



EPRI



Linking Domestic and Industry Greenhouse Gas Emission Trading Systems

Prepared for:

Electric Power Research Institute (EPRI), International Energy Agency (IEA) and
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Executive Summary

The purpose of this report is to examine issues related to linking emissions trading systems for greenhouse gases.

Until international emissions trading (IET) under the Kyoto Protocol becomes operational (2008), any issues involved in linking trading systems must be resolved multilaterally by the organisations responsible for those systems or through intermediaries. The experience gained from linking domestic systems during this period may be pertinent to the practical operation of international emissions trading during the commitment period.

Our approach is to assess the potential impacts of linking emissions trading programs that differ in terms their design. We review each aspect of the design of an emissions trading program, consider how it is addressed by the existing and proposed trading programs reviewed, and assess the potential implications for linking trading programs. The programs reviewed raise a wide range of possibilities to inform the assessment of the implications of linking trading programs. The assessment of potential implications is based on possible links between any of the programs, rather than between specific programs. Many of those potential implications may not apply to links between two specific programs.

Each emissions trading program must resolve the following design elements:

- sources covered by the program
- voluntary or mandatory participation
- changes to the population of participants
- emissions covered by the program
- level of the aggregate cap
- absolute or rate-based emission limits
- method of distributing allowances/credits
- definition of the allowance or credit
- start date and credit for early action
- compliance period
- monitoring requirements
- registry provisions
- non-compliance penalty and safety valve
- liability regime
- banking, cross-period banking, and borrowing
- ability to use credits generated through emission reduction or sequestration projects
- taxation issues and transaction costs

Many of these design features are resolved differently by the different trading programs.

The fundamental question is which of those differences in design, if any, prevent or seriously inhibit effective links among trading programs.

The existing and proposed trading systems used to inform the analysis in this study are:

Domestic Systems		Industry Systems
<i>Existing Systems</i> Oregon Denmark ERU-PT (Netherlands) United Kingdom	<i>Proposed Systems</i> Australia Canada (TPWG) European Union France Germany Norway Slovakia Sweden Switzerland	<i>Existing Systems</i> Pilot Emission Reduction Trading (PERT), (Canada) BP Shell <i>Proposed Systems</i> Chicago Climate Exchange

The implications of linking trading programs with different designs are classified as affecting:

- Institutional compatibility - whether the institutional structures of the trading programs being linked, such as the definition of the allowances/credits and registries, make it possible to establish equivalence of the allowances/credits and to move them from one program to another;
- Environmental integrity - whether linking two or more trading programs could lead to smaller emission reductions than if they operate independently;
- Economic efficiency - whether differences in the designs of the trading programs being linked inhibit achievement of the potential compliance cost savings; or
- Equity and competitiveness - despite overall cost savings due to linking two or more trading programs some participants of each of the linked programs are likely to be financially disadvantaged as a result. In addition, linking programs may highlight differences in treatment of similar firms and create pressure to alleviate the resulting competitive distortions.

Government implemented domestic emissions trading programs have a different legal status and usually a different design than trading programs implemented voluntarily by industry. For this reason the analysis considers the implications of various possible linkages: among government implemented domestic emission trading systems; among industry emission trading systems; and between government implemented domestic emission trading and industry emission trading systems.

The analysis indicates that linking trading programs should yield economic benefits due to the creation of a market with a larger number of participants with increased diversity of sources and emissions control costs. Thus there is a net economic benefit to linking trading programs where this is administratively feasible and does not undermine the environmental objective.

The potential impacts due to linking emissions trading programs and their relevance to links among different types of programs are summarised in the following table.

Issue	Potential Impact of Linkage				Relevance for		
	Com	Effic	Envir	Eqty	G - G	I - I	I - G
Coverage of the Emissions Trading Program							
Sources Covered Differences in coverage do not preclude links With differences, links should improve efficiency but may raise equity concerns		✓		X	✓	✓	✓
Voluntary or Mandatory Participation Nature of the participation does not preclude links Small risk of increased leakage, equity concerns if voluntary program linked to a mandatory program		✓	X	X	✓	✓	✓
New Sources and Shutdowns Differences in treatment do not preclude linkage, but may raise equity concerns New sources should improve efficiency "Hot air" for new sources raises total emissions		✓	X	X	✓	✓	✓
Restructuring by Participants Differences in treatment do not preclude linkage Possible equity concerns				X	✓	✓	✓
Opt-in Provisions Differences in treatment do not preclude linkage, but may raise equity concerns More participants improves efficiency "Hot air" for opt-in sources raises total emissions		✓	X	X	✓	✓	✓
Emissions Covered Differences in coverage do not preclude linkage Diversity of emissions should improve efficiency		✓			✓	✓	✓
Coverage of Indirect Emissions Differences in coverage do not preclude linkage If indirect emissions are included, emission reductions could be double counted			X		✓	✓	✓
Emissions Targets							
Aggregate Cap with "Hot Air" "Hot air" in the cap does not preclude links, but could lead to higher total emissions			X	X	✓	✓	✓
Stringency of Targets Differences in stringency do not preclude links With differences, links should improve efficiency, but may raise equity concerns		✓		X	✓	✓	✓
Absolute or Rate-Based Limits Differences in limits do not preclude links Rate-based limits reward higher emissions, but this can be controlled by a gateway			X	X	✓	✓	✓
Distribution of Allowances/Credits Allowances can be distributed free or by auction Differences in distribution method do not preclude links, but may raise equity concerns				X	✓		✓
Issue	Potential Impact of Linkage				Relevance for		
	Com	Effic	Envir	Eqty	G - G	I - I	I - G

Operational Rules							
Nature of the Allowance/Credit Unit of measure is compatible for all programs, but the legal status varies Trade settlement in some company programs precludes direct links with other programs Differences in credit lifetimes could increase total emissions under some circumstances			X		✓	✓	✓
Start Date and Credit for Early Action Different start dates are not a barrier to linkage Different treatment of early action may raise equity concerns				X	✓	✓	✓
Compliance Period and Compliance Deadline Differences in deadlines are not a barrier to linkage					✓	✓	✓
Monitoring Requirements Differences in monitoring requirements are not a barrier to linkage, but total emissions could rise under some circumstances			X		✓	✓	✓
Registry Provisions Differences in registry structure do not preclude links, but make transfers slower, more costly and increase the possibilities for error	X	X	X		✓	✓	✓
★★ Restrictions on Trading Restrictions on trading within a program may seriously complicate links with other programs Restrictions on trade reduce efficiency	X		X		✓	✓	✓
Compliance Regime							
Non-compliance Penalties A non-compliance penalty in one program that is low relative to the market price after programs are linked could lead to higher total emissions			X		✓		✓
Effective Enforcement If compliance is not effectively enforced in one program it could lead to higher total emissions when it is linked to other programs			X		✓		✓
Liability Regime Differences in liability structure complicate, but do not preclude, links	X				✓	✓	✓
Banking Provisions Banking pre-2008 credits into 2008-2012 raises equity concerns and may lead to higher total emissions and so is likely to be restricted, but this does not preclude links		✓	X	X	✓	✓	✓
Borrowing Provisions Different borrowing rules do not preclude links Borrowing could lead to higher total emissions		✓	X		✓	✓	✓
Issue	Potential Impact of Linkage				Relevance for		
	Com	Effic	Envir	Eqty	G - G	I - I	I - G
Credits Generated from Projects							

Use of Credits Generated from Projects Different rules for credits do not preclude links Credits improve efficiency, but if one program approves non-additional credits emissions rise		✓	X		✓	✓	✓
The Permanence of Sequestration Actions The mechanisms used to ensure permanence determine the environmental integrity, but do not preclude links		✓	X		✓	✓	✓
Transaction Costs							
Transaction Costs Differences in combined taxes and transaction costs don't preclude links but may shift trading activity to program with lowest cost Higher transaction costs reduce efficiency	X	X			✓	✓	✓
Potential Double Counting							
Credits for Multiple Pollutants from a Single Reduction Action Multiple credits for a single action can increase total emissions, but do not preclude links			X		✓	✓	✓
★★ Membership of a Single Firm in Multiple Programs Corporate membership in multiple programs may preclude links with government programs This could lead to higher total emissions	X		X				✓
Legend:							
<p>★★ indicates an issue where program differences could preclude linking two programs</p> <p>Com. = administrative compatibility; Effic. = economic efficiency; Envir. = environmental integrity; and Eqty. = equity</p> <p>G - G = links between government administered programs; I - I = links between industry trading programs; I - G = a link between an industry program and a government program</p> <p>For the potential impacts, a ✓ indicates that links would have a beneficial impact while an "X" indicates potential adverse impacts, such as a smaller overall emission reduction, due to linking trading programs. A blank cell indicates that no potential impact was identified.</p> <p>In the columns for links between different types of trading programs a ✓ indicates that the issue is potentially relevant. A blank cell indicates that the issue is not relevant to links between those program types.</p>							

Only a few situations were identified that might prevent linkages. The settlement mechanisms used by the BP and Shell programs prevent participants in those programs from trading directly with participants in other trading programs and so preclude a complete link with other programs. Membership of a single firm in multiple programs creates the potential for double counting if one or more of those programs is linked with another trading program.

A number of other issues were identified that could complicate links between two or more emissions trading programs. Most of these issues, such as concern over the effectiveness of compliance enforcement, involve protection of the environmental objective -- the combined

emissions target of the programs being linked. These issues can be addressed with some cost or loss of efficiency if the administrators wish to link the programs, for example by limiting purchases to allowances/credits that have been banked by participants.

Almost all of the programs reviewed indicate a willingness to establish links with other trading programs. The main benefit of linking emissions trading programs is the increased economic efficiency. Linking emissions trading programs should reduce the total cost of achieving the aggregate emissions reduction target of the linked programs.

The main disadvantages of linking emissions trading programs are that:

- some participants will be adversely affected while others benefit;
- when domestic trading programs are linked it changes the emissions trajectories and so can make achievement of the Kyoto target more difficult for one of the countries; and
- linking programs in ways that secure the economic benefits while protecting environmental integrity can be complex and time consuming.

When two emissions trading programs are linked, the market price will be higher than the pre-link price in one of the programs and lower than the pre-link price in the other program. This means that buyers in the high price program and sellers in the low price program benefit from the link. Conversely, sellers in the high price program and buyers in the low price program suffer financially as a result of the link. Thus, even though linking trading programs should yield a net economic benefit, some participants may be worse off. In addition, linking programs may highlight differences in treatment of similar firms and create pressure to alleviate the resulting competitive distortions.

Linking domestic emissions trading programs can also change national emissions levels; one country is likely to be a net importer of allowances/credits while the other is a net exporter. This means that actual emissions are below the aggregate emissions cap/baseline in the net exporter country and that the participants in that program earn revenue from the sale of allowances/credits. Conversely, national emissions will be higher than the desired trajectory in the net importer country, which may make achievement of its national emissions limitation commitment for 2008-2012 more difficult. However, the imported allowances/credits reduces compliance costs and may help protect the competitiveness of domestic industry.

Differences in the design of linked programs have the potential to result in higher total emissions, to limit the economic benefits of the larger market, or to raise equity issues. These issues can be addressed, but depending upon the differences between the programs the resolution could be complex and time consuming.

Possible approaches to linking emissions trading programs in advance on International Emissions Trading under the Kyoto Protocol are:

- to negotiate an agreement to ensure that any imported allowances or credits are acceptable as substitutes for those of the importing program. The existence of such an agreement means, in principle, that proposed transactions do not require individual approval.
- to evaluate proposed imports of credits and allowances individually using the criteria and procedures established for emission reduction credits. Once the "standard method" has been approved for credits or allowances from a specific external source, subsequent imports, in principle, should be routine.
- to rely on proposed commercial mechanisms to link different programs.
- in the case of industry trading programs, to allow membership of a single firm in multiple programs.

The options for linking different types of trading programs are summarised in the following table.

Options for Linking Different Types of Emissions Trading Programs

	Government- to- Government	Industry- to- Industry	Industry-to- Government
Agreement among program administrators to establish equivalence of allowances	✓	✓	
Treat allowances/credits from other programs as emission reduction credits	✓	✓	✓
Membership in multiple programs		✓	
Commercial mechanisms to link trading programs	✓	✓	✓

Agreements for mutual recognition of allowances/credits can be used when similar types of programs (government-to-government or industry-to-industry) are being linked. Such an agreement could take a long time to negotiate, but once in place trades between programs should be relatively quick, easy and low cost.

In general, the greater the similarity of the programs -- stringency of targets, distribution of allowances/credits, banking provisions, registry structure, etc. -- being linked, the fewer the issues that need to be addressed and the simpler it becomes to negotiate an agreement. This suggests that an agreement to link emissions trading programs is likely to lead to changes to the designs of the programs to increase their similarity. Where design features are not harmonised and have economic value, they will give rise to arbitrage trading.

In effect, the EU emissions trading program is an agreement through which allowances/credits can be transferred among the trading programs of the Member States. It could therefore serve as a starting point or model for negotiated agreements between other emissions trading programs. However, other groups of domestic trading programs will not be able to rely on the legal framework that will serve as a foundation for the EU program.

Any trading program that allows the use of credits generated through emission reduction actions could apply the same criteria and approval process to imports of credits or allowances from other programs. This effectively links the programs and allows inter-program trading to begin quickly. However, each transaction must be individually reviewed and approved, so completing a transaction could be a relatively slow and costly process. The process may become more efficient as the number of trades with a given program increases. When the Clean Development Mechanism becomes operational it may facilitate this process by setting international standards for emission reduction and sequestration actions.

Two types of commercial mechanisms are being developed that have the effect of linking trading programs. Several investment funds are being established to provide investors with access to high quality credits generated in other jurisdictions. In addition, the proposed 'Carbon Repository' would receive and evaluate emission reductions from a variety of sources and exchange them for allowances/credits that can be used for compliance in specified countries at specified dates. The cost of this type of service and exactly how it would operate are not yet known.

In the case of industry programs, an alternative to formal links between the programs is to have participants become members of the different programs.

In summary, linking emissions trading programs should reduce the cost of meeting the combined emissions target of the programs. Virtually all potential adverse impacts of linking emissions trading programs can be addressed. However, a government may be reluctant to agree to a link due to the impacts on national emissions and tax revenue.

When IET is available, probably in 2008, it will simplify some of the issues involved in linking emissions trading programs. A country need only establish rules governing exports, and possibly imports, of Kyoto mechanism credits (AAUs, ERUs and CERs) to link its trading system to those of other Annex B Parties. Those rules can differ from country to country as long as they are consistent with the international rules for IET. However, the international rules for IET will raise other issues such as the need to establish mechanisms to comply with the commitment period reserve and complementarity provisions.

1. Introduction

1.1 Purpose

Emissions trading can significantly reduce the cost of meeting an aggregate emissions target. Greenhouse gases are well suited to emissions trading. The Kyoto Protocol establishes three different trading mechanisms to help countries meet their emission limitation commitments. Many countries with emission limitation commitments are likely to establish domestic emissions trading systems to help meet these commitments.

To date experience with emissions trading outside the United States has been very limited, although there is considerable experience with tradeable quota systems such as milk quotas in Europe, fish quotas in Iceland and New Zealand, packaging recovery notes in the UK and various agricultural quotas in Canada. Emissions trading for greenhouse gases now has substantial support from Annex B governments and industry because its ability to reduce the cost of achieving an environmental objective is well understood.¹

An emissions trading system should be designed to suit the circumstances to which it is applied. Countries are beginning to implement domestic emissions trading programs for greenhouse gases to begin to reduce emissions and to gain experience with this form of environmental regulation. Companies are also beginning to establish their own internal trading systems and to participate in inter-company trading programs to understand their opportunities for reducing emissions and to gain experience with greenhouse gas emissions trading.

The purpose of this report is to examine issues related to linking existing and proposed domestic and industry emissions trading systems for greenhouse gases.

Linking emissions trading programs should increase the diversity of sources and hence the diversity of costs for emission reduction actions. It is the diversity of emission reduction costs that generates the cost savings from emissions trading. Thus where the links are administratively feasible and do not undermine the environmental objective, linking emissions trading programs should yield cost savings.

1.2. Institutional Context

The international institutional context affects the range of issues involved in linking domestic and industry emissions trading systems.

¹ Annex B countries are countries that will have a national greenhouse gas emissions limitation commitment for the period 2008-2012 if they ratify the Kyoto Protocol and it comes into force.

At present none of the trading mechanisms created by the Kyoto Protocol is operational. Until the international legal basis for linking trading systems is in place, probably in 2008, such links can only be established bilaterally or multilaterally by the organisations responsible for the trading systems or through commercial intermediaries. This is the institutional context assumed for the report unless explicitly stated otherwise.

The European Union is developing an emissions trading program for greenhouse gases to begin in 2005. The program would require each Member State to implement a domestic emissions trading program with some common features and other elements that can differ across countries. In effect the EU program is a structure for linking the trading programs of the Member States.

The Kyoto Protocol, assuming that it comes into force, will affect the institutional setting for linking emissions trading programs in two ways. First, it will establish internationally agreed procedures for generating emission reduction credits under the Clean Development Mechanism (CDM) and Joint Implementation (JI). Second, it will establish International Emissions Trading (IET), which can be used to link domestic emissions trading programs in Annex B Parties.

Following the Bonn agreement of July 2001, the CDM could become operational and begin to generate certified emission reduction credits in 2002.² The procedures adopted by the CDM, since they are internationally agreed, could become the standard used by most emissions trading programs for accepting credits from emission reduction and sequestration actions.

Domestic emissions trading systems are most likely to be implemented in countries with emissions limitation commitments, Annex B Parties. When IET is available, probably in 2008, it will establish a framework for linking domestic emissions trading programs and thus resolve some of the issues identified in this study.³ A country need only establish rules governing exports, and possibly imports, of Kyoto mechanism credits (AAUs, ERUs and CERs) to link its trading system to those of other Annex B Parties.⁴ Those rules can differ from country to country as long as they are consistent with the international rules for IET. However, the rules for IET will raise other issues, such as the need to establish mechanisms to comply with the commitment period reserve and complementarity provisions.⁵

² Under some conditions credits can be earned for reductions achieved since January 1, 2000.

³ For a discussion of the possible use of the Kyoto mechanisms by entities in Annex B Parties with different types of domestic policies, see Erik Haites and Malik Amin Aslam, *The Kyoto Mechanisms & Global Climate Change: Coordination Issues and Domestic Policies*, Pew Center on Global Climate Change, Arlington, Virginia, September 2000.

⁴ Assigned amount units, defined as one metric ton of CO₂ equivalent emissions, are the accounting units for the emissions limitation commitments of Annex B Parties (Annex B countries that have ratified the Kyoto Protocol). AAUs could be used as the allowances for a domestic emissions trading system.

⁵ The commitment period reserve requirement in the draft rules for international emissions trading establishes minimum holdings for each Party and so may restrict net exports of AAUs. A Party may also establish rules governing imports of AAUs to help ensure that domestic action is a significant element of the effort to meet its

Some countries may establish domestic emissions trading programs but not ratify the Kyoto Protocol. Under the draft rules for the Kyoto mechanisms allowances or credits from such a country could not be used by an Annex B Party to help meet its emissions limitation commitment.⁶ However, it would be difficult to prohibit the use of AAUs by participants in the domestic trading system of a country that is not a Party to the Protocol.⁷ In short, a non-Party could be a buyer, but not a seller, of Kyoto mechanism allowances and credits.

1.3 Analytical Approach

Our approach is to assess the potential impacts of linking emissions trading programs that differ in terms their design. We review each aspect of the design of an emissions trading program, consider how it is addressed by the existing and proposed trading programs reviewed, and assess the potential implications for linking trading programs.

The assessment of potential implications is based on possible links between any of the programs, rather than between specific programs. Since many design features are resolved differently by the different trading programs, the assessment identifies numerous possible implications of linking trading programs. Many of those potential implications may not apply to links between two specific programs.

After assessing the potential implications of linking different emissions trading programs, we identify and review approaches to linking trading systems.

1.4 Design Elements of Emissions Trading Programs

Each trading program must specify a large number of design elements, including:

- sources covered by the program

emissions limitation commitment.

⁶ It is possible in principle, although unlikely, that a Party could decide to allow companies in its domestic trading system to use allowances from a non-Party towards domestic obligations under national law. The domestic allowances of the non-Party could not be used by the Party to help comply with its national commitment under the Kyoto Protocol. Thus the emissions covered by the domestic allowances of a non-Party would need still to be offset in ways recognised by the Protocol. In short, the domestic allowances of a non-Party have no value to a Party and hence are unlikely to be accepted by a Party for compliance purposes.

⁷ Parties might want to prohibit the use of AAUs (and CERs and ERUs) by a non-Party because this would increase the demand and so increase the price and compliance costs. However, a non-Party could allow the use of AAUs by requiring that participants in its trading program to provide documentation that they had purchased and retired AAUs. This could consist of a contract with a broker in an Annex B Party to purchase and retire a specified quantity of AAUs. More explicit co-operation, such as allowing transfers of AAUs to a non-Party, might be agreed to facilitate such use of AAUs.

- voluntary or mandatory participation
- changes to the population of participants
- emissions covered by the program
- level of the aggregate cap
- absolute or rate-based emission limits
- method of distributing allowances/credits
- definition of the allowance or credit
- start date and credit for early action
- compliance period
- monitoring requirements
- registry provisions
- non-compliance penalty and safety valve
- liability regime
- banking, cross-period banking, and borrowing
- ability to use credits generated through emission reduction or sequestration projects
- taxation issues and transaction costs

Each country that decides to implement a trading program has a plethora of existing policies and institutions that will interact with the trading system, such as voluntary agreements, energy taxes, energy efficiency standards, renewable energy incentives, and fuel security policies. Therefore, trading programs will resolve these design features in different ways.

The fundamental question is which of those differences, if any, prevent or seriously inhibit effective links among trading programs.

1.5 Trading Systems Reviewed

The domestic and industry trading systems reviewed for this study are:

Domestic Systems		Industry Systems
<i>Existing Systems</i> Oregon Denmark ERU-PT (Netherlands) United Kingdom	<i>Proposed Systems</i> Australia Canada (TPWG) European Union France Germany Norway Slovakia Sweden Switzerland	<i>Existing Systems</i> Pilot Emission Reduction Trading (PERT), (Canada) BP Shell <i>Proposed Systems</i> Chicago Climate Exchange

The list indicates which systems are already operating and which are still being designed. In addition to the trading systems listed, several other domestic and industry trading systems have been proposed.⁸ But none of them are sufficiently far advanced in terms of their detailed design to provide useful input to this study.

There are two basic types of emissions trading system -- a “cap and trade” system and a “baseline and credit” system. In a “cap and trade” system, such as IET under the Kyoto Protocol or the US SO₂ emissions trading system, an overall limit or “cap” is established for emissions by the participants. Allowances equal to the overall cap are distributed and may be traded.⁹ The list of participants is specified and each must hold allowances equal to its actual emissions. The concept is the same regardless of whether the participants are countries, firms, or both. Since the number of allowances is equal to the overall limit, emissions can not exceed this cap if compliance is enforced.

