked or not) for the government. For example, in emissions trading systems where parts of the units are allocated via auctioning, higher prices lead to higher revenues for the auctioning authority.

For compliance entities that are subject to international competition, the additional cost factor may lead to higher end-user prices for goods and potentially lower international competitiveness. For this reason, the impact on international competitiveness is one of the key aspects to consider when designing carbon markets. A further consequence could be the transfer of production to other countries that may be subject to less-stringent or even no carbon regulation. This may lead to carbon leakage, where reductions in emissions in the emissions trading system with high prices may be more than compensated for by an increase of emissions abroad—leading to a net increase in emissions.

### 2.1.2. Other Price-Related Risks

In early carbon market phases, maintaining a robust floor price may be a key to fostering long-term investments in GHG mitigation actions. Table 2.1 provides an overview of these risks.

<table>
<thead>
<tr>
<th>Low unit prices</th>
<th>General impacts:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impacts on installations:</td>
<td>• The carbon market ceases to function</td>
</tr>
<tr>
<td>• Low profitability of some earlier GHG mitigation measures</td>
<td>• Low investments in GHG mitigation</td>
</tr>
<tr>
<td>• Risk of low prices leads to low investments in GHG mitigation</td>
<td>• Risk of policy switch to (economically potentially less-efficient) command-and-control policies or no climate policies</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Price volatility (in particular in early and small markets)</th>
<th>General impacts:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impacts on installations:</td>
<td>• Carbon market ceases to function</td>
</tr>
<tr>
<td>• High price volatility may lead to uncertainty in the investment climate</td>
<td>• Risk of policy switch to (potentially economically less-efficient) command-and-control policies or no climate policies</td>
</tr>
<tr>
<td>• High volatility may lead to business opportunities</td>
<td></td>
</tr>
<tr>
<td>• Implementation of mitigation measures may (i) be considered highly risky (because reward is uncertain); or (ii) be seen as a hedge against price volatility</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lack of market information</th>
<th>General impacts:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impacts on installations:</td>
<td>• General market ignorance/uncertainty about existing trends, opportunities, and risks</td>
</tr>
<tr>
<td>• Uncertainty and less investment in mitigation activities</td>
<td></td>
</tr>
</tbody>
</table>

### 2.2. Non-Price-Related Risks

Besides the risks directly related to prices, there exist a number of other risks that may be relevant in some jurisdictions. This section identifies additional risks in carbon markets where an international approach could help develop efficient risk mitigation measures.
2.2.1. Risk of Invalidity of Issued and Allocated Units

There is a risk in current carbon markets that issued or allocated units that are accounted for in a carbon asset registry or tracking system will be rendered invalid. Indeed, the principle that issued certified emissions reductions (CERs) are not revoked is an important element to assure the confidence of markets in carbon markets. In the Clean Development Mechanism (CDM), for example, once CERs are issued by a decision of the CDM Executive Board, the CERs maintain their full validity; this is true even though the methodology that was the basis for the issuance may later turn out to be flawed and have led to over-crediting of units.

Risks for issued and allocated units are, in most cases, limited to cases of fraud and crime (e.g., in recent cases in the EU-ETS, criminals acquired access to carbon registry systems and carried out illegal transactions). Buyers of illegally obtained units risk losing the value of their purchases.

2.2.2. Risk of Non- or Underperformance of Mitigation Activity

Entities investing in mitigation activities incentivized by a carbon market build their investment decision, among other things, on expectations about the performance of the activity and its impact on greenhouse gas emissions and expected revenues from carbon markets. Several risks may, however, undermine the performance of the mitigation activity:

- Project risks, including technological risks and natural disasters
- Country risks, including political and regulatory risks and expropriation of assets trading systems
- Carbon cycle risks during methodology, registration, monitoring, verification and reporting, and at issuance

2.2.3. Risk of Non-Permanence of Agriculture, Forestry and Other Land Use Units

Measures that aim at increasing the terrestrial carbon stock, such as afforestation, reforestation, improved forest management, and land use change (as well as carbon capture and storage projects) face the risk of non-permanence (i.e., that at a given time after the implementation of the project, part or the entire increase in the terrestrial carbon stock will be released into the atmosphere). Reasons for non-permanence risk in the Agriculture, Forestry and Other Land Use (AFOLU) activities include:

- Natural disasters, such as damage by fire, wind, hail, pests and disease, snow, ice, and/or flood
- Political risks, such as when a government no longer honors legal contracts, changes in regulation, expropriation, and riots and other social unrest

2.2.4. Risk of Non-Eligibility of Units in Carbon Markets

Compliance entities may purchase units with the aim of using them to fulfill their compliance obligations. However, there is a regulatory risk that certain asset trading systems may lose their eligibility. For example, in Phase 3 (post-2012) the EU-ETS restricted the use of CERs from CDM projects that are registered after 2012 to projects from least developed countries. As a result, CERs from new projects in other countries lose their eligibility for compliance under the EU-ETS.
The Benefits of Pooling Risk Mitigation Measures

3.1. The Principle of Pooling

While many risks may be addressed at the jurisdiction or national level, there are other risks that may benefit from pooling at an aggregated level. As this section describes, the pooling of carbon market related risks on an aggregated level may address any risk mitigation limits at the local level and provide efficiency gains and benefits for a range of risk mitigation functions. Pooling the reserves of individual emissions trading systems into an ICAR covering all the participating carbon markets may help to lower the need for reserves in the participating jurisdictions and, therefore, reduce costs.¹

Figure 3.1 illustrates the benefit of pooling reserves from different carbon markets. If several carbon markets agree to pool their (costly) reserves in an ICAR, the number of the required units in the pooled reserve per carbon market is smaller (yellow) than if each carbon market held each individual reserve (orange). The benefit from pooling of reserves depends on the risk profiles of individual participating carbon markets and on their level of correlation.

Figure 3.1(a) assumes three (similar) carbon markets (A, B and C) that are not linked. In the absence of an international pool of reserves, each carbon market has its own reserve that is used to supply additional units to the market, increasing the supply in order to defend a price ceiling. The number of units that is necessary for each reserve to serve this function depends on a number of parameters, including the current unit price, the level of the price ceiling, the duration of pooled reserves, an estimate of future price volatility (depending on perception of risks), and the required level of certainty with which the instrument would defend the price ceiling (e.g., a jurisdiction may require its local reserve to defend the price ceiling with a probability of 95 percent).

Figure 3.1(b), meanwhile, posits the pooling of reserve units in an ICAR that jointly serves all participating carbon markets in cases of high price levels. In this scenario, the required number of units in the pooled reserve to defend the same price level(s) with the same probability is lower. This reduces the costs to participating carbon markets of establishing and maintaining the reserve function. Similarly, with a given number of reserve units per carbon market, participating countries can increase their level of risk mitigation by pooling their reserves (i.e., they can afford a lower price ceiling with the same reserves per carbon market).

The benefits of pooling depend on the risk profiles of individual participating carbon markets and their capacities to mitigate risk. The benefits could also depend on their level of correlation. The less correlated the price developments in the carbon markets are, the higher the benefits from pooling. This may make pooling of reserves from carbon markets on different continents, for example, an instrument to explore in more detail.

¹ In many carbon markets, building up and holding reserves for risk mitigation comes at a cost. For emissions trading systems, at a given overall cap that has been set based on an international pledge, putting aside allowances reduces the number of allowances available for compliance entities and therefore increases costs (at least in the short-to-medium term). In crediting systems, units put into the reserve have to be deducted from the issued units from crediting activities, which reduces the number of units available for monetization (again, at least in the short-to-medium term).
3.2. Enhancing Risk Mitigation by Pooling

The benefits of pooling of risks among different carbon markets lies either in the reduction in the need for potentially costly reserve capacity for the individual jurisdiction or in an increased level of risk mitigation for jurisdictions with the same reserve capacities. In either case, these benefits depend on the level of correlation between and among carbon markets.

While there are numerous studies on the correlation between energy and carbon markets (e.g., Koenig 2011), the correlation between different non-connected carbon markets is less well analyzed. The EU Emissions Trading System and the Kyoto Protocol’s Clean Development Mechanism (CDM) have been the only large scale and liquid carbon markets in the past decade. The EU-ETS and the CDM are linked, and their close correlation was an important feature of their prices until the CDM market petered out. Meanwhile, the emerging landscape of fragmented carbon markets suggests that most of these future markets are unlikely to be linked any time soon.

