Doc 9949

Scoping Study of Issues Related to Linking "Open" Emissions Trading Systems Involving International Aviation

Approved by the Secretary General
and published under his authority

First Edition — 2011

International Civil Aviation Organization

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AMENDMENTS

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EXECUTIVE SUMMARY

For international aviation, compliance with an ambitious target to reduce emissions from the sector may require the use of tradable compliance units from another sectoral, multi-sectoral or economy-wide national, regional or international emissions trading scheme. In addition, units from project-based or programme-based mechanisms such as the Clean Development Mechanism could also be considered for use.

Of interest in this study is the linking of schemes that will result in “open” emissions trading involving international aviation. Although in different definitions for open emissions trading can be found in literature, its use here is aligned with the way ICAO has used the concept in the past. Thus, a system is regarded as open when the international aviation sector has access to compliance units from outside the aviation sector. Although not part of the scope of this study, “closed” emissions trading system would be an international aviation-only system where only units from the international civil aviation sector could be traded and used for compliance purposes.

Schemes that include emissions from international aviation as well as other sectors could have unique aviation and non-aviation tradable units, and could restrict the type of tradable units that are accepted for achieving compliance by participants in the system. However, the key benefit of an open system for participants in the international aviation sector comes from their ability to use non-aviation tradable units for compliance purposes, which is likely to reduce compliance costs for the sector.

The administrator of a trading system can establish a unilateral link with another system by agreeing to accept tradable units issued by the other system for compliance purposes. Alternatively, the administrators of two systems can establish a bilateral link if each agrees to accept tradable units issued by the other system for compliance purposes. With a bilateral link, tradable units can be freely traded between the systems and are equally valid for compliance purposes in both systems.

When considering the creation of either a unilateral or bilateral link, the choice of the system(s) with which it might be possible to link will be assessed in terms of:

a) the perceived quality of the tradable units of the target system;

b) the ease of establishing a link with the target system; and

c) the size of the target system relative to the projected demand for external tradable units by the international aviation sector.

The potential benefits of linking one or more systems involving international aviation emissions include:

a) lower net cost of meeting emissions obligations in linked systems as a result of the flexibility to acquire and use, for compliance purposes, the lowest cost emissions reduction measures across all participants;

b) increased incentives for entities to find cost-effective ways to reduce their emissions as the market for selling excess emissions reductions grows;

c) reduced price volatility of tradable units due to the creation of a larger, more liquid market for these units; and

d) reduced competitiveness concerns and a reduced likelihood of carbon leakage due to the convergence of tradable unit prices in the linked systems.

The main risks associated with linking are as follows:

a) higher prices for the tradable units in the net supplier system (with unilateral or bilateral linking);

b) higher total emissions if differences in system design, including provisions related to monitoring, verification, reporting and compliance penalties, result in the effective application of the least stringent requirements; and

c) incentive to limit the requirement to achieve emissions reductions (for example, make smaller reductions to the emissions cap over time) so that participants can benefit from exporting tradable units to the linked system.

Many of the risks noted above can be reduced by harmonizing the relevant provisions enough to make the linked systems "compatible".

GLOSSARY

The terms contained herein are intended to clarify concepts as used in this document.

Accountable entity. The entity in a cap-and-trade emissions trading system that is responsible for measuring and reporting actual emissions and for submitting sufficient allowances to cover those emissions.

Additionality. To avoid giving credits for greenhouse gas emissions reductions that would have happened anyway, eligibility criteria have been developed to determine whether the reductions are "additional" — that is, are more than would have occurred in the absence of the project (environmental additionality) or in the absence of the incentive from the clean development mechanism (CDM) (project additionality).

Allocation. The initial distribution of allowances to accountable entities for a compliance period. This allocation could, for example, be based on historical emissions or a performance standard and level of production and could be made "gratis" or through an auction process.

Allowance (emissions allowance). An allowance is a tradable emissions permit that can be used for compliance purposes in a cap-and-trade system. Each allowance allows the holder to emit a specific quantity of a pollutant (e.g. one tonne of CO_2) one time.

Allowance life. The allowance life is the period during which an allowance can be used for compliance purposes.

Annex B Parties or Countries. Group of industrialized countries and economies in transition listed in Annex B of the Kyoto Protocol that have commitments to limit or reduce their greenhouse gas emissions over the 2008-2012 period.

Annex I Parties or Countries. Group of industrialized countries and economies in transition included in Annex I to the United Nations Framework Convention on Climate Change (UNFCCC) that committed individually or jointly to returning to their 1990 levels of greenhouse gas emissions by the year 2000.

Assigned amount units (AAUs). Emissions targets for industrialized countries that are Parties to the Kyoto Protocol are expressed as levels of allowed emissions or "assigned amounts" for the 2008–2012 commitment period. Such assigned amounts are denominated in tonnes of CO_2 equivalent emissions (CO_2e). The inventory on which this number is based is approved by the UNFCCC, and the Kyoto Party can (if needed) issue the AAUs.

Auctioning. The distribution of allowances — either the initial distribution or from a set-aside. This is achieved through an auction in which system participants bid for the right to purchase allowances. Different auction models could be used. Auctions often complement other forms of allowance allocation.

Aviation bunker fuels. The international share of fuel sold to aircraft.

Banking. A banking provision permits allowances issued for one compliance period to be saved for use during a subsequent compliance period.

Baseline. A reference level of emissions. For example, a baseline can be used to calculate the total quantity of allowances to be distributed under a cap-and-trade system or the quantity of credits generated under a baseline-and-credit (emissions intensity) system. A baseline also sets the level of emissions that would occur without policy intervention in an offset programme.

Baseline-and-credit (emissions intensity) system. An emissions trading system that establishes an emissions performance standard and allows regulated participants to generate tradable credits (or "emissions performance credits/allowances") by reducing their emissions intensity below that standard. Regulated participants that remain with an emissions intensity above the standard would need to submit credits to the regulating authority.

Benchmarking. A reference level, such as emissions per unit of output, that can be part of the formula for the free allocation of allowances under a cap-and-trade system or that can define the target in an emissions intensity system.

Bilateral link. A bilateral link is established if the administrators of two emissions trading systems agree to accept allowances issued by the other system for compliance purposes.

Borrowing. A borrowing provision permits an accountable entity to use allowances for a future period to achieve compliance in the current period.

Buyer. A legally recognized entity (individual, corporation, not-for-profit organization or government) that acquires allowances or other compliance units from another legally recognized entity (the seller) through a purchase, lease, trade or other means of transfer.

Cap-and-trade emissions trading system. A cap-and-trade system allows for the trading of emissions allowances that are limited or "capped" in quantity by a regulatory authority. Before each compliance period, the regulatory authority distributes the allowances through a free allocation, sale and/or auction. At the end of the compliance period each accountable entity must surrender sufficient allowances to cover its actual emissions during the period. The trading of allowances promotes cost-efficient emissions reductions because entities that can reduce emissions at lower cost have the incentive to pursue these emissions reductions and to then sell their surplus allowances to entities that face higher emissions reduction costs.

Certified emissions reductions (CERs). A compliance unit under the Kyoto Protocol issued for emissions reductions achieved from project activities in non-Annex I Parties that meet the requirements of the Clean Development Mechanism (CDM). One CER is equal to one metric tonne of CO_2 equivalent.

Cirrus cloud. A type of cloud composed of ice crystals and shaped like hair-like filaments. May be partly induced by aviation.

Clean development mechanism (CDM). A mechanism established by the Kyoto Protocol that enables emissions reduction projects in non-Annex I Parties to earn CERs that can be sold to entities in Annex I Parties for compliance with their emissions limitation or reduction commitments under the Kyoto Protocol.

Climate change. A change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and is in addition to natural climate variability over comparable time periods.

Closed emissions trading. An emissions trading scheme that is designed to limit or reduce emissions within the boundaries of the scheme itself and thus does not allow for allowances or credits from outside the scheme to be used for compliance purposes.

Contrails. The condensation trail left behind jet aircraft. Contrails only form when hot humid air from jet exhaust mixes with ambient air of low vapour pressure temperature.

Credit or offset credit or offset. In this report the term "credit", "offset credit" or "offset" is used to denote the compensating emissions reductions (product) that have been achieved and can be applied in the activity of offsetting. An offset credit could equate to a one-tonne reduction of carbon dioxide (CO_2) emissions or a one-kilogram reduction of nitrogen oxide (NO_x) emissions, for example. These credits can be tradable units.

Distribution. The allocation of allowances among accountable entities in a cap-and-trade system.

Domestic aviation emissions. Emissions from civil domestic passenger and freight traffic (commercial, private, agriculture, etc.) that departs and arrives in the same country, including take-offs and landings for these flight stages.

Emissions intensity target. An emissions target defined in terms of emissions per unit of output.

Emissions reduction units (ERUs). The Joint Implementation (JI) project- or programme-based credits created in Annex B countries under their own authority (Track 1) or under the authority of the Joint Implementation Supervisory Committee (Track 2) that are issued by the Kyoto Party. ERUs are issued by converting AAUs/RMUs into ERUs so as to avoid the double counting of reductions.

Emissions trading. Emissions trading is a market-based tool that provides entities the flexibility to select cost-effective solutions to achieve their environmental targets. With emissions trading, entities can meet these targets either by reducing their own emissions or by securing, through the market, compliance units that take account of emissions reductions achieved elsewhere.

Gateway. Instrument created to regulate the net flow of allowances between different groups of buyers and sellers.

Greenhouse gas (GHG). The atmospheric gases responsible for causing global warming and climate change. The major GHGs are carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). Less prevalent but very powerful GHGs include hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6).

Greenhouse gas reduction or emissions reduction. A reduction in emissions intended to slow down the process of global warming and climate change. GHG reductions are often measured in tonnes of carbon-dioxide-equivalent (CO_2e), which is calculated according to the global warming potential (GWP) of a gas.

Indirect link. A system that establishes a unilateral or bilateral link with another system also establishes an indirect link with any other system to which the partner system is linked. An indirect link occurs without any formal or informal agreement between systems.

Intergovernmental Panel on Climate Change (IPCC). The Intergovernmental Panel on Climate Change was established by the World Meteorological Organization (WMO) and the United Nations Environmental Programme (UNEP) to assess scientific, technical and socio-economic information relevant for the understanding of climate change, its potential impacts and options for adaptation and mitigation.

Joint Implementation (JI). Joint Implementation is a flexible mechanism established by Article 6 of the Kyoto Protocol for project-based emissions reduction activities in Annex B countries. Emissions reductions from JI projects earn ERUs.

Kyoto Protocol. An international agreement reached in Kyoto in 1997 that is linked to the UNFCCC and inscribes, among other things, the emissions limitation and reduction commitments made by developed countries for the 2008-2012 First Commitment Period.

Kyoto unit. A unit, representing one tonne of carbon dioxide equivalent emissions, that an Annex B Party to the Kyoto Protocol can surrender to meet its limitation or reduction commitment under the Kyoto Protocol. These units are tradable between Kyoto Parties and include assigned amount units (AAUs), certified emissions reductions (CERs), emissions reduction units (ERUs), and removal units (RMUs). In addition, under the second phase of the EU emissions trading scheme, EU allowances are specific Kyoto units which have been designated as being valid for trading under the scheme. Transactions in EU allowances are therefore recorded automatically as transactions under the Kyoto Protocol.

Leakage. Leakage is the indirect effect of emission reduction policies or activities that lead to a rise in emissions elsewhere (e.g. fossil fuel substitution leads to a decline in the price of fossil fuels and a rise in their use elsewhere).

