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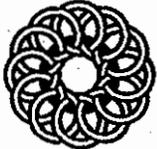
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**National Round Table on the Environment and the Economy
Table ronde nationale sur l'environnement et l'économie**

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Domestic Emissions Trading

**Analysis of Emissions Trading
Program Design Features**

Issue 8

Prepared for:

Multistakeholder Expert Group on Domestic Emissions Trading

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Analysis of Emissions Trading Program Design Features

INTRODUCTION

This is one of a series of National Round Table on the Environment and the Economy (NRTEE) papers dealing with issues common to several possible designs for a domestic greenhouse gas emissions trading system.

A number of issues related to the administration and operation of an emissions trading system must be addressed before a domestic greenhouse gas emissions trading system can be put in place. Many of these features are common to different trading system designs. This paper addresses the following features of an emissions trading program and options for resolving them:

Issues Relating To The Scope Of The Emissions Trading Program

- Geographic scope of the trading program;
- Basket of gases and sources;
- Creating a competitive market;
- Incorporating multiple trading programs into a single market.

Issues Relating To The Measurement, Reporting And Verification Of Allowances And Credits

- Emissions monitoring;
- Reporting;
- Legal liability for allowance/credit validity;
- Audit and verification;
- Market institutions;
- Operation of the registry.

Issues Relating To The Costs Of Trading For Participants

- Price disclosure;
- Transactions costs;
- Fees.

Issues Relating To The Use Of Allowances And Credits

- Banking;
- Allowance or credit life;
- Borrowing;
- The compliance period;
- Penalties for non-compliance.

Issues Relating To Changes To The Emissions Trading System

- Allocation of allowances to sources that cease to operate;

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- Allocation to new sources;
- Expansion of the system;
- Changes to GWP values;
- Changes to the emissions cap as international commitments change.

In some cases a particular resolution is preferred, while in other cases a range of acceptable resolutions is possible. The preferred outcome or range of acceptable resolutions will be identified for each design feature.

ISSUES RELATING TO THE SCOPE OF THE EMISSIONS TRADING PROGRAM

Geographic Scope of the Trading Program

The economic gains from emissions trading arise from differences in the marginal costs of emissions control. Sources whose marginal cost of control is higher than the market price reduce their compliance costs by buying credits or allowances. Sources whose marginal cost of control is less than the market price can earn additional revenue by reducing their emissions and selling the surplus credits or allowances.

In general, the larger the number of sources, the greater the diversity of marginal control costs and the bigger the economic gains from emissions trading. A larger geographic area generally also means a larger number of sources and a greater diversity of marginal control costs. Therefore an emissions trading program should have as broad a geographic scope as possible, consistent with the geographic dimensions of the environmental problem and the jurisdiction of the regulatory authority responsible for the trading program.

The key considerations influencing the choice of the geographic scope of an emissions trading program are the environmental or jurisdictional considerations. Greenhouse gases have no local environmental impacts. The climate change impacts of a given discharge of greenhouse gases are virtually identical regardless of where in the world the emissions occur. Climate change considerations, then, allow global trading of greenhouse gases. Economic considerations also argue for greenhouse gas emissions trading on a global scale. That would maximize the range of marginal control costs and hence the economic benefits of emissions trading.

Although climate change considerations allow trading of greenhouse gas emissions on a global scale, these emissions are often associated with emissions of other pollutants that have local health or environmental impacts. Actions to lower greenhouse gas emissions tend to reduce emissions of other pollutants as well and hence create ancillary benefits

where those actions are implemented.¹ But trading also allows emissions of greenhouse gases to rise in other locations. Discharges of the ancillary pollutants will increase as well unless the applicable environmental regulations limit total emissions of those pollutants by these sources.

Thus, consideration of the environmental impacts of ancillary pollutants is a choice of the geographic scope of a greenhouse gas emissions trading program. To ensure that emissions trading does not lead to local environmental or health damage due to increased emissions of ancillary pollutants, total emissions of all of those pollutants would need to be limited throughout the trading region. This condition is unnecessarily stringent if total greenhouse gas emissions are being reduced substantially or if the emissions of the ancillary pollutants are well below the levels that cause environmental or health damage.²

In defining the geographic scope of the greenhouse gas emissions trading program, then, it is prudent to consider the scale of the reduction in greenhouse gas emissions, the severity of the environmental and health damages due to ancillary pollutants in different parts of the proposed trading region, and the stringency of existing regulations governing emissions of ancillary pollutants throughout the proposed trading area. Based on those considerations, restrictions on the net quantity of allowances or credits purchased by sources in different parts of the trading area may be appropriate to minimize the potential health and environmental damages due to ancillary pollutants.³ A requirement for case-by-case review of proposed uses of allowances or credits is another way to ensure greenhouse gas emissions trading does not increase health and environmental damages due to ancillary pollutants.⁴

¹ This suggests that governments may wish to consider complementary policies, such as financial incentives, or regulations on emissions of the ancillary pollutants, to encourage sources located in regions where the benefits of lower emissions of ancillary pollutants would be large to reduce their greenhouse gas emissions.

² Some pollutants do not have a damage threshold, so any increase in emissions leads to greater damage.

³ Geographic restrictions on trades are fairly common in trading programs for ground level ozone precursors. The purchaser is typically required to buy the credits or allowances from an upwind source to ensure an environmental benefit in the vicinity of the purchasing source. So the geographic restrictions could have both a quantity (net increase in total emissions allowed) and a directional (reductions in upwind locations) component.

⁴ Case-by-case review could create a significant administrative burden. To reduce the administrative burden case-by-case review might only be required in specific circumstances, for example for purchases of more than a specified quantity of CO₂ equivalent allowances or credits, or cumulative purchases of allowances or credits during a given period in excess of a specified level, or for purchases by sources that emit specific ancillary pollutants but whose total emissions are not limited by existing regulations. Geographic restrictions and case-by-case review could also be combined to reduce the administrative burden. For example, case-by-case review of specified transactions (using criteria such as those listed above) would apply only in regions with net increases in greenhouse gas allowance or credit holdings.

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Jurisdictional considerations dictate that the greenhouse gas emissions trading market be national and/or provincial in scope. Jurisdiction over entities involved in emissions trading will rest with the federal and/or provincial governments.⁵ The experience of the PERT and GERT projects indicates that government recognition is important even if emissions trading is voluntary. Jurisdiction to enforce compliance is clearly important when emissions trading is being used to meet a national commitment to limit emissions.⁶ In either case, the economic benefits can be maximized through federal-provincial cooperation to create a national emissions trading market.

In the absence of an international agreement to limit greenhouse gas emissions, participants in a voluntary trading program decide to accept credits or allowances from emission reduction or sequestration actions implemented anywhere in the world.⁷ An international agreement, such as the Kyoto Protocol, to limit greenhouse gas emissions defines the range of emission reduction or sequestration actions that can be counted toward national commitments.

The Kyoto Protocol establishes international trading in assigned amount among Parties with national commitments, joint implementation involving Parties with national commitments, and a clean development mechanism to facilitate emissions reduction, and possibly sequestration, measures in developing countries. The extent to which these mechanisms can be used to meet national commitments is still being negotiated.⁸ The Kyoto Protocol also allows sequestration through direct human-induced land-use change and afforestation, deforestation and reforestation activities since 1990 to count toward national commitments.⁹ Specific rules on all of these mechanisms remain to be agreed.

⁵ See NRTEE Issue Paper 2, *Analysis of Legislative Authority to Implement Different Forms of Emissions Trading for Various Sources and Sinks* for a discussion of jurisdictional issues.