As economic development is one of the key factors determining emissions, it is likely that the path of economic development in different jurisdictions will be one of the main factors determining the correlation among these various emerging

Figure 3.2: Illustration of Different Economic Developments

carbon markets. Without going into a deeper analysis of factors that may influence the correlation of carbon markets, this paper assumes that jurisdictions with lower levels of economic integration may also exhibit lower levels of correlation in their carbon markets in the absence of linking.

As each country is part of a global system, economic cycles and fluctuations have an impact on the global economy, leading to a certain degree of correlation; however, each country has different stressors and responses to these patterns. Figure 3.2 illustrates how differently economies evolve and respond to global economic patterns, such as the financial crisis that began in 2008. The limited correlation between economies that can be observed today may hint to the possibility of limited correlation between future carbon markets. The less markets are correlated, the higher the potential efficiency gains from pooling risk mitigation instruments.

### 3.3. Addressing Limits of Local Level Risk Mitigation

#### 3.3.1. Limited Capacity to Build a National Price Stabilization Scheme

If a jurisdiction wishes to benefit from using a price stabilization measure or reserve, this requires considerable technical, institutional, and regulatory resources. In particularly, smaller and less affluent countries may not be in a position to design, build, and operate jurisdiction-level price containment schemes to stabilize their emissions trading systems. This would be particularly relevant for smaller standalone emissions trading systems, where the limited number of compliance entities may lead to an illiquid market with high price variability.

#### 3.3.2. Limited Capacity to Link or Network

Linking or networking could be an important mitigation measure to lower overall mitigation costs and smooth out price spikes in individual emissions trading systems. So far, however, full linking between and among carbon markets has proven to be a difficult process. Only California and Quebec have linked; the prospects of linking other schemes has recently become less certain.
The concept for ICAR is an international (or inter-jurisdictional) instrument that would complement and support jurisdictions to address carbon market related risks (see chapter 2). Participation would be on an opt-in basis. In addition, it would be assumed that (local) jurisdiction-level risk mitigation measures would be the “first line of defence” in addressing risks in the carbon markets. ICAR could then play an important supplementary role to local risk mitigation instruments, where local schemes are facing limits (see section 2.2) or where there are efficiency gains or other benefits from pooling some of these functions at the international level (see chapter 3).

Numerous functions, structures, and design options for an ICAR may be considered. This chapter looks into some design options in order to provide a starting point for discussion; this is not, however, an exhaustive analysis of the options.

Section 4.1 provides an overview of potential functions; it remains an open question, however, whether and how each of these functions could be implemented at an international level. The subsequent sections in this chapter introduce the important elements of an ICAR, including potential structures, capitalization, and so forth. This preliminary analysis focuses on the function of mitigating the risk of high carbon prices. Many of the identified elements and observations are, however, equally relevant for the other reserve functions outlined in section 4.1.

4.1. Potential Reserve Functions

This section highlights a number of functions that an ICAR might serve. In line with the mandate for this paper, the focus lies on functions to mitigate high unit price risks.

4.1.1. Mitigate High Price Risk

The ICAR may use several instruments to mitigate high price risk to support domestic measures. Depending on the circumstances and needs of the specific carbon markets, some of the options will be more relevant and work better than others. The following list provides an overview of potential functions without going into a discussion of which options may work better under which circumstances.

If carbon prices in Carbon Market A reach the agreed trigger price ceiling, then the ICAR, in coordination with participating jurisdictions, may take one or more of the following actions:

1. Release units to market from ICAR at price X USD/t (in limited or “unlimited” volumes) (see also structures A1–A3 in section 5.2)
2. Allow Carbon Market A to borrow units from the ICAR
3. Support temporary linking or networking of Carbon Market A to other existing carbon markets that are not linked (for a limited time/volume) (see also structure B in section 5.2)
4. Enable a higher use of units from other carbon markets for compliance in Carbon Market A
5. Enable a higher use of offsets from crediting mechanisms for compliance in Carbon Market A
6. Enable a swap, in which there is an increase in the caps of compliance entities in carbon market A and, at the same time, a corresponding decrease caps in Carbon Market B (e.g., to reflect high economic growth in Carbon Market A and low growth in Carbon Market B)
7. Provide funds or loans to compliance entities in Carbon Market A for the implementation of a specific mitigation action, thus lowering emissions and demand and reducing prices
8. Issue derivative instruments. An ICAR could play a role in providing market participants with financial instruments that compliance entities can use to hedge against the risk of high prices. An ICAR may, for example, support private sector financial institutions in the following functions:

a. Acting as a market maker by providing participants in new carbon markets or asset classes with both buy and sell prices and by holding a limited amount of the units over a predetermined time frame. Providing a market maker function may be especially important in early and not yet established carbon markets where liquidity may be low.

b. Selling futures on carbon market units (e.g., market participants could enter future contracts under which they would buy a fixed number of units at a
c. Selling call options on carbon market units (e.g., market participants could purchase the right (but not the obligation) to buy a specific number of units at a fixed (strike) price at or before a fixed expiration date in the future, thus hedging against future price increases while still being able to benefit from potential price decreases). The price of the option would depend on the current unit price, the strike price, the interest rate and the counterpart risk, expiration date, and estimate of future volatility (e.g., the Black-Scholes formula).

d. Support private sector institutions by providing certain guarantees and covering higher risk layers.

These derivative instruments have proven to be useful to compliance buyers for short- to mid-term hedging purposes and have made carbon markets attractive for various speculative market participants. Such instruments may be useful to cover short- to mid-term price risks, but may be less suitable to cover long-term (systemic) risks in carbon markets. ICAR support for financial instruments would likely be faded out over time as markets, and financial instruments for carbon markets, mature.

In general, an ICAR could be empowered with the flexibility to use a combination of the above instruments. With most of these instruments, the ICAR might typically have more of a coordinating role, with the decisions made by the participating jurisdictions.

4.1.2. Mitigate Low Price Risk

Similar to introducing price ceilings, an ICAR might also support participating jurisdictions in sustaining price floors by using a buffer (section 2.1) or through opt-in rules that require a participating jurisdiction to exercise its own instruments should prices in the domestic market fall too low.

4.1.3. Carbon Asset Eligibility Risk

An ICAR could also be used as a buffer to insure project participants in crediting mechanisms against the risk of non-permanence of Agriculture, Forestry and Other Land Use (AFOLU) units; the risk of underperformance of mitigation activity; and the risk of non-eligibility of units in carbon markets. An example might be a buffer pool for the non-permanence risk of AFOLU projects.

For the AFOLU sector, the permanence risk is inherent to carbon sequestration activities and requires, in most crediting systems, some sort of buffering. The permanence risk is that the carbon that has been sequestered in forests or other living biomass will be released at a later point in time (reversal) because of natural disasters (fire, wind, and so forth), thus devaluing the issued carbon units. An ICAR could, in case of a reversal, directly compensate for the reduced carbon stock or provide funds for replanting the forest, thus restoring the carbon stocks indirectly over time.

One example of an international buffer solution for AFOLU risks is the Verified Carbon Standard2 (VCS), which introduces a buffer to mitigate the permanence risk. Depending on an assessment of the permanence risk for each AFOLU project, a specific share of issued units is set aside in a central buffer. Buffer credits in the VCS are non-tradable and are maintained in an AFOLU Pooled Buffer Account to cover the risk of unforeseen losses in carbon stocks (reversal) across the AFOLU project portfolio.

4.1.4. Provide Market Information and Intelligence

An ICAR could provide markets with information and intelligence about the different participating jurisdictions, as well as market forecasts and risk analyses that may better prepare market participants to address potential risks.

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2 See http://www.v-c-s.org/develop-project/agriculture-forestry-projects
5 Potential ICAR Structures to Address Risk

This chapter sketches out different options for carbon reserve structures that may mitigate the risk of high unit prices in carbon markets. Similar structures could be considered for price floor or price collar instruments and insurance pools.

5.1. Agreement
For any ICAR structure, there will need to be some kind of agreement—or an opt in set of rules and requirements—among participating countries and jurisdictions that seek to benefit from an international pooling of carbon reserve functions to mitigate risk. Table 5.1 provides a preliminary overview of structures that could be used to implement an ICAR. Structures A to C are listed in increasing degree of autonomy of the ICAR.