Multilateral link. A multilateral link is established when more than two systems agree to accept allowances issued by the other system(s) for compliance purposes.

Offset or offset credit. See definition of credit or offset credit or offset.

Offsetting. In this study offsetting is the activity of "cancelling out" or "neutralizing" emissions from a sector like aviation using offset credits – compensating emissions reductions created in a different activity or location that have been rigorously quantified and verified. It is only when credits are acquired from outside the emissions trading scheme or linked schemes and used to meet commitments/obligations under the scheme that the activity is referred to as offsetting. On the other hand, if a regulated emitter acquires compliance units (allowances or credits) from another regulated emitter within the same emissions trading scheme, or from a linked scheme, this is referred to simply as emissions trading.

Open emissions trading. An emissions trading system where allowances or credits from outside the scheme can be used for achieving compliance with obligations under the scheme.

Removal units (RMUs). A tradable unit that will be issued by the UNFCCC to an Annex B Party for CO_2 removals from the atmosphere achieved from specified sequestration activities during the first commitment period of the Kyoto Protocol.

Retirement. The permanent surrender of offset credits (or allowances) to achieve compliance with a regulatory or voluntary obligation or a country's international greenhouse gas commitment.

Seller. A legally recognized entity (individual, corporation, not-for-profit organization, government, etc.) that transfers allowances or credits to another legally recognized entity via a sale, lease or trade in return for a monetary or other consideration.

Surrender of allowances/credits. The submission of emissions allowances/credits by an accountable entity to fulfil its obligations under an emissions trading scheme.

Tradable unit. A generic term for compliance units that can be traded either domestically or internationally, including allowances from a cap-and-trade system, credits from a baseline-and-credit system, and offset credits created from either domestic or regional trading regimes or through the Kyoto flexibility mechanisms (from the Clean Development Mechanism and Joint Implementation projects).

Unilateral link. A unilateral link between two emissions trading systems occurs when the administrator of one system agrees to accept allowances issued by the other system for compliance purposes. This acceptance of units is "one-way".

United Nations Framework Convention on Climate Change (UNFCCC). The United Nations Framework Convention on Climate Change has been ratified by 192 countries, and it sets an overall framework for intergovernmental efforts to tackle the challenge of climate change. Under the Convention, governments share information on greenhouse gas emissions, national policies and best practices, commit to GHG limitation/reduction activities/targets, and provide financial and technical support for the adaptation and mitigation activities of other countries.

Verification. Verification provides independent assurance that the emissions quantification and reporting have been accurately completed. The “level of assurance” provided depends on the system requirements. In most systems the verifiers must be accredited by a standard-setting organization.

Voluntary action or commitment. This is an action or commitment, undertaken by an entity, that reduces GHG emissions in the absence of any requirements to undertake such reductions.

ACRONYMS

AAU	Assigned amount unit
ACESA	American Clean Energy and Security Act
CAD	Canadian dollars
CAEP	Committee on Aviation Environmental Protection
CDM	Clean development mechanism
CCX	Chicago Climate Exchange
CER	Certified emissions reduction
EEA	European economic area
EFTA	European Free Trade Association
ERU	Emissions reduction unit
ETS	Emissions trading scheme
EU	European Union
EUA	European Union allowance
EUAA	European Union aviation allowance
GHG	Greenhouse gas
GWP	Global warming potential
IATA	International Air Transport Association
ICAP	International Carbon Action Partnership
IPCC	Intergovernmental Panel on Climate Change
ISO	International Organization for Standardization
JI	Joint implementation
JVETS	Japan's Voluntary Emissions Trading Scheme
lCER	Long-term certified emissions reduction
LULUCF	Land use, land use change and forestry
MPMTF	Market-based Measures Task Force
MRV	Monitoring, reporting and verification
NSW GGAS	New South Wales GHG abatement scheme
NZU	New Zealand unit
RF	Radiative forcing
RGGI	Regional greenhouse gas initiative
RMU	Removal unit
tCER	Temporary certified emissions reduction
UNEP	United Nations Environmental Programme
UNFCCC	United Nations Framework Convention on Climate Change
US	United States
USD	United States dollars
WCI	Western Climate Initiative
WMO	World Meteorological Organization
WTO	World Trade Organization

Chapter 1

INTRODUCTION

1.1 BACKGROUND

1.1.1 During the Seventh meeting of the Committee on Aviation Environmental Protection (CAEP) in February 2007, the reports "Guidance on Emissions Trading for Aviation" (CAEP-IP/20) and "Report on Voluntary Emissions Trading for Aviation" (CAEP-IP/19) were finalized and adopted by CAEP.[1] To further CAEP's work on emissions trading and other market-based measures, the Market-Based Measures Task Force (MBMTF) was created with a mandate of scoping out several issues related to the use of market-based measures to address air emissions from the aviation sector.

1.1.2 One of the work items identified for the MBMTF was to write a scoping study on issues related to linking "open"' emissions trading systems involving international aviation. This document has been prepared in response to that request.

1.2 CONTEXT

1.2.1 The Kyoto Protocol of the United Nations Framework Convention on Climate Change (UNFCCC) requires countries listed in Annex I of the Convention (largely developed countries) to reduce greenhouse gas (GHG) emissions.[2] The first compliance period of the Kyoto Protocol covers the period 2008 to 2012; its successor is currently under discussion (see Glossary for a brief description of the Kyoto Protocol and Annex 1 countries).

1.2.2 The Kyoto Protocol treats emissions from the international and domestic aviation sector differently. Domestic aviation emissions are included in national targets.[3] Emissions from domestic aviation include emissions from civil domestic passenger and freight traffic that departs and arrives in the same country (commercial, private, agriculture, etc.), including take-offs and landings for these flight stages.[4] On the other hand, although international aviation emissions are not included in the targets listed in Annex B of the Kyoto Protocol, the Protocol assigns the UNFCCC Annex 1 Parties, working through ICAO, the responsibility of pursuing the limitation or reduction of GHG emissions from aviation bunker fuels (see Article 2.2 of the Protocol).[5] Emissions from international aviation include emissions from flights that depart in one country and arrive in a different country, including take-offs and landings for each flight stage.

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1. ICAO. *Guidance on the Use of Emissions Trading for Aviation* (Doc 9885). Montréal, 2008. *Report on Voluntary Emissions Trading for Aviation (VETS Report)* (Doc 9950). Montréal, 2010.
   <http://www.icao.int/icao/en/m_publications/html> <http://www.icao.int/icao/en/env/vets_report.pdf>
   Note.— It should be mentioned that there was a European Union reservation to adoption of these reports.
2. Throughout this scoping study, reference to developed countries implies Annex I countries; reference to developing countries implies non-Annex I countries.
3. ICAO. *ICAO Environmental Report 2007*. Montréal, 2007, p. 149. <http://www.icao.int/icao/en/env2010/pubs/Env_Report_07.pdf>
4. Intergovernmental Panel on Climate Change (IPCC). Prepared by the National GHG Inventories Programme. H.S. Eggleston et al. (eds.). *2006 IPCC Guidelines for National GHG Inventories*. Volume 2, *Energy*. Institute for Global Environmental Strategies (IGES), Hayama, Japan, 2006, pp. 3.57–3.58.
   <http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_3_Ch3_Mobile_Combustion.pdf>
5. "The Parties included in Annex I shall pursue limitation or reduction of emissions of greenhouse gases not controlled by the Montreal Protocol from aviation and marine bunker fuels, working through the International Civil Aviation Organization and the International Maritime Organization, respectively." Kyoto Protocol, Article 2, paragraph 2.

1.2.3 Aviation emissions contribute to the radiative forcing (RF) of climate.[6] The primary direct GHG emissions of aircraft are carbon dioxide (CO_2) and water vapour (H_2O). Other emissions are oxides of nitrogen (NO_x), particles containing sulphur oxides (SO_x) and soot. These gases and particles alter the concentration of ozone (O_3) and methane (CH_4) in the atmosphere, can trigger the formation of condensation trails (contrails), and may increase cirrus clouds — all of which contribute to climate change.

1.2.4 The Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report estimated aviation's contribution to global carbon dioxide emissions in 2005 to be 2 per cent, and its contribution to total anthropogenic RF to be 3 per cent.[7] These figures are based on aircraft operations data for 2000 (see Glossary for a brief description of IPCC). In a more recent scientific study that included new operational data for the period 2000–2005, total aviation RF in 2005 (excluding cirrus) was found to be 3.5 per cent of total anthropogenic forcing (or 4.9 per cent if estimates for aviation-induced cirrus are included).[8]

1.2.5 Even though the aviation sector continues to improve the relative efficiency of its operations through fleet renewal, improved scheduling/routing, fuel efficiency and other technical advances, operational adjustments alone will not fully counterbalance CO_2 emissions increases that are expected to be in the range of approximately 3–4 per cent[9] per year as the sector continues to grow. Other measures that would allow the sustainable growth of the sector and contribute to further mitigation of CO_2 emissions could be implemented.

1.2.6 The global warming impacts of CO_2 emissions are the same regardless of where the emissions occur. Thus, reductions in CO_2 from the international aviation sector could be achieved or recognized through participation in a multi-sector emissions trading system or through offsetting — the purchase and retirement of emissions reduction allowances or credits from sources outside of the sector. Alternatively, emissions trading systems could be linked to allow compliance units from other systems to be used to achieve the voluntary commitment or regulatory obligation.

1.2.7 A number of emissions trading systems for GHGs are operational, and some of these systems have already been linked. As more and more countries or regions are establishing emissions trading systems, the interest in linking is growing. This interest is indicated in the establishment of the International Carbon Action Partnership (ICAP) as a forum for public authorities committed to mandatory cap-and-trade systems to generate a better understanding of good ETS design and to promote the development of systems that could be compatible for linking.

1.2.8 It is also important to note that beginning 1 January 2012, CO_2 emissions from international aviation will be included in the European Union Emissions Trading Scheme (EU ETS). Covered under the scheme will be all flights from, to and within the EU performed with aircraft with MTOW above 5 700 kg. There will be a number of exclusions, including a de minimis rule that excludes flights performed by a commercial air transport operator operating less than 243 flights per period for three consecutive four-month periods, or operating flights with total annual emissions under 10 000 tonnes per year.[10]

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6. Radiative forcing components arise from: emissions of CO_2 (positive RF); emissions of NO_x (positive RF), including the sum of three components: production of tropospheric O_3 (positive RF), a longer-term reduction in ambient methane (CH_4) (negative RF), and a further longer-term decrease in O_3 (negative RF); emissions of H_2O (positive RF); formation of persistent linear contrails (positive RF); aircraft-induced cirrus cloudiness (potentially a positive RF); emission of sulphate particles (negative RF); and emission of soot particles. David S. Lee et al. "Aviation and Global Climate Change in the 21st Century." *Atmospheric Environment*, Volume 43, Issues 22 and 23, 2009.
7. IPCC. "IPCC Fourth Assessment Report: Climate Change 2007 (AR4)." Working Group III Technical Summary, 2007, p. 49. <http://www.ipcc.ch/ipccreports/ar4-wg3.htm>
8. David S. Lee et al, *Atmospheric Environment*, April 2009.
9. "IPCC Fourth Assessment Report: Climate Change 2007 (AR4)." p. 49.
10. European Union. "Directive 2008/101/EC of the European Parliament and of the Council of 19 November 2008 Amending Directive 2003/87/EC so as to Include Aviation Activities in the Scheme for Greenhouse Gas Emission Allowance Trading Within the Community." *Official Journal of the European Union*, Volume 52, 13 January 2009.