⁶ If provinces and territories have separate emissions budgets the regulatory authority of an importing province would want to ensure that the credits or allowances are a valid part of the exporting province's budget before they could be used. This could give rise to inter-provincial trade barriers or price differences for allowances and credits originating in different provinces and territories.

⁷ The participants in the voluntary trading program, including the government participants, decide on the conditions under which emissions reductions achieved in other jurisdictions will be accepted by the program. GERT, for example, accepts emissions reduction actions implemented anywhere in the world but requires one of the parties to the trade to be based in Canada, makes use of the emission reduction for compliance purposes subject to future international trading agreements signed by Canada, and requires the reductions to be registered only in Canada.

⁸ The use of international emissions trading, joint implementation and clean development mechanism credits is subject to "supplementarity" conditions that remain to be defined. The conditions ultimately agreed may limit the extent to which any country with a national commitment can use any of the mechanisms to meet its commitment. That could limit the scale of international trading and the geographic scope of trading activity. As with any restriction on the scale of trading, supplementarity conditions that limit trading activity will increase the cost of meeting the national commitments.

⁹ It is possible for Parties to the Protocol to agree to rules for other sinks as well.

An emissions trading program for greenhouse gases should have the broadest possible geographic scope. At the domestic level, that means federal-provincial cooperation to create a single national market. At the international level, it means any agreement to limit greenhouse gas emissions should allow emissions trading on a global scale as is the case for the Kyoto Protocol. If an international agreement to limit emissions comes into force, the domestic trading program should provide participants with access to all of the flexibility mechanisms available through the agreement.

Basket of Gases and Sources

Which sources and sinks of greenhouse gases should be included in a domestic emissions trading program? There are a number of different greenhouse gases and most have multiple anthropogenic sources. Human actions can also increase the amount of carbon sequestered in different sinks and reservoirs. The marginal costs of emission reduction can be expected to differ across the gases/sources, sinks and reservoirs. Thus, the economic benefits of emissions trading are increased by including as many gases/sources, sinks and reservoirs as possible in the trading program. NRTEE Issue Paper 1 examines the suitability of greenhouse gases/sources and sinks for different forms of emissions trading.¹⁰

Some greenhouse gases/sources do not lend themselves to a cap and trade program. In many of those cases it is possible to reduce emissions or increase sequestration to create credits. In the absence of a national commitment to limit greenhouse gas emissions, then, a voluntary credit trading program would be well suited to a wide range of greenhouse gas sources and sinks where emission reductions/sequestration can be accurately documented.¹¹ If a national commitment to limit greenhouse gas emissions comes into force, that commitment will be defined relative to a set of gases/sources and sink enhancement activities.

The Kyoto Protocol commitments cover six greenhouse gases -- carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF₆) -- from energy, industrial process, solvent and product use, agriculture, and waste sources. As noted above the Protocol also allows sequestration through direct human-induced land-use change and afforestation, deforestation and reforestation activities since 1990. These provisions would limit the scope of gases/sources, sinks and reservoirs covered by a domestic emissions trading

¹⁰ NRTEE Issue Paper 1, *Potential of Including Non-Energy Sources of GHG Emissions in a Domestic Emissions Trading Program*.

¹¹ Voluntary programs often include among their objectives testing innovative approaches to emissions reduction or sequestration and understanding methodological issues related to credit creation for various credit creation actions.

program to help meet the Kyoto Protocol commitment.

In summary, the domestic emissions trading program should cover as broad a range of gases/sources, sinks and reservoirs as possible. If a national emissions limitation commitment exists it will define the range of gases/sources, sinks and reservoirs. The range of gases/sources, sinks and reservoirs covered by a voluntary program will be limited by the interests of the participants.

Creating a Competitive Market

To function well, an emissions trading market needs enough participants to create a competitive market. This requires both a reasonable number of participants and that no single source, or small number of sources, be large enough to influence the market.¹² Generally, the larger the number of participants, the less likely that one or more participants are able to exercise market power.

A voluntary credit or allowance trading program established in the absence of a national commitment to limit greenhouse gas emissions would probably have a relatively small number of participants. But market power is not a concern for such programs because they are voluntary; an attempt to wield market power to drive prices up (down) would lead to lower purchases (sales) by other participants.

Assuming a national commitment to limit greenhouse gases is in force, market power is unlikely to be a concern for a domestic credit trading program. The number of sources able to create (use) credits will be large unless most are subject to regulations that do not allow credit creation (use).

With a national commitment to limit greenhouse gas emissions in force, a domestic allowance trading program would need to include enough sources to create a competitive market. This should not be a problem.¹³ An energy-related CO₂ allowance trading

¹² Trading programs involving less than 15 participants in the same industry, ozone-depleting substances (except methyl bromide) in Canada and the ABT provisions for heavy-duty vehicle engines in the U.S., experience relatively little inter-firm trading because firms are concerned that they may be helping their competitors. The U.S. Department of Justice, Antitrust Division, *U.S. Department of Justice Merger Guidelines*, Washington, D.C., June 14, 1984 pp. 13-14 defines four firm concentration ratios (the share of total sales accounted for by the four largest firms) it uses as tests of a competitive market. A ratio of 50% is considered to be a moderately concentrated market. In the U.S. Treasury Bill auction, the top five primary dealers routinely purchase over half of the issue, yet market power is not a serious concern.

¹³ Of course, if the domestic policy to limit greenhouse gases creates several separate trading programs for different regions, gases, or sources, the ability to establish a competitive market could be a concern. If separate provincial/territorial trading programs are implemented, smaller jurisdictions may not have enough sources to create a competitive market. Or the market might be dominated by a few large sources. The same is true if separate national emission limitation commitments were agreed for different gases. Then the

program, regardless of the design, will include well over one hundred participants. Adding other gases/sources to the market would increase the number of participants. And linking the domestic trading system to the international market would eliminate the market power concern completely because any buyer or seller would be such a small part of the world market.¹⁴

In summary, an emissions trading program needs enough participants to create a competitive market if it is to function well. This is unlikely to be a problem for a national greenhouse gas trading program that includes energy-related CO₂ emissions. Linking the domestic trading system to the international market would eliminate the market power concern completely. Analysis of market power will be addressed further in NRTEE Issue Paper 16.

Incorporating Multiple Trading Programs into a Single Market

Various greenhouse gases/sources are better suited to different trading program designs (see NRTEE Issue Paper 1, *Potential for Including Non-Energy Sources of GHG Emissions in a Domestic Emissions Trading Program*). And different source categories might be regulated by the federal or provincial and territorial governments. Thus the policy for meeting a national emissions limitation commitment could include multiple emissions trading programs. But efficiency is maximized by establishing a market that includes as many participants as possible.

It is possible to establish a single market for greenhouse gas allowances and credits that covers multiple trading programs, in the sense that a program consists of a specific set of participants under the jurisdiction of a given regulatory authority. Think of each gas/source as a separate trading program. Then there could be a credit, substance or

market for a gas such as N₂O might not have enough participants or might be dominated by a few large sources.

It is possible to address some of these problems in the program design. If a market is likely to be dominated by a few large sellers, the program could withhold a percentage of the allowances allocated to each participant for auction with the auction revenue being divided among the participants on the basis of the number of allowances sold, as in the case of the SO₂ allowance program (see NRTEE Issue Paper 7, *Analysis of Options for Distributing Allowances by Auction*). That reduces the market power of the sellers. Allowing unlimited imports of allowances and credits from other jurisdictions would reduce the market power of large buyers. It also solves the problem of having too few participants. Market power will be addressed in NRTEE Issue Paper 16.