5.2. Options for Structures
A wide range of options is included here to indicate the extent of options. This paper recognizes, however, that sovereignty considerations may make it difficult or even impossible for many governments to consider options that provide significant decision-making power to an ICAR (i.e., options A3, B, C).

Table 5.1: Options for ICAR Structure

<table>
<thead>
<tr>
<th>Structure</th>
<th>Description</th>
<th>Ownership/Governance</th>
</tr>
</thead>
</table>
| Option A1 | - Coordination of local carbon reserves  
- High price threshold triggers coordinated release of units from local reserves to market  
- Decision making is “rule based” | - Each member country owns and manages its own contribution to the pooled reserve  
- Release of units follows agreed-upon rules |
| Option A2 | - International pool of carbon units  
- High price threshold triggers release of units from ICAR to that carbon market  
- Decision making is “rule based” | - ICAR owns and manages the reserve  
- Release of units follows agreed-upon rules |
| Option A3 | - International body manages risk of high prices by releasing units from ICAR pool to carbon market in need  
- Decision making is “management based” | - International body takes autonomous decisions to release units |
| ICAR enables connectivity between or among carbon markets | - International body manages risk of high prices by allowing for (partial) linking or networking between or among specific systems  
- Decision making is “management based” | - International management body decides on linking in line with regulations and guidance from participating jurisdictions |
| ICAR is an international management body | - International body regularly analyses developments and risks in carbon markets and decides on measures to reduce risks and increase stability  
- Decision making is “management based” | - Member countries provide the international carbon management body with far-reaching powers |
| ICAR is an international support fund (“pool of money”) | - International fund to support countries and compliance entities in financing the implementation of mitigation measures in case of too-high carbon prices  
- Decision making is “management based” | - Mitigation action to be governed and implemented by country  
- Support fund to decide on financial support for investments in mitigation |
5.2.1. ICAR as a Pool of Carbon Units

If ICAR were to be structured as a pool of carbon units, there would be different options for ownership and control of units. In Option A1, the reserves would remain under the ownership of the individual jurisdictions. The ICAR would act more as a coordinating body, organizing the joint release of units from individual carbon market reserves to the carbon market where the intervention is taking place (in loose analogy to the coordination of national oil reserves in the International Energy Agency [IEA]—see appendix C). In Option A2, the ICAR would own and control its own units and release them directly to the relevant carbon market to trigger the action.

Option A3 is similar to Option A2, but the release of units would not be purely rule based; instead, it would be at the discretion of the governing body of the ICAR. Different modes for the management of market interventions could be considered, including limiting prices at an ex-ante fixed price ceiling, defining timing and volumes to be released to the market; or limiting prices at a level determined on an ad hoc basis by the reserve’s governance body, taking into account other factors (e.g., the economic situation in the considered jurisdiction).

The governing body of the ICAR could either be formed by representatives from the participating jurisdictions or by a body that is tasked by the participating jurisdictions (e.g., with the objective to limit price levels in order not to damage economic growth). Pursuing these objectives, however, would require a certain level of independence in how and when to intervene in markets, similarly to the autonomy that central banks have in pursuing their objectives (e.g., low inflation, low unemployment, and economic growth).

The coordination and pooling of locally held reserves (Option A1) may be easier to agree on between and among participating jurisdictions than handing over units to a centralized ICAR (Option A2). At a later stage, or if the number of participating jurisdictions grows significantly, it may be more efficient to hand over units to the ICAR. In practice, the difference between Options A1 and A2 may be rather small when transaction procedures for units from local reserves are efficient.

A purely rule-based decision structure (Options A1 and A2) may be easier to agree on between and among participating jurisdictions than a structure where the decision for intervention would be at the discretion of a more autonomous governing body (Option A3). This is because “opt in” jurisdictions may have to give up some of their sovereignty. This could be mitigated, however, by adequate governance rules—which could go as far as granting each participating jurisdiction with a veto right to block any interventions from the reserve. From an efficiency perspective, a more elaborated carbon ceiling management (Option A3) might provide more subtle market interventions than a simple rule-based approach. The reserve’s governing body could anticipate upcoming risk and, together with the participating jurisdictions, take preventive action before high price levels are reached. Furthermore, the governing body could adjust the price ceiling to adequate levels in relation to other factors. For example, the (carbon) price sensitivity in a jurisdiction with low economic growth may be much higher than in an economy that is in good shape and better able to sustain higher carbon prices.

It is clear that price management could directly impact key economic parameters in participating jurisdictions. As a result, a reserve governance body would need to be able to take into account and balance the requirements and interests of each of its jurisdictions—and such a structure would need adequate time to develop. It might therefore be wise to start with a simple structure (Option A1). After the ICAR has proven its functionality and usefulness, then it might be more appropriate to move to more elaborate and autonomous governance structures (Options A2 and A3).

5.2.2. Structures with Other Functions (Options B and C)

Besides releasing units to specific carbon markets to mitigate high price risks, an ICAR could also serve to stabilize participating markets and/or provide insurance functions. Another important function could be coordination or even management of (partial) linking activities between and among participating carbon markets in order to mitigate high price risks (Option B). For instance, where there are high carbon prices in Carbon.
Market A, the ICAR could coordinate a controlled and limited transfer of units from Carbon Markets B and C to ease the supply situation in Carbon Market A—even though the three markets would not otherwise be linked. Participation in such partial linking could be completely voluntary or be governed by the ICAR agreement.

Theoretically, an ICAR could have a whole spectrum of market management instruments at hand to mitigate high price risk. This could include the release of pooled reserves, partial linking of carbon markets, and adjustment of rules for borrowing, banking, and eligibility of units in different carbon markets (Option C). Similar to a central bank, such an ICAR would manage these instruments independently to achieve the objectives defined by participating jurisdictions (following the rules of the reserve’s agreement).

The combination of different functions may significantly increase the efficiency of an ICAR’s market interventions as the reserve’s action could be tailored to the specific situation. For instance, partial linking may support price levels once the ICAR buffer of units is depleted (or might replace it altogether). A coordinated increase in allowed borrowing levels agreed on by the participating jurisdictions may be an efficient measure to further strengthen a price ceiling. Of course, the potential transfer of market management functions from local jurisdictions to the level of an ICAR would require an enormous amount of time and trust-building between and among participating countries; this thus makes this more of a long-term vision than an option for a starting structure.

5.2.3. International Support Fund (Option D)

A supporting fund is a qualitatively different function for an ICAR. Instead of units from participating carbon markets, under Option D an ICAR would be a financial reserve to finance mitigation action as an instrument to contain unit prices. In case of high carbon prices in a participating carbon market, such a fund could then be used to finance mitigation activities from offsets outside the carbon market (within or outside the jurisdiction) and to supply the carbon market with the generated offset units to increase supply and lower prices in the carbon market (it may even be cost neutral); or to subsidize or provide loans for the implementation of mitigation activities in specific compliance entities in the carbon market in order to reduce demand.

Such a support fund could operate as a standalone instrument or could be used to support some of the other reserve functions discussed above. In a supplementary role, and in (developing country) jurisdictions where access to financial sources for low carbon technologies is a major obstacle, such a support fund could be an efficient tool to catalyze low carbon investments and thus reduce demand for units in the carbon markets. A support fund needs to be designed carefully, however, so as not to lead to market distortions and to minimize rent-seeking by compliance entities. A further consideration is that a support fund instrument may be rather slow and mitigate only in the mid-term—which may be too slow for a market stabilization measure.

5.3. Institutional Setting and Roles

The ICAR could be founded on a multilateral agreement of the participating jurisdictions that would define the governance structure, regulatory setting, and opt-in requirements needed for the reserve to operate. The reserve could be managed, for example, by an executive board formed of representatives from participating jurisdictions. In establishing the reserve, there would need to be discussion about the role of member jurisdictions, including addressing issues of sovereignty, decision-making power, and the right to set the rules.

In setting up the ICAR, there would need to be procedures established that specify how the reserve is used and who is in charge of making various decisions. This would need to include procedures for application into the reserve, requirements for deploying units from the reserve, and accounting of the units used in national and international carbon accounting systems (e.g., an international transaction log). In addition, there would need to be a set of rules to determine who owns the carbon markets in the reserve as well as for determining who would be eligible to use the reserve and to what extent.