1.3 PURPOSE

1.3.1 The purpose of this scoping study is to review issues related to the linking of GHG emissions trading systems. Two systems are linked if entities can trade compliance units across scheme boundaries, with a participant in one system able to use a compliance unit issued by the administrator of the other system to achieve its voluntary commitment or regulatory obligation. More specifically, it is the linking of schemes that will result in open emissions trading involving international aviation that is of interest. Although different definitions for open emissions trading can be found, the concept as used here is aligned with the way it has been used in recent ICAO publications. Thus, a system is regarded as open when the international aviation sector has access to compliance units from outside the aviation sector; a closed emissions trading system would occur if compliance units could be traded within the aviation sector only.

1.3.2 It is noted that the definitions used in *Guidance on the Use of Emissions Trading for Aviation* (Doc 9885) characterize "open" and "closed" with reference to whether or not the sector has access to allowances and credits from outside an aviation trading scheme. Earlier analysis of emissions trading by Working Group 5 and FESG during CAEP/5, describe an open system as one in which emissions from all aviation sources are treated identically, with bilateral trading allowed between the aviation sector and other sectors.[11,12] A closed system, on the other hand, was described as a system in which aviation emissions could only be traded within the aviation sector with a fixed cap. The CAEP/5 conclusion was that "a closed emissions trading system does not show cost benefit results to justify further consideration".[13]

1.4 SCOPE AND STRUCTURE

1.4.1 This study is limited to considering and assessing emissions trading systems for GHGs.[14] For aviation, only the CO_2 emissions are considered.[15] It would be more technically challenging to include the non-CO_2 effects of aviation, such as NO_x, contrails and water vapour, in a trading system as such a system would need to take into consideration the scientific evidence related to these effects, their duration and their variability over time and location. So far such a scheme has not been implemented anywhere.[16]

1.4.2 The trading activities described in this study focus on trading at the source, facility, project or corporate level. Trading between countries of assigned amount units (AAUs), or other credits used by countries for the purposes of balancing national accounts to maintain compliance with international commitments, is considered only in the context of describing direct or indirect links between emissions trading systems.

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11. ICAO. CAEP/5-WP/16, "Report Overview from Working Group 5 on Development of Market-based Measures to Limit or Reduce Emissions from Civil Aviation." 1 December 2000.
12. ———. CAEP/5-WP/24, "Economic Analysis of Potential Market-based Options for Reduction of CO_2 Emissions from Aviation." 8 December 2000.
13. ———. *Report of the Fifth Meeting of the Committee on Aviation Environmental Protection* (Doc 9777). Montréal, 2001.
14. The six gases covered by the Kyoto Protocol are Carbon dioxide (CO_2), Methane (CH_4), Nitrous oxide (N_2O), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs) and Sulphur hexafluoride (SF_6).
15. As indicated in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, aircraft engine emissions are roughly composed of about 70 per cent CO_2, a little less than 30 per cent H_2O, and less than 1 per cent each of NO_x, CO, SO_x, NMVOC, particulates, and other trace components including hazardous air pollutants. Little or no N_2O emissions occur from modern gas turbines (IPCC, 1999). Methane (CH_4) may be emitted by gas turbines during idle and by older technology engines, but recent data suggest that little or no CH_4 is emitted by modern engines. Emissions also depend on the number and type of aircraft operations; the types and efficiency of the aircraft engines; the fuel used; the length of flight; the power setting; the time spent at each stage of flight; and, to a lesser degree, the altitude at which exhaust gases are emitted. For more information see: <http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_3_Ch3_Mobile_Combustion.pdf>
16. It is also noted that CO_2 emissions have impacts that extend beyond climate change/global warming. For more information, see: <http://www.iata.org/whatwedo/environment/climate_change.aspx>

1.4.3 Arrangements for linking emissions trading systems are reviewed in Chapter 3. The experience with linking and the prospects for future links are discussed in Chapter 4. Options for linking trading systems involving international aviation with other emissions trading systems are considered in Chapter 5, as well as issues that could affect the compatibility of a trading system for international aviation with other emissions trading systems.

Chapter 2

EMISSIONS TRADING SYSTEMS

2.1 TYPES OF TRADING SYSTEMS AND TRADABLE UNITS

2.1.1 An emissions trading system requires specified entities to monitor or calculate their emissions. In a scheme where total emissions are capped, and tradable emissions units are allocated either without cost or through sale/auction — a **cap-and-trade system** — at the end of the compliance period (which in current systems varies from one to five years),[1] each entity must provide the regulatory authority with tradable units equal to its actual emissions. In schemes where specified entities have a target based on emissions per unit of production — an "emissions intensity system" (or baseline-and-credit system), at the end of each compliance period each entity must submit tradable units to cover any excess of actual emissions over target emissions or will receive credits from the regulatory authority to the extent its actual emissions are less than its target emissions.

2.1.2 The types of tradable units that will be accepted for compliance purposes (each representing the equivalent of one tonne of carbon dioxide emissions), and quantitative limits on their use (if any), are identified in advance by the responsible authorities.

2.1.3 Annex B of the Kyoto Protocol lists the binding GHG emissions targets taken on by industrialized countries. The tradable Kyoto units that an Annex I Party of the UNFCCC can surrender to meet its Kyoto Protocol obligations are:

a) **Assigned amount units (AAUs)** — Emissions targets for industrialized countries that are Parties to the Kyoto Protocol are expressed as levels of allowed emissions or "assigned amounts" for the 2008-2012 commitment period. Such assigned amounts are denominated in tonnes of CO_2 equivalent emissions (CO_2e). The inventory on which this number is based is approved by the UNFCCC, and the Kyoto Party can (if needed) issue the AAUs;

b) **Removal units (RMUs)** — tradable units issued to an Annex B Party for the GHG removals from the atmosphere for specified sequestration activities during the Kyoto Protocol first commitment period. These units are approved and issued by the UNFCCC;

c) **Certified emissions reductions (CERs)** — A compliance unit under the Kyoto Protocol issued for emissions reductions achieved from project activities in non-Annex I Parties that meet the requirements of the Clean Development Mechanism (CDM). One CER is equal to one metric tonne of CO_2 equivalent; and

d) **Emissions reduction units (ERUs)** — the Joint Implementation (JI) project- or programme-based credits created in Annex B countries under their own authority (Track 1) or under the authority of the Joint Implementation Supervisory Committee (Track 2) that are issued by the Kyoto Party. ERUs are issued by converting AAUs/RMUs into ERUs so as to avoid the double counting of reductions.

1. The EU ETS has multi-year trading periods though compliance is annual.

2.1.4 Under the Kyoto Protocol, countries with binding targets listed in Annex B can meet some or all of their obligations through international emissions trading, that is, the trading of AAUs. This government-to-government trading can be supplemented by regional, national and subnational emissions trading systems, where individual entities (corporations, facilities or other participants) can buy and sell tradable units with other system participants. These systems are important tools to allow countries or regions to meet their Kyoto Protocol or other GHG emissions reduction targets at least cost.

2.1.5 Depending on the design of the scheme, entities participating in subnational, national or regional emissions trading systems may be able to meet domestic compliance obligations by using tradable units created outside of the UNFCCC system. Therefore, the jurisdiction administering the emissions trading system does not have to be a Party to the Kyoto Protocol or the UNFCCC in order to establish a system involving exchange of non-Kyoto units. These non-Kyoto units could include:

a) **Allowances** — units equal to the system "cap" that are freely allocated, sold or auctioned by the regulatory authorities; and

b) **Credits** — units that are created when emissions reductions or removals have been achieved; the validity of each credit is established by the regulatory authority during the credit creation process.

2.1.6 Many supranational (e.g. the EU ETS), national, subnational and regional emissions trading systems are intended to help countries with Annex B commitments meet international obligations under the Kyoto Protocol. In these cases, it is important that tradable units transferred between linked systems are backed by or can be settled with Kyoto units. The first compliance period for the Kyoto Protocol ends in 2012. The continuing presence of AAUs and other Kyoto units in the future will depend on the outcome of the next international agreement on climate change.

2.1.7 To ensure that the environmental integrity of the trading system is maintained, it is crucial that the tradable units be confirmed as valid through the application of rigorous monitoring, reporting and verification (MRV) requirements. If units are accepted for compliance that do not represent real reductions or removals, emissions will effectively be higher than reported.

2.1.8 For simplicity, unless explicitly stated otherwise, it is assumed in the remainder of this scoping study that:

a) the scheme is a mandatory cap-and-trade system;

b) the term "tradable units" includes both allowances and credits; and

c) the tradable units (Kyoto units and non-Kyoto units) are valid units.

2.2 LINKING MECHANISMS

2.2.1 An emissions trading system establishes a **direct link** with another system when participants in one or both of the systems can use tradable units issued by the administrator of the other system to meet domestic compliance obligations. In other words, for those participants the tradable units of the two systems are equivalent for compliance use. The forms and variations of linking, including unilateral, bilateral and multilateral linking, are outlined below.

2.2.2 The administrator of a trading system can establish a **unilateral link** with another system by agreeing to accept tradable units issued by the other system for compliance purposes but not vice versa.[2] A unilateral link could be easy to implement. It does not require that the two systems be "compatible" or that a bilateral agreement be completed. It does require that the user system have access to compliance units in the supplier system registry. If it is not possible to open an account in this registry, a unilateral link can still be made without the agreement of the supplying system administrator as the transfer of tradable units can be completed through a "hold/cancel and create" action as outlined in 2.3.3. In practice, however, as a result of political pressure from participants in the supplier system and to address the potential problem of the double counting of reductions, agreement of the supplier system would be valuable even if the export of compliance units is expected to be small.

2.2.3 The main effect of a unilateral link is that the in-flow of tradable units from the supplier system (depending on relative prices) reduces the price of tradable units in the system establishing the link. Depending on the relative size of the in-flow, this effect can be negligible or very significant. If there is a limit on the quantity of the tradable units from the linked system that can be used for compliance, the price reduction could be limited.

2.2.4 The administrators of two systems can establish a **bilateral link** if each accepts tradable units issued by the other system. Thus with a bilateral link, there can be two-way trade of units that are equally valid for compliance purposes in either systems. A bilateral link requires that the systems be compatible, and some form of agreement is needed. If more than two systems participate, this becomes a **multilateral link**. However, as no multilateral links have been established to date, and as a multilateral link is equivalent to two or more, possibly identical, bilateral links, this study only considers unilateral and bilateral links.

2.2.5 Market forces will push tradable unit prices to converge in any system that allows for the trading of tradable units. When a bilateral link is established, tradable unit owners in the system with the lower price will sell to buyers in the system with the higher price. If not constrained, this trading would continue until the prices of the tradable units of the two systems are the same. In practice, however, the degree of price convergence (the amount the price of tradable units in each system changes) partly depends on the relative size of the systems. Linking a small system to a large system could have a negligible effect on the price of tradable units in the larger system. Restrictions on the type and/or quantity of the tradable units from the other system that can be used for compliance will also moderate the price convergence effect of the link. The price elasticity of demand and supply of GHG reductions in each system (i.e. the change in quantity in response to a change in price) could also influence the volume of trade after linking.