In “baseline and credit” trading systems, such as the Kyoto Protocol project mechanisms CDM and JI, a baseline of future emissions is defined.¹⁰ An entity then implements mitigation actions and documents the reductions from baseline emissions achieved. Once a regulator has approved the baseline and the reductions achieved, the entity receives “credits” for the reductions.¹¹ Credits can be traded and be used for compliance with specified regulatory obligations such as an emissions cap or baseline.¹²

The cap or baseline can take many forms. An historical level of emissions or emission trend could be used as the basis for determining the cap or baseline. A cap or baseline could be set at a constant level for each period, or could increase or decrease over time. A cap or baseline can also be defined in terms of emissions per capita or per unit of output, where these rates may remain constant or change over time. As a result total emissions may not be known in advance.

⁸ For a survey of existing and proposed emissions trading systems see Henrik Hasselknippe with Geir Høybye, *Meeting The Kyoto Protocol Commitments Summary - Domestic Emissions Trading Schemes*, Confederation of Norwegian Business and Industry (NHO), Oslo, September 2000, with periodic updates posted on the website: www.nho.no.

⁹ Allowances are permits issued *ex ante* by a government that allow the holder to emit a specified quantity, such as one metric ton of CO₂ equivalent, of emissions.

¹⁰ The baseline is often defined as the emissions in the absence of mitigation action, but it can also be defined to require some emissions mitigation action.

¹¹ Credits are permits issued *ex post* by a government for the reduction of a specified quantity, such as one metric ton of CO₂ equivalent, of emissions relative to the baseline. Credits allow the holder to emit the specified quantity of emissions. Since a credit is used to permit (extra) emissions, the credit user is often a different entity than the credit generator because the generator has reduced its emissions below the baseline.

¹² Emissions trading requires both buyers and sellers. Participants in a voluntary baseline and credit system generate credits for sale. For trades to occur, there must be one or more buyers with voluntary commitments who buy credits to help meet their commitment, as is the case for PERT, or a mandatory program whose participants can use approved credits to help meet their obligations, as is the case for the UK system.

The programs reviewed include both “cap and trade” and “baseline and credit” systems and feature a wide range of design choices. This diversity of designs helps to inform the assessment of the implications of linking trading programs.

1.6 Issues Involved in Linking Trading Programs

The primary issue for linking emissions trading programs is whether the administrator of a scheme will accept allowances/credits from other programs as valid “tender” for meeting the emission limits of participants in its scheme. This requires sufficient *institutional compatibility* to establish the equivalence of allowances/credits and to move them from one program to another.

Linking emissions trading programs creates a market with a larger number of participants and more diversity of control costs, which should reduce the total compliance cost and so improve *economic efficiency*. Since the purpose of emissions trading is to reduce the cost of achieving a given emissions target, the potential impact of linkage on total emissions -- *environmental integrity* -- is likely to be an important consideration for program administrators when evaluating possible links with other schemes.

Linking two emissions trading programs should lead to a market price that is higher than the pre-link price in one of the programs and lower than the pre-link price in the other program.¹³ This means that buyers in the high price program and sellers in the low price program benefit from the link. Conversely, sellers in the high price program and buyers in the low price program suffer financially as a result of the link. Thus linking trading programs will create winners and losers, which has *equity and competitiveness* implications.

Assuming that the designs of the programs being linked differ, linkage will highlight differences in treatment of similar participants, such as free distribution of allowances in one program and a requirement to buy them in the other program. Highlighting such differences by linking the programs is likely to raise equity concerns. These differences may also have competitiveness implications. The differences, with their equity and competitiveness implications, would exist whether or not the programs are linked, but linking the programs gives them new prominence.

Linking domestic emissions trading programs can also change national emissions levels; one country is likely to be a net importer of allowances/credits while the other is a net exporter. The analysis focuses on the period prior to 2008 when countries do not have emissions limitation commitments. However, governments will want to begin to limit the growth of, or reduce, national greenhouse gas emissions to minimise the cost of meeting their 2008-2012

¹³ As noted above, linking programs should reduce the total compliance cost summed over all participants.

commitment.¹⁴ Thus, governments are likely to have a target emissions trajectory even if they do not have an emissions limitation commitment during this period.

A government is likely to be pleased if participants in its domestic emissions trading program to sell allowances/credits to companies in other countries. This means that actual emissions are below the aggregate emissions cap/baseline and participants earn revenue from the sale of allowances/credits. However, the government of a country whose trading program participants are net importers of allowances/credits may be more cautious. It means that actual emissions will be higher than in the absence of the allowance/credit purchases, which may make it more difficult for the country to get its national emissions on the desired trajectory. On the other hand, permitting the use of imported allowances/credits reduces compliance costs and may help protect the competitiveness of domestic industry.

1.7 Types of Possible Linkages

The focus of this analysis is linkages among emissions trading programs prior to the establishment of international emissions trading mechanisms. Already there are a mandatory domestic trading program with penalties for non-compliance (Denmark), a voluntary domestic trading program with strong incentives to participate and penalties for non-compliance (UK), a voluntary international credit procurement program (ERU-PT, Netherlands), a voluntary internal corporate trading program that is mandatory for all business units (BP), a voluntary internal corporate trading program (Shell), and a voluntary industry trading program (PERT).

These programs, as well as proposed emissions trading schemes that have not been implemented yet, provide the basis for analysing the following types of possible linkages:

- Linkages among government implemented domestic emission trading programs;
- Linkages among industry emission trading schemes; and
- Linkages among government implemented domestic emission trading and industry emission trading programs.

The commitments of participants in industry trading programs will overlap the targets of government programs. When a given entity is covered by two or more trading programs the commitments and their fulfillment need to be reconciled. The government could require the entity to participate in its program and drop out of the industry program. Alternatively, the government could consider a link between its program and the industry program.

1.8 Structure of the Report

¹⁴ Annex B Parties also have a commitment under Article 3.2 of the Protocol to have made demonstrable progress toward that commitment by 2005.

The next chapter presents a short description of each of the trading programs reviewed. Chapter 3 assesses the implications of differences in design features for the feasibility of linking emissions trading programs. Chapter 4 discusses ways of linking emissions trading programs.

2. Overviews of the Trading Programs Reviewed

This section provides a brief overview of each of the emissions trading programs reviewed. Existing government programs are presented first in chronological order, followed by proposed government systems in alphabetical order. These are followed by industry programs in the same sequence.

2.1 Oregon

The Oregon Energy Facility Siting Council sets CO₂ emissions standards for new energy facilities -- base-load gas plants, non-base load power plants, and non-generating energy facilities. Emissions beyond the standard must be offset with approved offset projects. The emissions standards do not apply to existing energy facilities, nor to existing or new non-energy facilities.

Neither the law nor the rules specifically address emissions trading, but the requirements preclude trading. The statute prohibits the use of allowances that have already been allocated or CO₂ reduction credits for reductions or sequestration awarded in another regulatory setting. Thus, purchased credits or allowances currently can not be used to achieve compliance. And CO₂ offsets required to meet the standard can not be sold; they are held in trust by the Council.

An applicant can meet the CO₂ standard by:

1. using cogeneration to reduce fossil fuel emissions for steam production;
2. implementing CO₂ offset projects directly or through a third party; or,
3. providing \$0.85 per ton of CO₂¹⁵ plus contracting and selection funds to the Oregon Climate Trust so that it can purchase CO₂ offsets.

The Klamath Cogeneration project is using a combination of all three approaches to meet its offset requirement. The Hermiston Power project and Coyote Springs Unit 2 project have both chosen to rely exclusively on the third option.

2.2 Denmark

In Denmark, an emissions trading system for electricity generators was established by the Danish *CO₂ Quota Act*, which was passed by the Danish Parliament in 1999.¹⁶ The Act

¹⁵ The Council increased the offset fund rate from \$0.57 to \$0.85 per short ton CO₂ (\$1.03 per metric tonne of CO₂) on September 14, 2001. No further increases are allowed until September 2003 and then the increase is limited to a maximum of 50%.

¹⁶ This description is based on Sigurd Lauge Pedersen, "The Danish CO₂ Emissions Trading System," *RECIEL*,

entered into force in July 2000, and became operational after formal approval by the EC in April 2001. The system sets limits on total CO₂ emissions from power production for the years 2001 to 2003, allocates emissions allowances to eight individual power companies and allows emissions trading and banking.

The emissions cap is set at 22 mtCO₂ for 2001 declining by 1 mtCO₂ each year to 20 mtCO₂ for 2003.¹⁷ The cap covers emissions by about 500 electricity producers, most of which are very small combined heat and power plants.¹⁸ The small plants are not part of the emissions trading program.¹⁹ The emissions trading program is limited to eight firms.

Allowances are allocated free to the eight firms based on the 1994-98 base period.²⁰ Allowances are allocated first to combined heat and power plants (about 50% of total electricity generation) with the balance being allocated to the remaining plants.²¹ The allocation is adjusted annually taking into account trading during the previous year. The first allocation was carried out on 15 December 2000 for 2001. Two firms, Elsam and Energi E2, received 93% of the allowances allocated.²² The penalty for failing to hold sufficient allowances is DKK 40 (about US\$4.90) per metric ton of CO₂.

A “saving limit” is also established annually for each of the eight producers in the trading program. The saving limits total 20 mtCO₂ each year, so a firm's saving limit is a little less than its allowance allocation in 2001 and 2002. If actual emissions are above the saving limit banking is not allowed. If actual emissions are less than the saving rate, the difference can be banked for future use.²³ Although caps have only been set through 2003, banking for use after

vol. 9, no. 3, 2000, pp. 223 - 231.

¹⁷ For comparison, the average of annual emissions over the period 1994-98 was 30.3 mtCO₂. Total Danish emissions are around 60 mtCO₂, so the system covers about 33% of national emissions.

¹⁸ A small plant has annual emissions of less than 100,000 tonnes of CO₂.

¹⁹ The small plants do not receive an allocation of allowances and are not required to pay a penalty in case of non-compliance.

²⁰ Although the allocations are calculated by plant, the allowances are given to firms.

²¹ Given the electricity supply from wind generation and combined heat and power plants, plants that generate electricity only are the marginal suppliers. During several thousand hours (out of 8,760 hours) per year the electricity supplied by wind generators and combined heat and power plants is sufficient to meet the Danish load. During such periods some of the electricity is, in effect, a waste product.

²² To work well, an emissions trading program should establish a competitive market for the allowances. A program with only 8 participants, 2 of which account for 93% of the allowances, will not be a competitive market. Since the firms are all in the same industry, selling allowances could be interpreted as providing market share to a competitor. Trading activity, therefore, is likely to be minimal in the absence of links to other trading programs. With a link to another program, the overall market might be competitive and so could yield the anticipated economic benefits.

²³ If A is the firm's allocation, E its actual emissions for the same year and S its saving limit for the year, $A > S$ and banking is limited to $S - E$ when $S > E$.

2003 is possible if the program is extended.

The *CO₂ Quota Act* empowers the Minister for Environment and Energy to issue guidelines on the participation of Danish electricity producers in the use of the Kyoto mechanisms (IET, JI, CDM). However, under the Act the guidelines can only be issued when international rules for the mechanisms exist, which is not yet the case. So far, power producers have not lobbied for such guidelines.

To date no trades have taken place to date, although Natsource reports a mid-market bid/offer price of US\$3.78 per metric ton of CO₂ for 2001 to 2003.²⁴

2.3 ERU-PT (Netherlands)

Through the Emission Reduction Units Procurement Tender, ERU-PT, the Ministry of Economic Affairs of The Netherlands is effectively implementing JI projects by providing funds for acquisition of Emission Reductions Units (ERUs) from eastern European countries.²⁵ This program is unique in that it has a single buyer, the Dutch government, purchasing ERUs and CERs from multiple sellers in other countries. The Dutch government signs a Memorandum of Understanding with the host government to the effect that any credits accruing from these projects from 2008 on count towards the Dutch Kyoto target.

Any company, worldwide, can bid for projects undertaken in Annex B countries with a focus on eastern Europe. The quantity of ERUs generated by a project is calculated as the difference between the baseline emissions of greenhouse gases and the estimated actual emissions during the period 2008 to 2012. The emission reductions due to the project must be demonstrated to be additional and significantly larger than what would have occurred in the absence of the project activity. The revenue from the sale of ERUs or CERs is an additional source of income to boost the feasibility of projects and accelerate their implementation.

Projects are selected through a tendering process. The initial call for expressions of interest was issued on May 15, 2000. A total of 26 proposed projects in nine countries were submitted by the July 17 closing date. Nine of those projects were shortlisted and invited to submit detailed bids. On April 17, 2001 the Dutch government signed contracts to purchase ERUs from five of the projects. The purchases involve more than 4 million tonnes of CO₂ (0.8 million tonnes per year) at a cost of US\$30 million. The reductions from the first procurement round will be realised at:

- A 60 megawatt wind-power park in Poland
- A hydro-power plant in Romania

²⁴ *Utility Environment Report*, August 24, 2001 p. 6 reporting on a study of greenhouse gas trades conducted by Natsource LLC for the World Bank Prototype Carbon Fund.

²⁵ Based on reports in *Joint Implementation Quarterly*, vol. 6, no.3, October 2000, p.3; vol. 6, no. 4, December, 2000, p. 3; and vol. 7, no. 2, July 2001, p. 2.

- A series of biomass-fuelled boilers in the Czech Republic and
- Two urban heating projects in Romania.

The Dutch government purchases ERUs representing emission reductions during the 2008-2012 commitment period.²⁶ Projects must therefore be operational and distinguishable between 2008-2012. The actual emission reductions achieved may differ from the estimates used to evaluate the projects. Prices for the tenders to date average approximately US\$7.50 per tonne CO₂.

The Dutch government has recently decided to extend the program and to extend it to developing countries under the CDM. As part of this decision the program has been renamed Carboncredits.nl. The tentative schedule is for the CDM program to begin by 1 November and the next JI program on 1 December, 2001.²⁷

2.4 United Kingdom

The UK Emissions Trading Scheme is a voluntary scheme that has been developed through an industry led process with government involvement - the Emissions Trading Group. This is the most developed emissions trading scheme in the world to date and the most extensive in terms of coverage of industry sectors. The rules for the scheme framework were published in August 2001.

There are three ways to enter the UK Emissions Trading Scheme:

1. Through Climate Change Levy Agreements (CCLA) energy intensive sectors take on energy efficiency or emissions targets in return for an 80% discount of the Climate Change Levy. Participants can earn tradeable allowances for CO₂ reductions computed from the targets.
2. Companies with annual emissions greater than 10,000 metric tonnes of CO₂ equivalent may also 'bid' absolute emission reduction targets measured relative to average annual emissions for 1998-2000 in return for incentive payments offered by the government. Successful bidders (Direct Participants) can engage in emissions trading to help meet their commitments. Entities covered by a CCLA, electricity generators, the transport sector, households and large landfills are not eligible to participate in this way.
3. Any UK company may carry out a project that results in verified emissions reductions credits, which are also tradeable, although the rules for project participation have not yet

²⁶ Note that the Dutch government is contracting for the purchase of ERUs. It is not investing in the projects, although the contract for the sale of ERUs can help finance the project.

²⁷ If the same approach of purchasing credits, rather than investing in the project, is used for CERs, at least some of the projects are likely to be unilateral CDM projects.

been devised.

Participants covered by a Climate Change Levy Agreement (CCLA) enter the trading program with the target set by agreement with the government. The target may be defined in either absolute or rate-based terms and may be expressed in terms of energy savings or greenhouse gas emission reductions. Regardless of how the target is defined, it is converted to CO₂ reductions. These participants get an 80% rebate on the Climate Change Levy (an energy tax) provided they meet their target. Roughly 40 energy-intensive industrial sectors have such agreements covering some 8,000 individual companies.

The first allocation of allowances to participants covered by a CCLA is made after they achieve their first milestone target for the period 1 January 2002 to 31 December 2002 (some have selected slightly different compliance periods). The targets are set for every second year to 2012 and after meeting each milestone target the companies earn the rebate on the levy for the following two years. In case of non-compliance the principal penalty is the removal of the 80% Climate Change Levy discount for the following two-year period.

Companies not covered by a CCLA can bid for absolute emission reduction targets in return for government incentive payments. Successful bidders (Direct Participants) will have annual targets over five years.²⁸ They will receive their allowances annually from the beginning of the scheme in April 2002. The penalties for non-compliance with the absolute cap are non-payment of the incentive, possible clawing back of previous years' payments with interest, and docking allowances for subsequent years at a rate between 1.1 and 2 times the shortfall.

Because many CCLA participants have rate-based targets, a "gateway" has been established between the absolute and the rate-based sectors to avoid inflation of the absolute sector from the rate-based sector. The gateway will close whenever aggregate sales from the rate-based sector to the absolute sector equal the sales in the other direction.²⁹ Effectively, trading will only take place between the two sectors when the marginal cost of abatement is lower in the absolute sector than in the rate-based sector.

The rules and approval process for generating credits from UK based emission reduction projects are under development. At a minimum the project manager will have to demonstrate that the proposed emissions reductions are additional to a 'business as usual' baseline. Electricity generators are not able to join the emissions trading scheme directly at this stage, however they will be able to implement approved emission reduction projects and sell the resulting credits.

The first compliance period will start on 1 January 2002 for the calendar year. There will be a

²⁸ Each time a Direct Participant changes its structure, it must assess whether the baseline emissions from the sources involved in the change are equal to or greater than the Change Threshold: 25,000 tCO₂e or 2.5% of total baseline emissions, whichever is less. This threshold is cumulative over the period 2002 to 2006. If the Change Threshold is triggered, adjustments must be made to the baseline and annual targets.

²⁹ It is expected that the gateway would close permanently at the end of 2007.

three month grace period before compliance is assessed at the end of March 2003. Unlimited banking is allowed by all participants through 2007. Banking of pre-2008 allowances for use during 2008-2012 is available to participants with absolute caps to the extent that they have over-complied with their targets (i.e., they cannot buy to bank). The Government reserves the right to impose restrictions on banking of all other allowances and credits beyond 2007.³⁰ Borrowing is not allowed.

Each Direct Participant will be required to measure and report its emissions annually using the Guidelines for the Measurement and Reporting of Emissions in the UK Emissions Trading Scheme (Reporting Guidelines). Measurement and reporting requirements for CCLA participants are specified by the respective agreements. Direct Participants and CCLA participants that wish to sell allowances must have their annual emissions reports verified by an accredited independent verifier.

An electronic real time registry will record the holdings of allowances/credits for each participant, and track allocations, transfers, and final cancellation or retirement of allowances/credits. Initially the registry will serve only the UK Scheme, but in time it is envisaged that it will act as the UK's national registry for international trading under the Kyoto Protocol. By 2008 the registry will need to interface with overseas registries and will become the main tool for tracking changes to UK allowance/credit holdings.

Allowances will be treated as revenue items for tax purposes. The cost of purchased allowances is a business expense and revenue from the sale of allowances is taxable income. Allowances are not subject to stamp duty.

Prior to 2008 allowances from other emissions trading programs may be used for compliance only if a bilateral agreement with the UK emissions trading scheme has been negotiated. Ultimately, the government envisages that participants will be able to use any allowances or credits obtained through the Kyoto mechanisms subject to the appropriate approval.

2.5 Australia

The Australian Greenhouse Office (AGO) has been consulting with stakeholders on the development of an emissions trading scheme for greenhouse gases.³¹ The AGO released four discussion papers dealing with various aspects of emissions trading for greenhouse gases during 1999 and invited comments from stakeholders.³² Since then work has continued on

³⁰ These restrictions will be in the form of percentage-based cancellation applied to applicable holdings at the end of 2007.

³¹ Brett Janissen, "Design Issues for a National Greenhouse Gas Trading System: an Australian Perspective," *RECIEL*, vol. 9, no. 3, 2000, pp. 276-284.

³² Australian Greenhouse Office, *National Emissions Trading – Establishing the Boundaries*, Discussion Paper 1, Canberra, March 1999; Australian Greenhouse Office, *National Emissions Trading – Issuing the Permits*, Discussion Paper 2, Canberra, June 1999; Australian Greenhouse Office, *National Emissions Trading –*

more detailed examination of design options, including the distribution of allowances.³³ However, a specific design has not yet been proposed.

The fourth discussion paper compares a baseline and credit system with a cap and trade system, and concludes that the cap and trade system is more attractive for a national emissions trading system. However, the AGO finds that a baseline and credit arrangement could be used to encourage emission reductions by sources not covered by the cap and trade system. Several submissions to the discussion paper, primarily by industry groups, express a preference for a baseline and credit system.

A decision on the coverage of an emissions trading program and which sources would be required to hold allowances covering their emissions has not yet been made. The AGO is still considering all options to reduce the administrative and compliance costs of an emissions trading program. A domestic emissions trading program is likely to recognise credits created through CDM and JI projects as well as eligible domestic sequestration actions.

The Allen Consulting Group evaluated four options for *gratis* allocation to firms, distribution on the basis of:

- their direct emissions;
- the disadvantage suffered by the introduction of GHG abatement policy;
- their fuel inputs; and
- industry agreements.

The report concludes that

*"the ultimate choice, therefore, lies between two problematic alternatives. Any administrative (gratis) allocation system will be deficient both in efficiency and equity terms yet the principle is strongly favoured by a key stakeholder, namely business. The sale of permits with revenue recycling, on the other hand, has the potential to satisfy both efficiency and equity objectives but faces deep opposition from business. We propose that the second approach, based on the sale of permits, be adopted (subject to meeting business concerns)."*³⁴

Although the consultant recommended distribution of permits by auction with revenue recycling, the government has not yet decided how permits would be distributed.

Allowances would be issued annually and participants would be required to establish compliance annually. Each allowance would permit the holder to emit one metric tonne CO₂ equivalent of greenhouse gases. Allowances could be used any time after they have been

Crediting the Carbon, Discussion Paper 3, Canberra, October 1999; and Australian Greenhouse Office, *National Emissions Trading – Designing the Market*, Discussion Paper 4, Canberra, December 1999.

³³ The Allen Consulting Group, *Greenhouse Gas Emissions Trading: Allocation of Permits*, Report to the Australian Greenhouse Office, Canberra, August 2000.

³⁴ The Allen Consulting Group, *Greenhouse Gas Emissions Trading: Allocation of Permits*, Report to the Australian Greenhouse Office, Canberra, August 2000, p. 10.

issued during the 2008-2012 commitment period, or be banked for future use. The allowances will be tradeable domestically and internationally subject to the need to comply with the international rules for the Kyoto mechanisms.

Current government policy is that Australia will not implement a mandatory emissions trading system until ratification and entry into force of the Kyoto Protocol is ensured.

2.6 Canada (TPWG)

As part of the National Climate Change Process established by the federal, provincial and territorial Energy and Environment Ministers, the Tradeable Permits Working Group (TPWG) was formed to explore the potential contribution of a mandatory domestic emissions trading system to achieving a substantial reduction in greenhouse gas emissions in Canada.³⁵

A final decision to proceed with a domestic emissions trading program will not be made until the Kyoto Protocol is ratified. The trading program would begin operation in 2008.