4 The international body could be structured to allow sub-national jurisdictions, such as regions and provinces, to participate.
5.4. Moral Hazard
When different jurisdictions team up to implement a common ICAR system covering differing carbon markets in different jurisdictions, risk for moral hazard exists. Using a price ceiling as an example, participating jurisdictions may want to implement very low price ceilings in their carbon markets in order to spare their compliance entities from high carbon compliance costs. As industries from different carbon markets compete, this could lead to a race to the bottom as each jurisdiction would want to set their ceiling very low, resulting in the frequent triggering of interventions and rapid depletion of the ICAR. In addition, price ceilings set too low will prevent investments in low carbon technologies. The higher level of connectivity between and among carbon markets that comes with an ICAR may also lead to additional risk as the state of the carbon market in one jurisdiction may deplete ICAR capacity that may be needed in another carbon market at a later point in time.

Moral hazard should be a key issue in the negotiations for a reserve agreement. As the ICAR will build on some form of agreement among participating jurisdictions, moral hazard can be mitigated during the negotiations defining the governing rules and the reserve’s interaction with participating carbon markets. Indeed, it will be in the interest of participating jurisdictions to include measures against moral hazards. Jurisdictions wishing to participate in the reserve may even first need to adjust some of their own regulations and/or the stringency level of their carbon markets.

One way to mitigate the risk of moral hazard issues would be to have the ICAR act only as a supplement to the national carbon reserves of participating jurisdictions. For example, there could be an agreement under which the national reserve would need to absorb the first tranche of risk layers of high price risk. Only after the national reserve were depleted would the ICAR step in and provide further units to hold a price ceiling. Another option would be to have the units, in order to be put on the market, be supplied by local jurisdictions and ICAR based on a fixed share (e.g., one-third locally provided and two-thirds contributed from the ICAR).

5.5. The Need for Fungibility of Units
An international pooling of reserve capacity is only possible if the units from different carbon markets in the reserve can be made fungible, at least for the limited number of units in the ICAR. Thus participating countries need to agree on a mechanism for comparing the mitigation value of units among participating carbon markets. The conversion rate could be one-to-one for similar asset types in markets of similar design and level of ambition. Alternatively, exchange rates for different type of units from different markets could be established.

In the context of an ICAR, the introduction of such conversion rates for units from different markets may lead to additional requirements. For example, the number of units that a specific jurisdiction has to deposit in the ICAR may depend on the value of the units compared to the units from other markets. Furthermore, in the case of a change in the assessing of the units from a particular market system (e.g., an upgrading) and the related change in the conversion rate, the participating jurisdiction might adjust (decrease) the number of its units in the ICAR.

5.6. Capitalization
Different options for the capitalization of the ICAR may be considered.

5.6.1. Reserve of Carbon Assets
Where the reserve is a pool of carbon markets (tCO₂e) from different carbon markets, various approaches for capitalization may be considered. These include:

- A specified share of each allocation in a cap-based carbon market (e.g., an emissions trading system) or each issuance in a crediting based carbon market could be assigned to the ICAR.
- A specified number of units (which may depend, among other things, on the agreed-upon “exchange rates” of the units) in each carbon market allocation could be assigned to the ICAR. Each jurisdiction may also buy units from its carbon market for the ICAR with revenues (e.g., from their auctioning of allowances, from carbon taxes, and so forth).
- Where participating jurisdictions agree to, for example, combine a price ceiling with a suitable floor price.
mechanism (assuming that adequate safety valves are included), interventions to buy units to sustain a price floor at one point in time would increase the buffer. These units may be released later if the price ceiling is triggered.

5.6.2. Reserve of Financial Assets

The reserve could be designed as a pool of money (e.g., in U.S. dollars—structure D in section 5.2), and this could be implemented in the form of a multilateral fund. The fund could be capitalized by the reserve’s member countries and/or by donors. It could also receive money from other funds (e.g., the Green Climate Fund). On a national/sub-national level, participating jurisdictions could draw funding from shares of revenues from the auctioning of allowance units, from a carbon tax, or from governmental budgets. The reserve could also be set up by a private sector initiative (e.g., from the members of an industry association), with capitalization for this private sector insurance pool coming from the members.

5.6.3. Cost of Revenues

The required size for an ICAR depends, among other things, on the characteristics of the participating carbon markets and the required level of protection (e.g., level and robustness of price ceiling, correlations between carbon markets), and pooled reserves may be more efficient than individual reserves for most carbon markets (see chapter 3).

Under certain circumstances, it may be possible to implement a reserve function in a cost-neutral way or even to generate revenues for the jurisdiction. For example, if in a cap-based carbon market (emissions trading systems), the price is so high so as to trigger price ceiling activities, the ICAR may make additional units (of comparable environmental quality and mitigation value) available to the market at the price ceiling level; these units may be priced significantly higher than the average price of the comparable units still in the reserve. This (limited) exchange by the reserve of units with a comparable mitigation value but lower price units from other carbon markets into a high price carbon market may generate revenues, as the reserve effectively would buy units at a lower price and sell them at a higher price level.

5.7. Potential Role of the Private Sector

In recent years, the private sector has played an important role as a risk taker and market maker in the EU-ETS, the CDM, and other liquid emissions markets. Banks and other financial institutions have developed a wide range of financial product for market participants to hedge against price risks and to speculate on market movements. In addition, the insurance industry has been designing insurance products to specifically cover the risks of investors in mitigation activities that seek to tap into the revenues from selling carbon units.

Private sector institutions are well-positioned to provide financial instruments and serve insurance functions (see section 4.1). The private sector can only play the role of a risk taker, however, if the risks can be adequately assessed. In the early phases of emissions markets, in particular, private sector entities may be reluctant to engage, in particular in markets where assets are created by regulation (as in carbon markets) and are thus less tangible. In addition, the time span over which private sector entities are prepared to engage may be shorter. As a result, in early phases of carbon markets in particular, the role of financier and insurer may need to be undertaken by the public sector.

It is difficult to foresee a private sector role in pooling reserves, one of the potential key functions of an international carbon market. On the one hand, private sector entities may be more efficient in their operational processes and may also provide access to larger funds. On the other hand, private sector entities do not have the political mandate to carry out the reserve functions that require delicate balancing of participating jurisdictions’ economic and political interests. Thus, one might derive that the ICAR should have a public form, implementing an agreement between participating jurisdictions.

As a public institution, an ICAR could source out certain activities to private sector companies (e.g., administration, information technology). Once the reserve is established and up and running, it can also consider collaborating with private sector entities in a public-private partnership in order to buy risk coverage from the market. The size of the reserve could be reduced (in order to reduce costs), for example, if private sector
entities replaced part of the reserve by privately held reserves or by insurance products.\(^5\)

### 5.8. Implementation of an ICAR

Given the numerous regulatory and institutional complexities within and among participating carbon markets, it would seem to make sense to adopt a step-wise process in the design and implementation of an ICAR. The phases illustrated in Figure 5.1 could be considered, depending on the characteristics and needs of the participating jurisdictions and the objectives and requirements of the ICAR function.

Experience from the design and implementation of ETSs indicates that each phase typically takes 2-5 years. In addition, implementing an ICAR needs to be closely coordinated and synced with the development phases of the participating carbon markets.

In a network of carbon markets with partial linking, an ICAR could complement and support domestic measures for the mitigation of carbon market risks by operating as an instrument for participating countries to benefit from a pooling of market reserves. This function builds on the characteristics, rules, and regulations of the participating carbon markets—with many elements having strong links to the local market regulations (e.g., on the assignment of units for the reserve and capitalization, the eligibility of units from other carbon markets for compliance, and so forth). The design and implementation of an ICAR requires the close cooperation of all participating jurisdictions and their agreement on key aspects of the reserve. Jurisdictions wanting to opt in at a later point in time would, therefore, need to agree to a basic set of existing rules.

In order for each jurisdiction to be able to assess the risks and benefits of its participation in the ICAR, an intensive exchange of information on the rules and regulations of the participating carbon markets, on emissions intensities, on cap allocation, on crediting rules, and on other factors is required.