2.2.6 The price adjustments due to a link, which lead to lower overall net costs of regulatory compliance than if no link had been established, will create winners and losers in the linked systems. Tradable unit sellers in the lower price system and buyers in the higher price system benefit from the price convergence, while tradable unit sellers in the higher price system and buyers in the lower price system are worse off. The size of the gains and losses in each system depends on the scale of the price change in that system. Thus, although linking two emissions trading systems can lower the overall cost of reaching a given GHG reduction, the potential distribution effects need to be considered.

2.2.7 A system that establishes a link with another system also establishes an **indirect link** with any other system to which the partner system is linked. An indirect link occurs without any formal or informal agreement between systems.

2.2.8 Note that the CDM and Joint Implementation (JI) are project-or programme-based mechanisms under the Kyoto Protocol — they are not trading systems per se. For example, any trading system can choose to "accept" CERs for compliance purposes, and a linking agreement is not required or used. Although CERs are electronic units that only reside in a Kyoto Protocol compliant tracking system, effectively, they can be made available to all trading systems (see 3.3).

2. Michael Mehling and Erik Haites. "Mechanisms for Linking Emissions Trading Schemes." *Climate Policy*, Vol. 9, Issue 2, 2009, pp. 169-184.

2.3 TRACKING SYSTEM OR REGISTRY

2.3.1 Tradable units usually exist as electronic entries in a **tracking system** or **registry**. A participant has an account in its system registry that records the tradable units it holds, transfers and uses.[3] Generally, since these tradable units must be used only once for compliance, the participant must transfer tradable units equal to its actual emissions from its registry account to the account of the regulatory authority in order to achieve compliance with its regulatory obligation. In a linked system a participant will transfer tradable units issued by the administrator of the other system to its own regulatory authority. However, if this transfer is not possible, an equivalent action shall be completed to ensure that the tradable units are used only once for compliance (see 2.3.3).

2.3.2 The registries of different trading systems may be electronically linked. Where this is the case, a participant could buy tradable units from the other system and have these units transferred directly into its account in its own registry. For compliance purposes, these purchased tradable units would then be transferred to the regulatory authority's account in this registry. Before completing the transfer of a tradable unit, the transaction log linking the registries typically performs quality control functions such as checking the unit serial numbers to ensure the tradable units being transferred are valid, and ensuring that all requirements for the transfers of units have been met.

2.3.3 However, a transaction log linking the registries is not a prerequisite for linking trading systems. For a bilateral link, the regulatory authority could agree to allow accounts to be opened in each other's registry. A participant that wishes to use tradable units from the other system opens an account in that system's registry, has the purchased tradable units transferred into this account, and as required for compliance purposes, transfers these units to its regulatory authority's account. No transfer of tradable units takes place between registries. In the absence of linked registries, a unilateral link could be implemented in the same manner as a bilateral link if the supplier system allows entities outside their system to hold accounts in their registry. Without the ability to open such accounts, the administrator of the user system may accept to create or recognize compliance units where there is evidence that an account holder in the supplier system has cancelled compliance units or will continue to hold (not sell, retire or cancel) compliance units. It is noted, however, that the supplier system could try to block this access if it determines the benefit derived from exporting compliance units is not in its best interest. So while it would be difficult or impossible to prevent unilateral linking, in practice an agreement of some sort may be necessary.

2.3.4 If the registry systems are not electronically linked, the potential for the double-counting of emissions reductions, that is, for using a tradable unit more than once, increases. In addition, since a bilateral link requires an agreement between the regulatory authorities, it is very likely that the registries of bilaterally linked systems will be linked electronically.

2.4 BENEFITS OF LINKING

The potential benefits of linking could be significant and include:

a) lower net cost of meeting the emissions cap across the two systems as a result of the flexibility to implement the lowest cost emissions reduction measures across all participants;

b) increased financial incentives for entities to reduce emissions in systems where scarcity and price are increased due to linking;

3. Entities with no compliance obligations, such as individuals and brokers, may also have accounts in the registry to enable them to participate in the carbon market.

c) reduced price volatility due to the creation of a larger, more liquid market for the tradable units of the linked systems; and

d) reduced competitiveness concerns due to the convergence of tradable unit prices in the linked systems, as well as a reduced likelihood of carbon leakage.

2.5 DIFFICULTIES OR OBSTACLES WITH LINKING

2.5.1 Some of the potential difficulties or obstacles associated with linking are noted below. Many of these elements could be adequately addressed in the design of the system.

2.5.2 The net benefits of linking trading systems will rarely be evenly distributed. A link generates a convergence of prices and thus leads to a higher market price in the supplier system (as the supply of tradable units in that system decreases), and a lower price in the buyer system. However, in practice the effect of linking on the convergence of prices of tradable units would depend on a combination of factors including the relative price difference for achieving reductions in the two systems, the size of the market and the additional reductions or commitments undertaken (if any) when the market is broadened through linking.

2.5.3 Linking could compromise the environmental integrity of the system with the stronger requirements. For example, if tradable units from a system with weak MRV requirements did not achieve the intended reductions, but were, nevertheless, used for compliance purposes in the stronger system under the assumption that the reductions were real, the environmental integrity of the stronger system would be compromised. This issue could also arise through indirect linking when, for example, the policy decisions of one system, with respect to the type, quality or quantity of international credits or offsets it recognizes for compliance purposes are not compatible with the requirements of the system with which it is directly linked.

2.5.4 There is the potential for higher total emissions if the systems are linked than if they operate independently. This could be the result of differences in system requirements. For example, in a bilateral linked system, if the financial penalties are set at different levels, and there is no requirement to submit tradable units equal to the shortfall, effectively the lower penalty acts as a price cap for the entire system. Specifically, if the penalty in one system is lower than the market price, a bilateral link would create an incentive for participants in the former system to over-sell tradable units and pay the non-compliance penalty, resulting in still higher emissions. In addition, there could be an incentive for one or both systems to make smaller reductions to its cap over time so that its participants could remain or become exporters of tradable units in the linked system.

Note 1.— In some systems the non-compliance penalty does not take away the obligation to surrender these allowances sometime in the future.

Note 2.— It is always the case that a financial penalty on its own effectively acts as a price cap for tradable units. There is an added dimension, however, if the financial penalties differ in a bilaterally linked system.

2.5.5 Differences in the level of ambition in systems which could have a significant impact on the availability and price of tradable units may be an impediment to linking. Similarly price caps or price interference, when present, could also be obstacles to linking.

2.5.6 These obstacles, including the possibility of higher total emissions, could be reduced or avoided by harmonizing the relevant provisions enough to make the linked systems compatible. Much of the literature on linking trading systems focuses on the question of the compatibility of the systems that could be linked.[4] With a unilateral link a certain degree of cooperation between systems is likely required. Clearly a level of compatibility will be a necessary prerequisite for any bilateral link to be established, and this compatibility would need to be sustained despite economic, technological and administrative developments over time. Sustaining the compatibility of the linked systems would require a process for agreeing on revisions to the requirements of the linked systems, a mechanism to provide assurance of the environmental effectiveness of each of the linked systems and a procedure for terminating the linking agreement.

2.6 LINKING TRADING SYSTEMS WITH VOLUNTARY AND MANDATORY PARTICIPATION

2.6.1 Though for most existing and proposed trading systems participation by specified entities is mandatory, in a few systems participation is voluntary. In some voluntary systems there are incentives to participate. For example, entities in Switzerland subject to the CO_2 tax can significantly reduce their tax payments if they join the emissions trading system. In other systems, there are both voluntary and mandatory elements. For instance, under the Chicago Climate Exchange (CCX) system the option to participate is voluntary, but participants are then bound by a reduction target.

2.6.2 A voluntary system will rarely include all entities in the specified sectors, so the risk of an increase in emissions outside of the scope of the emissions trading system due to the constraint on emissions established by the trading system (often referred to as "leakage") is high. If a unilateral or bilateral link between a mandatory system and a voluntary system raises the price of tradable units in the voluntary system, the incentive for leakage from that system increases. Thus, a link between a mandatory system and a voluntary system creates a risk that aggregate emissions will increase, and some systems may determine that it is necessary to have a mandatory cap-and-trade system in place to enable linking to occur.

4. Baron and Bygrave, 2002; Haites, 2003; Haites and Mullins, 2001; Jaffe and Stavins, 2007; Sterk et al., 2006; Springer et al., 2006.

Chapter 3

GHG EMISSIONS TRADING SYSTEMS

3.1 EXISTING SCHEMES

3.1.1 This chapter provides a high-level overview of a number of the mandatory and voluntary emissions trading systems that have emerged over the past decade. It includes a brief discussion of the key lessons learned from the design and implementation of these systems, the identification of linking arrangements that have been made between systems (if any), and, where relevant, a brief analysis of the implications for linking an emissions trading system including international aviation with another emissions trading system.

Mandatory schemes

3.1.2 The **EU** ETS requires each of its 27 Member States to implement emissions trading covering GHG emissions by electricity generators and specified industrial installations. More than 40 per cent of total EU GHG emissions are covered by the scheme, increasing to over 50 per cent from 2013. The EU ETS is of unlimited duration; the first two phases cover 2005–2007 and 2008–2012. Beginning in 2013, the trading periods will have an eight-year duration.

3.1.3 The same linking legislation applies to Phase 1 and Phase 2 of the EU ETS. During Phase 1 (2005–2007), the pilot phase, the EU ETS did not link with any other trading system. However, in addition to the free allocation of European Union Allowances (EUAs), installations were able to use CERs for compliance; ultimately no CERs were used. This can be explained in part by the low price of EUAs, which was the result of:

a) the over-allocation of allowances in Phase 1; and

b) the rule that Phase 1 allowances were not bankable after 2007 (they would have no value after 2007). Furthermore, at the time there was no link between the UNFCCC and EU transaction logs so that CERs could not be transferred to the registries in the EU Member States.

3.1.4 In Phase 2 of the EU ETS (2008-2012) there is the possibility of full linking with other Annex B Parties to the Kyoto Protocol. As of 29 December 2007, the EU ETS legislation has been included in the European Economic Area (EEA) Agreement,[1] thus making Iceland, Liechtenstein and Norway integrated members of the EU ETS with obligations to implement domestic ETSs that are compatible with the scheme in the EU Member States. In effect, the extension of the EU scheme to cover installations in Iceland, Liechtenstein and Norway constitutes full linking between trading schemes in states with separate targets under the Kyoto Protocol. The EU ETS allows for the use of CERs and ERUs for compliance purposes, though the quantity of these Kyoto units that each installation can use annually has been limited to an average of about 13 per cent of the emissions cap for Phase 2.[2] Qualitative restrictions in the EU ETS also

1. The EEA Agreement allows the Member States of European Free Trade Association (EFTA) to participate in the European Single Market without joining the EU. The EEA Agreement is continuously updated with new relevant EU legislation, resulting in obligations for the EFTA States to enact domestic legislation equivalent to that which applies in the EU Member States.
2. *Tendances Carbone*, Issue No. 21, January 2008, p. 3.

apply; CERs and ERUs from land use, land use change and forestry (LULUCF) projects and nuclear projects are banned, and restrictions apply to the use of CERs and ERUs from hydroelectric projects with installed capacity exceeding 20 MW.

3.1.5 Aviation emissions will be included in the EU ETS from 1 January 2012. The EU Directive requires airlines to surrender tradable units to a designated Member State for the emissions associated with flights within, into or out of the EU.[3] For 2012, the total allocation will be 97 per cent of the annual average 2004–2006 emissions. For the period starting in 2013, the cap will be 95 per cent of the annual average 2004–2006 emissions. Airlines will receive approximately 82 per cent of the allocated tradable units free; 3 per cent will be held in a special reserve for new entrants and fast growing airlines, and the remainder will be auctioned.