The Tradeable Permits Working Group analyzes two possible designs:

- *Large Final Emitters.* This is a "downstream" design that covers only large emitters, including electricity generators, major industrial emitters (including some direct emissions at upstream stages of oil and gas production), and possibly large transportation carriers. Approximately 700 to 900 firms representing 40% to 50% of Canada's total greenhouse gas emissions would be involved.
- *As Broad as Possible Coverage.* This design uses a midstream or upstream design for CO₂ from fossil fuel combustion with non-combustion CO₂ and most other greenhouse gas emissions covered at final emitter.³⁶ This design could cover over 80% of Canada's total greenhouse gas emissions with about 800 to 1,000 participants.

The TPWG proposes that an allowance be equal to one metric tonne of CO₂ equivalent. Unlimited banking of allowances is proposed.

The Tradeable Permits Working Group proposes that allowances be distributed in the following ways:

- auctioning of the total supply of allowances less the allocations under the following two *gratis* components, with revenue recycled in a manner to address equity and efficiency

³⁵ Canada, Tradable Permits Working Group, *Options Report: Using Tradable Emissions Permits to Help Achieve Domestic Greenhouse Gas Objectives*, Ottawa, April 2000.

³⁶ Imported fossil fuels would be subject to the permit requirement and exports of fossil fuels would be effectively exempt from the permit requirement.

objectives not addressed by the two *gratis* components (for example, through reductions in personal and corporate income taxes);

- a continuing *gratis* allocation of allowances to address competitiveness of industries competing primarily with producers in non-annex B countries (estimated at about half of the total allowances) based on appropriate dynamic benchmarks (emissions per unit of output or input); and
- a transitional *gratis* allocation of allowances to firms in sectors that would be expected to suffer significant capital losses because of the reduction in value of their existing capital stock. This allocation could include firms that are not part of the emissions trading program.³⁷

Further work on analysis of allocation options and other issues is currently being undertaken by a federal/provincial/territorial domestic emissions trading working group.

2.7 European Union

The European Commission is drafting a Directive that would require each Member State to implement a domestic emissions trading program for specified sources of CO₂ emissions beginning in 2005. A draft of the Directive was distributed for interservice consultation on 14 September 2001.³⁸ Some elements of the draft Directive may change as a result of the consultations. The aim is to release the Directive prior to COP 7 in late October 2001.

The Directive would require each Member State to implement a domestic greenhouse gas emissions trading program. Some elements of the design would be common to all of the domestic programs, while other elements of the design could vary across Member States at the discretion of the national government. The Directive allows Member States more flexibility during the 2005-2007 introductory period than during the 2008-2012 Kyoto Protocol compliance period.

During 2008-2012 participation is intended to be mandatory for sectors listed in the Directive responsible for about 46% of the projected 2010 CO₂ emissions of the European Union,

³⁷ Assume an upstream design were implemented for the as broad as possible option with fossil fuel producers and importers being required to hold allowances for the carbon content of the fuel sold in Canada. The value of fossil-fired generating stations, oil refineries and other energy-intensive facilities that are not participants in the trading program would be reduced. They could receive allowances to compensate these losses even though they are not participants in the trading program.

³⁸ European Commission, *Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL Establishing a Framework for Greenhouse Gas Emissions Trading within the European Community and Amending Council Directive 96/61/EC*, Commission of the European Communities, COM(2001) xxx, Brussels, 14 September 2001. While the description of the EU program is based on this draft and earlier documents, the draft has not been officially released and could change substantially.

specifically:

- Energy activities: Combustion and combined heat and power (CHP) installations covered by IPPC³⁹ that exceed 20 MW (excepting hazardous or municipal waste); mineral oil refineries; and coke ovens.
- Production and processing of ferrous metals: Metal ore roasting and pig iron and steel installations.
- Mineral industry: Cement clinker installations with capacity of over 500 tonnes per day and lime kilns over 50 tonnes per day and other furnaces with a production capacity exceeding 50 tonnes per day. Installations for the manufacture of glass with melting capacity over 20 tonnes a day. Ceramic installations with a production capacity over 75 tonnes per day.
- Other activities: pulp from timber and other fibrous materials, and paper.

The scheme would cover 4,000 to 5,000 installations from 2008. During the 2005-2007 period a Member State could exempt installations required to make an equivalent effort under domestic policies such as negotiated agreements.

Initially the program would apply to CO₂ emissions by the designated sources. Coverage can be extended to additional gases and sectors at the request of a Member State or the initiative of the Commission.

The total quantity of allowances issued and their distribution to participants is largely left to the Member States. Each Member State must submit a national allocation plan in advance to the Commission. The total quantity issued: may not exceed the total emissions of the participants if they were to be regulated under the IPPC Directive; must reflect an appropriate contribution by the sources covered to meeting the country's emissions limit under the EU burden sharing agreement; and must be consistent with EU requirements regarding state aid.

The Directive specifies that allowances be distributed free during the 2005-2007 period, but allows some or all of the allowances to be auctioned during subsequent periods. If allowances are to be distributed free, the national allocation plan must include objective and transparent criteria for the distribution of allowances. In addition, the distribution of allowances to participants must be consistent with the EU requirements regarding state aid and must treat new entrants fairly.

An allocation of allowances is an absolute cap since each allowance entitles the holder to emit greenhouse gases equal to one metric tonne of CO₂ equivalent. However, the Directive notes that a Member State could allocate allowances to participants on the basis of output-related performance standards by using output forecasts for the relevant period.

³⁹ The IPPC is the Integrated Pollution Prevention and Control Directive, which requires designated plants to implement pollution prevention and energy efficiency measures.

The life of allowances would be limited to the period for which they are issued, 2005-2007 or 2008-2012. Thus unrestricted banking is allowed within each period. Member States will have the option to allow banking from 2005-2007 into the 2008-2012 period. The Directive requires Member States to allow banking between subsequent periods, e.g., from 2008-2012 into 2013-2017, even if the Member State does not meet its national emissions limitation commitment⁴⁰.

Common monitoring, verification and reporting obligations will be established. The Directive includes basic monitoring and reporting criteria and sets up a framework for elaboration of these criteria. The monitoring and reporting requirements for each participant will be incorporated into its operating permit. The Directive also contains a list of binding verification criteria, but allows verification to be performed by an appropriate government authority or by independent verifiers.

Each Member State will be required to establish and maintain an electronic national registry. The rules governing the registries will be the subject of a separate regulation.

By March 31 of each year participants are required to surrender allowances equal to their actual emissions during the previous calendar year. The penalty for non-compliance will be loss of allowances equal to the excess emissions plus a financial penalty equal to the higher of 100 euros and twice the average market price during a predetermined period per metric tonne of excess emissions. During the 2005-2007 period the financial penalty will be the higher of 50 euros and twice the average market price during a predetermined period.⁴¹

The Directive states that the proposed scheme is consistent with international emissions trading among Annex B Parties under the Kyoto Protocol. In addition it can be linked to domestic emission trading programs in non-EU countries through agreements to mutually recognise each scheme's allowances toward fulfillment of compliance obligations. Beginning in 2008, transfers of allowances between Member States (or other domestic programs) will need to be mirrored by transfers of AAUs under Article 17 of the Kyoto Protocol.

The Directive indicates that eventual inclusion of joint implementation (JI) and clean development mechanism (CDM) is desirable. A separate proposal for their inclusion will be made once the international rules governing those credits have been agreed.

2.8 France

⁴⁰ This would be accomplished by exchanging banked allowances for an equal number of allowances for the new period.

⁴¹ Thus the financial penalty will be at least US\$45 per metric tonne of CO₂ equivalent during 2005-2007 and at least US\$90 per metric tonne of CO₂ equivalent during 2008-2012.

French industry is proposing an emissions trading system based on a combination of voluntary agreements with energy intensive companies and emission credits.⁴² The proposal would cover 30 industry sectors with 1,100 sources responsible for about 80% of industrial CO₂ emissions.⁴³ Participation in a voluntary agreement would be mandatory for sources with annual emissions greater than a specified level.⁴⁴ Smaller sources could opt-in.

Emission reduction targets specified by the voluntary agreements would be negotiated with the government taking into account the following principles:

- the sector's average performance level (emissions of a given gas per production unit) relative to performance levels attained abroad or by other sectors in France, for those sectors for which such a comparison makes sense;
- the state of the market, its foreseeable development, and therefore whether or not there is potential for investment, growth and revitalization;
- the age of industrial equipment and the capital replacement time;
- the realization times for any necessary investments and the time frames needed for them to be translated into emission reductions;
- recent or projected technological developments (the evolution of best available technologies); and
- possible public-sector support for R&D or innovation.

The target for a sector would cover all relevant greenhouse gas emissions. Where agreement on a voluntary emissions target can not be reached with the industry sector, the government would impose targets on the sources based on independently verified information.

The negotiated voluntary agreements, in effect, specify the free allocation for each source. Hence, the procedure used to negotiate the agreements must be transparent enough to be understood by all the parties involved, and be as suitable as possible for extension to the European or even international level. The targets could be defined in absolute or rate-based terms, although a credit would be defined as one tonne of CO₂ equivalent.

Three sub-periods are proposed: 2002-2004, 2005-2007, and 2008-2012. The targets in the

⁴² *Enterprises pour l'Environnement*, "Proposal for an effective plan of action to reduce greenhouse gas emissions in the manufacturing sector," Paris, April 1999 and France, MIES-Industry Working Group, "Implementing an Emission Credits Trading System in France to Optimize Industry's Contribution to reducing Greenhouse Gases," Paris, March 31, 2000.

⁴³ More study of options to address emissions due to electricity generation is proposed. The two main options are to hold industry participants accountable for the emissions associated with the electricity they use or to add an appropriate price signal to the cost of electricity used by electricity.

⁴⁴ Each industry sector would voluntarily negotiate emissions targets for its members with the government. Once negotiated, the targets would be binding and a participant would be subject to penalties for non-compliance. In the event of that an industry sector and the government could not reach agreement on targets, the government could set targets for the participants in that sector.

negotiated agreements would decline over time. Unlimited banking would be allowed within each period. Inter-period banking is also proposed with the understanding that the 2008-2012 aggregate target for the industrial sector could be revised downward if banking into this period might have an adverse impact on other sectors.

A monitoring and reporting system would be developed by industry drawing upon appropriate expert bodies. Each participant would implement the monitoring system. Each participant reports its actual emissions to the government annually. The emissions report must be audited by an accredited auditor selected by the participant. The government may ask the participant or auditor for clarification and additional information and may undertake its own on-site verification.

The emissions report is to be filed within one month after the end of the year. Participants then have a three-month grace period to acquire the credits needed to cover their actual emissions. If participants have been unable to purchase sufficient credits by the end of the grace period, the government would alleviate the shortage by selling credits at the highest price charged for transactions effected during this period.⁴⁵

When a company fails to provide sufficient credits to cover its actual emissions, even after receiving a reminder from the authorities, the government may opt to:

- suspend its operating authorization; or
- adopt a decree requiring the deposit of a sum, yet to be defined, depending on the level of the company's emissions as shown in the last inventory.

Participants would be allowed to use JI and CDM credits for compliance, possibly subject to restrictions, if needed, to comply with the international rules on the use of the mechanisms. The French program could also be linked with other domestic emissions trading programs through mutual recognition agreements or pooling.

2.9 Germany⁴⁶

In October 2000, the Federal Government created the Arbeitsgruppe Emissionshandel zur Bekämpfung des Treibhauseffektes (AGE) to investigate how emissions trading could be used within Germany to help meet the national greenhouse gas emissions target. The AGE

⁴⁵ The price must be higher than the reference price for fossil carbon. As part of the national plan to address climate change, the French government has decided to set a reference price for avoided fossil carbon. This will serve as the basis for the taxation differential to be introduced by 2010. The government has adopted a target level of FF 500 (about US\$70) per metric ton of carbon for 2010, with a starting level of FF 150 to 200 per metric tonne of carbon (about US\$5.00 to US\$7.50 per metric ton of CO₂).

⁴⁶ Based on Germany, "The German Emissions Trading Programme," Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, Berlin, September 28, 2001.

includes representatives of the Federal Government, Parliament, industry (30 companies and 9 trade associations) and environmental NGOs. The working group intends to propose key elements of a German emissions trading scheme as part of the national climate protection strategy by the end of 2001.

Although work on the design of a German emissions trading program is still underway, some of the elements of such an emissions trading scheme have been defined in position papers of the working group and the Federal Government for the September hearing on emissions trading within the European Union in September 2001. The main features of the German emissions trading program, based on the positions adopted for the hearing, can be summarised as follows:

- Participants in an emissions trading system must commit themselves to an absolute cap on their emissions. The cap should be set below the participant's "business as usual" emissions.
- The initial distribution of allowances should be mostly free, but with a portion of the total sold by auction to obtain an early price signal.
- The base year/period for the calculation of the free distribution should be 1990 or the average of 1990-1992.
- In principle all greenhouse gases listed in the Kyoto Protocol should be included in an emissions trading program, but given the difficulties of monitoring some gases, starting with CO₂ and expanding coverage to other gases seems appropriate.
- In principle all sectors – including transport and private households – should be included in the emissions trading program. However, given some of the technical issues raised by the transport and household sectors, such as the standard for initial allocation, beginning with large emissions-intensive facilities seems appropriate.
- Power stations should participate in emissions trading based on their direct emissions. An indirect system provides little incentive to reduce greenhouse gas emissions by power stations, but involves higher costs for monitoring.
- Suitable market infrastructures and institutions for emissions trading can be expected to develop without state intervention. Emitters, trade intermediaries, and governments should all be permitted to engage in trading.
- International emissions trading requires harmonised monitoring, verification, reporting, and sanctioning systems, otherwise differences between trading programs are likely to result in distortion of competition.
- Emission credits from JI and CDM should be incorporated into the trading system subject to rules to ensure the environmental integrity of the trading system.

- To gain practical experience and to clarify the interactions with the existing policies and measures, the German Government suggests a European-wide pilot phase with voluntary participation, encouraged by economic incentives, of companies.

2.10 Norway

A Royal Commission report in December 1999 recommended that Norway implement a domestic emissions trading system for greenhouse gases.⁴⁷ Following the Commission's recommendation, the Government published a white paper in June 2001, proposing rules for the system. The system would begin in 2008, although an earlier start is possible depending upon the policies implemented by other countries.⁴⁸ In any case, the proposal is to develop the regulations for the trading system, especially the regulations concerning monitoring and reporting of greenhouse gas emissions, as soon as possible.

The proposed system would cover all greenhouse gases, as many sectors as possible, and carbon sinks. To achieve coverage of a large percentage of Norway's total emissions, the system would include large industrial sources as well as importers or wholesalers of fuels to other sectors. The only sources excluded from the system are:

- N₂O and CH₄ from combustion and from agriculture;
- CO₂ from the use of lime in agriculture and from solvents;
- HFCs and PFCs as substitutes for CFCs; and
- Halons and SF₆ except from production of magnesium.

The system would be mandatory for between 100 and 200 entities and cover about 80% of Norway's total greenhouse gas emissions.

Legally the allowance would be a permit to release one metric tonne of CO₂ equivalent emissions. The CO₂ equivalence of other gases would be calculated using the 100-year global warming potential values as calculated by the Intergovernmental Panel on Climate Change. Allowances could be banked for future use.

The Commission was not able to agree on the method of distribution. A majority recommended that the allowances be auctioned. A minority recommended that industries exposed to international competition and currently exempt from the CO₂ tax receive allowances equal to 95% of their 1990 emissions free.⁴⁹ Another minority stated that the

⁴⁷ See Per Schreiner, "The Norwegian Approach to Greenhouse Gas Emissions Trading," *RECIEL*, vol. 9, no. 3, 2000, pp. 239-251. See also Norway, Commission for a National Trading System for Greenhouse Gases (the Quota Commission), *A Quota System for Greenhouse Gases: A Policy Instrument for Fulfilling Norway's Emission Reduction Commitments under the Kyoto Protocol*, Oslo, NOU 2000. An English summary is available at: <<http://odin.dep.no/md/engelsk/publ/rapporter/022021-020006/index-dok000-b-n-a.html>>.

⁴⁸ A minority of the Commission argued that introduction of a system prior to 2008 would impose unnecessary costs on Norwegian industry and might disturb the introduction of the permanent trading system.

⁴⁹ The Confederation of Norwegian Business and Industry has since proposed that firms in these sectors be

method of distribution is a political decision.⁵⁰ The government prefers an auction but is prepared to consider free distribution for a period of time to enterprises exposed to international competition if necessary to avoid excessive adjustment costs.

The Commission concluded that the market would develop on its own. The Central Norwegian Securities Depository might be well suited to perform the registry function, but a number legal questions would need to be investigated first. The importance of compatibility of the national registry with international rules was recognised.

The system would allow international trade in allowances. Companies will be allowed to buy AAUs, ERUs and CERs, or to generate credits through investment in Norwegian sources that are not regulated by the quotas. If the international rules, such as complementarity and the commitment period reserve, restrict trade, the Commission suggests that the right to import or export Kyoto Mechanism quotas be auctioned or sold domestically by the Norwegian government.

The Norwegian government wishes to cooperate with other countries to develop emissions trading and is prepared to consider implementation of emissions trading in Norway prior to 2008. It recognises that if several countries are to participate in a joint emissions trading scheme, some elements, such as non-compliance penalties, will need to be harmonised while other elements, such as the coverage of the program, can differ across countries. The structure of a possible emissions trading program prior to 2008 has not been discussed in any detail and the parameters for such a system are very uncertain.

2.11 Slovakia⁵¹

An emissions trading program for CO₂ is being considered. It would begin with a pilot phase during 2005-2007. Full operation would begin in 2008. Participants would include:

- Combustion sources with a capacity over 20 MWh; power plants, heating plants, and industrial boilers.
- Industrial process emissions: non-combusted fuel, cement, refineries, etc.

allowed to choose either 1990 or 1998 as their base year and that they receive a free allocation equal to 84% of their base year emissions.

⁵⁰ A majority of the Commission recommended that if allowances are distributed free, that the allocation be based on historic emissions and that they not be tradeable. A minority recommended that some of the allowances distributed free be tradeable.

⁵¹ Based on Stanislav Kolar, "Recent Developments in Emissions Cap and Trade," Center for Clean Air Policy, Warsaw, April 2, 2001.

Slovakia does not want sectoral criteria for source inclusion in the emissions trading program. The number of participants would be less than 300 covering approximately 70% of Slovakia's CO₂ emissions.⁵² EU proposal would cover only 45%

It is likely that allowances would be distributed free based on historical emissions during the last 3 years. Most sources would receive allowances in excess of current CO₂ emissions to ensure that the emissions cap does not restrict economic growth.⁵³ Then with effective carbon management, companies would have surplus CO₂ allowances they could sell on the international market to generate revenue. There would be no restrictions on domestic trading.⁵⁴ However, international sales might be subject to limits and government clearance to ensure Kyoto Protocol compliance.

The problems with SO₂ monitoring and verification highlight the need for strict and accurate monitoring, reporting and verification of CO₂ emissions and for training of government personnel. Allowances would be equal to one metric tonne of CO₂ with each allowance having a unique number to allow accurate tracking.

Sources not covered by the emissions trading program would be subject to policies and measures to ensure fair competition and compliance with EU policies. The government would retain some allowances to cover potential risks of greater emissions by sources not covered by the emissions trading program. If this reserve is not needed, the government might sell the allowances to international buyers or retain them for the second commitment period.

2.12 Sweden

The report of the one-man commission, Kjell Jansson, on emissions trading for greenhouse gases in Sweden was published in April 2000.⁵⁵ The report was prepared after release of, and is shaped by, the EU's Green Paper on emissions trading.

The report recommends that legislation to establish a domestic emissions trading scheme for greenhouse gases be passed as soon as the Kyoto Protocol comes into force, which is assumed to be 2002.⁵⁶ Distribution of allowances would also start in 2002. The trading program would begin on 1 January 2005 and be divided into two periods: 2005-2007 and 2008-2012.

⁵² The EU proposal would cover about 45% of Slovakia's CO₂ emissions.

⁵³ District heating plants may not receive allocations in excess of their current emissions because growth of their output is not expected.

⁵⁴ But if most participants have surplus allowances, prices in the domestic market may be quite low relative to prices in the international market.

⁵⁵ Sweden, Ministry of Industry, Employment and Communications, *Emissions Trading: A Way of Achieving the Climate Goals*, A summary of the final proposal found in SOU 2000:45, Stockholm, 2000.

⁵⁶ Jansson recommends against unilateral implementation of emissions trading.

Initially, the trading scheme would be limited to CO₂ emissions by six industrial sectors covering about 30% of Sweden's 1998 emissions, but it would be expanded to all greenhouse gases in 2008.⁵⁷ The report suggests that wholesalers of fossil fuels to the transport and domestic sectors be included and so raise coverage to 80% of 1998 emissions during the 2005-2007 period rising to close to 90% in 2008.

Sweden currently has a CO₂ tax and some industries are exempt for international competitiveness reasons. The report suggests that the allowances be auctioned and that the CO₂ tax be phased out by 2005. It recommends that industries currently exempt from the CO₂ tax be excluded from the emissions trading scheme during the 2005-2007 period to enable them to compete internationally, even though the EU proposes that some of those industries be covered. Since the CO₂ tax yields more revenue than the permit auction, budgetary considerations might slow down implementation of the emissions trading scheme.

The report notes that an auction of the allowances might contradict existing Swedish law. A company that has been given the right to emit in the past has legal ownership of this emission right and the Swedish state cannot auction these emission rights without financially compensating the company. This will need to be analysed further and be addressed by the legislation establishing the emissions trading system. An upstream design might avoid this issue. In a downstream design, the affected companies could receive free allowances as compensation.

The report recommends that unlimited banking be allowed both within periods and from the 2005-2007 period into the 2008-2012 period. If it appeared that Sweden was not going to meet its 2008-2012 commitment due to higher emissions by sources outside the trading program, the government could purchase allowances on the market. The report also notes that under certain special circumstances (unspecified) there might be reason to withdraw, annul, or modify emission rights under carefully regulated conditions and with good advance planning. Further work on the conditions under which this could happen is needed.

Other recommendations include:

- No use of sink enhancement credits initially, but investigation of their possible introduction from 2008.
- Borrowing of allowances within each period, but not between periods.
- Heavy fines (unspecified) for failure to comply with the emissions trading regulations.
- Use of the project-based Kyoto mechanisms from 2005 on subject only to the restrictions needed to comply with the provisions, such as supplementarity, of the international rules.

⁵⁷ The six downstream sectors cover approximately 45% of the CO₂ emissions in the EU. Jansson recommends that Sweden promote an upstream design within the EU to achieve greater coverage for the trading program.

- Inclusion of applicant countries to the EU and European Economic Area countries in the emissions trading scheme from 2005.
- Allowances be defined as the right to release one metric tonne of greenhouse gases measured as CO₂ equivalent calculated using the 100-year GWP values.
- Annual compliance on a calendar year basis with a two month grace period.