The main challenges in building up an ICAR seem not to be the technical issues and institutional questions of such a buffer function; these seem to be manageable. A key challenge in establishing and building an ICAR is the design of a step-wise process that leads participating countries/jurisdictions to a sound agreement on an ICAR and the mechanism for comparing the mitigation value of different types of assets in different type of markets.

Finally, the process of jurisdictions coming together to negotiate on the role and function of an ICAR may bring benefits in itself. For example, the exchange of information on different carbon markets and negotiations on how risks can be efficiently managed in a joint approach while efficiently limiting moral hazards may help regulators in different jurisdictions to better understand the different systems and to make their own carbon markets more comparable and robust. In the end, assuring the robustness of carbon markets in competing economies may support the international competitiveness of the industry in individual carbon markets.

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\(^5\) Such public-private partnerships might draw elements from existing structures, including the Pacific Catastrophe Risk Assessment and Financing Initiative.
Appendix A: Risk Mitigation Measures

A.1. Approaches to Mitigate the Risk of a High Unit Price

Table A.1 provides an overview of risk mitigation approaches that regulators may use to address the risk of high prices. Each of these approaches has its pros and cons, and some of the instruments are listed for completeness and may not provide for a robust approach to risk mitigation in all circumstances.

In addition to government intervention, the market itself can also address the risk of high prices. For example, the use of derivative instruments in a financial market may help compliance entities to hedge against the risk of high prices in the future. In the EU-ETS, a wide range of derivative instruments is offered, including futures, calls, and collars.

<table>
<thead>
<tr>
<th>Risk mitigation measure</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>A) Implementation of a jurisdiction-level carbon reserve buffer and price ceiling(^a)</td>
<td>Units from reserve are sold at a fixed (threshold) price that is defined and published ex-ante</td>
</tr>
<tr>
<td></td>
<td>• New Zealand, California (4 percent of allowances go to the reserve; quarterly sales at fixed prices)</td>
</tr>
<tr>
<td></td>
<td>• Carbon market regulator decides on market interventions on an ad hoc basis and defines price and volume of units to be introduced to market as deemed fit to regulate the market price</td>
</tr>
<tr>
<td></td>
<td>• Similar to a national bank’s intervention to implement monetary policies (e.g., low inflation)</td>
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<tr>
<td></td>
<td>• Price signal may trigger release of units from the reserve to the market in a rule-based approach</td>
</tr>
<tr>
<td></td>
<td>• No current example in carbon market</td>
</tr>
<tr>
<td>B) Fixed penalty in case of non-compliance that acts as a price ceiling</td>
<td>Government imposes a fixed penalty on compliance entities in case of non-compliance that is paid in lieu of handing over allowances</td>
</tr>
<tr>
<td></td>
<td>• Swiss emissions trading systems existing penalty is 130EUR/tCO(_2)</td>
</tr>
<tr>
<td>C) Banking and borrowing of units</td>
<td>Price signal may trigger an increase in the level of permitted borrowing and the release of previously banked permits</td>
</tr>
<tr>
<td>D) Linking or networking with ETS or crediting system to access additional abatement options</td>
<td>Link or network with schemes that have lower unit prices (i.e., high price signal may trigger increased level of use of allowed offsets)</td>
</tr>
<tr>
<td></td>
<td>• Restrict transfer of units to schemes that have high demand (and high price)</td>
</tr>
<tr>
<td></td>
<td>• Linking with crediting scheme: EU-ETS, Switzerland, New Zealand allow for (restricted) use of CERs</td>
</tr>
<tr>
<td></td>
<td>• Regional Greenhouse Gas Initiative (RGGI) employs two upper price triggers (related to domestic offsets and international offsets)</td>
</tr>
<tr>
<td></td>
<td>• Emissions trading systems linking: California with Quebec, and EU-ETS with Switzerland</td>
</tr>
<tr>
<td>E) Adjusting the cap</td>
<td>Government increases the cap for individual compliance entities and introduces additional units into the market</td>
</tr>
<tr>
<td></td>
<td>• No current example in carbon markets.</td>
</tr>
<tr>
<td>F) Supporting mitigation efforts</td>
<td>Use of returns from unit sales or other incomes (e.g., taxes) for mitigation measures (e.g., through subsidies on a sectoral level)</td>
</tr>
<tr>
<td></td>
<td>• Switzerland: subsidy of low-carbon investments in housing and industry sector with revenues from carbon tax</td>
</tr>
</tbody>
</table>

\(^a\) The term “price ceiling” is often used for existing price containment instruments that mitigate the risk of high prices but do not provide for a price assurance. For example, if the national reserve is depleted, the authorities lack the means to further sustain the price ceiling via this instrument.
A.2. Explaining the Risk Mitigation Approaches

Table A.1 highlights six mitigation approaches, which are explained in more detail here.

Under the carbon reserve buffer and price ceiling risk mitigation approach, a pool of carbon units could be administered by either a governmental entity or a private institution. Units come from a certain percentage or a fixed amount of total allowances in the emissions trading system or other cap-based market. The buffer offers a hedge option: units from the carbon reserve are introduced at a fixed price to the market when the unit price exceeds a certain threshold. This threshold can either be defined ex-ante and communicated publicly (thus facilitating planning certainty) or determined “just in time” as prices rise. Such fixed price ceilings, combined with (inevitable) finite reserve capacities, require specific regulations to fend off potential speculators who may bet against the price ceiling until the reserve is depleted. One way to ensure continuous price containment is to hold announced sales at one or different fixed prices. The board responsible for California’s emissions trading system, for example, offers allowances for sale four times a year in three price tiers.

Penalties for non-compliance require compliance entities to pay fixed penalties for each unit of the difference between their emissions and their allowances. In cases where penalties may be paid in lieu of handing over allowances, this in practice results in a price ceiling.

Allowance banking and borrowing of units is a mitigation strategy designed to equilibrate present value prices across years and trading periods. However, borrowing could undermine early abatement efforts.

Connecting two or more emissions trading systems (or other market trading systems) is intended to extend markets and stabilize prices. High prices in emissions trading system A will decrease when linked to emissions trading system B when unit costs are lower than in emissions trading system A (and/or the supply of units in its market is higher). There are multiple approaches to connect systems, including both linking and networking.

Raising the cap in the emissions trading system (or other market) allows for the generation of more units—and thus for additional supply in the market. This may trigger unit prices to decline. Respective countries, however, would need to implement additional measures to meet their international and/or domestic emissions reduction obligations. Furthermore, adjusting the cap could introduce uncertainties in the market and undermine the environmental integrity of the system.

Finally, market prices could be steered indirectly by supporting mitigation efforts. This could foster further investment and facilitate projects at both individual compliance entities and across sectors and, in turn, reduce the demand for emissions units from the emissions trading systems (or other market trading systems). The funding for these support measures could come from the returns of auctioning of emissions trading units or from ring-fenced carbon taxes. These mitigation supports would need to be implemented at a sectoral or multi-sectoral level to target the compliance entities that they are created for and to avoid rent-seeking by other entities. Eligibility restrictions and conditions for such support would also need to be assessed beforehand in order to avoid market distortions and not inadvertently provide perverse incentives for project implementation.

A.3. Mitigating Other Price-Related Risks

Table A.2 provides an overview of mitigation approaches to address the risks of low prices, price volatility and illiquidity, and a lack of market information. Each of these approaches has its pros and cons and some of the instruments are only listed for completeness (and may not provide for robust approaches to risk mitigation).

A.4. Mitigating Non-price Related Risk

In addition to government intervention, the market itself can address the risk of carbon price volatility. For example, the use of derivative instruments in a financial market may help compliance entities to hedge against the risk of volatility. On the other hand, such instruments could attract new market participants (e.g., property traders), which may or may not lead to an increase in price volatility. In the EU-ETS, a wide range of derivative instruments are offered, including futures, calls, puts, and collars. In addition, carbon market exchanges could be established and, as an important prerequisite for liquidity, could help to address volatility risk. Examples of exchanges that
trade carbon market contracts include the European Climate Exchange and Nord Pool.

A.4.1. Risk of Invalidity of Issued and Allocated Units

There is a risk in current carbon markets that issued or allocated units that are accounted for in a carbon asset registry or tracking system will be rendered invalid. Risks for issued and allocated units are, in most cases, limited to cases of fraud and crime (e.g., in recent cases in the EU-ETS, criminals acquired access to carbon registry systems and carried out illegal transactions). Buyers of illegally obtained units risk losing the value of their purchases. This risk can be mitigated by implementing best practice safety and security rules and regulations in carbon registry systems. The situation is a bit more complex in the case of units from carbon sequestration activities.