¹⁴ The supplementarity conditions, or other domestic or international rules, could limit access to the international market and so make potential market power in the domestic emissions trading market a more significant concern. But as noted earlier, a domestic trading system is likely to have at least 100 participants, so the possibility that a few firms will be able to exercise market power is quite small.

emissions rights trading program for each of the greenhouse gases/sources that is part of the national emission limitation commitment.

These programs can be integrated into a single market by allowing the participants in any of the trading programs to use allowances or credits from any domestic program, or valid assigned amount, joint implementation reductions, or clean development credits from other countries, to achieve compliance. If the regulatory authority for a given program agrees to accept allowances from any other domestic program, all allowances will be equally valuable to the participants in that program. And if the regulatory authorities for all trading programs do the same, the market value of all allowances will be virtually the same. Thus, all participants in all trading programs, and the sources subject to voluntary or regulatory policies and measures able to create or use credits, would face the same marginal cost of control.

This might not happen if provinces and territories have separate emissions budgets. Then the regulatory authority of an importing province would want to ensure that the credits or allowances are a valid part of the exporting province's budget before they could be used. Prices of credits and allowances from provinces likely to exceed their budget would then be lower than those from provinces likely to achieve their commitments.

Credits are heterogeneous. Every credit creation action is unique, so the quality varies. As long as a credit is accepted by a regulatory authority it is equivalent to a government-issued allowance. Thus, if credits are certified by the regulatory authority before they are sold, credits and allowances will have the same price.¹⁵

But if credit trading operates with buyer liability there is a risk the credits will be rejected when the buyer attempts to use them for compliance purposes. That risk does not exist for allowances issued by the regulatory authority. Because of the risk of regulatory rejection, credits will trade at a discount relative to allowances under a buyer liability system for credits.

The risk of regulatory rejection of credits can be addressed in at least two ways. Firms could insure credits; if the credit is rejected the insurer replaces it with an allowance acceptable to the regulatory authority. Then the risk of rejection is reflected in the premium charged by the insurer.¹⁶ The market price of insured credits should be the same as that of allowances.¹⁷

¹⁵ As discussed below, the regulatory authority could audit credit creation actions on a sample basis.

¹⁶ If regulatory authorities apply very different standards for accepting credits the premiums could depend on where the credits are used as well as on how they are created.

¹⁷ The price of insured credits could differ from the price of allowances if the entity providing the insurance is judged to be a credit risk.

A second approach is to allow market prices of credits to reflect the risk of regulatory rejection. Given the diversity of the credit creation actions possible, rating agencies would probably evaluate the risks associated with different credits available on the market. Those ratings would guide purchasers in making their offers.¹⁸ The supply of credits is likely to be small relative to the allowances available on the market, which could depress credit prices beyond the levels justified by the risk of rejection.

It is also possible, but unlikely, that the criteria for acceptance of credits by regulatory authorities will be so clear and will be so consistently applied that the risk of rejection is negligible. Then credits would trade at the same price as allowances without insurance.

To summarize, the regulatory authorities should create a single market for all trading programs by agreeing to accept allowances or credits from any domestic trading program, or valid assigned amount, joint implementation reductions, or clean development credits from other countries, for compliance purposes. This would minimize the cost of achieving the emissions limitation commitment for these sources. The risk of regulatory rejection inherent in credits would be reflected in lower prices unless it is addressed by purchasing insurance.

ISSUES RELATING TO THE MEASUREMENT, REPORTING AND VERIFICATION OF ALLOWANCES AND CREDITS

Emissions Monitoring

An emissions monitoring system is used to measure or calculate actual emissions of a given pollutant by a specific source. Credit trading programs require monitoring systems to measure or calculate actual emissions and to estimate avoided emissions. Allowance trading programs require monitoring systems to measure or calculate actual emissions. Emissions monitoring systems differ by gas and source category. Several options with different levels of measurement accuracy and different costs may be available for a given gas and source.

The integrity of an emissions trading system depends on the quality of the emissions monitoring systems used. The trading system is intended to limit emissions by participants. Actual emissions by each participant must then be monitored accurately to determine how many allowances or credits are needed for compliance, or how many

¹⁸ Ratings would only affect how the credit creation action affected the risk of rejection, not the risk due to the use of different standards for accepting credit by different regulatory authorities.

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credits are created. Since surplus allowances and credits can be sold, sources can profit by under reporting their emissions. Under reporting also damages the environment.

Monitoring systems must also be properly maintained and be tested periodically to ensure that they are accurate. Since the monitoring system must determine total emissions, it should operate continuously. But all systems break down or require periodic maintenance. Missing data protocols must be developed to estimate emissions for periods when the monitoring system is not operational. The emissions estimated using these protocols should be biased upward, so that participants have an incentive to ensure their monitoring systems are operational.

Monitoring systems can be costly to install and operate and the costs of alternative systems vary substantially. The regulatory authorities responsible for the emissions trading system will need to decide which systems offer sufficient accuracy and reliability given the cost. Large sources are likely to be required to install more costly monitoring systems than small sources, since the potential under reporting is greater and the monitoring costs can be spread over a larger volume of emissions.

Some greenhouse gas emissions, such as energy-related CO₂ emissions, can be estimated quite accurately from other information, such as energy use by fuel type and emissions factors by fuel type. In such cases, collecting the other information may be less costly than monitoring actual emissions. Fuel meters, for example, are much less expensive than continuous emissions monitoring systems. Where such an option exists, it should be considered as an alternative to an emissions monitoring system.

If the emissions trading system is part of a program to meet a national commitment, the monitoring system requirements should be consistent with those of the commitment. Parties to the Framework Convention on Climate Change report their emissions calculated in accordance with an inventory methodology developed by the Intergovernmental Panel on Climate Change. This methodology calculates emissions at the national level using aggregate data, rather than summing emissions reported by individual sources. At present, then, there is no direct correspondence between the monitoring systems that would be used in a domestic trading program and the national emissions inventory.

In summary, credible monitoring systems are critical to the integrity of an emissions trading system. This is true for both credit and allowance trading systems. Monitoring systems can be costly to install, operate and maintain. The regulatory authorities responsible for the emissions trading system will need to decide which systems offer sufficient accuracy and reliability given the cost for each source/gas.

Reporting

Participants in allowance trading programs must report their monitored emissions to the regulatory authority in the case of a mandatory program, or to the program administrator

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in the case of a voluntary program so that compliance can be established. For the same reason, sources creating credits must report the emissions reduced or sequestered, or the credits created, to the regulatory authority or program administrator for mandatory and voluntary programs respectively. And sources using credits must report their actual emissions and the credits used to meet their regulatory obligations or voluntary target.

Larger sources in mandatory allowance trading programs are often required to report their emissions electronically¹⁹. For smaller sources in allowance trading programs and for credit trading programs, paper reports are still widely used.

Parties to a credit or allowance trade must notify the registry of the transaction. This is usually a simple form, signed by both parties, that identifies the credits or allowances sold and the date of the sale. The registry typically confirms the transaction to both parties. If seller is not recorded as the owner of the allowances or credits being sold, the parties are notified and the transaction is not registered.

The regulatory authorities responsible for the emissions trading system will need to decide on suitable reporting systems. This includes: the information to be reported, the format in which it is to be reported, whether reporting should be electronic or paper or both, the frequency of reporting, and the deadlines for reporting. Since the data reported is used for determining compliance, certification by a responsible person that the information is accurate and complete may be required for legal purposes.