Jansson believes that the market infrastructure for emissions trading will develop without state intervention. The behaviour of participants in the market, including persons and entities not required to hold allowances for compliance purposes, would be subject to regulation by the Swedish Financial Supervisory Authority.

2.13 Switzerland⁵⁸

The Swiss CO₂ law, which entered into force on May 1, 2000, aims to reduce emissions from fossil fuel combustion by fostering energy efficiency and the use of renewable energy.⁵⁹ The objective of the law is to reduce CO₂ emissions by 10% from 1990 levels over the period 2008 through 2012.⁶⁰ The emission reductions are to be achieved through voluntary actions implemented by industry and consumers. If the goal cannot be achieved by voluntary action, the government can impose a tax on fossil fuels beginning in 2004.

The tax rate will depend on the gap between target and actual emissions. The tax is limited to a maximum of 210 Swiss francs per metric tonne of CO₂.⁶¹ Tax revenues from the business sector will be recycled through a reduction of employer social security contributions while tax revenues from households will be recycled on a per capita basis. Participants could sell their allocation of allowances abroad and pay the carbon tax if the carbon tax rate is lower than the international market price, but the difference would need to be large to make such sales profitable.⁶²

⁵⁸ Based on Josef Janssen and Urs Springer, "The Swiss CO₂ Emissions Trading System," Institute for Economy and the Environment, University of St. Gallen, St. Gallen, Switzerland, September 2001.

⁵⁹ Switzerland, "Federal Law on the reduction of CO₂ emissions (CO₂ law)," The Federal Assembly of the Swiss Confederation, 8 October 1999.

⁶⁰ The Swiss commitment is to reduce emissions of all greenhouse gases covered by the Kyoto Protocol by 8% from 1990 levels during 2008-2012. The goal of the CO₂ law is to reduce CO₂ emissions from fossil fuel combustion by 10% from 1990 levels during the same period. The law further specifies that emissions from the combustion of fossil fuels for heat and power production (industry, commerce, and households) shall be reduced by 15% and emissions from the combustion of automotive fuels (transport sector) must be cut by 8%.

⁶¹ Approximately US\$130 per metric tonne of CO₂.

⁶² Entities exempted from the tax are awarded allowances for the period 2008-2012. The revenue would be based on the sale of those allowances. However, non-compliance due to the sale of allowances would trigger a requirement to pay the tax plus interest for the entire period after introduction of the tax in 2004. Thus to make

In July 2001, the administration released a directive on voluntary measures to reduce energy use and CO₂ emissions.⁶³ The directive clarifies the rules in the CO₂ law and establishes a limited emissions trading system. Article 9 of the CO₂ law allows large companies, groups of companies, or companies in energy intensive sectors to be exempted from the tax if they commit themselves to reduce their emissions.⁶⁴ Such a commitment includes the adoption of an absolute limit of CO₂ emissions by 2010, a list of measure to be implemented, an assessment of the effects of those measures, and a continuous reporting of emissions. The directive allows companies or groups of companies with a voluntary emission limitation commitment to exchange emission rights among each other and, if they are unlikely to be needed for compliance, also between groups or companies.

The directive does not specify an allocation rule for the distribution of allowances. Rather each (group of) companies negotiates its own target for 2010. Since participants will be engaged mainly in heat and power production, the average reduction should be 15% from 1990 emissions. However, targets may differ from 15% based on the remaining reduction potential, the profitability of the measures to reduce CO₂ emissions, and expected output growth. Allowance allocations are adjusted *ex post* for differences between projected and actual output growth.⁶⁵ The allowance allocation will be the individual target multiplied by five to cover the years 2008 through 2012. Allowances will be distributed free.

During the 2008-2012 period participants must retire allowances equal to their actual emissions annually. But compliance is assessed for the 2008-2012 period as a whole, not annually. Participants that do not meet their targets must pay the carbon tax with interest for all of their emissions since the introduction of the carbon tax.⁶⁶ Non-compliant participants also will not benefit from any redistribution of the carbon tax revenue. And additional sanctions as specified in the formal commitments will apply. If a group of companies does not meet its target, the group is held liable. How the penalties are to be borne by the members of the group must be agreed by the group itself.⁶⁷

non-compliance due to the sale of allowances profitable, the market price would need to be much higher than the tax rate.

⁶³ Switzerland, *Guidelines on Voluntary Measures to Reduce Energy Consumption and CO₂ Emissions*, Bundesamt für Umwelt, Wald und Landschaft (BUWAL), Bern, July 2001.

⁶⁴ The directive specifies that companies or groups of companies must have annual emissions of at least 250,000 metric tonnes of CO₂ to take on such commitments.

⁶⁵ If actual output growth for all participants as a group is higher than projected output growth during 2008-2012, this provision could make compliance with Switzerland's national emissions limitation commitment more difficult.

⁶⁶ If sellers of allowances are out of compliance, they are held liable for the non-compliance penalties (seller liability).

⁶⁷ This provision creates a relatively high risk of free-riding if clear and credible non-compliance rules are not agreed and communicated from the beginning.

Participants must report annually the following data, using a uniform reporting format: energy consumption and corresponding emissions coefficients, CO₂ emissions and CO₂ intensities. Groups report aggregated company-level data to the government. More detailed reports that also indicate sales and acquisitions of allowances must be prepared in 2003, 2007 and 2012. Participants need to conduct internal audits of their data. External audits will verify the plausibility of reports on basis of experience and cross-checks with publicly available data. The government may conduct additional audits.

Only allowances that are “unlikely to be used for compliance” are tradable. The directive does not specify how this provision is to be implemented. Trading within a group of firms (intra-group trading) is unrestricted. Trading between different groups (inter-group trading) is subject to regulation by the groups involved. The directive states that all inter-group transactions need to be reported to a registry to be set-up and maintained by the group. This suggests the possibility of multiple registries each tracking inter-group trades rather than a national registry.

The directive does not contain explicit provisions on banking and borrowing. However, since allowances are allocated for the five-year period and retired annually, banking and borrowing within the 2008-2012 period are allowed.

The directive allows limited use of the Kyoto Protocol mechanisms, but the rules are not completely clear. The directive states that the use of the Kyoto mechanisms should be supplemental to domestic measures, but it is not clear how this will be implemented.⁶⁸ Emission reductions achieved through energy efficiency and renewable energy projects are eligible. As soon as an international consensus has been reached, the eligibility of other project types will be examined. The directive is ambiguous with respect to the possible use of international emissions trading (IET) for compliance.⁶⁹ The eligibility CDM or JI projects that reduce non-CO₂ emissions or that enhance sequestration by sinks is not clear.

2.14 Pilot Emission Reduction Trading, (Canada)

The Pilot Emission Reduction Trading (PERT) project was established in 1996 as a

⁶⁸ The directive was released before the resumed session of COP 6 in Bonn. Prior to that session quantitative limits on use of the mechanisms was proposed. However, Parties agreed that "the use of the mechanisms shall be supplemental to domestic action and domestic action shall thus constitute a significant element of the effort made by each Party..."

⁶⁹ Clause 79 states that emission reductions achieved abroad may be taken into account "in an appropriate way" through use of the three Kyoto mechanisms. Clause 55 indicates that emission reductions achieved through energy efficiency and renewable energy projects will be recognised as part of a reduction commitment regardless of whether the Kyoto protocol enters into force. Clause 55 also states that emission reductions achieved via JI or CDM projects will be recognized as part of a reduction commitment. IET is not mentioned in clause 55.

demonstration project for a multi-stakeholder group of government, industry, and environment and health organizations.⁷⁰ PERT is a self-funded and non-profit organization.

The objectives of the PERT pilot are to:

1. Evaluate the environmental and economic benefits of using emission reduction credit trading as a tool to improve air quality in southern Ontario;
2. Examine the compatibility of credit trading with the regulatory framework in Ontario;
3. Identify and resolve stakeholder concerns with trading program design elements; and
4. Design a trading system for Ontario and bordering airsheds that is acceptable, easy to use, and can be integrated with other trading systems.

Initially PERT focused on smog precursors but it quickly expanded to greenhouse gases and other pollutants.

Credit creation actions are documented in the form of a “protocol” that describes the actions implemented and the reductions achieved.⁷¹ The protocols are reviewed by PERT to ensure that the reductions are real, quantifiable, surplus, verifiable and unique before they are listed in the PERT registry. As of March 2001, 43 projects had been reviewed and registered and a further 21 were under review but not yet registered.

The PERT review is designed to provide advice to the proponent; it is not an approval process. Any member can post a protocol describing a credit creation action on the registry. The proponent can choose to accept all or none of the advice given through the review process, but the comments are attached to the file on the credit registry and are available to anyone purchasing the credits.

PERT operates on “buyer beware” basis. The onus is on the purchaser to conduct the due diligence investigations required to satisfy itself as to the quality of the credits. PERT does not act as a verification or certification body for the credits developed and traded by participants. Approval occurs when the emission reduction is presented to a regulator, such as the Ontario Ministry of the Environment, to satisfy a particular obligation.

The emission reductions achieved through actions reviewed by PERT are listed on the PERT registry. Reductions are measured in metric tonnes. Greenhouse gases are converted to CO₂

⁷⁰ See Erik Haites and Tallat Hussain, "The Changing Climate for Emissions Trading in Canada," *RECIEL*, vol. 9, no. 3, 2000, pp. 264-275. PERT grew out of the recommendation by an informal Industry NOx & VOC Emission Reduction Trading Working Group that a pilot program be established. The Working Group prepared a discussion paper entitled “A Framework for Open Market Emission Reduction Trading (OMERT) for NOx & VOC in the Windsor-Quebec Corridor and Bordering Airsheds”, 23 October 1995.

⁷¹ Reduction actions implemented since 1 January 1994 are eligible.

equivalents using the IPCC 100-year GWP values. Reductions are reported on a calendar year basis.⁷² In the registry, each credit is tracked electronically from its creation and transfer of ownership, to its use and retirement. Once used, a credit is permanently removed from the registry. The registry records relevant information on all credits registered, such as type and quantity of pollutant, location, generation season (if applicable), creation and use histories, and links to the review comments. It also maintains account balance information on each series of reductions, and for each organization that has created or owned credits.

A letter of understanding with the Ontario Ministry of the Environment dated July 1998, states that emission reductions created or transacted in the PERT project will be recognized as early progress towards future requirements or regulations or towards all self-imposed commitments. If a trading program is created, all emission reductions created or transacted will be subject to the rules of that program.

Ontario Power Generation has purchased substantial quantities of both the NO_x and CO₂ reductions registered with PERT for use in meeting its voluntary commitments that begin in 2000 and the NO_x cap announced for 2001. No emission reductions have yet been approved by the Ministry of the Environment for compliance use in Ontario. However, in 1998, NO_x emission reduction credits created in Ontario under PERT were sold to a firm in Connecticut which used them to comply with a regulatory penalty.

Apart from reviewing proposed credit creations and dealing with the issues that arise from those reviews, PERT Working Group has been developing a draft rule for ERC trading.⁷³ Development of this rule started with a review of relevant trading rules, guidelines, policies and regulations from the United States. PERT participants are currently formulating a proposal for the draft rule, which is expected to include the substance and form of emission reduction credits; credit use and transfer, including participant and credit eligibility, credit banking; registry, reporting and monitoring rules; and audit and verification procedures.⁷⁴

2.15 BP

The BP Emissions Trading Scheme was the first company scheme to be established, and has been mandatory for all BP Business Units worldwide since January 2000. The BP system runs on a Direct and Equity basis globally across all Business Units for both CO₂ and CH₄. The BP program excludes emissions from purchased power and heat used in operations.

⁷² Reductions of ozone precursors, NO_x, are reported for ozone season and the balance of the year.

⁷³ The most recent draft of the Trading Rule is available on the PERT web site: www.pert.org in the resources section.

⁷⁴ Other issues being discussed in the development of the trading rule include: trading zones (distance), directionality, seasonality, ownership of emission reductions, possible double counting, and interjurisdictional issues.

A group cap is set annually to steer BP towards its greenhouse gas reduction target of a 10% reduction from 1990 levels by 2010. The cap was set initially at the 1998 emissions level. Each Business Unit is given an annual allocation based on 1998 emissions and the group cap for the year and must hold allowances equal to its actual emissions during the year. Business Units can trade allowances with other Business Units.

An allowance is 1 metric tonne CO₂ equivalent. Each allowance has a specific serial number that is used as a tag to identify the vintage year, the Business Unit and country of origin. The compliance period is the calendar year. There is no reconciliation period and no borrowing from future allocations. Banking is allowed but regulated with an initial rule that a maximum of 5% of an individual Business Unit's allocation may be banked.

Each Business Unit is responsible for measuring or calculating its emissions. Standard reporting protocols for carbon dioxide (CO₂) and methane (CH₄) have been established and have been used by the Business Units to collect and report 1990 and 1998 emissions data. Emissions data are verified by external auditors. Annual emissions are calculated using the same reporting protocols.

BP's Integrated Supply and Trading group operates the emissions trading program. It maintains the registry of allowance holdings, registers trades completed through the BP intranet, and receives the reports of greenhouse gas emissions. Bids and offers are placed on an intranet site. Trades are final when the trading manager confirms the transaction. Each Business Unit is provided with a report detailing its trades. This structure keeps the transaction costs of trading low.

Prices are in US dollars. The average price since the program started has been approximately \$12 per metric tonne of CO₂ equivalent. But trades have been made at prices ranging from \$0.50 to \$99.00 per metric tonne of CO₂ equivalent.

Compliance is ensured via management performance contracts. The greenhouse gas allocation for each Business Unit is specified in the performance contract. Progress is reported along with financial data. Business Unit Leader are accountable for meeting their targets on an annual basis.

BP has an interest in some afforestation projects, but none are currently being used to offset their emissions of greenhouse gases. BP is considering the contribution that project-based trading could make in the scheme.

2.16 Shell

Shell's Tradeable Emission Permits Scheme (STEPS) is pilot scheme with the principal aim of raising awareness of emissions trading in the Shell Group. The Shell Group has pledged to cut its overall greenhouse gas emissions by 10% from 1990 levels by 2002. The target for STEPS is a 2% reduction over three years. Both CO₂ and CH₄ are traded in STEPS.

In keeping with the design of the Kyoto mechanisms, participation in STEPS is restricted to companies operating in Annex B countries. Six business units in Australia, Canada, Europe, and the USA are participating in the scheme. They contribute over one third of Shell's emissions from chemicals, refining, and upstream oil, and nearly three quarters of the Group's Annex B emissions. They have absolute reduction targets. Operations where Shell is a joint venture partner are not included in the system.

Shell will increasingly be involved in external emissions trading programs, such as the UK and EU schemes, and expects the internal system to disappear eventually. How and when this will happen has yet to be decided. In the interim, STEPS may be linked to international trading systems.

The scheme distributes allowances to participants based on 1998 emissions. Each year 5% of the allowances issued are withheld and sold at auction to increase trading liquidity. Allowances are valid for the year they are issued and may be banked for subsequent years. Unlimited banking is allowed. Each allowance confers the right to emit 100 tCO₂ eq. The scheme began in January 2000 and will continue in its current form until the end of 2002. The compliance period is the calendar year. A small quantity of project-based credits are expected to be accepted into the system.

Business Units must hold sufficient allowances to cover their actual emissions during the year. They can purchase allowances from other participants or at the auction if their emissions exceed their allocation for that year. Seller liability prevails in all trading transactions (i.e. if a company has sold allowances to another company and is later found to be non-compliant, the buyer may keep the purchased allowances).

An issue with the system, for fiscal and tax reasons, remains the transfer of funds to pay for the allowances. Presently, this is done via "management reporting" with no actual money movements.

STEPS is managed by Shell Energy, Shell's electricity and gas trading organisation. Shell Energy functions as a broker, recorder, and market maker. All trades are channelled through the trading manager, who maintains records of allowance holdings and maintains trading records on the Shell intranet. This is designed to minimise transaction costs. Participating companies need to demonstrate that they satisfy the stringent conditions on their Health Safety and Environment management. At the end of each year, the Trading Manager reconciles emissions and allowance positions. Compliance is assessed and the Trading Manager may impose a fine of three times the average fourth quarter price for each allowance shortfall.

2.17 Chicago Climate Exchange

The Chicago Climate Exchange (CCX) is a voluntary pilot program whose aim is to demonstrate a cap and trade emissions trading program. The design is still being developed.

A “downstream” approach with participation by large emission sources (at least 250,000 tons CO₂e) such as power plants, refineries, factories, and vehicle fleets is contemplated. To-date 33 entities have expressed interest in participating.⁷⁵ The proposed emissions reduction schedule is 2% below 1999 levels during 2002, 3% below 1999 in 2003, 4% below in 2004, 5% below in 2005. Each year 2% of the issued allowances will be withheld and auctioned in “spot” and “forward” auctions with the proceeds returned to each entity on a *pro rata* basis.

The proposed design also allows crediting for a range of offset projects (100,000 tons CO₂e) that encourage micro-level greenhouse gas mitigation actions. Eligible credit creation actions will include: carbon sequestration from forest expansion, and domestic no-till agricultural soils and agricultural tree and grass plantings; electric power generated by wind, solar and geothermal systems activated after 1998; and methane capture and destruction in agriculture, landfills and coal beds.

The program will develop monitoring and reporting guidelines for participants. Failure to hold allowances equal to actual emissions will trigger, as yet unspecified, automatic non-compliance penalties. Work on definition of the tradeable instrument, the mechanics of executing trades, settlement, standard contract terms, accounting and tax treatment, provisions for new entrants, and treatment of jointly owned facilities is at various stages of completion.

The CCX is actively seeking to build links to other emerging greenhouse gas markets.

2.18 Summary

The following table summarises the design choices made by the programs reviewed for this study. Many design features are resolved differently by the different trading programs. Thus, the programs reviewed raise a wide range of possibilities to inform the assessment of the implications of linking trading programs.

⁷⁵ The entities are mainly American although a number of them have operations in other countries as well. The list also includes several firms with headquarters outside the United States.

	Participation	Start, End Date	Sources Covered	Emissions Covered	Absolute or Rate-based Limits
Oregon	M	1997	New energy facilities	CO ₂ emissions, indirect reductions	A
Denmark	M	2001, 2003	Electricity generators, 8 participants	CO ₂ emissions	A
ER-UPT	V	2000	Emission reduction projects in other countries	Multiple gases, indirect reductions	R
United Kingdom	V ¹	2001	Industrial energy users, electricity generators only through projects (8,000)	Direct and indirect CO ₂ emissions	4
Australia	M	2008(?)	Not yet decided	Not yet decided	A
Canada	M	2008(?)	Large final emitters (700 - 900) or broad as possible (800 - 1,000) options	All Kyoto gases under broad option	A
European Union	M	2005	Electricity generation, iron & steel, lime, cement, glass, ceramics, pulp & paper	Direct CO ₂ emissions only	A
France	M ²	2002	Major emitters in 30 most fossil-fuel intensive sectors (1,100 participants)	Direct CO ₂ , possibly indirect	5
Germany	M	2005(?)	Start with large emitters and extend to all sectors	Direct CO ₂ initially, expand to other gases	A
Norway	M	2008	Large industrial sources plus wholesalers of fossil fuel (100 - 200 participants)	All Kyoto gases	A
Slovakia	M	2005, 2008(6)	Combustion sources with capacity > 20Mwh Industrial process emissions	Direct CO ₂ emissions	A(7)
Sweden	M	2005	Same as EU, plus wholesalers of fossil fuels (80 to 90% of total GHG emissions)	Direct CO ₂ , possibly other gases	A
Switzerland	V	2008	(Groups of) companies with a voluntary emissions limitation commitment	Direct CO ₂ from fossil fuel combustion	A(8)
PERT	V	1996	43 projects registered, 8 reviewed, 13 being reviewed (March 2001)	Direct + indirect CO ₂ , CH ₄ and non-GHGs	R
BP	3	2000	All operating units in Annex I countries	Direct CO ₂ , CH ₄	A
Shell	V	2000-02	6 business units in Annex I countries	Direct CO ₂ , CH ₄	A
Chicago Exchange	V	2002, 2005	Companies with emissions over 250,000 tonnes CO ₂ e, 33 entities	All Kyoto gases	A

Notes:

Participation: V indicates that participation is voluntary; M indicates that participation by designated sources is mandatory.

Limits: A indicates that participants have an absolute emissions limit; R indicates that participants have a rate-based emissions limit (emissions per unit of output or activity)

1. Participation in the UK program is voluntary, but strong incentives exist to encourage participation.
2. Participation in the French program would be through voluntary negotiated agreements, but in the event that an agreement could not be negotiated, the government could impose limits on firms.
3. Participation is voluntary for BP, but mandatory for the operating units.
4. The UK program has both absolute and rate-based participants.
5. Both absolute and rate-based limits are proposed for the French program.
6. A pilot phase would begin in 2005, the full program would start in 2008.
7. The allowances allocated would exceed their current emissions for most sources.
8. The emission limitation commitment may be rate based, but the allocation will be an absolute quantity based on projected output with the allocation adjusted *ex post* to reflect actual output.