A.4.2. Risk of Non- or Underperformance of Mitigation Activity

An important instrument for mitigating non- or underperformance risks is an Emissions Reduction Purchase Agreement (ERPA) between a project owner/operator and the off-taking carbon aggregator. ERPAs may include a prepayment that may or may not be reimbursable in case of project failure. The agreed price is often related to market prices and unit issuance volume. For example, ERPA structures routinely involve a floor price with upside sharing, guaranteeing a minimum price for project owners and operators and, thus, a minimum profitability for the investment. The pooling of projects in a portfolio may be bought at a higher price than for units that exceed this tranche.

The pooling of projects in a portfolio offers another strategy to mitigate risk. Carbon aggregators build up a portfolio of ERPAs with units from different projects. As in other financial portfolios, the pooling of risks and a diversity of project types and

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Table A.2: Other Price-related Risks

<table>
<thead>
<tr>
<th>Low unit prices</th>
<th>General impacts:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impacts on installations:</td>
<td></td>
</tr>
<tr>
<td>• Low profitability of some earlier GHG mitigation measures</td>
<td>• The carbon market ceases to function</td>
</tr>
<tr>
<td>• Risk of low prices leads to low investments in GHG mitigation</td>
<td>• Low investments in GHG mitigation</td>
</tr>
<tr>
<td>• Risk of policy switch to (economically potentially less-efficient) command-and-control policies or no climate policies</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Price volatility (in particular in early and small markets)</th>
<th>General impacts:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impacts on installations:</td>
<td></td>
</tr>
<tr>
<td>• High price volatility may lead to uncertainty in the investment climate</td>
<td>• Carbon market ceases to function</td>
</tr>
<tr>
<td>• High volatility may lead to business opportunities</td>
<td>• Risk of policy switch to (potentially economically less-efficient) command-and-control policies or no climate policies</td>
</tr>
<tr>
<td>• Implementation of mitigation measures may (i) be considered highly risky (because reward is uncertain); or (ii) be seen as a hedge against price volatility</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lack of market information</th>
<th>General impacts:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impacts on installations:</td>
<td></td>
</tr>
<tr>
<td>• Uncertainty and less investment in mitigation activities</td>
<td>• General market ignorance/uncertainty about existing trends, opportunities, and risks</td>
</tr>
</tbody>
</table>
countries helps to reduce overall risk. Portfolio risk is assessed by probabilistic modelling and carbon markets in portfolios are routinely hedged with derivative instruments in the carbon market.

**A.4.3. Risk of Non-permanence of AFOLU Units**

Measures that aim at increasing the terrestrial carbon stock, such as afforestation, reforestation, improved forest management, and land use change (as well as carbon capture and storage projects) face the risk of non-permanence (i.e., that at a given time after the implementation of the project, part or the entire increase in the terrestrial carbon stock will be released into the atmosphere). The following mitigation approaches have been or could be used to address the risk of non-permanence:

- **Temporary units:** In the CDM, units for afforestation and reforestation projects are issued on a temporary basis, and these temporary certified emissions units (t-CERs) and long CERs (l-CERs) needed to be replaced eventually by permanent units. This condition significantly limited the attractiveness of these market instruments, and the t-CER and l-CER markets have never taken off.

- **Buffers:** Under a buffer strategy, a specific share of issued units is set aside (e.g., by a forestry offset program or project participants) in a central buffer, and then released in the case of an event that results in non-permanence.

- **Insurance:** It may also be possible to develop insurance products that cover some or all of the relevant risks for non-permanence for single projects or portfolios of projects. Such insurance instruments could be built on existing insurance products for natural disasters and (to a lesser extend) to hedge against political risk. Insurance may be particularly efficient in combination with a buffer system.

**A.4.4. Risk of Non-eligibility of Units in Carbon Markets**

One way to mitigate changes in eligibility is to use financial instruments for carbon markets that can act as a hedge. For example, investors in mitigation projects that will generate units can enter into future contracts that assure them that they can sell those units in the future at a predetermined price. If, later, the units from their specific project type lose their eligibility for compliance (and therefore their market value), the future contract should protect future cash flows and assure the sustainability of the investment.

**A.5. Risks Related to the Nature of Absolute Caps**

Most of the existing and emerging emissions trading systems cover countries or jurisdictions that cover a single common economy or a national economy (e.g., the European Union, New Zealand, Quebec, California, and the Republic of Korea). As a result, economic cycles impact the entire economic area of these systems in a similar way. Many emissions trading systems are cap-and-trade systems that define absolute caps for emissions trading systems compliance entities (i.e., caps are set ex-ante and are not (or only marginally) adjusted with economic development). The process of ex-ante cap-setting usually takes into account historic and current emissions and production levels and/or projections of future growth.

The level of emissions covered by an emissions trading system in a jurisdiction tends to depend heavily on the jurisdiction’s economic development. When the actual economic development within a jurisdiction significantly deviates from the projections that were the basis for the cap-setting process, emissions trading systems with absolute caps may suffer from extreme carbon price levels (at least compared to price levels assumed in the cap-setting process). The more homogenous the economy underlying an emissions trading systems, the more vulnerable the carbon market is to swings in the economic cycle:

- In case of an economic downturn or crisis, the entire economy is hit and emissions and carbon prices may drop sharply, causing severe stress on the capacity of the national/jurisdictional price containment system to maintain a price floor.

- In case of higher than expected economic growth, the growing emissions may lead to rising carbon prices, causing stress on the capacity of the price containment system to maintain its predefined price ceiling.

This suggests that, in a cap-and-trade system with absolute caps, the more homogenous and uniform the underlying economy, the more vulnerable the price containment system to economic cycles.
Absolute caps are a risk that may limit the effectiveness and functioning of national price containment measures. If the reserve capacity is too low compared to the requirements of the economic cycle in terms of risk mitigation capacity, reserves may be depleted. This risk may be mitigated by increasing the level of linking between carbon markets (where feasible) or, as an intermediate solution, by pooling the risks and price containment measures over different carbon markets and jurisdictions that are less correlated or not correlated at all (see chapter 3).
Appendix B: Existing Price Containment and Reserve Instruments

The pros and cons of measures for carbon market price stabilization have been the subject of healthy debates in policy circles and academia (e.g., Burtraw, Palmer, and Kahn 2009; Jones, Purvis, and Springer 2013; Murray, Newell, and Pizer 2009; Pizer 2002) ever since carbon markets were established. This paper does not make the case for price containment measures and they are not the subject of this discussion. This paper does, however, examine ways to support jurisdictions that would like to implement such measures and provide options to complement and support domestic price containment measures with ICAR functions that may make these measures more efficient and effective.

The following section provides a preliminary overview of some existing and planned emissions trading systems and their regulation of carbon prices. Appendix C then provides a brief description of the International Energy Agency’s Emergency Response System of the International Energy Program is provided, as this multilateral instrument may also serve as a model from which to borrow ideas and concepts for an ICAR.

B.1. Existing, Emerging, and Potential Regional, National, and Subnational Carbon Pricing Instrument

In the past couple of years, several new initiatives have started their implementation process. Notably, in 2014 the implementation of pilot ETSs in Hubei and Chongqing have started. Meanwhile, France and Mexico adopted carbon taxes and Chile passed carbon tax legislation. Figure B.1 shows the increase in carbon pricing initiative over time as a share of global emissions covered while Figure B.2 illustrates existing, emerging, and potential regional, national, and subnational carbon pricing instruments. Table B.1 provides latest update on emerging carbon pricing instruments.