3.1.6 Separate European Union aviation allowances (EUAAs) will be created. Airlines will be able to use EUAAs, unlimited quantities of EUAs and some credits from the CDM and JI (CERs and ERUs, respectively) for compliance purposes. Other sectors covered by the EU ETS will not be allowed to use EUAAs for compliance in order to maintain the integrity of the accounting system of the EU ETS since emissions from international aviation are not integrated into Member States' commitments under the Kyoto Protocol. Carbon market analysts expect EUAAs to trade at a slight discount to EUAs as they are of use to a smaller number of market participants. While there are no restrictions on who can buy EUAA, it is expected most will eventually be used by the aviation participants for compliance.

3.1.7 Details for the EU ETS beginning in 2013 were formally adopted in April 2009, setting a single EU-wide emissions cap which reduces linearly over time, widening the scope of the scheme. Phase 3 will enable use of CERs and ERUs in advance of a successor to the Kyoto Protocol being agreed to under the UNFCCC. The legislation includes amended rules on linking with other GHG ETSs. It specifies that bilateral links may be made with compatible mandatory schemes with absolute emissions caps in any other country or sub-federal/regional entity.

3.1.8 **Norway** implemented an emissions trading system for the period 2005-2007 that was very similar in design to the EU ETS. The Norwegian system had a unilateral link with the EU ETS and also allowed the use of CERs for compliance. Some EUAs (one transaction), but no CERs were used for compliance purposes. Like the EU ETS, the Norwegian system accumulated surplus allowances during 2005-2007. The system terminated at the end of 2007 when Norway joined the EU ETS.

3.1.9 **New Zealand** is phasing-in its ETS from 2008 to 2015. The forestry sector entered the scheme in 2008. The stationary energy and industrial processes sectors and the liquid fossil fuels (transport) sector, including domestic aviation, entered the scheme on 1 July 2010.[4] The scheme will ultimately cover all sectors, including agriculture. Participants will be able to surrender both New Zealand units (NZUs) and Kyoto units to meet their compliance obligations, although some types of CERs and ERUs will be excluded.[5] Generally there are no restrictions with regard to the import and export of units, although some restrictions apply between 1 July 2010 and 31 December 2012, when a price cap will be in place. New Zealand is considering the potential for bilateral links with a future Australian system.

3.1.10 **Switzerland** imposed a tax on heating and process fuels to reduce CO_2 emissions. Large companies that agree to a legally binding emissions reduction target for 2008–2012 are exempt from the tax. Firms that agreed to emissions reduction targets were allocated allowances equal to their target.[6] They may trade allowances and use

3. Flights performed with aircraft with a maximum take-off weight of less than 5.7 tonnes would be excluded. Commercial airlines with emissions of less than 10 000 tonnes of CO_2 or which fly less than 243 flights into, out of or within the EU within three subsequent four-month periods would be among other exemptions.
4. Further details can be found at www.climatechange.govt.nz.
5. CERs and ERUs relating to nuclear projects cannot be used for compliance, nor can lCERs and tCERs from LULUCF projects.
6. The Swiss Federal Council. "Launched in the Emissions Trading in Switzerland." Federal Office of the Environment, Berne, Switzerland, 11 June 2008. <http://www.bafu.admin.ch/dokumentation/medieninformation/00962/index.html?lang=de&msg-id=19266>

specified types of CERs and ERUs to achieve compliance.[7] Allowances from approved foreign emissions trading systems may also be used for compliance. Use of foreign credits and allowances is limited to 8 per cent of the firm's target or up to 3 per cent if reductions cannot be achieved within the firm itself.[8]

Note.— Switzerland has also stated its intentions to link with the EU ETS in the future.

3.1.11 In the **United States** ten states in the northeast established the Regional Greenhouse Gas Initiative (RGGI) in January 2009. Credits are accepted from programmes in RGGI states or any other US state or jurisdiction. If prices for RGGI allowances exceed a specified threshold, participants may use "allowances or credits issued pursuant to any governmental mandatory carbon constraining programme outside the United States that places a specific tonnage limit on GHG emissions, or certified GHG emissions reduction credits issued pursuant to the UNFCCC or protocols adopted through the UNFCCC process".[9]

3.1.12 The United Kingdom ETS (2002–2006), New South Wales (Australia) Greenhouse Gas Abatement Scheme (2003) and Alberta (Canada) Climate Change and Emissions Management Act (2007) do not have links with any other systems.

Voluntary schemes

3.1.13 The **CCX** GHG emissions trading system is voluntary, but members are required to adopt binding limits for their GHG emissions. The CCX created a unilateral link to the EU ETS, allowing up to 1 000 EUAs per participant to be used for CCX compliance. In May 2006, a participant in both the CCX and the EU ETS transferred 100 EUAs to a CCX account in the United Kingdom; the CCX retired the EUAs and issued 100 allowances into the participant's CCX account. Prompted by the dramatic drop in EUA prices during 2006, the CCX decided in December 2006 that Phase 1 EUAs would no longer be accepted for compliance with 2006 and 2007 CCX obligations. The CCX also accepts CERs for compliance, subject to approval on a project-by-project basis by the CCX Offsets Committee.

3.1.14 **Japan's** voluntary emissions trading scheme (JVETS) was launched in 2005 involving 31 participants; the commitment period and trading began in 2006. Participants were offered an incentive of approximately USD10/tCO_2 to participate. The JVETS did not link with any other system. However, participants were allowed to use CERs to achieve compliance, though none were used. The programme ended in 2007.

3.1.15 In 2008 Japan commenced the trial of a new voluntary ETS for the 2008–2012 period. Over 500 companies signed up to participate. Targets were submitted by each company for approval by the Government. Companies that manage to exceed their CO_2 emissions reduction targets can trade their surplus credits to other companies in the scheme to use for compliance purposes. There are no penalties for not meeting targets. This scheme does not link with any other system.

3.2 FUTURE SCHEMES

3.2.1 More jurisdictions are implementing emissions trading systems, and links between systems continue to attract the interest of policy makers. Reflecting the high level of interest in linking, more than 15 national and regional

7. Credits for afforestation and reforestation with genetically modified or invasive species are excluded.
8. The Swiss Federal Council. "641.711.1 Ordinance of 22 June 2005 on the Crediting of Foreign Emission Reductions (CO_2 Crediting Ordinance)." 22 June 2005. <http://www.admin.ch/ch/e/rs/c641_711_1.html>
9. RGGI. "Regional Greenhouse Gas Initiative Model Rule." 15 August 2006. The Model Rule defines this "stage two trigger event" as a sustained allowance price of USD 10 or more for two consecutive 12-month periods, adjusted for inflation relative to 2005. <http://www.rggi.org/docs/model_rule_8_15_06.pdf>RGGI, 2006.

governments launched ICAP in October 2007 as a "forum to discuss relevant questions on the design, compatibility and potential linkage of regional carbon markets"[10]. Monitoring, reporting, verification, compliance and enforcement issues and options, and issues related to auctioning have, for example, been examined by ICAP. To date ICAP has 25 members and three observers.

3.2.2 **Australia** released a White Paper in December 2008 which outlined the design of a "Carbon Pollution Reduction Scheme" — a cap-and-trade system that would cover approximately 75 per cent of Australia's GHG emissions, commencing 1 July 2011. The draft legislation outlined in the White Paper proposed that CERs, ERUs and RMUs be accepted for compliance by regulated firms.[11] Future bilateral links would be considered based on a range of criteria including an internationally acceptable (or mutually acceptable) level of mitigation commitment; adequate and comparable monitoring, reporting, verification, compliance and enforcement mechanisms; and compatibility in design and market rules. There would be no export of Australian allowances unless:

a) a five-year advance notice was provided; or

b) the allowances would be exported as part of a bilateral linking agreement where trading was not anticipated to have an adverse effect on carbon prices. The draft legislation for the scheme was defeated in parliament in December 2009. The Government has indicated it will reintroduce the draft legislation in 2010.

3.2.3 **Canada** has committed to reducing its total GHG emissions by 20 per cent from 2006 levels by 2020, and 60–70 per cent by 2050. To assist in achieving this target, Canada is in the process of developing detailed cap-and-trade policies that would enable harmonization with the US cap-and-trade policy beginning to take shape in Congress. Canada is also developing draft GHG regulations that could be harmonized with a broad range of possible future actions in the United States. The Government of Canada has also signalled interest in potentially linking the Canadian programme with other existing or future trading systems.

3.2.4 In the **United States** both Chambers of Congress have been working on the development of legislation that would establish a national GHG emissions trading system. On 26 June 2009, the House of Representatives passed the *American Clean Energy and Security Act of 2009* (ACESA), which would establish a cap-and-trade system for GHGs. If the Senate passes its own legislation, the House and the Senate will establish a conference committee to develop a compromise bill that would then require the approval of Congress.

3.2.5 ACESA would cap the GHG emissions of entities responsible for approximately 85 per cent of US emissions once the sector phase-in is complete. It is proposed that the phase-in begin in 2012 and be completed in 2016. The entities covered include refineries, electric generators, natural gas distributors and industrial facilities.[12] Allowances from certain "qualifying" international climate change programmes run by foreign governments may be used for compliance under certain conditions. These conditions include the imposition of an absolute tonnage limit on emissions that is at least as stringent as that imposed by the United States under ACESA.[13]

3.2.6 Regional initiatives in North America, including the Western Climate Initiative (WCI) and the Midwestern Regional Greenhouse Gas Reduction Accord, could lead to the establishment of emissions trading systems covering

10. International Carbon Action Partnership (ICAP). "Political Declaration." Lisbon, Portugal, 29 October 2007. <http://www.icapcarbonaction.com/index.php?option=com_content&view=article&id=12&Itemid=4&lang=en>
11. Australian Government. "Carbon Pollution Reduction Scheme: Australia's Low Pollution Future". White Paper, Volume 1, Canberra, Australia, December 2008. <http://www.climatechange.gov.au/publications/cprs/white-paper/cprs-whitepaper.aspx>
12. In each category, only entities surpassing certain threshold limits are covered under the cap-and-trade programme.
13. The programme must also include provisions to ensure comparable monitoring, compliance, enforcement, quality of offsets and restrictions on the use of offsets.

multiple American states and Canadian provinces. Individual states and provinces, including California and British Columbia, are developing emissions trading systems that could be independent or part of a regional initiative. All of the proposals that have considered linking favour its adoption in some form.

3.2.7 **Mexico,** the **Republic of Korea** and the **Ukraine** have also expressed interest in establishing ETSs, but details have not yet been worked out.

3.3 OPPORTUNITIES FOR LINKING

With more emissions trading systems in operation there will be more opportunities for linking. The EU, Australian, New Zealand and Swiss systems were intended to help comply with Kyoto Protocol obligations, and all are potential candidates for bilateral links. However, a decision on whether any of these schemes are compatible is still to be made. In addition, regional systems such as RGGI and the WCI that are not designed to assist with Kyoto compliance are mandatory cap-and-trade systems that also have the potential for linking. Several of these systems have expressed a willingness to explore bilateral links, but discussions are still at an exploratory stage. The potential for a bilateral link of a cap-and-trade system with an emissions intensity system is also being explored.