	Level of Aggregate Cap	Distribution of Allowances	Ability to Use Credits from Emission Reduction or Sequestration Projects
Oregon	Actual less allowable emissions calculated for life of each project		Can only use credits from new projects
Denmark	Drops by 1 mtCO ₂ /yr from 22 mtCO ₂ in 2001 to 20 mtCO ₂ in 2003	Free based on 1994-98 emissions with preference for CHP plants and adjustment to cap	Use of CDM and JI credits planned
ER-UPT	Baseline agreed for each project		Purchases credits from new JI and CDM projects
United Kingdom	Targets in negotiated agreements or absolute caps bid into auction	Free based on target in negotiated agreement or absolute cap bid into auction	Domestic sources can generate emission reduction credits
Australia	Not yet decided	Industry favours free distribution, consultant recommends auction	Will allow use of JI and CDM credits
Canada	Not yet decided	Auction with free distribution to offset loss of capital and for sectors facing international competition	Will allow use of JI and CDM credits
European Union	Not yet decided	Free distribution as decided by each Member State	No
France	Agreements negotiated with participants	Free based on targets in negotiated agreements	Not yet decided
Germany	Not yet decided	Mostly free with some auctioned to provide a price signal. Free portion based on 1990 or 1990-92 emissions	Use of CDM and JI credits should be allowed.
Norway	Target 30% reduction from 1990 emissions	Free allocation equal to 84% of 1990 or 1998 emissions for industry with the rest auctioned	Will allow use of JI and CDM credits
Slovakia	Not yet decided	Free based on emissions during last 3 years	Not decided, but entities will have surplus allowances
Sweden	Not yet decided	Auctioned, but existing CO ₂ tax dropped	Will allow use of JI and CDM credits
Switzerland	15% below 1990 emissions for 2008-2012	Free based on negotiated emissions limitation commitment	CDM and JI credits allowed
PERT	Baseline set for each project		Yes
BP	10% below 1990 emissions by 2010	Free based on 1998 emissions	Not at present, but to be explored
Shell	10% below 1990 emissions by 2002	Free based on 1998 emissions	Not at present, but to be explored
Chicago Exchange	Drops by 1% of 1999 emissions per year from 2% below in 2002 to 5% below in 2005	Free based on 1999 emissions	Yes

	Banking, Borrowing	Compliance Period	Allowance, Credit Unit	Non- compliance Penalty, Safety Valve
Oregon	NA	C	1t CO ₂	Energy Siting Board can impose penalties up to loss of operating permit
Denmark	B ⁶	C	1t CO ₂	Safety valve price of DKK 40/tonne CO ₂
ER-UPT	NA	C	1,000 t CO ₂ e	Purchase contracts presumably include penalties for failure to deliver contracted JI or CDM credits
United Kingdom	B, C ⁹	C	1t CO ₂	Negotiated agreement sources lose 80% tax reduction, absolute cap participants must repay incentive with penalty
Australia	B ¹⁰	C	1t CO ₂ e	Not yet decided
Canada	B ¹⁰	C	1t CO ₂ e	Not yet decided
European Union	B, C ¹¹	C	1t CO ₂	The lesser of Euro 200 per t CO ₂ and twice the average price for 1 January to 31 March of the year
France	B, C ¹²	C	1t CO ₂ e	The higher of the government's reference price for fossil carbon and the highest market price during the year
Germany		C	1t CO ₂ e	Not yet decided
Norway	B ¹⁰	C	1t CO ₂ e	Not yet decided
Slovakia		C	1t CO ₂	Not yet decided
Sweden	B, C, b ¹³	C	1t CO ₂ e	Heavy (unspecified) fines
Switzerland	B, b ¹⁰	C	1t CO ₂	Payment of CO ₂ tax with interest plus sanctions specified in the emissions limitation agreement
PERT	B	C	1t CO ₂ e	Not applicable; voluntary program. Purchase contracts will specify penalties for failure to deliver contracted reductions
BP	B ¹⁴	C	1t CO ₂ e	Business Unit Leader's performance contract
Shell	B	C	100t CO ₂ e	Three times average fourth quarter price
Chicago Exchange	B	C	1t CO ₂ e	Automatic non-compliance penalties yet to be determined

Notes:

Banking: B indicates that banking is allowed; C indicates that cross-period banking into the 2008-2012 period is allowed; b indicates that borrowing is allowed; NA indicates that banking is not applicable

Compliance Period: C indicates that the compliance period is the calendar year

9. Cross-period banking is allowed by participants with absolute caps to the extent that their cumulative emissions are lower than their cumulative cap for the pre-2008 period.
10. Since the program is expected to begin operation in 2008, the issue of cross-period banking into the 2008-2012 period does not arise.
11. The EU proposes that decisions on cross-period banking be left to the Member States.
12. The French proposal allows cross-period banking but with the possibility that the aggregate cap for the industrial sector would be adjusted if the banked units would adversely affect other sectors.
13. Sweden supports unlimited cross-period banking and unlimited borrowing within, but not between, periods.
14. BP limits banking to 5% of the allowances issued to a participant for that year.

3. Issues Raised by Linking Emissions Trading Programs

This section assesses the implications of linking emissions trading programs. Design features for emissions trading programs are considered in turn. Differences across the programs reviewed are noted and the implications of linking programs with different designs are assessed.

3.1 Coverage of the Emissions Trading Program

The coverage of an emissions trading program is determined by the participating sources and the emissions covered. The sources that participate in a trading program depend upon the eligibility criteria set by the program and whether participation is voluntary or mandatory.

3.1.1 Sources Covered

An emissions trading program for greenhouse gases can address energy-related CO₂ emissions, which dominate the greenhouse gas emissions of most countries that will have national commitments, using an upstream, downstream or hybrid design.

- An upstream design is a trading program for the carbon content of fossil fuels consumed in the country with producers and importers of fossil fuels as the participants.
- A downstream design is a trading program covering greenhouse gas, or CO₂, emissions by large, stationary sources, such as fossil-fired generating stations and large industries.
- A hybrid design combines a downstream trading program for large emitters with an upstream program for the carbon content of fuel oil, natural gas and gasoline used in the residential, commercial, small industrial and transportation sectors.⁷⁶

A downstream design typically covers less than 50% of the country's total greenhouse gas emissions. An upstream design can cover up to 90% of a country's total greenhouse gas emissions, often with fewer participants than a downstream program. A hybrid design generally covers roughly the same share of national emissions as an upstream design.⁷⁷

⁷⁶ Other options are also called hybrid designs; for example upstream compliance with allocations to upstream and downstream entities or a downstream trading program for large emitters and efficiency standards for automobiles and other energy consuming products, possibly with tradeable credits for the standards. Such differences in the definition are not important to the argument in this section.

⁷⁷ An advantage of hybrid schemes is that large emitters have a direct incentive to reduce emissions as much as possible, rather than simply an energy price incentive. A disadvantage of hybrid schemes is that mechanisms are needed to avoid double counting of emissions between upstream and downstream participants.

All of the programs reviewed, with the exception of Norway and Sweden, are downstream designs. Sweden favours an upstream design, with a hybrid design if necessary for consistency with the EU Directive. The proposed Norwegian program is a hybrid design. The UK will include upstream participants if they choose to join the scheme, and many are expected to join as direct entrants and on a project basis.

Although almost all of the trading programs are downstream programs, they differ in terms of the categories of emitters covered. The Danish program is limited to electricity generators and the EU program would cover only specific sectors initially. The French and Swiss programs would be available to all industrial groups with negotiated agreements.⁷⁸ The Slovak program would apply to all sources that meet the size criteria.

Thus if two or more programs are linked, they may cover different categories of sources. The cost savings due to emissions trading arise from differences in control costs among participants. In general the more diverse and the more numerous the participants, the larger the potential cost savings. Thus, linking trading programs that cover different categories of sources should increase the potential cost savings.

Differences in the design of the trading program, or in the sectoral coverage of a downstream design, should increase the potential cost savings. Such differences should not affect environmental integrity nor raise issues of institutional compatibility. However, if an industry sector is part of the program in one country but excluded from the trading program in another country it may raise concerns about equitable treatment of comparable sources.

3.1.2 Voluntary or Mandatory Participation

Participation is mandatory for specified participants in most domestic trading programs (e.g., Denmark, EU, Canada, France, Norway, Slovakia and Sweden) and in the BP's company program.⁷⁹ Participation in the UK and Swiss programs is voluntary, but encouraged by strong incentives.⁸⁰ Participation in the ERU-PT, Shell, PERT, and Chicago Climate Exchange programs is voluntary.

Participants in both voluntary and mandatory programs are required to hold valid allowances or credits equal to their emissions. Voluntary and mandatory programs will have both buyers

⁷⁸ The UK program would also include direct participants. Participants in the Swiss program must meet a size threshold.

⁷⁹ While the decision by BP to establish a corporate emissions target and emissions trading program is voluntary, participation in the trading program is mandatory for all business units.

⁸⁰ Participants have a powerful incentive to join the UK scheme in the form of an 80% tax rebate or incentive payments from the government if they achieve an agreed target. Participants in the Swiss program are exempt from the CO₂ tax if they meet their emissions limitation commitment.

and sellers as long as the "business-as-usual" emissions for all participants exceed the allowances issued.

In some voluntary programs, where participants are able to establish their own targets, such as PERT, demand is low relative to the supply. This is because participants prefer to be sellers rather than buyers and so often adopt targets that they plan to achieve mainly or exclusively through internal emission reduction actions. The same situation may occur in the proposed Slovak program, which is expected to provide allocations in excess of actual emissions to most participants.⁸¹

Linking two or more trading programs integrates the demand and the supply of the individual programs, which should result in an overall market price that differs from the prices in the separate programs. Some buyers (sellers) will pay (receive) higher prices for their allowances/credits, while others will pay (receive) lower prices, but overall compliance costs should fall. Thus, linking trading programs should reduce the overall compliance cost, but change the distribution of the cost among participants.

If one of the programs being linked is based on voluntary participation, leakage -- shifting emissions to a similar source without an emissions cap through deliberate action or market responses -- could increase.⁸² Government programs typically try to ensure participation by all sources above a minimum size in the affected sectors. Voluntary programs typically achieve much lower coverage, so the scope for leakage is greater unless non-participants are covered by other policies, such as negotiated agreements or an emissions tax. Linking a voluntary program with a mandatory program may provide an incentive for deliberate action to increase leakage and so generate more allowances/credits for sale to participants in the mandatory program.⁸³

In short, the voluntary or mandatory nature of participation in a program in itself does not restrict the ability to link trading programs. However, linking a voluntary program with a mandatory program may provide an incentive for deliberate action to increase leakage. Although linking trading programs reduces the total compliance cost, the change in the distribution of that cost may raise equity concerns.

⁸¹ The Slovak program would be mandatory for sources that met the specified criteria.

⁸² If participation in the trading program increases the cost of the goods or services produced, sales by participants should decline while sales by firms outside the program should rise thus increasing the emissions of the firms outside the program. A participant in a trading program with a defined allocation, baseline or negotiated agreement, whether absolute or rate-based, may be able to reorganize their operations, by subcontracting to a non-participant for example, so that some of the emissions are transferred to non-participants. Such deliberate action frees up allowances/credits for sale but increases leakage.

⁸³ Although it will not be the case in practice, assume that BP's refining operation in the UK participates in both the UK scheme with an absolute cap and in the BP program. By shifting some refining activity to a BP refinery in another country and importing the products, BP's UK operation could sell allowances to other participants in both the UK scheme and the BP program while total emissions have not changed (indeed total emissions might rise due to the extra transport of the products).

3.1.3 New Sources and Shutdowns

Some programs make provision for accepting new participants as long as the new sources meet specified criteria, usually an industry sector and a minimum size. The European Commission required the Danish government to commit to providing new producers with free allowances based on objective and non-discriminatory criteria. The UK scheme, which allows any sector and any size of participant, plans to increase the aggregate cap by the quantity of allowances distributed to the new sources. The ability to increase the aggregate cap may be constrained after 2008 when countries have national commitments under the Kyoto Protocol.

If the allowances are auctioned (as is proposed in Canada, Norway and Sweden for at least some of the allowances) new sources are treated the same as existing participants. However, if the program distributes allowances *gratis*, then a decision must be made on how to treat new sources. The treatment of new sources is not yet clear for most of the programs reviewed. However, it can range from having to purchase all of the allowances/credits needed (Oregon) to provisions that give new sources allowances/credits free (Denmark).

The treatment of new sources affects the level of demand and supply and hence allowance/credit prices. New sources could have a significant impact if they are very large, as is the case in the UK where electricity generators may choose to participate through projects or in the EU scheme where entire new sectors may be added by Member States. Uncertainties over allowance/credit prices in a program once large new sources enter could be a concern for countries considering linking with it.

Few of the programs reviewed specify how shutdowns will be treated.⁸⁴ Where the distribution is based on a negotiated agreement (France, Switzerland), is revised based on output or emissions (Denmark), or is tied to specific purposes (Canada) the quantity of allowances received by a facility that shuts down quickly falls to zero. The UK program specifies that closures will be removed from both the baseline and targets of direct participants.

Giving new sources free allowances or requiring them to purchase the allowances they need does not affect economic efficiency. Price uncertainty due to potential large new entrants could reduce economic efficiency. Unless the free allocations to new sources include "hot air", the treatment of new sources does not affect environmental integrity. Linking programs that differ in their treatment of new sources may raise equity concerns.

3.1.4 Restructuring by Participants

Acquisitions by trading program participants increase their actual emissions and divestitures reduce their actual emissions. Some programs adjust the quantity of allowances distributed to participants for acquisitions and divestitures. In the UK program the targets for direct

⁸⁴ The treatment of shutdowns is not an issue if all allowances are auctioned.

participants are adjusted for significant acquisitions and divestitures from other direct participants.⁸⁵ The allocations to operating units in the BP program are adjusted for acquisitions and divestitures that involve annual emissions in excess of 20,000 metric tonnes of CO₂ equivalent. In the Swiss program the target established by a negotiated agreement is adjusted for changes to the composition of a group.

Differences in how programs deal with restructuring do not preclude linkages. It is unlikely that there would be any economic efficiency or environmental integrity effects due to linking programs that deal with restructuring differently. However, linking programs that treat restructuring differently could raise questions about the equity of the provisions in one or more of the linked programs.

3.1.5 Opt-in Provisions

Some programs have "opt-in" provisions that allow sources not required to be part of a mandatory trading program to join voluntarily. Sources typically would not join a mandatory trading program unless they expect to benefit from that decision. A source that is able to make relatively large emission reductions at relatively low cost could benefit from the sale of those reductions.⁸⁶ A source that receives some "hot air" in its allocation would also benefit from joining the program.

Assuming that two programs with mandatory emission limits are linked, a source that wishes to opt-in would probably be eligible to join only the program in its jurisdiction. Thus differences in the opt-in provisions would not change the ability of a source to join the relevant trading program. However, linking two trading programs is likely to increase the market price for one jurisdiction and reduce it for the other. Thus the incentive to opt-in would rise in one jurisdiction and fall in the other. The net impact on economic efficiency, if any, can not be predicted *a priori*.

All participants in programs with voluntary participation have chosen to opt-in. If two such programs are linked the ability to join either program does not change. However, a change in the market price due to the program linkage may increase the incentive to join one of the voluntary programs and reduce the incentive to join the other.

If a program with voluntary participation is linked to a program with mandatory participation, a source might have the choice of using the opt-in provision of the mandatory program or of joining the voluntary program. If the program rules effectively dictate which program a source must join, the impact is determined by the provisions of the relevant program. If the

⁸⁵ The target is adjusted if the change exceeds the lesser of 25,000 metric tonnes of CO₂ equivalent or 2.5% of the verified baseline emissions at the time of the auction.

⁸⁶ If non-participants are also able to generate credits through emission reductions, a non-participant could compare the benefits of opting in, making the reductions and selling the surplus allowances with making the reductions and selling the credits generated.

program rules allow a company to choose which program to join, it could select the more attractive option -- the opt-in provision of the mandatory program or membership in the voluntary program.

In summary, differences in the opt-in provisions would not preclude linkages among emissions trading programs. Linking programs with different opt-in provisions could lead to higher total emissions if the provisions of one program allocate excess allowances to new participants and linking the programs leads to higher prices for those participants. Differential treatment of comparable sources may also raise equity issues when programs are linked.

3.1.6 Relationship between the EU and Domestic Trading Programs

The proposed coverage of the EU trading program and that of the domestic trading programs of various Member State programs (Denmark, UK, France, Germany, and Sweden) and other countries that might be linked with the EU program (Norway, Slovakia, and Switzerland) differs. The Danish program, if it is extended beyond 2004 in its current form, would have more limited coverage than proposed for the EU scheme. All of the other country programs propose broader coverage than the sectors specified by the EU scheme for 2005, but the differences could be much smaller by 2008.

Countries that have domestic programs with broader coverage than specified by the EU might choose to maintain the domestic program for sources outside the sectors specified by the EU program. In other words there would be two domestic trading programs for different groups of participants -- the EU program sectors and the remaining sources. In that case it may be possible to link the broader domestic trading program with the EU program. Depending upon the rules for the EU program, it may be easier to establish such a link if the broader domestic program is a buyer from, rather than a seller to, the EU program. An alternative during the years prior to 2008 is for the Member State to show that sectors required to participate in the EU program are making an "equivalent effort" under the domestic program and to put off joining the EU program until 2008.

There are two further complications in the case of the UK program. First, participation in the UK scheme is voluntary while participation by companies in the specified sectors is intended to be mandatory for the EU program. Thus, UK firms in the specified sectors might need to join the UK scheme to be exempted from the EU emissions trading program. Second, electricity producers are among the sources to be included in the EU program, but they will participate in the UK scheme on a project basis until 2006. It is not clear what the rules are for participation on a project basis are or whether this would qualify as an "equivalent effort" and so exempt the sector from the EU program during the 2005-2007 period.

The differences in coverage between the EU program and domestic programs of Member States and other countries are likely to diminish over time as mandatory coverage of the EU program grows. Where a country prefers broader coverage for its domestic emissions trading program at least three options appear feasible. First, the EU Directive might allow Member

States to add sectors to the domestic component of the EU program. Second, the additional sources could be included in a separate domestic trading program linked to the EU program by an agreement to mutually recognise each scheme's allowances. Third, the additional sources could be included in a separate domestic trading program and the allowances of that program could be treated as project credits by the EU program.

3.1.7 Emissions Covered

The Kyoto Protocol applies to emissions of six categories of greenhouse gases -- carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons, (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF₆). Energy-related CO₂ emissions dominate the total emissions in most countries that will have emissions limitation commitments. The Kyoto Protocol adopts the 100-year Global Warming Potentials (GWPs) as published by the Intergovernmental Panel on Climate Change to establish equivalence among emissions of the different gases.

The programs reviewed differ in terms of their coverage of greenhouse gases. The Oregon, Danish and Swiss programs apply only to energy-related CO₂ emissions. The EU and Slovak proposals cover all CO₂ emissions by affected sources, although the EU proposes to expand coverage to other gases over time. The BP and Shell programs cover CO₂ and CH₄ emissions. The UK allows participants to choose coverage of CO₂ emissions only or all greenhouse gases. The proposed Canadian, French and Norwegian programs cover all of the greenhouse gases. PERT covers emissions of CO₂ and CH₄ as well as emissions of other pollutants. Where multiple gases are covered, the equivalence of greenhouse gas emissions is calculated using the 100-year GWPs.

Linking programs that differ in terms of the gases covered could lead to larger cost savings. The available evidence suggests that the marginal costs of control differ for the different gases. These differences in marginal costs should yield larger cost savings. Differences in the gases covered should not pose any difficulties in linking trading programs, but may raise concerns about differences in treatment of comparable sources. Changes in the gases covered may cause governments to consider the possible impacts on net allowance flows.

3.1.8 Coverage of Indirect Emissions

Most of the programs apply to the direct emissions of the participant.⁸⁷ Participants in the UK program are responsible for the indirect emissions associated with their electricity consumption. This represents less than half of the total emissions due to electricity generation

⁸⁷ This is the case for the Kyoto Protocol as well.

and has complicated participation by electricity generators in the UK trading system. PERT also recognises indirect emission reductions for actions to reduce electricity use or increase electricity generation by renewable sources.

Links with programs that recognise indirect emissions reductions can lead to double counting of emission reductions under some circumstances and so undermine environmental integrity. Many of the indirect reductions claimed by PERT participants occur at generating units operated by Ontario Power Generation Inc. (OPG). If OPG were to join the Chicago Climate Exchange and its actual emissions were below the assigned cap, it could sell its surplus allowances. But part of the surplus represents indirect emission reductions due to electricity conservation and renewable generation projects registered with PERT.

Imports of French electricity by the UK provide another possible example although one that is unlikely to be problem in practice.⁸⁸ Participants in the UK scheme are responsible for the emissions associated with the electricity they use with the emissions being calculated on the basis of the UK average carbon intensity for electricity. The calculated emission reductions from any decrease in electricity consumption in the UK are not realised on the imported electricity because the carbon intensity of French electricity is much lower than that of UK electricity.⁸⁹

In principle potential double counting can be avoided by having each generator bundle greenhouse gas allowances corresponding to its actual emissions with the electricity it sells. Participants in a trading system responsible for the emissions associated with the electricity they use would receive the bundled allowances with the electricity they buy. Possible double counting due to projects that displace electricity generation remains. Other forms of indirect emission reduction, such as substitution of wood for steel or cement, also can not be handled in this way.

Linking programs that recognise indirect emission reductions could undermine environmental integrity under some circumstances. It is difficult to know how significant such impacts might be and this would need to be considered when deciding whether to link the schemes.

3.2 Emissions Targets

The environmental effectiveness of an emissions trading program is determined by the aggregate emissions of the participants. The aggregate emissions may be related to output or

⁸⁸ Imports are a small share of total electricity consumption in the UK. Current imports are near the capacity of the transmission line, so imports are unlikely to rise unless the transmissions capacity is increased.

⁸⁹ If imports remain roughly constant, as is likely because of surplus capacity and lower prices in France, then using a UK carbon intensity calculated without the imported electricity should be accurate. If imports change in proportion to total consumption, then the carbon intensity of UK electricity should include the emissions associated with the imported electricity.

be capped in absolute terms. Depending upon the design of the program, a baseline must be established for each participant or allowances must be distributed to participants.

3.2.1 Aggregate Cap with "Hot Air"

If the aggregate emissions cap exceeds the "business-as-usual" emissions of the participants, the difference is called "hot air". Some trading programs for pollutants other than greenhouse gases have been implemented with an aggregate cap that exceeds "business-as-usual" emissions initially to facilitate the transition into the trading program. These programs have included restrictions on the allowance life and/or banking to minimise the environmental consequences of the extra allowances.

Of the programs reviewed, the proposed Slovak program is most likely to include "hot air" in the aggregate cap. It is difficult to determine whether the aggregate cap includes "hot air" even after it has been set because the "business-as-usual" emissions can never be observed.⁹⁰ Although it is not possible to know whether the cap for the Danish program includes "hot air", the use of the saving limit to restrict banking during the initial years is an effective way to minimise the environmental consequences of the extra allowances.

If the aggregate cap includes "hot air" the targets for some, perhaps all, participants will include "hot air". If the aggregate cap leads to a reduction of aggregate emissions, it is possible that the targets for some participants include "hot air". In that case the impact is a windfall gain to the participants whose targets include "hot air", but the environmental impact of the scheme remains intact. Hot air is a potential issue both for "cap and trade" and "baseline and credit" programs.

If one of the programs being linked includes "hot air" in the aggregate cap, it could reduce the environmental integrity. This could happen if the program with "hot air" had restrictions on allowance life or banking that would cause some of the allowances not to be used, but the link with another program then enabled some of those allowances to be used. Then aggregate emissions would rise as a result of linking the programs. Linking the programs also may cause participants to compare targets and so raise questions about equitable treatment of similar sources.

3.2.2 Stringency of the Targets

The stringency of the overall emissions target will vary across programs for various reasons. This will affect the stringency of the targets for, and compliance costs of, participants. Stringency can be measured in various ways, including percentage reduction from historic or

⁹⁰ In principle the price of allowances in a program with "hot air" in the aggregate cap would be zero. But with banking the price will reflect the forecast price at some future date when the "business-as-usual" emissions rise or the aggregate cap falls enough to eliminate the "hot air".

projected emissions and marginal cost of compliance.⁹¹ For the purposes of this analysis the marginal cost of compliance is used as the measure of stringency.

Data on the marginal cost of achieving the aggregate emissions cap or baseline are not available for any of the programs reviewed and only limited data on allowance/credit prices is available from early trades.⁹² Consequently, it is impossible to know how stringent the targets in existing programs are. It is clear, however, that the marginal cost of compliance will differ across the programs and over time.

Programs that differ in terms of the stringency of their targets will have different marginal compliance costs since we have chosen to define stringency in this way. Differences in marginal compliance costs indicate that linking the programs could lead to costs savings. The market price after linking the programs should be higher than that of the less stringent program and lower than that of the more stringent program.