B.2. Overview of Current Price Floor and Ceiling Policies

Figure B.3 provides prices of existing carbon pricing instruments. Table B.2 then provides examples of price floors and price ceilings in various emissions trading systems. The information on price floors and ceilings are provided based on a review of current literature and is not exhaustive.
Figure B.1: Regional, National, and Subnational Carbon Pricing Initiatives: Share of Global Emissions Covered

Figure B.2: Summary Map of Existing, Emerging, and Potential Regional, National, and Subnational Carbon Pricing Instruments

### Table B.1: Latest Update on Emerging Carbon Pricing Schemes

<table>
<thead>
<tr>
<th>Countries</th>
<th>Update</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chile</td>
<td>Chilean parliament approved a carbon tax of US$5 per tCO₂ in September 2014. Starting in 2018, this tax will be applied to power generators with a thermal plant capacity greater than 50 megawatts.</td>
</tr>
<tr>
<td>China</td>
<td>Following the start of the pilot ETSs in Beijing, Guangdong, Shanghai, Shenzhen, and Tianjin in 2013, and in Chongqing and Hubei in 2014, the designs of some of these schemes are rapidly evolving. Until March 2015, approximately 17 million allowances worth US$100 million had been traded in all schemes combined. A nationwide ETS may be launched by the end of 2016 and be fully implemented in the course of 2019.</td>
</tr>
<tr>
<td>Kazakhstan</td>
<td>Full implementation of the Kazakhstan’s ETS started in 2014, including enforcement and trading. The trading volume was low, with only 35 transactions representing a total of 1.3 MtCO₂. The average price of allowances in 2014 was KZT406 (US$2).</td>
</tr>
<tr>
<td>Republic of Korea</td>
<td>The Korea ETS entered into force on January 1, 2015, and covers 23 subsectors. In the first phase—from 2015 to 2017—ETS installations will receive a free allocation of 100 percent of their average 2011–13 GHG emissions. No auctioning will take place.</td>
</tr>
<tr>
<td>Portugal</td>
<td>In Portugal, a carbon tax of €5 per tCO₂e (US$5 per tCO₂e) was approved in November 2014, which entered into force on January 1, 2015. It applies to non-EU ETS sectors and covers approximately 26 percent of the country’s GHG emissions. The tax is expected to generate revenues of over €95 million (US$104 million) in 2015.</td>
</tr>
<tr>
<td>Switzerland</td>
<td>In Switzerland, the first two auctions of allowances in its ETS took place in May and November 2014. Allowances in these auctions were sold at two different prices: CHF40 (US$42) and CHF20 (US$21), respectively. Switzerland and the EU continued negotiations on linking, with a seventh round of talks taking place in March 2015, aimed at establishing an agreement in the first half of 2015.</td>
</tr>
</tbody>
</table>


### Table B.2: Overview of Price Floors and Ceilings in Various ETSs

<table>
<thead>
<tr>
<th>Scheme</th>
<th>Price floor</th>
<th>Price ceiling</th>
<th>Notes</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>California</td>
<td>$10.71, increase of 5% p.a. plus inflation rate</td>
<td>$40/45/50, increase of 5% p.a. real Reserve tranche volume increasing over time.</td>
<td>The floor appeared to influence the first auction and some future tranches</td>
<td>California Air Resources Board—CARB (2012); OCCP (2013)</td>
</tr>
<tr>
<td>Quebec</td>
<td>C$10, increase of 5% p.a. real escalation, auction floor</td>
<td>C$40/45/50, increase of 5% p.a. real.</td>
<td>Linked to California as part of the Western Climate Initiative</td>
<td>Government of Quebec (2013); OCCP (2013)</td>
</tr>
<tr>
<td>Regional Greenhouse Gas Initiative (RGGI)</td>
<td>$1.93 constant auction floor price in real terms</td>
<td>Cost Containment Reserve at $4 in 2014 increasing to $10 by 2017, and an increase of 2.5% p.a. nominal post-2017</td>
<td>The floor has been effective in sustaining prices despite chronic oversupply</td>
<td>RGGI (2013); OCCP (2013)</td>
</tr>
<tr>
<td>New Zealand</td>
<td>No</td>
<td>Price ceiling at NZ$25</td>
<td>Effective ceiling lower due to 2 for 1 surrender provisions</td>
<td>New Zealand Government (2013); OCCP (2013)</td>
</tr>
</tbody>
</table>
Figure B.3: Prices of Existing Carbon Pricing Instruments (as of April 1, 2015)


B.3.1. California

The California Air Resources Board (CARB) has set in place an emissions trading system to help California meet its emissions reduction target (80-percent reduction from 1990 levels by 2050). The program started at the beginning of 2012 and foresees measures to contain the unit price, including reserves, for the purchase of offsets, and for linking with other systems.

In order to reduce the risk that substantially higher-than-anticipated compliance costs are incurred, the CARB implemented an allowance reserve as a cost-containment mechanism. This mechanism increases the amount of allowances available from the reserve. The reserve is generated by taking four percent from the program’s allowance budget across all three compliance periods. Units from the reserve are made available quarterly at pre-established prices in three tiers with limited volumes each.

In 2013, prices for tier 1, 2 and 3 were $40, $45, and $50 per metric ton respectively. Since 2013, allowances from each tier are being offered at prices equal to the tier prices from the previous calendar year increased by five percent, plus the rate of inflation as measured by the most recently available 12-month value of a consumer price index. Compliance entities (compliance entities) decide whether they want to purchase allowances from the reserve. Once all allowances from the reserve are sold, the reserve will not be refilled; it thus would be exhausted as a price containment mechanism.

The implementation body for this cost-containment mechanism is the CARB itself, which sets the fixed prices of the tiers and monitors activities from reserve sales. Application of the mechanism is rule based; as a result, sales are only held if there are qualified applicants for a scheduled reserve sale.

Neither scheduled reserve in 2013 was held for this reason. If a reserve sale is held in the future, the reserve sale administrator will offer all of the allowances in the reserve at each sale.

Compliance entities can also buy offsets from individual mitigation projects issued by the CARB but not covered under the emissions trading systems cap. Requirements for issuance are similar to the CDM standards. The limit for purchasing offsets is set at eight percent of the entities’ covered emissions. The amount of offsets that can be used for compliance is increased by the same quantity as the number of allowances put into the reserve.

The CARB also holds quarterly auctions to allow compliance entities to buy allowances directly from the CARB. Each year, a fixed floor price is determined ($10.71 in 2013); this increases by five percent per year (plus the rate of inflation).

Finally California linked its emissions trading system with Quebec in January 2014 according to the Western Climate Initiative’s (WCI)6 design recommendations for regional cap-and-trade programs. Each jurisdiction accepts the other’s compliance instruments and they hold joint auctions. For offsets, respective projects have to be located in either Quebec or California, and only credits issued by one of the two states will be accepted for offsetting (CARB 2013). The first auction took place in November 2014. The scope of both programs was enlarged in 2015 to incorporate transport fuels.7

B.3.2. Quebec

Quebec has a very similar price containment mechanism in place as California—namely, a carbon cost-containment reserve to conduct strategic reserve sales up to four times per year for entities covered by the emissions trading system. The reserve holds one percent of the allowances under the cap for 2013 and 2014. The reserve will hold four percent of the allowances under the cap for 2015–2017, seven percent of the

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6 The WCI is a nonprofit corporation formed to provide administrative and technical services to support the implementation of state and provincial greenhouse gas emissions trading programs (www.wci-inc.org).

allowances under the cap for 2018–2020, and then four per-
cent of the allowances under the cap for 2021 and beyond.

Prices in 2013 in tiers 1, 2 and 3 were $40, $45, and $50, respectively (the same as in CARB). The Quebec emissions trading systems planned to increase prices annually by five percent. Unlike in the California emissions trading system, inflation is not considered in this increase.

To contain overall compliance costs, Quebec allows the purchase of offsets from individual mitigation projects outside the emissions trading system with the same utilization limit as in California (eight percent). Respective projects have to be located in either Quebec or California, and only credits issued by one of the two states are accepted for offsetting.

The administrative implementation of this mechanism has been delegated to the Western Climate Initiative. The WCI organizes sales from the Quebec reserve on a mutual agreement between applicants and the WCI. As a result, the reserve mechanism is rule based, since sales only take place if demand for reserve units exists. In addition, there are regulations in place specifying who is eligible to buy reserve units. All requests for registration must be approved by a minister (similar to the reserve sale administrator in California). The minister may also choose to use the reserve allowances to adjust the amount of free allowances allocated to emitters.

B.3.3. New Zealand

The New Zealand emissions trading system has been in operation since 2008; it covers emissions from forestry, stationary energy, industrial processes, and liquid fossil fuels. The price ceiling is set at NZ$25. Under the emissions trading system, compliance entities may import an unlimited number of CERs to fulfil their compliance obligations (New Zealand Government 2013).