In summary, participants in allowance trading programs must report their actual emissions and sources that create or use credits must report the credits created or used to the regulatory authority or program administrator. The regulatory authority or administrator responsible for the emissions trading program will need to decide on suitable reporting systems. This includes: the information to be reported, the format in which it is to be reported, whether reporting should be electronic or paper or both, the frequency of reporting, and the deadlines for reporting.

Legal Liability for Allowance/Credit Validity

When allowances are traded, which party is responsible for ensuring that they are valid? If the seller is responsible, the buyer can accept the allowances knowing they will be valid. If the seller does not meet its commitments it incurs the penalties for non-compliance. If the buyer is responsible, it must decide whether the seller is likely to comply with its commitments before purchasing the allowances. If the buyer is responsible and the seller later needs the allowances to achieve compliance, the sale will be invalidated; the seller keeps the allowances and the buyer resorts to the contract provisions and the legal system to recover any payments that have been made. The buyer may also need to purchase replacement allowances quickly to achieve compliance.

¹⁹ Participants in the SO₂ and RECLAIM trading programs are required to report their emissions to the regulatory authority in electronic form in a specified format prior to established reporting dates.

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Administratively, making the seller accountable is simpler. Buyers need not worry about transactions being invalidated. However, this system relies on the penalties for non-compliance to ensure that sellers do not sell more than their surplus allowances. All domestic allowance trading programs use seller liability.²⁰

Credit trading systems have used both seller and buyer liability. Seller liability effectively means that the credit creator has to have the credits certified as valid by the regulatory authority before they can be sold. Then the buyer can be confident that the credits purchased will be accepted by the regulator when used for compliance purposes. Seller liability, then, increases the time it takes, and raises the cost, to create and sell credits.

Buyer liability means that the buyer must carefully scrutinize the credits before they are purchased. The regulatory authority only examines the credits when they are submitted for compliance purposes by the buyer. Since the buyer will tend to be cautious in the choice of credits purchased, the regulatory authority may decide that it is sufficient to review in detail only a sample of the credits used. Buyer liability, then, allows credits to be created and sold more quickly and transfers some of the administrative cost from the regulatory authority to the program participants. But buyers may be more reluctant to purchase credits due to the risk, so trading activity may be lower and prices will tend to be lower than under a seller liability system.

How liability is actually borne can be negotiated by the buyer and seller in their contract. The program rules on liability simply establish the starting point for those negotiations.

²⁰ In the SO₂ allowance trading program, allowances are issued to participants by the Environmental Protection Agency (EPA) prior to the beginning of the year for which they are valid. Participants can sell the allowances any time after they have been received. Sources report actual emissions and establish compliance within 60 days after the end of the year. As part of the compliance process a source must indicate which of the allowances it holds it wishes to use to cover the actual emissions. If a source does not own enough allowances to cover its actual emissions it must purchase enough to come into compliance within the 60 day period or face the automatic penalties for non-compliance.

This is a seller liability system because all sales of allowances are final. If a participant sells some of its allowances and then finds that it does not own enough to cover its actual emissions it must purchase enough additional allowances to achieve compliance before the deadline or face the penalties for non-compliance. The buyer can use or resell the allowances purchased with no risk that the transaction will be invalidated because the allowances will be required by the seller to achieve compliance.

The Clean Air Act clearly states that "an allowance allocated under this title is a limited authorization to emit sulfur dioxide in accordance with the provisions of this title. Such allowance does not constitute a property right."(section 403.f) This addresses a provision of the U.S. constitution that requires the government to compensate citizens for taking or reducing the value of their property. Since the allowances are not property rights the EPA could change the caps or introduce restrictions that change the value of allowances without being forced to pay compensation.

An allowance or credit is perhaps best compared to a consumable good with limited uses, such as detergent. Once an allowance has been used to help achieve compliance with specific regulatory obligations it can not be used again and has no residual value. If the allowance or credit has a limited life, it can be compared to a perishable good, such as fresh fruit. If the allowance or credit is not used for compliance purposes before the end of its life, it no longer has any value.

If the emissions trading system is part of a program to meet a national commitment, the liability rules of the domestic system may be affected by the liability rules for the international trading mechanisms. How liability should be addressed in the international emissions trading system established by the Kyoto Protocol is still being debated. Some experts favour seller liability for its administrative simplicity. Other experts are concerned that the currently unspecified, and traditionally weak, penalties for non-compliance with international agreements means that seller liability will simply reward non-compliance.

In summary, administrative simplicity and tradition recommend seller liability for a domestic allowance trading program. If a national commitment with international emissions trading comes into force, the seller liability provision might need to be adjusted to be consistent with the provisions of the international system. Either seller liability or buyer liability could work for a domestic credit trading system. Buyer liability transfers more of the administrative burden from the regulatory authority to the participants.

Audit and Verification

If a domestic emissions trading program is intended to help meet a national commitment, the regulatory authority must audit compliance by participants and verify that credits used for compliance meet the criteria. Audit and verification by the regulatory authority is not necessary in a voluntary program, although participants could choose to have an independent entity perform this function.

In an allowance trading program, the regulatory authority must ensure that for each participant the actual emissions reported are complete and accurate, the allowances used for compliance are valid, the emissions monitoring systems have been tested and comply with established requirements, missing data protocols have been implemented properly, and actual emissions have been reported in accordance with requirements.

In a credit trading program, the regulatory authority must ensure that credit creation action meets the established criteria. The criteria for credit creation are discussed in a separate NRTEE paper (Issue 9, *Possible Criteria for the Creation of Emission Reduction Credits Under a Domestic Emission Reduction Credit Trading Program*), but are likely to include requirements that the credits be real, measurable, long-term, and additional to what would have happened otherwise. This may include verification that the actions to create the credits have been, in fact, implemented and are operating properly.

Audit and verification of credits could occur shortly after they are created under a system of seller liability. Or it could be part of the compliance process for buyers under a system of buyer liability.

Audit and verification by the regulatory authority could be done on a sample basis or for all participants.²¹ The larger the share of total participants audited the greater the assurance that the reported emissions and claims of compliance are accurate, but the higher the administrative costs. More complete coverage may be needed initially to ensure that participants comply and that the trading program is operating as intended.

In short, audit and verification is essential to the integrity of a domestic allowance or credit trading program to help meet a national commitment. All, or only a sample, of participants in a the trading program could be audited. Similarly, some or all of the credit creation actions must be verified to ensure that they meet the established criteria.

Market Institutions

An emissions trading program creates a market and, like any market, it requires some institutions to facilitate trading and to regulate the activities of market participants. There is no standard set of institutions for an emissions trading program, but every program has a registry that tracks ownership of the credits or allowances. The registry is discussed in the next section.

Other possible institutions include brokers, a regulatory body for brokers and other market participants, and a centralized trading institution, such as a commodity exchange. Brokers are active in every emissions trading program with a significant volume of trading activity. Brokers for allowance trading programs provide services similar to brokers for share or commodity trading. Brokers for credit trading programs typically provide a wider range of services, including assistance in obtaining regulatory approval for the credits created or used.

No specific action has been necessary to encourage the establishment of brokers; the business opportunity attracts interested companies and individuals and the successful ones survive. To date no emissions trading program has established a regulatory body for brokers. Sources required to participate in emissions trading programs are typically relatively large firms. They are considered to be sophisticated buyers and sellers and hence to be capable of protecting their own interests when dealing with brokers and other buyers and sellers.