Chapter 4

LINKING TRADING SYSTEMS INVOLVING INTERNATIONAL AVIATION

4.1 INTRODUCTION

4.1.1 International aviation has unique features that must be considered when developing an open emissions trading system that includes the sector, as they could affect the willingness of other emissions trading systems to link. Some of these features have been briefly considered earlier in the paper and include:

a) the climate change impacts of aviation emissions; and

b) the status of the international aviation tradable units.

4.1.2 Aviation emissions have climate change impacts in addition to those caused by CO_2 emissions. However, it would be difficult to include the non-CO_2 effects such as NO_x, contrails and water vapour in a trading system as there are many scientific uncertainties related to these effects, their duration and their variability over time and location. On the other hand, aviation-tradable units for CO_2 emissions might be regarded as permitting a larger climate change impact than from CO_2 only. Other emissions trading systems might be reluctant to link with an international aviation trading system or a system that includes international aviation because of the difference in the climate change impacts associated with their respective tradable units.

4.1.3 Many emissions trading systems for GHGs are intended to help the country meet a national emissions limitation commitment under the Kyoto Protocol. It is important for such trading systems that the tradable units transferred between linked systems be settled in Kyoto units. In any emissions trading system that includes aviation, Kyoto units from the CDM or JI could be accepted for compliance purposes. However, access to these units is separate from the linking discussed in this report.

4.1.4 The tradable units used by a separate international aviation emissions trading system would not be backed by Kyoto units unless there was an agreement under the UNFCCC. Thus, schemes that include emissions from international aviation as well as other sectors may have unique aviation and non-aviation tradable units, and may restrict the type of tradable units that can be used for compliance by the aviation sector and other sector participants in the system. In addition, an emissions trading system for aviation could accept, for compliance purposes, project-based credits (offset credits) from emissions reductions achieved by uncovered sources that are issued through its own processes. The institutional capacity to ensure the environmental integrity of these offset credits, including avoiding double counting with other parallel systems, would be required. However, a mechanism that allows the international aviation emissions trading system to issue tradable units that are accepted for compliance with an international obligation (e.g. Kyoto units) could be a prerequisite for a bilateral link with many other systems.

4.1.5 In general, international aviation could be included in an open emissions trading system in one of two ways:

a) including some/all international aviation emissions in a national or regional emissions trading system that covers emissions from other sectors; or

b) establishing an emissions trading system for some/all international aviation emissions and linking this system to one or more emissions trading systems that involve emissions from other sectors. With reference to 2.3.2, it is noted that a system covering only international aviation would only be created with the precondition that it will be linked to one or more emissions trading systems involving other sectors.

4.1.6 Thus, in 4.2 and 4.3, the following two models for linking are briefly discussed:

a) links between national or regional trading systems that cover some international aviation emissions; and

b) links between a system that covers some/all international aviation emissions and a national or regional trading system.

As many issues related to linking would apply to either model, additional points to consider are set out in 4.4.

4.2 LINKING NATIONAL OR REGIONAL TRADING SYSTEMS THAT INCLUDE THE INTERNATIONAL AVIATION SECTOR

4.2.1 If international aviation emissions are covered by a national or regional trading system, the sector will be integrated with the other sectors in the system. However, some restrictions may be imposed on the use of aviation allowances by other sectors involved in the same emissions trading system. For example, there could be internal barriers or gateways that restrict transfers to/from the international aviation sector. In addition, allowances for aviation emissions may not be totally fungible with other tradable units in that system. This will occur, for example, as long as international aviation emissions are not included under the UNFCCC framework and thus cannot be backed by the UNFCCC budget currency (AAUs).

4.2.2 Regardless of how international aviation emissions are covered, however, if these national or regional systems link with other systems, unilaterally or bilaterally, the international aviation sector will also be linked to those other systems either directly or indirectly.

4.2.3 Only the EU ETS has a legal requirement to incorporate both national and international aviation emissions into a regional trading system. If the EU ETS links with another national or regional system, all participants in the EU ETS, including the international aviation sector, would be linked with that national or regional system directly or indirectly. If the linking agreement allows companies subject to the EU ETS to use, for compliance, the units of the linked system (Australian allowances for example), there would be a direct link.[1] If the linking agreement does not change the list of tradable units that companies subject to the EU ETS can use for compliance (a less likely scenario), there would still be an indirect link due to the convergence of tradable unit prices, including EUAs.

4.2.4 Other national and regional trading systems might use a different approach to cover international aviation emissions. The New Zealand system, for example, will cover emissions in the (liquid fossil fuels) transport sector at the point where refined oil products leave the refinery or are imported. Fuel suppliers will have to surrender units corresponding to the emissions that arise when the fuels are combusted — an upstream approach. A simple way to expand the system to cover international aviation emissions would be to include fuels used for international aviation.[2]

1. The linking agreement would have an impact on the price of EUAAs and EUAs.
2. New Zealand allows some large aircraft operators operating domestic flights to opt into the scheme, i.e. in such cases they can take over all emissions trading scheme obligations and liabilities from their fuel suppliers.

4.2.5 It may be difficult to coordinate national trading systems in order to ensure that a large part of global international aviation emissions are covered. However, this coordination could be significantly less of a challenge than would be required to develop an aviation-only emissions trading system that is linked to other systems. Furthermore, larger emissions trading schemes may find it easier to operate bilaterally. Negotiation of a link between two parties, such as the EU ETS and potentially a future US ETS would be easier than negotiating linking arrangements with a large group of parties. If aviation were included in both the US and EU emissions trading systems, a significant proportion of international aviation emissions would be captured. However, the need for more universal coverage to avoid artificial competitiveness advantages outside of these schemes may persist.

4.3 LINKING A TRADING SYSTEM FOR INTERNATIONAL AVIATION WITH A NATIONAL OR REGIONAL TRADING SYSTEM

4.3.1 This section briefly covers the case of linking an emissions trading system for international aviation only (a closed system) with other emissions trading systems. It is important to note here that it is the basic premise of this scoping study that a closed system for international aviation would not be created unless there was certainty that it would be linked to a system involving other sectors so as to make it an open system.

4.3.2 Issues related to the organization of the international aviation emissions trading system and the detailed elements of that system would need to be addressed. For example, with an international emissions trading system for aviation covering more than one State, the form of the agreement between States, the authorities that might best be centralized, and the system elements to manage the competitiveness impacts of excluding some markets (if a desirable feature) would need the agreement of all participating States. The ability to control these features in an aviation emissions trading system will, however, be attractive to many States. At the same time, States would also have to agree, probably unanimously, on the emissions trading systems it will link to and the design of these links. It is noted that the openness of this system would be enhanced as more links to emissions trading systems are added.

4.3.3 The choice of systems to link with an aviation emissions trading system would depend on:

a) the perceived quality of the tradable units and the environmental integrity of the target system (based on the stringency of the cap and other system requirements);

b) the ease of establishing a link with the target system and willingness for the target system to establish a link; and

c) the size of the target system relative to the projected demand for external tradable units by the trading system for international aviation emissions.

4.3.4 An international aviation trading system could establish a link with an emissions trading system in a country that has an emissions limitation commitment under the Kyoto Protocol. Depending on the design of the emissions trading system in question, this link could provide access to high quality Kyoto units. To avoid double counting reductions and thus maintain the environmental integrity of the system, these Kyoto units must be cancelled when used for compliance by participants in the international civil aviation system. Though it could be possible to manage this cancellation via a unilateral link, the cooperation of the government(s) involved may be required. For example, if linked with the EU ETS, the cancellation of Kyoto units will require the cooperation of Member States as the allowances in the EU ETS have recently been separated from the associated Kyoto units.

4.3.5 It is noted that the unilateral linking scenario would not be likely for a scheme that covers international aviation emissions associated with all ICAO States. This is because the target schemes for the unilateral link would be controlled by one or more of these ICAO States. In this scenario, these States would be agreeing to unilaterally link with their own system. Though hypothetically possible, in such a case a bilateral link seems a much more likely scenario.

4.3.6 At present only the EU ETS (in combination with the CDM) would likely be large enough to provide for the projected demand for external tradable units by a trading system for international aviation emissions.[3] However, a national trading system established in the United States or links with a number of smaller systems may also be sufficient to meet the projected demand.

4.4 OTHER ISSUES RELATED TO LINKING SYSTEMS INVOLVING INTERNATIONAL AVIATION

4.4.1 Establishing a unilateral link with most systems not linked with the Kyoto Protocol could be relatively simple. As discussed in 3.3, the registry for the system involving international aviation could be linked electronically with the target registry if the registry administrator of the target registry is cooperative. In the absence of an electronic link, the administrator of the system involving international aviation could establish an account in the registry of the target system. (It is noted that the New Zealand and proposed Australian systems, for example, do not allow the export of their emissions units.) Tradable units used for compliance could be cancelled in the registry of the target system. Difficulties would arise if external entities, such as the administrator of the system involving international aviation, are not able to establish or effectively operate an account in the registry of the target system.

4.4.2 Furthermore, as discussed in 4.4.1, participants in other systems may be concerned about the increased compliance cost they would face if a unilateral link with an international aviation emissions trading system is established. If the link will provide the aviation sector with access to lower cost credits from the target scheme, and it is expected that the demand tradable units through the link would be high, there could be political pressure for the government running the target system not to cooperate. In this case a bilateral linking agreement may be necessary to prevent the target scheme from erecting measures to disrupt the functioning of the link.

4.4.3 A bilateral link would require that the system involving international aviation emissions and the other systems be sufficiently compatible. (Compatibility issues are discussed in Chapter 5, section 5.5.) A bilateral link would also require that there be an agreement between the regulatory authorities of the two systems. The difficulty getting an agreement would be further complicated if the benefits of linking, and thus the importance of completing a linking agreement, are significantly different between the negotiating parties. As discussed in 3.2.2 and 3.2.5, although the prices of tradable units move toward convergence, and the net cost of reaching the combined environmental objectives of the two systems is reduced when the systems are linked, the distributive effects of the link may be undesirable to some participants.

4.4.4 Reciprocal unilateral links may be a way to avoid the complex issues raised by a bilateral link. A trading system involving international aviation emissions and another system, such as the EU ETS, could agree to establish unilateral links with each other or with a third system, such as a future US emissions trading system. The advantages of multiple unilateral links could include the following:

a) unilateral links could be easier to implement, particularly when considering linking with new systems. The systems would not need to be as fully harmonized, and a formal linking agreement may not be needed;

b) unilateral links could be easier to change if needed. For example, each system could change the list of tradable units it accepts using its internal procedure. As noted, the CCX decided to no longer accept EUAs when the price of these units collapsed as a result of over-allocation in the EU ETS; and

3. There are implicit assumptions here about the carbon price in the aviation emissions trading system.

c) linking could be approached gradually. Quantity restrictions could be applied to the other system's tradable units initially and be loosened over time as the effects of the link become clearer.

4.4.5 The economic benefits (i.e. lower tradable unit price) of reciprocal unilateral links will not differ significantly from a bilateral linking agreement. With reciprocal unilateral links, one system would be a net importer of tradable units from the other. Absent restrictions on the quantity of tradable units that can be imported (or exported), tradable unit prices in the two systems will tend to converge. If two systems are unilaterally linked to a third, or use significant quantities of CDM credits, prices will tend to converge as long as the caps of the two systems are such that both are net importers of tradable units from the third system or the CDM, and there are no restrictions on the quantities imported.