If programs of different stringency are linked, the buyers in the more stringent program benefit but the sellers receive lower prices for their surplus allowances/credits. Similarly, the sellers in the less stringent program benefit from the higher prices for their surplus allowances/credits, while buyers face higher compliance costs. Thus linking programs of different stringency produces winners and losers in each program, which may raise equity issues.

Consistency in the stringency of targets may be self-regulating once programs are linked. Once trading among linked programs begins, countries that have set relatively easy targets will see net exports from their registries. The governments of net exporting countries will then have empirical evidence to argue for setting tougher targets for participants in the future to provide equitable treatment for other sectors of the economy. At the same time industries in net importing countries will lobby their governments for more lenient targets to reduce their compliance costs. Thus regular review and revision of targets in linked programs can help reduce “unfair target” concerns. The Danish, UK and EU schemes include explicit mechanisms to review the stringency of the targets.

On the other hand, frequent revision of targets creates uncertainty and makes it more difficult for companies to plan their emission reduction investments and develop their trading strategies. Balancing the potential equity improvements against the cost due to uncertainty

⁹¹ With no trading the marginal cost of compliance is likely to differ across sources. It is those differences that are the sources of the cost savings due to emissions trading. With trading, the market price should reflect the marginal cost of achieving the aggregate target.

⁹² The \$0.85 per ton of CO₂ plus 4.286% for contracting and selection costs specified by the Oregon offset program could be considered the marginal cost of compliance for that program. Prices for the first round of projects under the ER-UPT program are approximately US\$7.50 per tonne CO₂. Natsource reports the mid-market bid/offer price for 2003 in the Danish and UK programs as US\$3.78 and US\$8.46 per metric ton of CO₂ respectively. The French government has adopted a target reference price for avoided fossil carbon starting at about US\$5.00 to US\$7.50 per metric ton of CO₂.

suggests periodic revision of targets at specified stages in the program life with at least 3 to 5 years between revisions.

Differences in the stringency of the targets of the respective programs indicate a potential for economic benefits from linking the programs. Differences in the stringency of the targets do not compromise overall environmental integrity nor raise issues of institutional compatibility. However, differences in stringency raise equity concerns. These concerns may be addressed by periodic revision of targets.

3.2.3 Absolute or Rate-Based Targets

The target, whether a cap, negotiated agreement or baseline, that applies to a participant in an emissions trading program may be expressed in absolute terms -- total emissions during a specified period -- or as an emissions rate -- emissions per unit of output or activity. If participants have absolute targets (tonnes of CO₂ equivalent emissions during the compliance period), total emissions should not exceed the sum of the targets of the participants. If participants have rate-based targets (kg of CO₂ equivalent per unit of activity during the compliance period), total emissions will vary with activity, although if the targets are set properly total emissions will be reduced from what they would have been.

A rate-based target provides an economic incentive to increase output, and hence emissions. The magnitude of this impact depends upon a number of factors such as the value of the allowances/credits earned relative to the value of the additional output.⁹³

Most domestic trading programs plan to use absolute targets largely because the national emissions limitation commitments under the Kyoto Protocol are absolute amounts. The UK program has both an absolute and a rate-based sector with a "gateway" to ensure that there is no net inflow of rate-based credits to the absolute sector.

The rate-based systems reviewed -- ERU-PT, PERT, the rate-based sector of the UK scheme, France and Switzerland -- calculate emission reductions during the compliance period as absolute amounts once the output is known. In each case the emission reduction is calculated *ex post* after verification of emissions and output levels as the difference between the projected emissions (based on actual output levels) and actual emissions.⁹⁴ When rate-based

⁹³ The magnitude of the impact clearly is an empirical question. And the magnitude will clearly depend on the value of the allowances/credits, the quantity of additional allowances/credits earned per unit of extra output, and the value of a unit of additional output. These amounts will be affected by the program design and will change over time. The only analysis of the magnitude of such an impact of which we are aware is Dallas Burtraw, Karen Palmer, Ranjit Bharvirkar and Anthony Paul, *The Effect of Allowance Allocation on the Cost of Carbon Emission Trading*, Discussion Paper 01-30, Resources for the Future, Washington, D.C., August 2001.

⁹⁴ The Canadian program would also have a rate-based component for industries competing primarily with producers in non-annex B countries. The Swiss program provides an *ex ante* allocation based on forecast output but adjusts the allocation *ex post* based on actual output.

programs calculate emission reductions as absolute amounts, the traded units will be the same, so this will not create problems for links between such programs.

If participants in a rate-based program are able to sell allowances/credits to participants in an absolute program, an increase in their output, if they are below their emission rate target, will generate more credits and inflate the total quantity of allowances available to participants with absolute targets.⁹⁵ Thus allowing the sale of credits from rate-based programs into absolute programs could lead to a smaller overall emission reduction. The main issue when linking a rate-based program with an absolute program is removing the incentive such a link would create to increase activity (and emissions) in the rate-based program.

A gateway to restrict the net inflow from the rate-based program can address this concern. The net inflow to the absolute program, as in the UK, may be set to zero. A positive net inflow might be allowed if the rate-based program was able to demonstrate that it had achieved an absolute reduction greater than that of the absolute program.⁹⁶

In summary, linking programs with rate-based and absolute targets is feasible, but it may create an incentive for rate-based participants to increase their output and emissions, thus reducing the expected environmental gain. This environmental goal can be protected by a gateway to limit the flow of rate-based allowances/credits to participants with absolute targets. The difference in the nature of the targets for similar entities may raise equity concerns.

3.2.4 Distribution of Allowances/Credits

Allowances for an emissions trading program may be distributed free of charge, by auction, or a combination of these methods.⁹⁷ The distribution of allowances to participants differs widely across the programs reviewed.

Denmark, Slovakia, BP, Shell, and the Chicago Climate Exchange distribute allowances to participants at no cost based on absolute targets.⁹⁸ Participants in the French and Swiss

⁹⁵ Each additional unit of activity earns credits equal to the difference between the baseline emission rate and the actual emission rate, but results in emissions equal to the actual emission rate. The credits can be sold to the absolute sector, thus providing an incentive to increase activity, which increases emissions.

⁹⁶ Assume, for example, that the absolute program had a target of a 10% reduction from the base year emissions during a given compliance period. And assume that the rate-based program achieved a 12% reduction from the base year emissions during the same compliance period -- an absolute reduction of total emissions by 12%. Then the rate-based program has made a greater contribution to the environmental objective and a net inflow might be allowed subject to a quantity constraint that ensured an absolute reduction of at least 10%. The calculation would need to be made on a cumulative basis over the life of the two programs to ensure a net environmental benefit.

⁹⁷ In principle allowances could be distributed to persons or entities other than those required to have allowances equal to their emissions. All of the programs reviewed that propose to distribute allowances free, plan to distribute them to the participants in the trading program -- the entities required to have allowances for their emissions. The Canadian program might distribute some allowances to non-participants that suffer capital losses as a result of introduction of the system.

programs negotiate emissions limitation commitments and receive allowances equal to those commitments free. The Climate Change Levy Agreement participants in the UK program will receive allowances equal to any reduction in emissions they have achieved relative to their targets. Most of these French, Swiss and UK participants are likely to have rate-based targets.

The UK will conduct an auction in which it will pay entities to adopt absolute caps. These "direct entry" participants receive their annual allocation of allowances free at the beginning of the program (April 2002) and in subsequent years as soon as they provide verified emissions data for the previous year. Payments are made annually after compliance with the cap for the previous year has been established.

Germany proposes that most of the allowances be distributed free, but with a portion of the total sold by auction to obtain an early price signal. Canada and Norway propose a combination of an auction with some free distribution.⁹⁹ Sweden favours an auction of the allowances, subject to harmonisation with the practices of other EU member states.¹⁰⁰

In principle a participant should make the same emission reduction decisions regardless of whether the allowances are received free or are purchased.¹⁰¹ However, a free distribution constitutes a wealth transfer to the recipient and the increased wealth may alter the firm's behaviour.¹⁰²

Credits are awarded for emission reductions or sequestration relative to a baseline. The entity implementing the emission reduction or sequestration action incurs the associated costs, but the credits are awarded free although some programs charge fees or costs for the process. Sellers in PERT, ERU-PT and Oregon Offset programs earn credits for implementing emission reduction or sequestration actions that meet the specified criteria.¹⁰³ The UK program also will allow entities to earn credits for implementing approved emission reduction actions within the UK.

⁹⁸ The Chicago Climate Exchange proposes to withhold 2% of the allowances allocated to each participant and to auction those allowances. The auction revenue would be returned to the participants *pro rata*. In effect 100% of the allowances are distributed free. The purpose of the auction is to ensure a minimal level of liquidity and price discovery rather than to distribute the allowances.

⁹⁹ In Canada the portion distributed free could be well over half initially, but would decline over time.

¹⁰⁰ In both Sweden and Norway the auction would replace existing CO₂ taxes.

¹⁰¹ Regardless of how the allowances are acquired, the firm should consider the opportunity cost (current market value) of the allowances in its decisions.

¹⁰² The significance of the wealth effect will depend upon the market price and the number of allowances/credits received free relative to the equity of the firm. Unless the firm is highly emissions intensive (so that it gets a large quantity of allowances for its size) and the market price is high, the wealth effect is likely to be negligible.

¹⁰³ The baselines for credit creation and the negotiated agreements may be defined as absolute quantities (metric tonnes of emissions per compliance period) or as emission rates (kilograms of emissions per unit of activity). In all cases the credits issued represent an absolute quantity -- metric tonnes of CO₂ equivalent emissions reduced.

Differences in how allowances/credits are distributed by different trading programs do not affect the ability to link the programs. However, participants who must buy their allowances while competitors in a linked program receive allowances free may feel they are being treated unfairly and seek to have their distribution method changed.

3.3 Operational Rules

The operational rules define how the emissions trading program operates. They cover the nature of the allowance/credit, the start date, compliance period, monitoring requirements, and registry.

3.3.1 Nature of the Allowance/Credit

The allowance or credit used by the programs being linked must be compatible. Every program where the allowance or credit has been specified has adopted a definition of 1 metric tonne CO₂ equivalent, except the Shell program where the unit is 100 metric tonnes CO₂ equivalent and the Dutch ERU-PT program where one ERU is 1,000 tCO₂. Programs that cover multiple greenhouse gases calculate the CO₂ equivalent of those gases using the 100-year GWPs of the Intergovernmental Panel on Climate Change.

A program may limit the life -- the period during which it can be used for compliance -- of an allowance/credit. The allowance/credit life can be limited by defining the life as a fixed time period, such as five years, or by canceling a fraction of the banked allowances/credits. Most of the programs reviewed have not addressed this issue explicitly, but many do so implicitly through the life of the program itself and the banking rules.¹⁰⁴ Linking programs that have different lifetimes for their allowances/credits should not be a problem as long as the remaining validity of an allowance/credit is clear to the buyer.

However, linking programs that have different lifetimes for their allowances/credits could have environmental integrity implications if one of the programs has an aggregate target that includes "hot air". Such a program might have a declining target and a short (less than 5 years) allowance/credit lifetime to ensure that actual emissions start to fall. If such a program is linked with one where allowances/credits have an unlimited lifetime, it could lead to immediate use of the allowances/credits with the short lifetime and banking of those with an unlimited lifetime leading to higher aggregate emissions than anticipated. It is not possible to tell whether this potential concern is relevant for any of the programs reviewed.

¹⁰⁴ The French proposal suggests that an annual deduction of x% (x is not specified) be applied to banked credits, but that the government sell these credits. This provision is intended to improve market liquidity rather than to limit the credit life.

The allowances issued by and the credits approved by the administrator of a government program for use by participants to comply with their obligations constitute a legally defined asset. The allowances or credits used in industry programs are accepted by the participants, but they have no value outside the program unless they are recognised by a government as valid for meeting some obligation. The emission reductions documented by participants in industry programs become credits that can be used for compliance with obligations of participants in a government program only after they have been accepted by the administrator of the government program.

Linking government programs requires the administrators of the linked programs to accept the allowances/credits of the other program(s) toward compliance with the obligations of their program participants. Thus, when linking mandatory domestic programs the administrators may want to establish minimum standards that the allowances/credits from other programs must meet. When linking industry trading programs, mutual recognition of the allowances/credits is the most likely approach.¹⁰⁵ The settlement systems used by BP and Shell make it difficult for participants in those programs to buy or sell allowances/credits directly with participants in other trading programs.

A voluntary industry program based on emission reduction or sequestration actions could be linked to a mandatory domestic program by establishing criteria and an approval process for the emissions reductions due to those actions. The rules of a domestic program are likely to supercede those of an industry program which have no legal basis. However, just as voluntary agreements can be used as a basis for emission limits, governments may decide to accept voluntary limits taken on by the company as valid emission limits under the domestic emissions trading program.

In summary, all of the programs reviewed define the allowance/credit in a similar way, so this is not a barrier to possible links. The legal properties of the allowance/credit differ across programs, especially between government and industry programs. Similar (government to government or industry to industry) programs can be linked despite differences in the legal properties of the allowances/credits through mutual recognition, perhaps with adjustments. An industry program based on emission reduction or sequestration actions could be linked to a mandatory domestic program by establishing criteria and an approval process for the emissions reductions due to those actions.

3.3.2 Start Date and Credit for Early Action¹⁰⁶

¹⁰⁵ It is conceivable that the administrators would agree to exclude or discount some allowances or emission reductions from one of the programs to ensure greater comparability. However, this would depreciate assets (allowances or documented emission reductions) held by participants in one program. This loss of assets would need to be weighed against the benefits of participating in a larger market.

¹⁰⁶ Note that "early action" means an action implemented prior to the start of the program. The term is often used to mean an action implemented prior to 2008.

Every program must set a date from which emission reductions can generate credits and/or allowances must be held to cover actual emissions. The programs reviewed have start dates ranging from 1996 (PERT) through 2008 (Canada, Norway, Switzerland). Consistency of start dates is not essential from an environmental perspective since the impacts of greenhouse gas emissions persist for a long time. Consistency of start dates also is not necessary for institutional compatibility.

The programs reviewed differ in terms of the recognition they give for emissions reduction actions implemented prior to the start of the program's first compliance period. The choice of an historic base period for the establishment of a participant's target or its allowance allocation automatically recognises any emission reductions since that time. Germany proposes 1990 or 1990-92 as a base period. The Confederation of Norwegian Business and Industry has proposed that firms be allowed to choose either 1990 or 1998 as their base year. A study for the Australian Greenhouse Office concludes that historic emissions data are an inadequate basis for allowance allocation, so some future year would need to be used.¹⁰⁷

Other programs may recognise early action in negotiating emission limits with participants (e.g., Denmark's allocation process favours generators that have already converted to combined heat and power) or in negotiations over both limits and base periods (e.g., UK Climate Change Agreement participants and French voluntary agreements). Regardless of how recognition for early action is implemented, participants in the program with the more restrictive treatment may feel they are not being treated fairly if programs with different provisions are linked.

In short, consistency of start dates is not a barrier to linking trading programs. But differences in the treatment of early reduction actions may be considered inequitable by the entities subject to the more restrictive requirement.

3.3.3 Compliance Period and Compliance Deadline

The compliance period is the period for which entities must comply with their mandatory obligations/voluntary commitments. The compliance period could range from a few months to several years, but all of the programs reviewed for which this information is available have adopted the calendar year as the compliance period.¹⁰⁸ In any case, differences in the compliance period are unlikely to be a source of institutional incompatibility.

Participants are usually required to report their actual emissions within a specified period after the end of the compliance period. Then they may be allowed an additional period of time, a

¹⁰⁷ The Allen Consulting Group, *Greenhouse Gas Emissions Trading: Allocation of Permits*, Report to the Australian Greenhouse Office, Canberra, August 2000, p. 57.

¹⁰⁸ The Swiss program requires participants to retire allowances annually, but assesses compliance for the 2008-2012 period as a whole.

grace period, within which to purchase allowances/credits if necessary to establish compliance. The combined reporting and grace periods determine the compliance deadline. The compliance deadlines range from none (BP) to 3 months (most common) for the programs reviewed.

Participants in a program with a later compliance deadline or a longer grace period could buy (sell) allowances/credits before participants with an earlier compliance deadline if they think the price will be lower (higher) then. Financial markets will make it possible to buy allowances/credits of various vintages from various programs years in advance so different compliance deadlines should not create an advantage/disadvantage for participants of different programs.

3.3.4 Monitoring Requirements

Alternative monitoring systems with very different costs and levels of accuracy are available for greenhouse gases. Thus monitoring costs for participants in different systems could be substantially different.

The monitoring system and the associated costs are a requirement for the participants of each program. Monitoring costs are fixed for the participant so they should not affect trading activity.¹⁰⁹ The same is true of the cost of independent verification where this is required for credits or emissions. Those costs may differ among participants and may change over time, but they do not depend upon the quantity of allowances/credits purchased or sold and so should not affect trading activity.¹¹⁰

Linking emissions trading programs with different monitoring requirements should not affect trading decisions. Since trading decisions are not affected, the potential cost savings due to linking the programs do not change. Thus, differences in monitoring requirements should not affect economic efficiency.

Conceptually the accuracy of a monitoring system can be interpreted as the difference between the observed reading and the corresponding true value.¹¹¹ The average difference between the observed value and the true reading is an indicator of the accuracy of a monitoring system. If for each monitoring system the observed value neither overstates nor understates the true reading on average, then it could be argued that differences in the accuracy of two monitoring systems should have no impact on environmental integrity.

¹⁰⁹ To the extent that the higher monitoring costs are due to the emissions trading program, rather than alternative approaches to regulating greenhouse gas emissions, they reduce the net cost saving due to trading.

¹¹⁰ The monitoring costs depend upon the type of monitoring system installed. The cost of installing, operating and maintaining the monitoring system does not change if the firm decides to buy or sell allowances/credits.

¹¹¹ The true value can not be determined without some margin of error, so the accuracy of a monitoring system can not be determined without some margin of error.

However, all participants have an incentive to observe lower values for their actual emissions. To the extent that some bias can be introduced into the observed values, a less accurate monitoring system increases the reward for such action. It is often possible to bias the monitoring data by choosing when samples are taken or by adjusting the operations to reduce emissions when they must be monitored. Lower observed values under report the source's actual emissions and allow it to sell more allowances/credits to other participants to cover their actual emissions thus reducing the environmental integrity.

Differences in monitoring requirements should not affect economic efficiency because trading decisions should not be affected by the cost of the monitoring system required. But if linking trading systems raises the market price for participants with less accurate reporting systems, they have a larger incentive to bias their observed values and so reduce environmental integrity.

3.3.5 Registry Provisions

To ensure that the market functions smoothly, each trading program must have a registry that, at a minimum:

- records the allowances/credits held by each market participant;
- records transfers of allowances/credits between market participants quickly;
- allows anyone to view publicly accessible information, such as allowance/credit holdings; and
- is tamperproof.¹¹²

Registries hold the information buyers need to be sure of the validity of their purchase and are the location where transfers take place (although transactions take place outside the registry, the allowances will not exist outside of the registry). Beyond this, registries can be used for other purposes, such as compliance checking (if they hold emissions data) and constraints on trading, such as the UK gateway.

The registry must be designed to ensure that a credit or allowance can be used only once for compliance purposes. Most registries also identify when and to whom a credit or allowance was first issued. In the case of credits they may also identify the action that generated the credit. When programs with different rules on the types of emission reduction/sequestration that are eligible are linked (e.g., no nuclear or no sequestration in one country), registry tracking where allowances originated may become important in both countries – not just for project credits.¹¹³

¹¹² Unauthorised changes to the information in the registry and disclosure of commercially confidential information must be prevented.

¹¹³ The identification may be incorporated into the serial number or included as separate information fields.

A national registry, in principle, could be a simple searchable database with appropriate protection features. But requirements, such as a commitment period reserve or “gateways” to limit the outflows of allowances from one country or inflows to another, may require “real time” checking of the validity of proposed transactions and immediate execution of valid trades. Such functions require a more sophisticated registry. As the structure of different registries becomes more complex, the chances of incompatibility rise.

When emissions trading programs are linked, it must be possible to move allowances or credits from one registry to the other. If the programs choose to share a common registry or to adopt the same structure, the transfers are straightforward. If the registry structures differ, transfers are still possible, but may take more time, involve higher administrative costs, and give rise to possible errors that increase total emissions.¹¹⁴ Credits or allowances are cancelled in the exporting registry with the indication that this is due to a transfer to another registry and the serial number of the unit in the recipient registry. The recipient registry creates a new unit indicating the original origin and the cancellation reference in the exporting registry.

In summary, linking emissions trading programs requires the ability to move allowances/credits between the respective registries. The more compatible the registries the simpler, quicker, cheaper and more accurate will be the processing of such transfers. However, transfers should still be possible, more slowly and at higher cost, if the registry structures are incompatible. Adoption by all emissions trading programs of the registry provisions for the Kyoto mechanisms would greatly simplify interactions among systems. Since some programs will require additional information, the registries could have a standard structure with the ability to add components, such as whether the allowance is from a rate-based or absolute sector in the UK scheme.

3.3.6 Restrictions on Trading

Internationally two types of restrictions have been proposed -- complementarity and a reserve requirement. Complementarity provisions were initially intended to limit the quantity of credits/allowances a buyer can use to achieve compliance, but are now defined in qualitative terms. A reserve requirement limits the quantity a seller can sell. Any restriction on trading, in principle, reduces the potential cost saving due to trading. A reserve requirement helps limit non-compliance given the absence of an effective compliance regime internationally. Neither of these requirements apply prior to 2008 which is the focus of this analysis.

Restrictions on trading reduce economic efficiency. Only two of the programs reviewed propose restrictions on trading. The Swiss program proposes that only allowances that are “unlikely to be used for compliance” are tradable, but does not specify how this provision is to be implemented. The UK program established a “gateway” to limit flows from the rate-based to the absolute sector.

¹¹⁴ Participants are more likely to insist on correction of errors that reduce total allowable emissions.

The existence of such restrictions could be a serious complication in attempting to link different programs. Since all emission reductions in the PERT program reflect reductions in emission rates, it could be linked to the rate-based component of the UK program. The Chicago Climate Exchange participants will have absolute caps, but credits generated by non-participants will be accepted beginning in 2002. In principle, the credits should be linked to the rate-based portion of the UK scheme and allowances net of credits used could be linked to the absolute sector of the UK scheme.

In summary, trading restrictions reduce efficiency. Their impact on linkages with other programs must be examined on a case by case basis. The UK gateway constraint will not complicate links between other programs and the absolute section of the UK scheme, but if a gateway were to apply to all exports or imports from/to a program this would seriously complicate linkages.

3.4 Compliance Regime

The compliance regime comprises the various provisions that ensure participants hold allowances/credits equal to their actual emissions during the relevant compliance period.

3.4.1 Non-compliance Penalties

Participants in programs with mandatory emission limits are generally subject to penalties if they do not hold sufficient allowances/credits to cover their actual emissions. Non-compliance penalties may include a financial penalty, a loss of allowances, or a combination of these.¹¹⁵ Participants in programs with voluntary emission limits generally are not subject to non-compliance penalties.