To date no emissions trading program has established a centralized trading institution. The market is more like buying a house, where a buyer (seller) chooses a broker to find a suitable seller (buyer). One broker in the South Coast Air Quality District's RECLAIM program offers a regular computerized auction. Participants submit offers to buy or sell

²¹ ICF Kaiser Consulting Group, *Improving Greenhouse Gas Emission Verification*, Environment Canada, Ottawa, February 1998 discusses ways to develop uncertainty estimates for emission inventories and appropriate ways to apply them in setting emission reduction targets and for emissions trading.

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which are then matched by computer, where possible, to complete the transactions. This service is similar to electronic trading of a stock or commodity, but it is only one way of trading RECLAIM credits.

A centralized trading institution, such as a stock or commodity exchange, establishes and enforces rules designed to create a fair and transparent market. Such rules address minimum disclosure requirements for the instruments (stocks, bonds, etc.) sold, creditworthiness of market participants (brokers), price disclosure, smoothing of price fluctuations, procedures for settling transactions, restrictions on "insider" trading and resolution of disputes. This infrastructure enhances the integrity of the market, which is particularly important for an intangible product such as a financial instrument.

Operating a centralized trading institution entails considerable overhead and so requires a large volume of trades to be viable. The only emissions trading program to approach the necessary volume of activity to date is the American SO₂ allowance program. During 1997 approximately 7 million allowances were traded between companies at an average price of roughly \$100 per allowance. Trading activity in this program has grown rapidly since 1995 and has only just reached a volume that might be sufficient to justify listing on an exchange. Exchanges may be waiting to see whether the volume is sustained before listing SO₂ allowances or derivative products, such as futures contracts.²² Or it may be impossible for exchanges to compete with the low cost of trading directly through brokers; commissions charged by the existing brokers are less than 1% of the price.

An allowance trading program for greenhouse gas emissions in Canada would probably involve much larger volume of trades than the SO₂ allowance trading program, but it is not clear how much larger the value of trades would be.²³ The experience of the SO₂ program to date suggests that a market for greenhouse gas emissions in Canada would attract brokers and probably would not need regulatory bodies or centralized trading.

In summary, every emissions trading program requires a registry and every program attracts brokers to facilitate trades and provide complementary services. No trading programs have yet established regulatory bodies for brokers and other market participants or involved a centralized trading institution. Participants are typically relatively large

²² The Chicago Board of Trade conducts the annual auction of SO₂ allowances on behalf of the U.S. Environmental Protection Agency. Neither SO₂ allowances nor derivatives, such as futures or options, are routinely traded on the Chicago Board of Trade or on any other exchange.

²³ 1995 emissions of greenhouse gases in Canada totaled 619 million tonnes of CO₂ equivalent. Not all, but presumably more than half, of these emissions would be covered by the allowance trading program. Allowable emissions under the SO₂ program are currently about 7 million tons, so the volume of emissions is likely to be at least 50 times larger. The price of SO₂ allowances was about \$100 per ton during 1997 (but has recently risen to about \$200 per ton). Estimates of the price of CO₂ allowances range from US\$1 to US\$100 per tonne of CO₂. Hence the value of CO₂ equivalent allowances could range from \$300 million to \$60 billion per year, compared to \$700 million for the SO₂ program in 1997.

firms, which should be capable of protecting their own interests when dealing with brokers and other buyers and sellers.

Operation of the Registry

Every emissions trading program requires a registry to track the ownership of allowances or credits. Most registries are now computerized.²⁴ The registry software is similar to that used by a bank to track customer account balances. Each participant in the program has an account. Purchases of allowances or credits are deposits that increase the account balance. Sales and use of credits or allowances for compliance purposes are withdrawals that reduce the account balance. The software must allow only authorized personnel to enter transactions and it must include audit trails so that it is possible to correct errors and detect fraud. In the case of a credit trading program, the registry may also include information on how the credits were created and used.

The registry can be operated by the regulatory authority or be contracted out to a private entity. Both arrangements are found in the United States. The registry for the SO₂ program is operated by the Environmental Protection Agency. Michigan has contracted operation of its trading program for pollutants subject to the National Ambient Air Quality Standards to a private firm.

If Canada has a national commitment to limit its greenhouse gas emissions, a single global registry, or multiple national registries, might be established to track holdings of assigned amount, joint implementation reductions and clean development mechanism credits. If Canada is required to establish a national registry for this purpose, it could probably serve as the registry for the domestic emissions trading program as well. If a global registry is established, a Canadian registry for the domestic program might be preferable although data would need to be transferred between the two registries.

The registry operated by the U.S. Environmental Protection Agency for the SO₂ allowance trading program provides a useful point of reference on the magnitude of the task. The SO₂ trading program involves over 2,000 participants and handles thousands of transactions involving over 20 million allowances annually.²⁵ It is capable of handling a much larger number of transactions. Operation of the registry, including software changes, is handled by ten people.

²⁴ Very few, if any, credits or allowances would be in the form of certificates. In any event they are recorded in the registry. Thus, counterfeiting is unlikely to be a major problem, but the registry must be tamper proof.

²⁵ Annual sales of SO₂ allowances are roughly 7 million tons. But the registry also handles transfers of allowances between units with the same owners. The volume of such transfers is about double the volume of inter-company trades, so ownership changes of roughly 20 million tons of allowances must be handled by the registry each year.

In short, a domestic trading program for greenhouse gas emissions will require a registry. The registry for an allowance program will differ somewhat from the registry for a credit trading program. In either case the registry could be operated by the regulatory agency or be contracted out. Both approaches are being use in the United States. If a national commitment to limit greenhouse gas emissions comes into force, the registry may need to communicate with the registry(ies) used to monitor compliance with that commitment.

ISSUES RELATING TO THE COSTS OF TRADING FOR PARTICIPANTS

Price Disclosure

A question in any emissions trading program is whether buyers and sellers should be required to disclose the price at which a transaction occurs. The buyer or seller or both may consider this valuable commercial information and hence want to keep it confidential. On the other hand information on prices for recent sales facilitates other transactions and helps firms evaluate alternative compliance strategies, including budgets to purchase allowances or credits, sales of allowances or credits and investments in emission reduction measures.

The issue of whether to require price disclosure is more important if the volume of trading activity is low. Then potential buyers, sellers, and investors are less likely to know someone that has reliable recent information they are willing to share. And information obtained from different sources is less likely to be consistent. When there is a lot of trading activity, as in the SO₂ allowance market, brokers and others will publish price information. And they can do so without disclosing information that is confidential for any particular buyer or seller.

No emissions trading program requires public disclosure of the price for a given transaction. Some programs require that price information be reported to the regulatory authority so that it can be compiled and released without revealing the identity of the buyer or seller. Provided the information is released quickly, it is sufficient to meet the needs of other participants.

In a credit trading program the volume of trades is typically low relative to an allowance trading program covering the same sources. And the credits differ in terms of the actions through which they were created. Thus, price information is less likely to be readily available for a credit trading program than for an allowance trading program. If the credit trading program is being implemented to help achieve a national commitment, requiring price reporting to the regulatory authority with public release in a way that does not reveal the identity of the buyer or seller is probably useful.

In an allowance trading program where the allowances are distributed by auction, price disclosure for the auction is automatic. No requirement to disclose prices for transactions

in the secondary market is necessary. In an allowance trading program with *gratis* distribution of allowances, price information could be handled in the same way as for a credit trading program if the volume of trades is small. Another option is to withhold some allowances for auction, as is done in the SO₂ program. The revenue could be distributed to the participants or used for other purposes.