Note.— The benefits would involve lower overall economic costs of achieving the reductions across the two systems, but allowance prices and economic costs in the supplier system may go up. While the overall economic benefits may exist, the supplier system may not wish to participate if these benefits represent a transfer from it to another system.

4.4.6 While it may be possible for national and regional trading schemes to link unilaterally or bilaterally as discussed above, some forms of linking could be restricted by national legislation. For example, the EU ETS legislation is clear that only bilateral links with another trading scheme could be considered.[4]

4.4.7 Even if national and regional systems agree to coordinate coverage of international aviation emissions, different approaches might make this difficult in practice and could potentially lead to issues of emissions being counted twice or not being covered at all. For example, airlines that are included in the EU ETS could be covered by a different system based on the carbon content of the aviation fuel sold in a State outside the EU. For this reason the EU ETS legislation provides a clear mechanism by which incoming flights can be excluded should equivalent measures be adopted by other countries or regions. Differences in the share of tradable units auctioned could also pose difficulties. For example, the EU ETS might continue to distribute a portion of the tradable units free, but making fuel refiners and importers responsible for the carbon content of aviation fuels would be equivalent to auctioning all of the tradable units for international aviation.[5] Thus, depending on the levels of cost passed through to customers in the industry, levels of potential windfall gains in the sector could vary.

4.5 LEGAL ISSUES

4.5.1 Many and perhaps most links will require some form of agreement between the systems. The agreement must balance the competing objectives of "leaving each government with sovereignty over its own system while providing linking partners adequate authority to influence those changes in linked systems that would materially affect their own system".[6]

4.5.2 Where divergent interests and other uncertainties generate demand for predictability and stability, a binding agreement will be preferred. Such an agreement could be an international treaty, though other forms of legal agreement could be possible. Agreements that might be established under the umbrella of ICAO have not been assessed as part of this scoping study.

4. European Union. "Directive of the European Parliament and of the Council Amending Directive 2003/87/EC so as to Improve and Extend the Greenhouse Gas Emission Allowance Trading Scheme of the Community." Article 25, Brussels, 26 March 2009. <http://register.consilium.europa.eu/pdf/en/08/st03/st03737.en08.pdf>
5. The fuel suppliers are likely to increase the price of the fuel sold to reflect the market value of the allowances needed for compliance. The effect for the airline is similar to buying the necessary allowances.
6. Jaffe and Stavins, 2007.

4.5.3 The agreement must reflect the consent to be bound, as expressed, for example, by signature or ratification. Aside from a provision specifying the recognition of tradable units, the agreement would need to include the following from the outset:

a) provisions to address legal issues such as equivalence;

b) a mechanism to provide assurance of the environmental effectiveness of each of the linked systems or of the aggregate system as a whole;

c) a process for revising the requirements of the linked systems;

d) a process to resolve disputes arising under the agreement; and

e) a procedure for terminating the linking agreement.

4.6 INTERNATIONAL TRADE ISSUES[7]

4.6.1 Much has been written about the potential for conflicts between emissions trading systems established to meet Kyoto Protocol commitments and various World Trade Organization (WTO) agreements.[8] Though an assessment of potential conflicts would be an important part of any system design, no significant issues or problems have emerged so far.

4.6.2 Trading compliance units, which are effectively permits to emit GHGs in an emissions trading system, is not covered under the General Agreement on Tariffs and Trade and the General Agreement on Trade in Services rules as these units are not considered either goods or services.

4.6.3 There is some question as to whether free distribution of tradable units to participants in an emissions trading system could be considered an actionable subsidy since a transfer of resources (tradable units) can be a subsidy.

4.6.4 The key issue raised in linking trading systems is whether the arrangement discriminates against potential tradable unit exporters in systems that are not included in the link. In the context of ICAO, non-discrimination is crucial.

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7. Based on an input paper by Aniel Bangoer (Climate Change and Industry Directorate, Dutch Ministry, VROM).
8. The General Agreement on Tariffs and Trade allows states considerable policy space to develop trade measures for environmental reasons. These measures may be unilateral, and while states need to try to get multilateral consensus, there is no WTO requirement that these efforts succeed, so long as they are made in good faith. The Korea beef, EC-Asbestos and US-Shrimp I case demonstrate that WTO jurisprudence would permit trade-related measures aimed at climate stabilization, under certain conditions.

Chapter 5

HARMONIZATION ISSUES RELEVANT FOR LINKING

5.1 INTRODUCTION

5.1.1 Much of the literature on linking trading systems focuses on issues related to the requirements for and the potential impacts arising from compatibility of the systems that are considering linking.[1] A bilateral link requires that the designs (or rules) of the two trading systems be harmonized enough to make them compatible. All the design elements covered in this chapter are of importance for a bilateral link. Although a unilateral link does not require the same level of compatibility, in practice it will be important that certain elements of the systems be harmonized. Thus, each element discussed in this section should be assessed when considering any form of linking.

5.1.2 From a technical perspective, harmonization of the system designs to enable a bilateral link may be essential for only a relatively small number of provisions, such as a price cap. However, for political reasons, harmonization of several other provisions, such as the method for allocating tradable units and the use of offsets, is desirable and possibly essential.[2] This is because a bilateral link effectively allows participants in one system access to many provisions of the other system.

5.2 DESIGN ELEMENTS RELEVANT TO THE TOTAL EMISSIONS OF LINKED SYSTEMS

5.2.1 Differences between systems in the following provisions could lead to higher total emissions after a bilateral link is established compared with the independent operation of systems:

a) cost containment measures;

b) non-compliance penalties and enforcement;

c) borrowing and banking restrictions;

d) compliance period and life of tradable units;

e) form of the emissions limit; and

f) measures to address leakage.

A number of key design issues are considered below.

1. Baron and Bygrave, 2002; Haites, 2003; Haites and Mullins, 2001; Jaffe and Stavins, 2007; Mace et al., 2008; Sterk et al., 2006; Springer et al., 2006.
2. Mace et al., 2008.

5.2.2 **Cost containment**. The cost of meeting the system emissions limit is uncertain. To manage what could be excessive price volatility or excessive costs for system participants, some systems adopt a price cap or "safety valve". A safety valve is a relatively high price at which the system administrator commits to selling enough additional tradable units to enable participants to comply with their regulatory obligation. This allows total emissions to exceed the original limit or hard cap (assuming there is no a set-aside or the set-aside proves insufficient for this purpose). If the safety valve price in one system is lower than the market price after it is linked with another system, additional tradable units would be issued until the market price for the linked systems fell to the level of the safety valve. A price cap is therefore an obstacle to linking. Eliminating the price cap mechanism could address the issue.

5.2.3 **Non-compliance penalties and enforcement**. Most trading systems have a non-compliance penalty that consists of a "make good" provision — an obligation to provide tradable units sometime in the future, plus a financial penalty — X dollars per tonne of excess emissions. Such a regime ensures that compliance is always less costly than non-compliance. It also protects the environmental integrity of the system, since all emissions are covered by tradable units.

5.2.4 A financial penalty alone can allow higher total emissions, and if set too low can act as a price cap. For example, if one system only has a financial non-compliance penalty, and this penalty is lower than the market price for tradable units after linking with another system, participants would have an incentive to sell tradable units into the other system and pay the penalty for non-compliance. As most firms would be uncomfortable profiting from deliberate non-compliance, the impacts of this behaviour could be small.[3] However, harmonizing the financial penalties may be difficult because the trading systems are in different jurisdictions. The penalties will be defined in the respective currencies of the jurisdictions, and the exchange rate will fluctuate over time. Differences in the inflation rates will also affect the penalties of the two systems over time. The best way to prevent an increase in total emissions due to the non-compliance penalty is for each system to adopt a penalty that consists of a tradable unit plus a financial penalty. Financial penalties should also increase over time.

5.2.5 In addition, the rules related to ensuring compliance with the emissions constraint and the rigour of their enforcement could have a significant impact on the environmental outcome of the regimes whether independent or linked. Of interest here is the potential for moving tradable units between systems in order to gain advantage from the system where the requirements and rigour of enforcement are more lax. The more harmonized the systems, the less scope there is for this type of trading.

5.2.6 **Borrowing**. A borrowing provision permits a participant to use tradable units for a future period toward compliance for the current period. For example, a participant could use tradable units from the 2011 compliance period to meet its regulatory obligations for 2009. Where there is sufficient liquidity in the market to provide system participants with the units they will need for achieving compliance without invoking excessive price volatility, a borrowing provision is not needed. Systems that allow borrowing usually limit the amount that can be borrowed and impose other requirements.

5.2.7 If the participant does not repay the borrowed tradable units (e.g. because the participant has ceased operation), emissions will exceed the emissions cap. If a system with a borrowing provision has a bilateral link with another system, the borrowing provision becomes accessible, indirectly, to the participants in the other system. That is, participants with access to the borrowing provision can sell tradable units to participants in the other system and borrow to achieve their own compliance. Thus, a borrowing provision in only one of the linked systems that increases the risk which over time total (aggregate) emissions will exceed the emissions cap. Extending the compliance period or elimination of the borrowing provision could address the increased risk that comes with the bilateral link. Other ways to reduce the risk are to harmonize the borrowing provisions and to design the system to maximize the probability of repayment.

3. Baron and Bygrave, 2002.

5.2.8 **Banking**. A banking provision permits tradable units issued for one compliance period to be saved for use during a subsequent compliance period. If the emissions cap of each system is lower than its projected emissions, banking yields both environmental and economic benefits. Banked tradable units mean emissions have been reduced more than required in the near term, though they will be higher (and may exceed the cap) when the banked units are used. Banking also contributes to greater liquidity and price stability. Most trading systems allow unlimited banking.

5.2.9 A system whose emissions cap may be higher than the projected emissions may limit banking so that emissions during each period are constrained by the cap for the period. (This is more likely during the early years of a trading system.) If a system that allows unlimited banking has a bilateral link with a system that limits banking, the banking provision becomes available to all participants. The result may be higher total emissions. More stringent emissions caps for the system that limits banking is the most effective way to address the potential increase in emissions due to a bilateral link.

5.2.10 **Compliance period**. Most trading systems use the calendar year as their compliance period. At the end of the year entities must remit tradable units equal to their actual emissions during the year. However, the compliance periods of systems with a bilateral link could have different end dates and/or be of different lengths. The "overlapping of compliance periods" can allow for short-term borrowing. An entity with an earlier compliance date can buy tradable units from an entity with a later compliance date. If the seller ceases operation before its compliance date and therefore has no obligation to cover its tradable unit shortfall, total emissions will have been increased. Harmonization of the compliance periods is the best way to address the potential increase in emissions due to a bilateral link. Establishing a compliance reserve — a minimum quantity of tradable units that must be retained in a participant's registry account — is another way to address this potential problem.

5.2.11 **Life of tradable units**. The life of a tradable unit is the period during which it can be used for compliance purposes. A limited tradable unit life is similar to limited banking. If a system with a short tradable unit life has a bilateral link with a system with a longer tradable unit life, all participants can use the tradable units with the shorter life for compliance and bank those with a longer life. As a result, fewer tradable units may expire unused and in this case total emissions would be higher. Harmonizing the tradable unit life and banking provisions is the only way to address the potential increase in emissions due to a bilateral link.