The Danish program has a penalty of DKR 40 (about US\$4.90) per metric ton of CO₂. The French proposal would require the government to alleviate any shortage by selling as many credits as necessary at the highest price recorded during the corresponding compliance period.¹¹⁶ The proposed EU program would have a penalty consisting of loss of allowances equal to the excess emissions plus a financial penalty equal to at least twice the average

¹¹⁵ The loss of allowances can be equal to or greater than the excess emissions.

¹¹⁶ The price must be higher than the reference price for fossil carbon. As part of the national plan to address climate change, the French government has decided to set a reference price for avoided fossil carbon. This will serve as the basis for the taxation differential to be introduced by 2010. The government has adopted a target level of FF 500/metric ton of carbon for 2010, with a starting level of FF 150 to 200 (about US\$21 to US\$28) per metric ton of CO₂.

market price during a predetermined period. The UK program is expecting to establish financial penalties for direct participants and Climate Change Levy Agreement participants and already includes loss of financial incentives in cases of non-compliance. Shell imposes a penalty equal to three times the average fourth quarter price on excess emissions.

A financial penalty that is independent of the price of allowances/credits, such as the Danish penalty, establishes a cap for the market price. Such a penalty is often called a "safety valve" price because it limits compliance costs. But if the penalty is applied, emissions will exceed the aggregate target. A penalty structured so that is always substantially higher than the market price, such as the EU proposal, ensures that the aggregate emissions target is always met regardless of cost.

Linking programs gives participants of both programs access to the price cap set by the lowest non-compliance penalty. If allowance/credit prices rise above the lowest non-compliance penalty, participants with the low penalty rate have an incentive to sell allowances/credits at the market price and to pay the resulting penalty. If the price of allowances/credits in one program is higher than the non-compliance penalties another program, linking the programs could encourage non-compliance in the program with the low penalties and so compromise the environmental integrity.

This could occur if the UK and Danish programs were linked. Natsource reports the mid-market bid/offer price for 2003 in the Danish and UK programs as US\$3.78 and US\$8.46 per metric ton of CO₂ respectively.¹¹⁷ The Danish price is below the penalty of US\$4.90 per metric ton of CO₂, so no fine would be imposed if the market price remains below that level. But the UK price is above the Danish market price and penalty, so linking the programs would lead to imports of allowances from Denmark. If the UK demand is large enough, the price of Danish allowances could be driven up to the penalty and exports of Danish allowances would continue until the price in both programs was equal to US\$4.90 per metric ton of CO₂.

This issue is limited to programs with mandatory emission limits, since programs that are entirely voluntary do not have non-compliance penalties.¹¹⁸ How to deal with differences in non-compliance penalties when linking trading programs depends on the objectives of the program administrators.

If the main goal is to achieve the combined emissions target without regard to cost, two possibilities are available. First, the non-compliance penalty for each program can be structured so that it is always above the market price. The penalties need not be the same as long as each is structured so that it will always be well above the market price. The second possibility is to allow purchases from other programs *ex post*, with the quantity that any one

¹¹⁷ *Utility Environment Report*, August 24, 2001 p. 6 reporting on a study of greenhouse gas trades conducted by Natsource LLC for the World Bank Prototype Carbon Fund.

¹¹⁸ In a completely voluntary program each participant sets its own target. Each participant also assesses the cost it is prepared to incur to meet its target. If the emissions are higher than anticipated the firm can choose to incur additional costs or to exceed its target. In effect each participant sets its own safety valve price.

company can sell being limited to the net amount of banked allowances/credits. This approach could be used when linking an industry program with a mandatory domestic program.

If limiting the compliance cost is more important than achieving the combined emissions target, the best approach for dealing with differences in non-compliance penalties is to harmonise the penalties.¹¹⁹ Harmonising non-compliance penalties may be difficult in practice because most domestic trading programs are part of a package of policies, often added onto existing policies, such as voluntary agreements and taxes. For example, the French penalty is tied to the national reference price for fossil carbon, the Swiss penalty is payment of the CO₂ tax, and the UK penalty for CCLA participants is loss of the 80% Climate Change Levy exemption.

In summary, if the non-compliance penalty in one program is below the market price in another program, linking the two programs could lead to a smaller overall emission reduction. How this issue is addressed depends on whether the priority is to achieve the combined emissions limit regardless of cost or to limit compliance costs.

3.4.2 Effective Enforcement

Even though the program rules may include stringent penalties for non-compliance, enforcement may be relatively ineffective. The program administrator may not have enough sufficiently well qualified enforcement staff to monitor and enforce compliance by all participants. Alternatively, the administrative or other burdens imposed on the enforcement staff may lead to negotiation of less stringent penalties.

If compliance is not effectively enforced in one program, participants could sell allowances/credits to participants in linked programs and then fail to comply with their obligations. This would lower the emission reductions actually achieved and so compromise the environmental integrity of the trading programs. This issue is limited to programs with mandatory emission limits.

Decisions on whether to allow the use of allowances/credits purchased from a program where enforcement is of uncertain quality could occur *ex post*. The administrator of the program where the purchased allowances/credits are to be used could then assess compliance by the seller and the program as a whole before their use is approved. An assessment of compliance by the seller and of the program as a whole could involve considerable time and effort.

3.4.3 Liability Regime

The program rules should clarify the legal responsibilities of the buyer and the seller.

¹¹⁹ If harmonising the non-compliance penalties is difficult, the program administrators could agree that penalty revenue collected by the program with the lower penalty would be shared on an agreed basis.

- Seller liability holds the seller accountable for meeting its target. Seller liability programs rely on the effectiveness of the enforcement regime to ensure that participants meet their targets. All allowances/credits are equally valuable to buyers in a seller liability regime, thus creating a market with a uniform commodity and low transaction costs.
- With buyer liability some or all of the allowances/credits purchased may be returned to the seller if necessary to help bring the seller into compliance. Buyer liability provides the buyer with an incentive to purchase only from sellers likely to comply with their obligations. This means that the value of allowances/credits purchased varies depending upon the probability that the seller will meet its target. Assessing the value of different allowances/credits leads to higher transaction costs.

The buyer and seller can redistribute these responsibilities contractually if they wish. For example, the seller could agree to replace any allowances/credits returned to it under a buyer liability provision.

The government programs all propose seller liability. The BP, Shell and Chicago Climate Exchange also adopt a seller liability approach. PERT, on the other hand, uses a buyer liability approach until credits are awarded for the reductions. The Oregon offset program holds the operator of the facility accountable for achieving the required CO₂ offsets unless it chooses the monetary option.

Linking programs is simpler if they have the same liability regime. If all linked programs have a seller liability regime, then the concern shifts to the effectiveness of the enforcement regime. Under seller liability programs governments effectively underwrite international transfers and the onus is on them to ensure compliance by companies so that the country as a whole remains on track to meet its Kyoto target.

If all programs have a buyer liability regime, no purchaser could establish compliance until the latest compliance deadline for all of the linked programs had passed. Buyer liability would likely result in either contractual agreements guaranteeing a transaction (e.g., an undertaking by the selling company to assure valid allowances are transferred) or in post verification trade (i.e., sales of banked allowances/credits). Alternatively, the consequences for buyers in the event of seller non-compliance could be harmonised across the linked programs.

If a buyer liability and a seller liability program are linked, trade would probably need to be restricted to banked allowances/credits. This assures the purchaser in the buyer liability program that the allowances/credits are surplus to the seller's compliance needs. It also assures the purchaser in the seller liability program that the seller (in the buyer liability program) has complied with its commitments.

In short, linking programs with seller liability regimes, almost all of the programs reviewed, poses no problems. Buyer liability programs or programs with different liability regimes can

be linked by limiting trades to allowances/credits surplus to the seller's compliance needs after compliance has been established.

3.4.4 Banking Provisions

Banking of allowances/credits reduces compliance costs by allowing participants to optimize their compliance strategies over longer time periods. In the case of greenhouse gases banking poses no environmental risks.

All of the programs reviewed allow banking within the pre-2008 and the 2008-2012 periods, although Denmark allows banking (pre-2008) only if a participant keeps its actual emissions below a specified "saving limit".¹²⁰ The main difference in the banking provisions is the potential for banking pre-2008 allowances/credits for use during 2008-2012.

By setting national emissions limitation commitments for 2008-2012, the Kyoto Protocol allows banking during this period. However, use of allowances/credits banked from prior periods means that emissions during the 2008-2012 period can be higher than would be possible if those banked allowances/credits could not be used. Thus the use of allowances/credits banked from prior periods makes achievement of the national commitment for 2008-2012 more difficult.

Banking pre-2008 allowances/credits for use during 2008-2012 would improve economic efficiency, but the difficulties it creates for achievement of the national commitment for 2008-2012 means that its use is likely to be restricted, if allowed at all.¹²¹ The UK program allows participants with absolute caps to bank into the 2008-2012 period to the extent that they have over-complied with their targets (i.e., they cannot buy to bank).¹²² The EU proposal leaves the decision on how much cross-period (2005-2007 to 2008-2012) banking to allow to the Member State governments. The French proposal supports cross-period banking but with an adjustment to the aggregate target of the industrial sector if such banking is likely to impact other sectors adversely. Sweden supports unlimited cross-period banking.

Linking a program that allows some cross-period banking with one that prohibits such banking is likely to lead to a transfer of units into the system that allows cross-period banking to earn a share of the banked units. Banked units in a program where cross-period banking is prohibited have no value at the end of the period. Moving them into a program where some cross-period banking is allowed, even if it is only a fraction of the banked allowances, gives them some value. The UK rule that allows participants in the absolute sector to bank only

¹²⁰ The quantity that can be banked is equal to the difference between the saving limit and the actual emissions.

¹²¹ Cross-period banking is not an issue for programs that do not become operational until 2008, such as the proposed programs in Australia, Canada and Norway.

¹²² The UK government reserves the right to impose restrictions on banking of all other allowances and credits beyond 2007.

what they have reduced would limit potential distortions among linked programs if that were the most lenient banking provision.

Since banking into the 2008-2012 period may lead to more stringent targets during that period, participants that do not expect to be able to bank allowances/credits will want to restrict this option in linked programs. And they would probably object to linking with other trading programs if this increased the potential for banking into the 2008-2012 period because it would make their future compliance obligations more stringent. The options then appear to be to harmonise the cross-period banking provisions of the linked programs or to make cross-period banking accessible only to participants within each trading program.

In short, banking improves economic efficiency and is allowed prior to and after 2008 by all of the programs reviewed. Banking pre-2008 allowances/credits into the 2008-2012 period raises equity issues, hence such cross-period banking is likely to be prohibited or severely restricted by government programs. Linking programs with different provisions for cross-period banking raises equity and environmental integrity concerns. These can be addressed by harmonising the cross-period banking provisions or by prohibiting banking of purchased allowances/credits, as has been done in the UK.

3.4.5 Borrowing Provisions

Borrowing allows a participant in a trading program to achieve compliance for the current compliance period by using allowances/credits allocated to it for a future compliance period. Borrowing can reduce environmental integrity if the participant ceases operation before the borrowed allowances are "repaid".

Sweden, which recommends borrowing within, but not between, periods, is the only program that includes a borrowing provision, so this concern is more hypothetical than real. Switzerland proposes to allocate allowances for the entire 2008-2012 period and to establish compliance only after the end of the period, so borrowing within this period is allowed.

If a program that allowed borrowing were linked to a program that did not allow borrowing, the environmental integrity could be protected by limiting purchases from participants in the program with borrowing to *ex post* purchases from participants that did not borrow allowances.

3.5 Credits Generated from Projects

Many of the programs reviewed contemplate the use of credits for documented emission reduction or sequestration actions for compliance purposes. This raises questions about the implications of differences in provisions governing the use of such credits and of provisions to ensure the permanence of sequestration actions.

3.5.1 Use of Credits Generated from Projects

Credits generated by sources or sinks outside the trading program increase the number and diversity of compliance options and so should lead to larger cost savings. Many of the programs reviewed contemplate the use of credits for documented emission reduction or sequestration actions for compliance purposes. Indeed, the Oregon, ERU-PT and PERT programs rely exclusively on such credits. While most of the other programs express a willingness to accept such credits, the provisions for generating credits are rarely defined.

Credits represent emission reductions or sequestration relative to an unobservable baseline. They necessarily involve a judgement as to what is a reasonable baseline. The environmental integrity of credits depends upon the baselines adopted, which will depend upon the criteria established and the review process. In general, the stricter the review process, the greater the environmental integrity of the credits and the higher the transaction costs.

The stringency of the baseline and the approval process, and the associated transaction costs, can vary across programs. If the credit creation review process for one of the programs being linked is weak, it undermines the environmental integrity of the linked programs by allowing the use of more credits created through the weak process. The risk is greater for industry programs than for government programs because governments will want to keep the national emissions trajectories on track to meeting the national commitment for 2008-2012 under the Kyoto Protocol.

If credit generation projects can be located in other countries, as is often contemplated, proposed credits are likely to be submitted to the program with the least stringent approval process. However, governments that impose less stringent baselines will find that they are not achieving their anticipated national emissions trajectory.¹²³ The baseline issue, as with stringency of targets, may be self-regulating once programs are linked. The key issue will be to ensure sufficient flexibility for revision of baseline setting processes once programs are linked.

It is conceivable that governments and companies with internal trading programs may wish to impose restrictions of various kinds on the credits that can be imported. For example, a company will want to ensure that imported credits adhere to principles that it has committed to in environmental reports to stakeholders and the public. A company or country may decide that it will not allow credits from certain sources or types of project to be used by participants in their program. Restricting the import of credits based on certain sources is not an effective way to address this issue because the credits will be used in the originating program so that other allowances/credits can be exported.

¹²³ Total emissions will be higher than with more stringent project baselines. Prior to 2008 the main consequence is that measures will need to be made more stringent or additional measures implemented to position the country to meet its emissions limitation commitment under the Kyoto Protocol. After 2008 the government may be required to transfer AAUs or ERUs for non-additional emission reductions, thus making compliance with the national commitment more difficult.

Environmental integrity can be protected by adopting common criteria and a common approval process for credits. When the Clean Development Mechanism becomes operational it may set the international standard for credit creation. It will adopt baselines for many credit creation actions. And it will accredit experts to verify the emission reductions achieved.

3.5.2 The Permanence of Sequestration Actions

Some programs award credits for actions to increase the amount of carbon sequestered by natural sinks, such as forests and agricultural soils.¹²⁴ Most actions to enhance carbon sequestration by sinks can be reversed, accidentally or deliberately, releasing some of the carbon to the atmosphere.

The integrity of sequestration credits depends upon the steps taken to ensure the carbon is sequestered permanently. Various mechanisms, including contract provisions, easements, and insurance, can be used to ensure permanence or to offset emissions from a sink for which credits were issued.

Some sink enhancement actions, such as conservation tillage to increase the carbon in agricultural soils, generally lead to higher emissions of other greenhouse gases -- methane and nitrous oxide in the case of conservation tillage. Credits should be awarded only for the sequestration net of the increased emissions. Fertilizer use and other practices need to be measured to estimate the extra emissions. They must then be subtracted from the measured increase in the carbon content of the soil to get the net sequestration.

If one or more of the programs being linked allows the use of credits generated through sink enhancement actions, the mechanisms used to ensure the permanence of the sequestration will determine the impact on environmental integrity. This becomes another consideration in the assessment of the environmental stringency of the programs being linked. Restricting the import of credits based on sequestration actions is not an effective way to address this issue because the credits will be used in the originating program so that other allowances/credits can be exported.

3.6 Transaction Costs

¹²⁴ Carbon dioxide emissions can also be captured and stored in natural reservoirs, such as oil and gas wells, aquifers, and the deep ocean. These capture and storage options currently are more costly than enhancing sequestration by natural sinks, hence the use of capture and storage options is expected to be very limited for at least the next decade.

Trading may be subject to various transaction costs including taxes, registry fees, brokers fees, costs for monitoring, reporting and third party verification, legal fees, and fees imposed by government regulators. Transaction costs deter trades and so reduce economic efficiency.¹²⁵

The full transaction costs are not yet known for any of the trading programs reviewed.

Trades of allowances/credits can be subject to two types of taxes -- (1) transaction taxes e.g., a sales tax or a stamp duty on each transaction based on the quantity or value and (2) taxes on the difference between the acquisition cost and the sale price. This difference may be subject to VAT, income tax and/or capital gains tax.

Transaction taxes deter trades and deter participation by speculators, thus reducing market liquidity. Taxes on the difference between the sale price and acquisition cost create an incentive for participants to sell only allowances/credits surplus to their compliance needs, thus reducing liquidity.

If trading programs with different transaction costs are linked, it is likely to shift trading activity to the program with the lowest total transaction costs. This will improve economic efficiency and market liquidity. The implication is that the combined tax burden and transactions costs must be harmonised when emissions trading systems are linked or the trading activity will move to the jurisdiction with the lower costs. While this will improve economic efficiency it may reduce the tax revenue for one of the governments.

If the potential loss of trading activity and/or tax revenue is a concern, the affected government will need to negotiate equivalent tax treatment when emissions trading systems are linked. Since many of the applicable taxes will apply more broadly in each country, harmonising the tax treatment of trading allowances/credits is likely to be very difficult. The simple solution is to have the government with the low tax regime impose a registry or processing fee to make the combined burden of taxes and transaction costs equivalent. Participants are likely to oppose such agreements to raise the cost of trading, however, the added cost is likely to be small compared to the cost reductions made possible by linking trading programs.

In summary, transaction costs deter trade. Linking programs should shift trading activity to the program with lower transaction costs and so improve economic efficiency and liquidity. But this may lead to a loss of tax revenue for one of the governments.

3.7 Potential Double Counting

¹²⁵ The experience with existing trading programs is that some of these costs fall over time, e.g., legal fees as contracts are standardized, third party verification costs as these entities gain experience, brokers fees as volume expands.

Potential double counting of emission reductions is possible through issuance of credits for multiple pollutants from a single reduction action or membership of a single firm in multiple programs.

3.7.1 Credits for Multiple Pollutants from a Single Reduction Action

Many actions to reduce greenhouse gas emissions also reduce emissions of other pollutants such as SO_x and NO_x. Sources may be able to earn credits for several pollutants from a single action. If the credits may be used by entities that only have voluntary or mandatory targets for a single pollutant, total emissions could rise.

The PERT program, for example, encourages participants to track reductions of all pollutants due to a given action. A reduction action registered with PERT could lead to lower NO_x and CO₂ emissions. The NO_x reduction might be accepted as a credit by the Ontario NO_x and SO_x trading program. When the NO_x credit is used for compliance in that program, it may allow an increase in CO₂ emissions by the user since the CO₂ emissions of the user are not regulated.¹²⁶ If the CO₂ reduction associated with the same reduction action is accepted as a credit by another program, total CO₂ emissions could increase.¹²⁷

The UK scheme is clear that CO₂ allowances can be generated from additional renewable energy capacity beyond the obligated level, but that CO₂ allowances cannot be used to meet Renewable Energy Obligations. Similar provisions are expected for energy efficiency commitments on electricity and gas producers.

Apart from PERT and the UK, the programs reviewed are silent on the possibility of generating credits for multiple pollutants from a single reduction action. To address this issue, rules for credit creation could limit an action to one pollutant as is being done in the UK. Alternatively, once credits for one pollutant are sold all credits for other pollutants from the same action could be cancelled.

3.7.2 Membership of a Single Firm in Multiple Programs

Some firms are members of more than one industry trading program. The industry trading programs have different designs, so membership in multiple programs yields a better

¹²⁶ Initially the only sources covered by the NO_x and SO_x program are the coal- and oil-fired generating units owned by Ontario Power Generation Inc., which has voluntarily capped its CO₂ emissions. As long as the only sources in the program are owned by OPG and it adheres to its voluntary CO₂ cap, there will be no increase in CO₂ emissions due to the use of the NO_x credits. However, if some of the units are sold to an owner without a CO₂ cap, or when other units owned by firms without a CO₂ cap enter the trading program, CO₂ emissions could rise through use of the NO_x credits.

¹²⁷ If the NO_x emissions of the source that uses the CO₂ reduction are not capped, total NO_x emissions could rise as well.

understanding of emissions trading. BP has its own corporate trading program and is a member of the Chicago Climate Exchange and the Partnership for Climate Action. DuPont, for example, is a member of PERT, the Chicago Climate Exchange, and the Partnership for Climate Action. Other companies are also believed to be members of more than one initiative.

The caps proposed for participants in the Chicago Climate Exchange (CCX) differ from the caps voluntarily adopted by these companies. It is not yet clear whether the company's voluntary cap or the standard allocation will be used by the Chicago Climate Exchange. For example, DuPont has a corporate target of reducing its greenhouse gas emissions by 65% from 1990 levels by 2010. At the end of 2000 its emissions were 59% below 1990 levels. To achieve the target its emissions will need to decline at a rate of just over 1.5% per year through 2010. This compares with the CCX proposal that corporate caps decline by 1% per year.

Regardless of the treatment of a corporation's voluntary cap in the Chicago Climate Exchange, membership in multiple programs raises that possibility that the same action generates multiple allowances or credits. Thus a company that is a member of PERT and the CCX could implement an emission reduction measure and register it with PERT. The same action would leave it with surplus CCX allowances. This does not matter as long as the programs are separate programs. But if they are linked to each other, or to other trading programs, the environmental integrity could be compromised.

Membership in multiple programs as a means of linking trading programs is a possibility for the UK, BP and Shell programs. Neither company's UK operations are covered by a Climate Change Levy Agreement. Thus the UK operation of either firm could bid for an absolute cap. If such a bid was successful, the administrators of the UK program and of the company would need to decide whether the firm's UK operation should cease to participate in the company trading program or on the conditions for linking the company program with the UK program. This would be defensible within the company if targets taken on by the UK operating units are equal to or tougher than their targets under the company scheme and may be necessary if the entities that are trading are different under the UK scheme than under the company scheme.

It is too early to be able to assess whether multiple membership in industry trading programs is sufficiently prevalent to be a potentially significant problem. Unless it can be shown to be insignificant, probably the only environmentally sound way to link voluntary industry programs to mandatory trading programs is to apply the criteria for credit creation to each proposed transfer.

3.8 Summary

While a number of potential difficulties have been identified, they are not insurmountable. The number of issues that would arise when linking two programs is likely to be relatively small, but to increase exponentially as the number of programs being linked rises. Linking

trading programs allows participants to take advantage of the rules of the different programs. For example participants could use credits from sequestration projects in their own program, and so free up allowances for sale to participants in another program that does not allow sequestration credits to be used for compliance.

Linking trading programs may raise equity concerns, such as the relative stringency of the targets faced by similar firms in the different programs. But the participants with unfair targets should, nevertheless, benefit from linking the trading programs. And if the programs allow the targets to be revised periodically, pressures will exist to reduce disparities in the stringency of targets. Differences in treatment of similar entities by different trading programs do not affect the ability to link the programs, do not diminish environmental integrity, and do not reduce the potential gains in economic efficiency.

Early emissions trading programs are likely to have few buyers relative to sellers as no country (company) wishes to impose an undue burden on its industry (itself) in advance of other countries (firms). Links among programs that have few buyers relative to sellers may yield fewer benefits than those between programs with tough emission limits and mandatory participation. This is because demand for allowances will be low, prices will be low, and transaction costs will represent a high share of the total price (even higher for international transactions).