To summarize, price disclosure is more important if the volume of trading activity is low. This is most likely to be the case for a credit trading program and during the initial stages of an allowance trading program. For a credit trading program or an allowance trading program with *gratis* distribution of allowances, participants could be required to report prices for subsequent release in a way that does not reveal the identity of the buyer or seller. Alternatively, a fraction of the allowances could be withheld from the *gratis* distribution for auction. The issue does not arise if allowances are distributed by auction. Any of the approaches could be discontinued if the volume of trades increases to the point where price information is readily available.

Transactions Costs

Transactions costs include all of the costs incurred by the buyer, seller, regulatory authority or other entity, to complete a trade.²⁶ The costs could be actual expenditures, such as brokerage commissions, or opportunity costs, such as interest foregone between the date of payment and the date title is transferred. Since transactions costs are an overhead burden rather than a productive use of resources, the design of an emissions trading program should seek to minimize them.

In general transactions costs can be lowered by reducing:

- Approval or review requirements
- Processing times
- Uncertainty
- Participation by small sources

Audit and verification to determine compliance are clearly needed. Enforcement of penalties for non-compliance is also essential. But other review or approval requirements should be carefully examined to determine whether they are truly needed to ensure an effective program. And if they are not essential for an effective program, such as prior approval of trades in an allowance trading program, the expected benefits should be compared with the transactions costs.

While a transaction is being processed, neither the buyer or the seller can use the allowances, credits, or money. This is an opportunity cost. The risk that the transaction

²⁶ Daniel J. Dudek and Jonathan Baert Wiener, *Joint Implementation, Transactions Costs, and Climate Change*, ENV/EPOC/GEEI(96)1/REV1, Organisation for Economic Cooperation and Development, Paris, August 1996, includes an extensive discussion of transactions costs relative to joint implementation that is relevant to credit trading programs generally.

will not be completed also rises. This is another opportunity cost. Processing times for approvals, the time taken to determine compliance, and the time taken to enforce penalties all entail opportunity costs as well. Reducing processing times reduces transactions costs.

Uncertainties entail risks and hence costs. Reducing uncertainties lowers transactions costs. Participants in an emissions trading program can exercise some control over their emissions, the quality of credits purchased (in a credit trading system), and the reliability of their partners in a trade, but can not eliminate the risks associated with these uncertainties completely.²⁷ They can reduce the risks associated with uncertain prices at a cost through various hedging mechanisms. These uncertainties are unavoidable. Frequent program changes, inconsistent regulatory decisions and similar factors create uncertainty which can, and should, be reduced.

Transactions cost considerations typically lead to the exclusion of small sources from emissions trading programs. The transactions costs for the source or for the regulatory authority may be so high relative to the emissions involved, that voluntary or regulatory policies or measures may be more cost-effective. As a result, some share of total emissions (typically from 0% to 30%) is often excluded from the trading program.

It is often alleged that credit trading entails higher transactions costs than allowance trading because each credit creation action is unique and must be assessed relative to the established criteria. Thus, credit trading involves relatively high transactions costs per unit traded compared with programs which deal in homogeneous, government-issued allowances. On the other hand, the volume of trades is typically higher for an allowance program than for a credit program. Thus it is not clear which type of trading program has the highest total transactions cost.

A credit trading program implemented to meet a national commitment is part of a regulatory structure for participating sources. The administrative costs associated with the regulations can be attributed to the trading program or to the regulations. Compliance may, for example, require changes to an operating permit. If compliance is achieved through purchase of credits, is the cost of the permit change part of the transaction cost for the trade or simply part of the administrative cost of the regulations? In short, trying to separate the transactions costs for credit trading from those of the underlying regulatory system is difficult and not very meaningful.

When comparing alternative policies for meeting a national commitment the one with the lowest total cost is the most attractive (assuming they are all feasible and equally

²⁷ Market mechanisms can be used to reduce some of these risks. An irrevocable letter of credit or holding payments in escrow are ways to reduce the risks that the other party to a transaction will default. The risks associated with purchasing credit can be reduced by buying from or investing in funds that participate in numerous projects. The funds become skilled at dealing with the complexities of credit creation and certification. They also spread the administrative burden over a larger base. And they reduce the risks associated with poor performance or failure of a single project by investing in a variety of projects.

effective). The transactions costs associated with each policy are generally a relatively small part of the total cost of limiting the emissions. Thus transactions costs should not be the basis for a policy choice. An analysis of transactions costs should cover all aspects of the policy to limit greenhouse gas emissions; implementation and operation of an allowance trading program and the regulations and trading program for a credit trading system.

In summary, it is difficult to say much beyond the platitude that minimizing transactions costs should be an important consideration in the design of an emissions trading program. In doing so it is important to remember that transactions costs include both specific expenditures and opportunity costs. Alternative policies should be compared on the basis of their total cost of meeting the national commitment and the transactions costs are likely to be a relatively small part of this total cost.

Fees

Trading programs may levy fees on participants for various activities or services to help defray the administrative costs.

Voluntary emissions trading programs are typically financed by the participants. Each participant bears its internal costs and contributes to the costs of administering the program. The participants agree on the budget and fee structure and adjust both over time as necessary.

An emissions trading program implemented by a regulatory authority to help achieve an environmental goal imposes an administrative burden on the authority. This is true whether the goal is achieved through emissions trading, emissions taxes, or conventional regulations. In some cases the regulatory authority may not be given sufficient budget or staff to administer the trading program efficiently. This can lead to delays and increase transactions costs.

Some emissions trading programs levy fees on participants and/or transactions to help cover administrative costs. Participants often resist fees on the grounds that the regulatory authority should be responsible for its own costs and that fees on transactions may inhibit activity. However, if the fees allow more efficient administration of the program, overall transactions costs may be reduced.

The distribution of the administrative costs would, of course, differ depending on whether they are funded from fees on participants or from general revenue. The administrative costs should be a modest share of the total cost of achieving the emissions limitation commitment. And the distribution of the administrative costs should be addressed when the incidence of the cost of the overall program is considered.

In short, some emissions trading programs levy fees on participants and/or transactions to help cover administrative costs. If such fees allow more efficient administration of the

program, overall transactions costs may be reduced. But the impact of the fees on behaviour and the appropriateness of relying on this source of funds for the administrative budget of a regulatory program need to be considered.

ISSUES RELATING TO THE USE OF ALLOWANCES AND CREDITS

Banking

Banking permits allowances (credits) to be saved for use after the period for which they are issued (the period during which they were created). This flexibility makes banking useful for entities in achieving compliance in the face of fluctuations in emissions due to weather, economic conditions, or other factors. Banking also helps participants adjust to more stringent emission limitation commitments.²⁸

Since banking gives participants greater flexibility to achieve compliance, the arguments in favour of banking are economic. The principal concern related to banking is environmental, namely that banked allowances or credits can be used for a large increase in emissions and associated health or environmental damage.

Banking of greenhouse gas emissions does not create direct environmental concerns. Greenhouse gases have no local environmental or health impacts. Their impact on climate depends primarily on their concentration in the atmosphere. Given the long atmospheric lives of the principal greenhouse gases, the timing and location of emissions has little effect on atmospheric concentrations.

Many sources of greenhouse gas emissions are also sources of ancillary pollutants, such as sulphur oxides (SO_x), nitrogen oxides (NO_x), volatile organic compounds (VOCs), and particulates, which have local health or environmental impacts. Emissions of these pollutants are usually regulated, but this is not true for all sources and all jurisdictions.