B.4. EU Market Stability Reserve

The EU Commission envisions the establishment and operation of a market stability reserve in the EU-ETS (EC 2014). The Commission does not directly consider price containment mechanisms. It would, however, regulate the amount of allowances in the system: from 2021 onward, 12 percent of the total number of allowances in circulation\(^8\) could be placed in the reserve if this amount were equal to or greater than 100 million allowances. The release of 100 million allowances would take place automatically if the total number of allowances in circulation in a given year falls below 400 million or if, for more than six consecutive months, the carbon price is more than three times the average carbon price during the two preceding years.

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\(^8\) The total number of allowances in circulation is defined as the difference between all allowances issued and international credits used (since 2008) until the end of each year and verified emissions recorded since 2008 and allowances in the reserve at the end of that same year.
The International Energy Agency (IEA) was founded in 1974 by major industrial countries in response to the 1973 oil crisis and the actions of the Organization of the Petroleum Exporting Countries. The security of the energy supply of IEA member countries and international cooperation among members are important aims of the IEA.

A central pillar of the IEA’s governing treaty is the Emergency Response System of the International Energy Program (IEP), implemented by participating countries through the IEA. Though not a carbon market, it is an example of a commodities market supply regulation instrument of international scope and voluntary participation—and implemented through an international entity. Elements of its operational set-up and its institutional structure, regulation, and governance may serve as a possible model for the design of an ICAR. In addition, lessons learned from the implementation of the IEP illustrate the potential challenges and shortcomings of such structures.

Through the IEP agreement, the participating countries commit themselves to the following actions:

- **National reserves.** Each party has to maintain emergency reserves sufficient to sustain consumption for at least 90 days with no net oil imports.
- **Action plan.** Each party has to prepare a program of contingent oil demand restraint measures, enabling it to reduce its rate of final consumption by seven percent (or 12 percent in the event of a very severe supply disruption).
- **Allocation.** In case of several supply disruptions, each party must participate in the allocation of its oil supplies according to IEA rules. This basically requires countries with higher reserves and fewer supply restrictions to supply to countries in need. Fair treatment of participating countries is sought and the price should be based on “conditions prevailing for comparable commercial transactions.”

The response system is triggered whenever “the group sustains or can reasonably be expected to sustain a reduction in the daily rate of its oil supplies at least equal to seven percent of the average daily rate of its final consumption.”

The decision to activate emergency response measures is taken by the IEA’s governing board, supported by advice from a panel of industry experts. The governing board is the IEA’s main decision-making body; it is composed of energy ministers (or their senior representatives) from each member country.

In 1984 the IEA introduced a second layer of emergency measures, the Coordinated Emergency Response Measures. They may be activated if the oil supply disruption is not acute enough to trigger the IEP emergency measures.

The IEP has been implemented within the complex geopolitical context of international energy policies—and its operation and efficiency have been debated extensively. Some of the preliminary lessons learned from this process include:

- The design, agreement, and implementation of international instruments are time consuming and difficult, in particular if a large number of countries are involved and consensus needs to be sought.
- The emergency response system has only been triggered three times since its inception (1990/91—Gulf/Iraq; 2005—Hurricane Katrina; and 2011—Libya). This may point to the fact that the main market impact from such an instrument comes mainly from its existence rather than from its actual application in emergency situations. In addition, it has been argued that the last activation of emergency measures was triggered more to contain prices on oil markets (and, with that, to stabilize global economic growth), as the trigger criteria of a 7-percent undersupply had not been reached.
- The quantitative requirement for countries to hold (public or private) national oil reserves does not specify the quality of the oil in the reserve. This, and the limitations in fungibility of different products in the reserve, should be taken into account. As different countries have different (and sometimes limited) refinery capacities, this has led to a situation in the past where, even though the overall national reserves and oil supply was sufficient according to IEP criteria, the actual supplies were mostly crude oil while the country suffered from a shortage of lighter fractions (e.g., diesel, gasoline).
The planning and operation of an emergency instrument to stabilize oil markets through an international agency requires extensive information and data on oil production and consumption patterns, changes in stocks, and so forth. The IEA has established itself as a leading provider of data, information, and analysis on energy markets and technologies.
The following table outlines examples of form, function, and organization of public and private international organizations as well as a public-private partnership.

<table>
<thead>
<tr>
<th>Institution</th>
<th>Form</th>
<th>Category</th>
<th>Purpose</th>
<th>Member Scope</th>
<th>Compliance by Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Public Institutions</strong></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>UN Framework Convention on Climate Change (UNFCCC)</td>
<td>Secretariat under convention</td>
<td>Convention or treaty related</td>
<td>Coordination of negotiations and information platform</td>
<td>Global</td>
<td>Yes, countries co-finance the Secretariat</td>
</tr>
<tr>
<td>International Monetary Fund (IMF)</td>
<td>United Nations Specialized Agency, Fund</td>
<td>Program</td>
<td>Surveillance, technical assistance, and lending to member countries, stabilization of economy</td>
<td>Global</td>
<td>Quota determines financial commitments and voting power</td>
</tr>
<tr>
<td>Bank for International Settlements</td>
<td>International Bank</td>
<td>Model of action: clearing</td>
<td>Serve central banks in their pursuit of monetary and financial stability, foster international cooperation, act as a bank for central banks</td>
<td>Global</td>
<td>Yes, through respective member or central banks, financial contribution</td>
</tr>
<tr>
<td>International Energy Agency</td>
<td>Cooperation Platform</td>
<td>Framework body</td>
<td>Steering of international energy policy: energy security, economic development, and environmental protection</td>
<td>OECD members only</td>
<td>Yes, financial contribution and maintenance of stock levels</td>
</tr>
<tr>
<td>Global Environment Facility</td>
<td>Fund</td>
<td>Convention mechanism, Fund</td>
<td>Address global environmental issues while supporting national sustainable development initiatives</td>
<td>Global</td>
<td>Yes, financial contribution by countries</td>
</tr>
<tr>
<td>Nordic Environment Finance Cooperation</td>
<td>Multilateral Financial Institution, Fund</td>
<td></td>
<td>Provide loans and make capital investments in order to generate positive environmental effects of interest to the Nordic region</td>
<td>Denmark, Finland, Iceland, Norway, and Sweden</td>
<td>Yes, financial contribution by countries</td>
</tr>
<tr>
<td>World Business Council for Sustainable Development</td>
<td>CEO-led Association of Companies</td>
<td>Business friendly international NGO</td>
<td>Sustainable development platform for companies to share knowledge, experiences, and best practices; and to advocate business positions</td>
<td>Global (by invitation only)</td>
<td>Members make knowledge and experiences as well as human resources available. They also publically report on their environmental performance</td>
</tr>
<tr>
<td>Institution</td>
<td>Form</td>
<td>Category</td>
<td>Purpose</td>
<td>Member Scope</td>
<td>Compliance by Countries</td>
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<tr>
<td><strong>Private Institutions</strong></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Cement Sustainability Initiative</td>
<td>Association of Companies</td>
<td>Business friendly international NGO</td>
<td>Platform to exchange information, provide data on cement sector, development of chart for sustainable development for cement sector</td>
<td>Invitation only</td>
<td>Commitment to the initiative charter, report on emissions and energy use, implementing good practices, and contribution to the budget</td>
</tr>
<tr>
<td>Carbon Disclosure Project</td>
<td>Independent NGO</td>
<td>NGO</td>
<td>Information platform, disclose greenhouse gas emissions, and other environment related information of major companies</td>
<td>Global</td>
<td>Members provide information on their resource consumption and emissions, member fees apply</td>
</tr>
<tr>
<td><strong>Public-Private Partnership</strong></td>
<td></td>
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<tr>
<td>Pacific Catastrophe Risk Assessment and Financing Initiative</td>
<td>Joint Initiative by International Organizations, Countries, Academic Institutions, and Private Companies</td>
<td>PPP Initiative</td>
<td>Provide Pacific Island Countries with Disaster Risk Modeling and Assessment Tools</td>
<td>SOPAC/SPC, World Bank Group, Asian Development Bank</td>
<td>Financial support by Japan and GFDRR, technical support from AIR Worldwide, New Zealand GNS Science, Geoscience Australia, Pacific Disaster Center, Open Geo, and GFDRR Labs</td>
</tr>
</tbody>
</table>
Bibliography