To link mandatory programs where at least one program uses allowances probably requires an agreement to accept the allowances toward compliance with the obligations, which could involve minimum standards that allowances from other programs must meet to address concerns over environmental integrity and equity. A voluntary industry program that uses credits could be linked to a mandatory domestic program by establishing criteria and an approvals process for the credits.

When linking voluntary industry trading programs mutual recognition of the allowances/credits is the most likely approach. Some technical concerns may arise, such as exchanging cash among business units in linked company systems, that could effectively preclude linking such systems.

Given a desire to link two or more programs differences in start date, compliance period, compliance deadlines, and definition of an allowance/credit are unlikely to cause problems. At present all programs reviewed use a similar compliance period and metric tonnes of CO₂ equivalent as the definition of an allowance or credit (although the quantities of tonnes that an allowance/credit represents varies from 1 to 1,000). The compatibility of the registries of the linked programs affects the speed and cost of transactions, but does not prevent links.

A desire for, or commitment to, cross-period banking raises important equity issues. Programs with different cross-period banking provisions could be linked if, as in the UK program, purchased allowances/credits can not be banked into the 2008-2012 period.

A number of program design features have the potential to lead to higher total emissions when two or more trading programs are linked. In the case of mandatory programs these include relatively low or ineffectively enforced penalties for non-compliance, policy combinations such as tax/trading schemes that cap the price of allowances, the ability to achieve compliance through borrowing, opt-in provisions, and differences in the accuracy of the monitoring systems participants can use.

Emissions could rise when two mandatory programs or two voluntary programs are linked if one has absolute targets while the other has rate-based targets, or if one of the programs has an allocation in excess of the "business-as-usual" emissions with restrictions on the credit or allowance life or banking. The stringency of the credit baselines and review process and of the mechanisms to ensure the permanence of credits for sequestration actions also affect the environmental integrity of linked programs.

Voluntary programs may allow the creation of credits for multiple pollutants from a single reduction action. And through membership in multiple industry programs a firm could earn multiple greenhouse gas credits for a single reduction or sequestration action. When voluntary programs are linked to mandatory programs these possibilities could lead to higher total emissions.

A mandatory program that is considering a link with another mandatory program will want to assess the environmental stringency of its potential partner. Some potential concerns, such as the non-compliance penalties, can be addressed in advance. Other potential concerns, such as the effectiveness of enforcement, can be evaluated only after the fact. This suggests that the best way to ensure environmental integrity when linking mandatory programs is to restrict transfers to banked allowances/credits that meet criteria equivalent to credits from emission reduction actions. Links between programs with different liability regimes can be accommodated in the same way. In addition, some issues may require additional restrictions, such as a gateway when linking programs with absolute and rate-based targets.

Fewer issues arise when linking voluntary programs, but to ensure environmental integrity the solution is the same. Transfers between programs should probably be limited to banked allowances/credits that meet criteria equivalent to credits from emission reduction actions and special provisions, such as a gateway, may be needed in some cases.

When a voluntary industry program is linked to a mandatory program the scrutiny of transferred allowances/credits is even more important to environmental integrity due to the possibility for multiple credits for a single emission reduction action.

Linking trading programs increases the number and diversity of participants and so should increase economic efficiency. Use of credits generated by non-participants and opt-in provisions also increase the number and diversity of sources and hence improve economic efficiency.

Economic efficiency can be reduced through inconsistent provisions governing banking, differences in the combined tax burden and transaction costs, differences in the stringency of the baselines and approval process for credits generated by non-participants, restrictions on trading, and heterogeneous allowances/credits.

Economic efficiency is not affected by differences in sources covered, monitoring requirements, or opt-in provisions. However, the impact on the market price of linking two trading programs is likely to affect the incentive non-participants in different jurisdictions have to opt-in.

Trading programs that use buyer and seller liability regimes can be linked but differences in the perceived quality of allowances/credits could lead to price differences and a loss of efficiency. Linkage of seller liability regimes should not face this problem.

4. Approaches to Linking Emissions Trading Programs

The chapter first summarises the considerations that affect the desire to link with other emissions trading programs. Then it describes ways in which links between trading programs can be implemented.

4.1 Desire to Link to Other Emissions Trading Programs

The main benefit of linking emissions trading programs is the increased economic efficiency. The linked programs create a larger market with greater diversity of emissions control costs than any of the component programs. This should reduce the total cost of achieving the aggregate emissions reduction target of the linked programs.

The main disadvantages of linking emissions trading programs are that:

- some participants will be adversely affected while others benefit;
- when domestic trading programs are linked it changes the emissions trajectories and so can make achievement of the Kyoto target more difficult for one of the countries; and
- linking programs in ways that secure the economic benefits while protecting environmental integrity can be complex and time consuming.

When two emissions trading programs are linked, the market price will be higher than the pre-link price in one of the programs and lower than the pre-link price in the other program. This means that buyers in the high price program and sellers in the low price program benefit from the link. Conversely, sellers in the high price program and buyers in the low price program suffer financially as a result of the link. Thus, even though linking trading programs should yield a net economic benefit, some participants may be worse off. In addition, linking programs may highlight differences in treatment of similar firms and create pressure to alleviate the resulting competitive distortions.

Linking domestic emissions trading programs can also change national emissions levels; one country is likely to be a net importer of allowances/credits while the other is a net exporter.¹²⁸ This means that actual emissions are below the aggregate emissions cap/baseline in the net exporter country and that the participants in that program earn revenue from the sale of allowances/credits. Conversely, national emissions will be higher than the desired trajectory in the net importer country, which may make achievement of its national emissions limitation commitment for 2008-2012 more difficult. However, the imported allowances/credits reduces compliance costs and may help protect the competitiveness of domestic industry.

¹²⁸ In principle, countries could address this impact by agreeing to an appropriate transfer of AAUs.

The analysis in chapter 3 indicates that differences in the design of linked programs have the potential to result in higher total emissions or to limit the economic benefits of the larger market. These issues can be addressed, but depending upon the differences between the programs the resolution could be complex and time consuming.

Almost all of the programs reviewed indicate a willingness to establish links with other trading programs. The rules for the Oregon Offset program preclude links with other programs. The BP and Shell programs are restricted to their operating units, but both companies are considering how to link their programs with international programs and interactions with domestic emissions trading schemes. The Australian, Canadian, Norwegian and Swiss programs might not go into operation until 2008. They could then be linked to other programs through bilateral or multilateral arrangements, international emissions trading under the Kyoto Protocol, or a combination of both.

Since a number of emissions trading programs indicate a desire or willingness to consider links with other programs, the relevant question becomes the feasibility of such links. The remainder of this chapter discusses ways to link emissions trading programs.

4.2 Approaches to Linking Emissions Trading Programs

We have identified four approaches to linking emissions trading programs in advance of International Emissions Trading (IET) under the Kyoto Protocol. Those approaches are:

- to negotiate an agreement to ensure that any imported allowances or credits are acceptable as substitutes for those of the importing program. The existence of such an agreement means, in principle, that proposed transactions do not require individual approval.
- to evaluate proposed imports of credits and allowances individually using the criteria and procedures established for emission reduction credits. Once the "standard method" has been approved for credits or allowances from a specific external source, subsequent imports, in principle, should be routine.
- to rely on proposed commercial mechanisms to link different programs.
- in the case of industry trading programs, to allow membership of a single firm in multiple programs.

Membership of a single firm in multiple programs is already happening. The implications of membership in multiple programs are discussed in section 3.7.2 and so are not discussed further here. The other three approaches are discussed in turn.

4.3 Negotiated Agreements among Trading Programs

A negotiated agreement among the administrators of different trading programs would set out the conditions under which each would accept allowances/credits issued or approved by the others. Depending upon the differences in the design of the programs, such an agreement could be quite simple or complex. Negotiating the agreement and getting it approved could take some time. But once the agreement is in place, trades between participants in the different programs should be able to be processed quickly with low transaction costs.¹²⁹

The Massachusetts Emission Reduction Credit (ERC) program allows ERCs to be traded with sources outside the state provided that the jurisdiction in which the generating or using facility is located has executed a Memorandum of Understanding with Massachusetts (see box 1). In effect, the agreement must ensure that the ERCs of the other jurisdiction are equivalent to Massachusetts ERCs. The draft EU Directive proposes that links to domestic emission trading programs in non-EU countries be implemented through agreements to mutually recognise each scheme's allowances toward fulfillment of compliance obligations.

The EU emissions trading program itself is basically an agreement under which allowances/credits can be transferred among the trading programs of the Member States. Each Member State will be required to implement its own domestic emissions trading program. The EU will require that some design features be the same for the programs of all Member States. But other design features will differ across Member State programs. The EU program could therefore serve as a starting point or model for negotiated agreements between other emissions trading programs. However, other agreements among other groups of domestic trading programs will not be able to rely on the legal framework that will serve as a foundation for the EU program.

Chapter 3 identified many issues that could arise as a result of differences in the design of linked programs. Many of those potential issues may not apply to links between two specific programs. In general, the greater the similarity of the programs being linked, the fewer the issues that need to be addressed. This also suggests that an agreement to link emissions trading programs is likely to lead to changes to the designs of the linked programs to increase their similarity.¹³⁰

¹²⁹ If the agreement is ambiguous, it may not help much since participants will need to seek clarification of how the agreement would apply to proposed transactions.

¹³⁰ This is what happens when free trade or common market agreements are implemented.

Box 1 Massachusetts Emission Reduction Credit (ERC) program

The Massachusetts Emission Reduction Credit (ERC) program for carbon monoxide (CO), nitrogen oxides (NO_x) and volatile organic compounds (VOCs) allows ERCs to be traded with sources outside the state provided that the jurisdiction in which the generating or using facility is located has executed a Memorandum of Understanding concerning emission trading with Massachusetts.¹

The regulations require that the Memorandum of Understanding must specify at a minimum that:*

- creditable emission reductions be real, surplus, permanent, quantifiable and federally enforceable;
- discounts be applied as appropriate to make ERCs generated outside Massachusetts equivalent with those generated in the state;
- restrictions on allowable directionality of trades if necessary;
- state-specific notification or other requirements, as necessary;
- ERC lifetimes and expiration dates, if applicable;
- ozone season definition and restrictions;
- use of any ERCs generated outside Massachusetts is subject to the regulations governing use of ERCs, except where specifically stated otherwise; and
- averments of cooperation on enforcement and reporting.

In effect, Massachusetts requires an agreement with the other jurisdiction to ensure that the ERCs are equivalent. The restriction on allowable directionality and the ozone season definition would not be needed for a greenhouse gas emissions trading system.

* Massachusetts, *Commonwealth of Massachusetts Regulations (CMR)*, 310 CMR: Department of Environmental Protection, Section 7.00 Air Pollution Control, Appendix B: U Emissions Banking, Trading, and Averaging, Commonwealth of Massachusetts.

4.4 Evaluate Proposed Imports of Allowances/Credits Individually

Some of the programs reviewed plan to allow the use of credits generated by emission reduction actions. Those programs will establish criteria that the actions must meet -- for example that reductions must be real, additional, quantifiable and unique -- and a review

process for issuing credits. The same criteria and review process could be applied to proposed imports of allowances/credits from other programs. This would allow imports to begin as soon as the criteria and review process have been established. But the review of a proposed trade is likely to take longer and to cost more than if an agreement on mutual recognition had been negotiated by the programs. However, as the number of trades from a particular program grows, the review process is likely to become more efficient.

The proposed NO_x and SO_x trading program in Ontario (see Box 2) adopts this approach to the use of allowances/credits from other programs. Allowances and credits from other trading programs can be used, but each proposed transaction must be reviewed to determine whether they meet the criteria for ERCs. Presumably the use of allowances/credits from a particular program, perhaps subject to various conditions, could become a "standard method" which would facilitate future transactions.¹³¹

Box 2 The proposed NO_x and SO_x trading program in Ontario

The proposed NO_x and SO_x trading program in Ontario sets limits for airborne emissions of NO and sulphur dioxide (SO₂) from Ontario's large coal and oil-fired electricity generators and defines the rules for trading of the associated allowances and emission reduction credits(ERCs).*

Emission reduction credits can be created by any emitter in the airshed not facing obligations under the regulation. Emission reductions must be real, surplus, quantifiable, unique and verifiable to be able to generate credits. Emission reductions must be generated using approved "standard methods".

Emission allowances issued by jurisdictions other than Ontario will be treated as ERCs and must meet all the requirements of ERCs in accordance with the Code and the Regulation. If the original recipient of the foreign emission allowance cannot be determined, it can not be used use in Ontario.

* Ontario, *Ontario Emissions Trading Code*, Emission Reduction Credit creation, registration and transfer rules, rules for renewable energy projects and conservation projects, and rules for the operation of the Ontario Emissions Trading Registry, Ministry of the Environment, Toronto, July 25, 2001.

Many of the programs reviewed plan to allow the use of JI and CDM credits. The CDM could begin operation in 2002, but JI is unlikely to begin in most of the countries with domestic emissions trading programs until 2008. The JI process for countries that have not established

¹³¹ Possible conditions might include the date of origin, ERCs can only be created by actions initiated since 1 January 2000; conversion of NO_x allowances/credits from NO₂ to NO, the basis on which NO_x is measured in Ontario; and conversion to metric tonnes if necessary.

eligibility to engage in international emissions trading, is expected to be similar to the process for the CDM. Thus, the CDM might be useful as a model for approval of allowances/credits imported from other emissions trading programs prior to 2008.

4.5 Commercial Mechanisms to Link Programs

Two types of commercial mechanisms are being developed that have the effect of linking trading programs -- investment funds to generate credits from emission reduction and sequestration projects and a proposed "Carbon Repository" that receives emission reductions from a variety of sources and exchanges them for allowances/credits that can be used for compliance in specified countries at specified dates. These commercial mechanisms provide a means of linking trading programs even if the programs have not established a linkage mechanism.

A number of existing and proposed carbon funds will invest in JI or CDM projects on behalf of the investors in the fund. Examples include the World Bank Prototype Carbon Fund, the UBS Carbon Fund, and the UtiliTree fund of the Edison Electric Institute.

The World Bank, in anticipation of the ratification of Kyoto Protocol, has put in place the Prototype Carbon Fund. In development since 1997, the Fund opened in the last months of 1999, and operations began in early 2000. The fund is designed to pool investment funds from participants and place those funds in projects that will realise tradable carbon credits. Fund resources are provided by both the public and private sectors. To increase the likelihood that the reductions will be recognized by the Parties to the Protocol, independent experts provide baseline validation and verification/certification procedures for emissions reductions that respond to the rules for CDM and JI projects as they develop.

UBS Swiss bank, a global integrated financial services firm, started marketing a Carbon Fund, the UBS Alternative Climate, in mid 2001. The Fund aims to raise SFr 15-20 million (\$8 - \$11 million) by the end of the year and SFr 100 million within two to three years. The fund will invest in about 10 CDM and JI projects, with priority given to projects that improve energy efficiency or switch to renewable energy. It will invest around 50% in equity stakes and 50% in loan financing. Investors in the fund will receive equity shares and potential access to carbon credits. The carbon credits will be either distributed directly among the investors or sold on national and international markets.

The Carbon Repository, announced by the Emissions Market Development Group -- a joint initiative of Arthur Andersen, Credit Lyonnais, Natsource and Swiss Re -- plans to produce a simple, universally-recognised carbon commodity.¹³² The Repository will receive and evaluate emission reductions from a variety of sources. Based on the quality of the reductions (allowances/credits) received, the Repository will issue an amount of 'Common Carbon

¹³² *Global Greenhouse Emissions Trader*, Issue 10, May 2001, pp. 3-4.

Credits' that will be guaranteed by the Repository as exchangeable for allowances/credits that can be used for compliance in specified countries at specified dates.

Details of how the Carbon Repository would work are not yet available, however it could facilitate links between different trading programs in at least the following ways. First, it could exchange allowances/credits offered by a participant in one program for allowances/credits of another program.¹³³ Such exchanges could occur even if each trading program insists that only its own allowances/credits could be used for compliance, but the economic benefits of linking the programs would not be realised under those circumstances.¹³⁴

The second possibility is that some programs will accept the Common Carbon Credits based on the evaluation process and guarantee provided. Essentially those programs agree to establish a link with the Common Carbon Credits. Then the Carbon Repository is responsible for administering the allowance/credit transfers between the programs through this mechanism.¹³⁵ The economic benefits of linking the programs are realised under this approach.¹³⁶

4.6 Linking Different Types of Greenhouse Gas Trading Programs

Government implemented domestic emissions trading programs have a different legal status and usually a different design than trading programs implemented voluntarily by industry. The implications of possible linkages among government implemented domestic emission trading systems; among industry emission trading systems; and between government implemented domestic emission trading and industry emission trading systems are summarised in this section.

4.6.1 Linking Government Programs

In principle, two or more government programs could be linked through an agreement under which each program administrator agrees to accept the allowances/credits of the other program(s) toward compliance with the obligations. Such an agreement is likely to specify

¹³³ For a single transaction this is equivalent to the participant selling the allowances/credits it holds and using the revenue to purchase the allowances/credits it wants. If the number of transactions is large, the repository may be able to make such exchanges at lower cost than the sale and purchase by an individual participant.

¹³⁴ Under those conditions the price in each program remains the same. Thus, there is no incentive to implement additional reductions in the program with the lower market price and hence no economic benefit.

¹³⁵ With negotiated links between the programs, direct transfers of allowances/credits could occur in parallel.

¹³⁶ There would of course be costs for the service, which might be higher or lower than the transaction costs of a direct transfer between the programs.

minimum standards that allowances/credits must meet if it is to be acceptable to the administrators of the different programs.

All programs reviewed use a calendar year compliance period and a multiple of 1 metric ton of CO₂ equivalent as the definition of an allowance or credit. The compatibility of the registries of the linked programs affects the speed and cost of transactions, but does not prevent links.

If one of the programs being linked has relatively low or ineffectively enforced non-compliance penalties, the ability to achieve compliance through borrowing, opt-in provisions, or allows the use of relatively inaccurate monitoring systems total emissions could rise as a result of the linkage. Some of these issues can be addressed through an agreement, but others, such as effective enforcement, can only be observed *ex post*.

Emissions also could rise when two government programs are linked if one has absolute targets while the other has rate-based targets, or if one of the programs has an allocation in excess of the "business-as-usual" emissions with restrictions on the credit or allowance life or banking. The stringency of the credit baselines and review process and of the mechanisms to ensure the permanence of credits for sequestration actions also affect the environmental integrity of linked programs.

Economic efficiency can be reduced through inconsistent provisions relating to banking, differences in the combined tax burden and transaction costs, differences in the stringency of the baselines and approval process for credits generated by non-participants, restrictions on trading, and heterogeneous allowances/credits. These provisions could be harmonised as part of an agreement linking the programs.

Economic efficiency is not affected by differences in sources covered, monitoring requirements, or opt-in provisions. However, the impact on the market price of linking two trading programs is likely to affect the incentive non-participants in different jurisdictions have to opt-in.

In summary linking two or more government programs so that the respective allowances/credits can be freely traded and used for compliance by participants in any of the programs requires harmonisation of numerous design features to ensure institutional compatibility, environmental integrity and economic efficiency. Where such design features are not harmonised and have economic value, they will give rise to arbitrage trading to capture that value. A few potential concerns can not be effectively addressed by such an agreement. Where those concerns do not apply, an agreement for mutual recognition can be effective.

The alternative is to achieve the linkage by permitting the use of banked allowances/credits from other programs that meet specified criteria, such as those established for credits generated by emissions reduction and sequestration actions. The quantity of allowances/credits available for trade under this approach is smaller and the cost of completing an inter-program trade is higher. On the other hand, inter-program trading could start more quickly.

4.6.2 Linking Industry Programs

Linking industry trading programs raises fewer issues than linking government programs. This is because industry programs do not have non-compliance penalties, enforcement issues, opt-in provisions and other features that need to be harmonised for government programs. However, a substantial number of issues, which need to be harmonised for institutional compatibility, environmental effectiveness, or economic efficiency reasons, remain.

The same basic approaches for linking programs are available: a negotiated agreement that leads to harmonisation of the necessary provisions leading to mutual acceptance of the allowances/credits or permitting the use of banked allowances/credits from other programs that meet specified criteria.

A third possibility exists in the case of industry programs, namely membership of a given entity in multiple programs. This is already evident in the programs reviewed.

Links between corporate trading programs may be inhibited by the methods used to enforce compliance and avoid tax complications on the associated cash transfers. For example, BP works through management performance contracts while Shell works through periodic adjustments to capital allocations. This means that the business units participating in these programs could not trade directly with each other. Rather the trade and financial transfer would need to be made through the central trading arms with the impacts being fed back to the business units through each company's internal mechanisms.

4.6.3 Linking an Industry Program with a Government Program

The only way to address the institutional compatibility, environmental integrity and economic efficiency issues when an industry program is linked with a government program is to have the government program assess banked allowances/credits from the industry program against specified criteria, such as those established for credits generated by emissions reduction and sequestration actions. In addition to the usual issues, such an assessment must consider the implications of membership of the participant in multiple programs or the ability to generate credits for multiple pollutants from a single action where these possibilities exist.

4.6.4 Summary

The options for linking different types of trading programs are summarised in the following table. Agreements for mutual recognition of allowances/credits can be used when similar types of programs are being linked. Such an agreement could take a long time to negotiate, but once in place trades between programs should be relatively quick, easy and low cost.

Options for Linking Different Types of Emissions Trading Programs

	Government- to- Government	Industry- to- Industry	Industry-to- Government
Agreement among program administrators to establish equivalence of allowances	✓	✓	
Treat allowances/credits from other programs as emission reduction credits	✓	✓	✓
Membership in multiple programs		✓	
Commercial mechanisms to link trading programs	✓	✓	✓

Any trading program can be linked to other trading programs by treating the banked allowances/credits from those programs as emission reduction or sequestration actions that must meet specified criteria. This allows inter-program trading to begin quickly, but completing a transaction could be a relatively slow and costly process. The process may become more efficient as the number of trades with a given program increases.

Two types of commercial mechanisms are being developed that have the effect of linking trading programs. Several investment funds are being established to provide investors with access to high quality credits generated in other jurisdictions. In addition, the proposed 'Carbon Repository' would receive and evaluate emission reductions from a variety of sources and exchange them for allowances/credits that can be used for compliance in specified countries at specified dates. The cost of this type of service and how it would work are not yet known.

In the case of industry programs an alternative to formal links between the programs is to have participants become members of the different programs.

When IET is available, probably in 2008, it will simplify some of the issues involved in linking trading emissions trading programs identified in this study. A country need only establish rules governing exports, and possibly imports, of Kyoto mechanism credits (AAUs, ERUs and CERs) to link its trading system to those of other Annex B Parties. Those rules can differ from countries to country as long as they are consistent with the international rules for IET. However, the international rules for IET will raise other issues such as the need to establish mechanisms to comply with the commitment period reserve and supplementarity provisions.

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