²⁸ Banking raises questions about paying interest on banked credits or allowances. No trading program pays interest on -- increases the quantity of -- banked credits or allowances although this has been proposed in the literature. Interest would provide an extra incentive for early action to reduce emissions. If total emissions currently exceed health or environmental standards and are being reduced, early reductions may be beneficial because the reductions would occur when total emissions are highest and the added emissions allowed by the "interest" would occur when total emissions are lower. This argument for paying interest does not apply to greenhouse gases. Since climate change is due to greenhouse gas concentrations, shifting emissions over a few years has little effect on concentrations. Instead, increasing total emissions due to payment of interest is likely to increase concentrations in the long run and hence to be detrimental.

Some emission trading programs for conventional pollutants discount banked credits or allowances. Discounting -- reducing the quantity of -- banked credits or allowances over time limits the extent to which they can be used to increase emissions temporarily in the future. Discounting reduces, but does not eliminate, the incentive for early action to reduce emissions. If the domestic trading program is intended to help achieve a national commitment, its banking provisions should reflect those of the national commitment. The Kyoto Protocol currently does not provide interest on, nor discount, banked assigned amounts, but that could change depending upon the outcome of future negotiations.

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Even where these ancillary pollutants are regulated, the requirements may not be binding. Thus, banking for greenhouse gases could, in principle, lead to higher emissions of these associated pollutants at some future date.

This is the temporal dimension of the issue whose spatial aspects were discussed in the section on the geographic scope of the trading program. The regulations governing emissions of the ancillary pollutants need to be assessed to determine whether they effectively prevent local health or environmental damage in the case of a temporary increase in emissions. If the regulations are deemed to be inadequate, they could be made more stringent to prevent damage due to the use of banked greenhouse gas credits or allowances. Alternatively, restrictions on the use of banked allowances or credits could be introduced. These could limit the use of banked allowances or credits to a maximum increase in net emissions, or a case-by-case review of the use of banked allowances or credits, or some combination of these.

Since banking offers economic advantages and poses no environmental risks, assuming emissions of associated pollutants are effectively regulated, it should be allowed as part of a domestic trading program for greenhouse gas emissions unless the national commitment prohibits banking. The Kyoto Protocol explicitly allows banking by allowing a Party whose actual emissions during 2008-2012 are less than its commitment for the period to add the difference to its allowable emissions for subsequent commitment periods.

In summary, banking should be allowed in a domestic emissions trading program for greenhouse gases since it gives participants greater flexibility to achieve compliance and poses no direct environmental risks. But the federal and provincial governments will need to ensure that regulations governing associated pollutants, such as SO_x, NO_x, VOCs, and particulates, which have local health and environmental impacts, do not allow emissions of these gases to increase to unacceptable levels due to the use of banked greenhouse gas allowances or credits.

Allowance or Credit Life

If credits or allowances can be banked, should there be a limit on the period of time they can be held before they are used? Such a limit is called the allowance or credit life. In some emissions trading programs the allowances or credits have an indefinite life. In other programs, the allowances or credits either have a defined limited life or have a limited life due to discounting of the banked allowances or credits. Programs with a limited allowance or credit life are typically intended to achieve specific emissions reduction targets. A limit on credit or allowance life reduces the risk that the target will not be met due to the use of banked allowances or credits.

If the allowance or credit life is too short, it makes banking (and hence early reductions) less attractive because there is a greater risk that the allowances or credits can not be used before they expire. In an allowance trading program with *gratis* distribution and annual

compliance, a life of 5 to 10 years is, in practical terms, almost equivalent to an indefinite life. By using the oldest allowances for compliance purposes, the banked allowances will always be less than 5 years old unless the quantity banked is more than five years of allocated allowances.²⁹

In a credit trading program, especially with buyer liability, buyers may prefer to wait until they need credits for compliance. They may also prefer to purchase credits created by actions for which precedents are well established. Credits created by innovative measures might sell at a substantial discount, or only in small quantities, until they have been accepted by the regulatory authorities. Thus, it could take a long time to sell the credits created by an innovative measure, especially if the number of credits involved is large. A credit life of 10 years should be long enough to effectively eliminate that risk.³⁰

If the domestic emissions trading program is part of the action plan to meet a national commitment, the provisions for credit or allowance life should be consistent with those of the commitment. That means credit or allowance life in the domestic program can not exceed, but could be shorter than, the credit or allowance life allowed by the commitment. The Kyoto Protocol does not propose a limit on credit or allowance life, although such a limit could still be established, explicitly or implicitly, by the rules governing international emissions trading, joint implementation and the clean development mechanism.³¹

In short, credit or allowance life for a domestic greenhouse gas emissions trading program should be no less than 5 to 10 years.

Borrowing

Borrowing is the use of future allowance allocations during an earlier period. The main reason to borrow is because compliance would otherwise not be achieved during the earlier period.³² Thus, borrowing is a substitute for purchasing surplus credits or allowances from another participant for the current period. A participant in a trading program would prefer to borrow, assuming this is allowed, if the cost is less than the cost

²⁹ If allowances are distributed by auction, a 5 year life should also be adequate. A participant with banked allowances simply uses the oldest allowances for compliance purposes and adjusts the quantity purchased. Holding an inventory of more than five years of emissions would be very costly.

³⁰ The longer the elapsed time before credits are used, the more difficult it becomes to audit the credit creation actions. Ten years appears to be a reasonable period to find an approved use of credits.

³¹ Since the commitment period under the Kyoto Protocol is 5 years and banking is allowed, a credit life of 5 to 10 years would facilitate calculation of the emissions reductions needed to meet national commitments for future periods.

³² A participant might also choose to borrow for speculative reasons; anticipating that the price in the future period will be lower than the price in the current period. But speculation on future prices is also possible through the use of futures and options contracts.

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of buying allowances or credits from other participants. It is assumed that the regulatory authority charges interest on borrowed allowances.³³

In a credit trading system borrowing would mean being allowed to use emissions reductions (or sequestration) expected to be achieved in a future period for compliance during the current period. Credits are typically not recognized until after the reduction or sequestration action has been implemented and the quantity of emissions avoided or sequestered has been documented. No credit trading program allows borrowing.

In a domestic trading program with *gratis* allocation of allowances, borrowing reduces the effectiveness of regulatory enforcement and weakens the market for allowances for the following reasons:³⁴

- Borrowing weakens regulatory enforcement and hence the integrity of a domestic emissions trading system. Sources can borrow from future periods rather than comply during the current period. If they cease operation, the borrowed allowances are never "repaid" through lower emissions during the future period.
- Borrowing undermines the emissions trading market because sources that need additional allowances can borrow against their future allocations rather than purchase allowances or credits from other sources during the current period. In effect, borrowing reduces the demand for allowances.

If the domestic trading system is part of a program to meet a national commitment, the domestic borrowing provisions would need to be consistent with those of the commitment. The Kyoto Protocol does not include a borrowing provision. A domestic trading program to meet a Kyoto Protocol commitment could still allow limited borrowing. But the domestic program would need to have annual compliance periods and participants could not borrow from periods beyond 2012.

In summary, borrowing is really only a possibility for a domestic allowance trading program with *gratis* distribution of allowances. If such a trading program is intended to meet the Kyoto Protocol, the potential for borrowing is further restricted. Borrowing is undesirable because it reduces the effectiveness of regulatory enforcement and weakens the market for allowances.

³³ In other words, a participant that wishes to borrow 100 units for compliance during the current period would have its allocation for the next period reduced by 100+X units.

³⁴ If allowances are auctioned, borrowing is not possible.