5.2.12 **Absolute caps and intensity targets**. The emissions cap for a period may be an absolute quantity (X tonnes of CO_2) or a function of production (Y tonnes of CO_2 per unit produced multiplied by the number of units produced). An absolute cap guarantees the environmental outcome. An intensity target could result in a better or worse environmental outcome depending on the stringency of the target and the level of production (e.g. during an economic downturn there would be no over-allocation of compliance units as often occurs within a capped system). Though the allocation of tradable units under a capped system could be gratis or via auction, an intensity target implicitly involves a free allocation of tradable units. As a result of these and other differences, it could be significantly more difficult to negotiate a link between systems if one has an absolute cap and the other has an intensity cap. Some systems, such as the EU ETS, require a mandatory cap for linking.

5.2.13 **Leakage**. Leakage occurs if implementation of the trading system leads to increased output and emissions by sources outside the trading system. For example, production could be transferred to entities whose emissions are below the threshold for participation in the emissions trading system or to entities in other jurisdictions. A bilateral link would tend to increase the tradable unit price in one jurisdiction and thus provide a stronger incentive for leakage from that system. However, it also tends to lower the tradable unit price and the incentive for leakage in the other jurisdiction. Though the net effect of leakage is unknown, it would be desirable to avoid the implementation of border measures or other means designed to reduce the impact of leakage. The harmonization of sources covered and harmonization of thresholds for participation in the emissions trading systems will help reduce the risk of increased leakage (if any) due to a bilateral link.

5.3 DESIGN ELEMENTS RELEVANT TO THE ACCEPTANCE OF LINKED SYSTEMS

5.3.1 As discussed in 3.2, a bilateral link requires the agreement of governments that control the two systems. Thus, a decision to establish a bilateral link is ultimately a political decision. Though a government is unlikely to agree to establish a link with a system it perceives to be less ambitious (as it would create pressure to make its system similarly less ambitious), it is important to note that the stringency of a system has various aspects. These include, among others, the scope of the system, the emissions constraint, the method of distributing tradable units, the types and quantities of emissions reduction credits available for use by participants, and the monitoring, quantification and verification methods participants must use.

5.3.2 Thus, while differences between systems in the following provisions would not result in higher total emissions due to establishment of a link, harmonization is desirable, perhaps crucial, to gain acceptance for the linking of the emissions trading systems:

a) coverage of the system;

b) emissions constraint;

c) distribution of tradable units;

d) use of offsets;

e) monitoring, reporting and verification requirements;

f) gateways; and

g) government intervention.

5.3.3 **Coverage**. One system may include different categories of sources than the other system. Such differences can raise political concerns related to competitiveness and fairness, and therefore inhibit the willingness to link. For example, a sector covered only by the system with a lower price prior to linking may object to a proposed link on the grounds that compliance would become more costly, and competitors in the other jurisdiction would not be affected. The same concern applies to differences in the accountable entities and the threshold for participation. An industry may feel disadvantaged if one system holds large industrial sources responsible for their emissions while the other places the responsibility on fossil-fuel suppliers.[4] Differences in thresholds would mean that sources in some size ranges are covered in one system and exempt in the other. In making an assessment of comparability, it is also important to look at measures which complement the emissions trading system. For example, a sector that is not included in one of the emissions trading systems may be regulated by other measures that lead to equivalent impacts.

5.3.4 **Emissions constraint**. Both the nature and level of the emissions constraint influence the real and perceived stringency of a system. Though linking systems — one with an absolute cap and one with an intensity cap — may be difficult (the latter has no absolute limit on emissions), it is not necessarily the case that an intensity cap is less stringent than an absolute cap.[5] For example, during an economic downturn many allowances under an absolute cap could be surplus to participants' needs, but such a surplus could not be generated in an emissions intensity system.

4. It is not obvious which approach would favour a particular industry, but the treatment is different and comparison of the treatment is difficult , so it is easy for a firm to argue that it is at a disadvantage.
5. Herzog, Baumert and Pershing, 2006.

5.3.5 In an unlinked trading system, the marginal cost of abatement that drives the carbon price can be used to assess the stringency of the target. The percentage reduction from projected emissions needed to achieve the cap, and the total cost of abatement measures already implemented under the cap, could also be considered valid indicators of the stringency. After a bilateral link has been established, the net export of tradable units can be used as an indicator of the stringency of the caps, though net changes in the size of the tradable unit banks must also be taken into consideration.

5.3.6 Harmonization of the type of cap may be necessary to gain political support for a bilateral link. Mandatory cap-and-trade systems are generally only willing to link with other mandatory cap-and-trade systems.

5.3.7 **Allowance distribution**. Any combination of free allocation and auctioning can be used to distribute tradable units in a capped system. Free allocation requires rules to determine the quantity awarded to each recipient. With different rules, comparable recipients in the two systems may receive different quantities of these tradable units. This problem disappears if all the units are auctioned. Common rules for the accountable entity and the threshold for participation facilitate the comparison of allocation rules. For this reason, harmonization of the rules for identification of the accountable entities, setting thresholds and the allocation of allowances may be necessary to gain political support for a bilateral link. It is important to note that the method of allocation within a cap does not affect the cap or the environmental integrity of the system.

5.3.8 **Offsets**. For compliance purposes, participants may be able to use credits awarded for emissions reductions outside the scope of the regulatory system. The types of emissions reduction actions eligible to earn credits, and the quantity of credits participants can use for compliance, influence the stringency and perceived integrity of the system. Some types of emissions reduction actions may be politically contentious in a particular country (e.g. some countries oppose the use of credits from nuclear power projects and from forest projects) and, consequently, recognizing these for compliance may inhibit the willingness of other systems to link. Common rules with respect to the creation and use of offset credits will facilitate linking.

5.3.9 **Monitoring, reporting and verification (MRV)**. Participants in an emissions trading system must monitor or calculate their actual emissions (and also their production in an emissions intensity system) and report them to the regulatory authority. Some systems require that the reported emissions (and production) be verified by an accredited independent body. The regulatory authority then assesses compliance and imposes non-compliance penalties for excess emissions. Concerns about the quality of emissions data would raise questions about the integrity of the system and undermine faith in the value of the tradable units. Differences in the MRV requirements and compliance assessment procedures between two systems could also raise competitiveness concerns.

5.3.10 The systems required for MRV do imply costs for the companies covered by the systems and for the administration responsible for approving the reports submitted by participants. However, good MRV is essential for successful linking. A bilateral link would create a requirement to ensure the MRV rules and compliance assessment procedures are comparable and of sufficiently high quality.

5.3.11 **Gateways**. Some trading systems include “gateways” to control the flow of specific tradable units. For example, the EU ETS has a gateway (a temporary arrangement) to prevent a net inflow of tradable units from Cyprus and Malta because they are not Annex I Parties to the Kyoto Protocol.[6] When international aviation is included in the EU ETS, industrial participants will not be able to use the aviation-tradable units for compliance. This restriction to one-way trading is, however, different from a gateway that manages the quantity of tradable units moving between participants or systems.

6. To ensure that international trades of EUAs do not affect a Member State’s compliance with its Kyoto Protocol commitment, such trades must be accompanied by an equal transfer of EU AAUs. Since Cyprus and Malta are not Annex I Parties under the Kyoto Protocol, they have no EU AAUs. To prevent an adverse impact on the compliance with the Kyoto Protocol commitments of other Member States, the gateway prevents a net inflow of EUAs from Cyprus and Malta.

5.3.12 Gateways have the potential to restrict trade. They can lead to price differences on either side of the gateway, which reduces economic efficiency. However, where a gateway exists, there is usually an important practical reason for its establishment. Gateways probably would need to be maintained if a bilateral link is implemented. A bilateral link might even create political pressure for additional gateways.

5.3.13 Thus, when aviation is included in the EU ETS, a bilateral link of the EU ETS with another system should not allow industrial sources in that system to use aviation-tradable units for compliance as that would not be consistent with the restriction on the use of those tradable units by industrial sources in the EU ETS.[7] A system for international aviation may wish to establish a gateway as part of a bilateral link with another trading system. For example, the international aviation system may wish to prohibit a net outflow of tradable units from its system. Such a gateway could be implemented through the transaction log linking the registries of the two systems or through the linking agreement with the other system – participants in that system would not have access to aviation-tradable units for compliance purposes when the gateway is closed.

5.3.14 **Government intervention**. When systems are linked, actions that affect one system have consequences for participants in both systems. Government intervention, such as an ex-post adjustment to allowance allocations or a price intervention, would have consequences for tradable unit prices and competitiveness. Systems may be reluctant to establish a link with a system that has a history of this kind of government intervention.

5.4 OTHER DESIGN ELEMENTS RELATED TO HARMONIZATION OF LINKED SYSTEMS

5.4.1 Other design elements that should be assessed when considering linking include:

a) mandatory versus voluntary systems;

b) tradable units accepted for compliance; and

c) inclusion of direct or indirect emissions.

5.4.2 **Mandatory versus voluntary systems**. Linking a mandatory system with a voluntary system could affect the environmental integrity of the mandatory system and risk competitive distortions. In order not to exclude links to voluntary systems but to address the potentially adverse effects on the mandatory system, a requirement to demonstrate "additionality" could be imposed. Opting for the mandatory system might also be a possible approach. Note that EU ETS legislation only allows for linking with other mandatory systems.

5.4.3 **Tradable units accepted for compliance**. When linking, it will also be necessary to identify the types of units that could be used for compliance purposes. For example, one issue will be to establish the role (if any) AAUs might play in the linking of schemes. AAUs are a creation of international agreement, and their credibility depends upon all countries that are granted AAUs taking on stringent requirements in the same system. Beyond 2012 there is no certainty about the continued use of AAUs; international aviation emissions are not presently covered by AAUs. The national and regional systems outlined in 4.1 and 4.2 are company-based systems whose operation is independent of

7. Industrial sources in the other system could buy aviation allowances for compliance use and sell other units to industrial sources in the EU ETS. The effect is to make aviation allowances available to industrial sources in the EU ETS, which circumvents the gateway.

external events, and banked tradable units are in most systems guaranteed to remain valid. It would therefore be possible to link schemes involving aviation without any AAU transfers, though it would be a challenge to establish a robust, transparent and credible international accounting system that would move forward.

5.4.4 **Direct or indirect emissions**. Emissions can be controlled directly at source or indirectly at the level of end-users. Linking two systems with different approaches can be technically complex.

5.4.5 Other provisions that do not create environmental risks and are rarely politically sensitive but may influence the ability to link include the **gases covered**, treatment of **new entrants** and treatment of **closures**. The **registries** that track holdings of tradable units do not need to be compatible. The trading systems can be linked without an electronic link between the registries and preferably through a transaction log that connects the registries electronically. Although harmonization is not necessary, the greater the similarity of these provisions, the easier it will be to establish a link.

5.5 MAINTAINING COMPATIBILITY OVER TIME

5.5.1 Systems that establish a bilateral link must maintain their compatibility over time. To do this (as outlined in 5.4) linked systems will require:

a) a process for agreeing on revisions to the requirements of each system, such as a regular meeting of administrators and the implementation of agreed revisions at specified intervals (e.g. every three or five years);

b) a mechanism to provide assurance of the environmental effectiveness of each system, such as external verification of the compliance assessment performed by each system; and

c) a procedure enabling either system to terminate the linking agreement with reasonable notice.[8]

5.5.2 Finally, with linked systems there is an incentive for one or both systems (depending on whether the link is unilateral or bilateral) to adjust its emissions constraint (cap) so that it will be a net exporter of tradable units. To address this concern, the rules and procedures for adjusting the emissions constraint of each system is of particular importance when considering linking.

8. See Haites and Wang, 2008, for more discussion on maintaining compatibility.

Appendix

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