The Compliance Period

The compliance period is the interval at which participants in an emissions trading program must establish that their actual emissions for the period are less than their allowance holdings (in the case of an allowance trading program) or the emissions allowed by applicable regulations and net credit holdings (in the case of a credit trading program). For every past and current trading program, except the lead in gasoline program, the compliance period is one year. For the lead in gasoline program the compliance period was three months.

It can be argued that a longer compliance period is appropriate for greenhouse gases. The climate change impacts of greenhouse gases depend on the concentration (stock) and the rate of change of the concentration of the gases in the atmosphere. Since greenhouse gases have long (decades to centuries) atmospheric lives, the stock responds slowly to emissions. Thus, variations in emissions over the course of a few years have a negligible effect on climate change impacts. But emissions depend, in part, on weather and economic conditions that participants in a trading program can not control. A longer compliance period would tend to provide average weather and economic conditions and so facilitate the task of managing compliance.³⁵ The Kyoto Protocol recognizes this and gives Parties a five-year compliance period.

The compliance period is not a significant issue for a voluntary trading program because compliance is not mandatory. Participants can choose any compliance period they find convenient.

If a national commitment comes into force, the compliance period for the domestic trading program can not be longer, but could be shorter, than the commitment period.³⁶ Establishing compliance imposes costs on both participants and the regulator. A compliance period of less than one year raises costs without offering a corresponding environmental benefit. A longer compliance period complicates enforcement because the number of participants that cease to operate, and the number of new sources, increase.

Assuming the national commitment covers a five-year period, should the compliance period for the domestic trading program be one year, five years, or some intermediate period? The arguments for a one-year compliance period include:

³⁵ Emissions of other pollutants also vary due to changes in weather, economic conditions and other factors. Nevertheless they are regulated on an annual basis. In some cases this is because damages depend on current emissions, emissions exceed desired levels, the trading program is designed to reduce total emissions, and banking is not allowed. But other trading programs allow banking and hence could adopt a longer compliance period. The main reason for an annual compliance period appears to be that this represents a reasonable balance between the administrative costs of establishing compliance and the risk of non-compliance due to turnover in the participant population.

³⁶ If it is longer than the commitment period, sources could comply with their obligations with larger reductions toward the end of the domestic compliance period, but leave Canada out of compliance with its national commitment.

- It is the standard for other emissions trading programs and for many other requirements, such as taxes.
- It represents a reasonable balance between of the administrative costs of establishing compliance and the risk of non-compliance by sources that cease to operate.
- It helps meet the annual reporting obligation under the Framework Convention on Climate Change.

The major drawback of a one-year compliance period is that weather or economic conditions, especially in the first year, may make compliance difficult. Higher emissions due to weather or economic conditions in later years can be addressed by allowing banking. Credits for early action would help participants in either a credit or allowance trading program cope with unusual conditions during the first year. In an allowance trading program unusual conditions during the first year can also be addressed by giving participants a slightly larger allocation for that year. Rather than allocating 100 units to participants each year for five years, for example, the program could allocate 110 units the first year and 98 units each of the next four years.

In short, a multi-year compliance period offers participants no advantages over a one-year compliance period with banking and a slightly larger allocation for the first year. A multi-year compliance period may reduce the administrative costs of establishing compliance, but it increases the enforcement difficulties for sources that cease to operate.

Penalties for Non-Compliance

Penalties for non-compliance are a concern mainly for emissions trading programs implemented to help achieve a national commitment.³⁷ In that case each participant in the trading program must comply with its obligations if the commitment is to be met.

In a voluntary trading program, penalties for non-compliance are not a significant concern. Participants could establish penalties for non-compliance. But a participant faced with penalties for non-compliance would probably withdraw from the program before the penalty is enforced. Thus, exclusion from the program is probably the only penalty a voluntary program can implement; any more stringent penalty would simply lead to withdrawal.

Under a credit trading program designed to help achieve a national commitment, participants will be subject to mandatory performance standards or other forms of regulation. Sources that reduce their emissions below the level required by the regulation can create credits for the difference. Sources whose emissions exceed the level allowed by the regulation can use credits to achieve compliance. Sources will be required to report how they have achieved compliance to the regulatory authority. The regulatory

³⁷ Penalties for non-compliance are discussed in NRTEE Issue Paper 11, *Evaluation of Possible Policies Complementary to a Domestic Emissions Trading System*.

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authority will audit all or a sample of the sources to verify compliance. Sources found to be in non-compliance will be subject to penalties that may include fines, loss of credits and criminal penalties.

Verification of compliance will include verification that credit creation actions meet the established criteria. Determining whether credits meet the established criteria will always be a matter of judgement. The regulatory authority will have the ultimate responsibility for that judgement and the compliance audit will need to ensure that the credits meet the established criteria. Credits that do not meet all of the criteria are neither certified nor accepted for compliance. Typically, no penalty, other than disallowance of some or all of the proposed credits, is involved. A source that purchased credits that are disallowed need to purchase replacement credits to achieve compliance.

Under an allowance trading program designed to help achieve a national commitment, non-compliance means that a participant has actual emissions during the compliance period that exceed its allowance holdings. Typical penalties for allowance trading programs consist of automatic loss of allowances equal to the excess emissions from future *gratis* allocations plus fines and possible criminal penalties in the case of flagrant or repeated violations. If allowances are distributed by auction, the only possible penalties are financial and criminal, however, the financial penalties could still be defined in terms of the cost of purchasing allowances equal to the excess emissions plus fines.³⁸

In summary, the penalty for non-compliance in a voluntary program is expulsion from the program. When a trading program is part of the policy to achieve a national commitment, effective penalties are critical to its success. In a credit trading program, sources must comply with the applicable standards or regulations or face fines and possible criminal penalties. Credits that do not meet the established criteria are disallowed. In an allowance trading program, the typical penalty is loss of allowances equal to the excess emissions plus fines and possible criminal penalties. If the allowances are distributed by auction, the financial penalty would need to be defined in terms of the cost of buying allowances equal to the excess emissions plus a fine.

ISSUES RELATING TO CHANGES TO THE EMISSIONS TRADING SYSTEM

Allocation of Allowances to Sources that Cease to Operate

Several of the existing emissions trading programs in the United States continue to allocate allowances *gratis* to sources even after they cease to operate. The justification for continuing to give a valuable commodity -- allowances -- to a source that is no longer operating and hence does not need allowances to achieve compliance is sometimes questioned. If new sources do not receive any allowances *gratis* from the regulator, the

³⁸ The fine for each tonne of CO₂ equivalent emissions beyond the allowances held by a source could be defined as the cost of purchasing an allowance for one tonne of CO₂ equivalent emissions plus a financial penalty of say \$1,000.

treatment of new and no longer operating sources seems particularly unfair. The basic arguments for continued distribution to sources that cease to operate is that this eliminates any incentive to continue to operate old, high-emitting facilities simply to continue to receive allowances.

In addition, it is argued, the distribution of allowances does not affect the efficiency of the allowance market. Thus, when new sources purchase the allowances from the sources that receive the allocation, that affects the distribution of costs but not the efficiency of the market. As discussed in the NRTEE paper on *gratis* allocation (Issue 6) this is not strictly true in a dynamic setting.

The main argument against continued allocation of allowances to sources that cease to exist is that it appears unfair. It appears to reward a source that is putting people out of work by shutting down by enabling it to benefit from the sale of the allowances it will be allocated in the future. It appears even more unfair when it is recognized that the buyer is a new source that is creating employment. It also means actual emissions differ increasingly from the allocation of allowances, which could lead to international challenges of the *gratis* allocation as an unfair subsidy.

Continued allocation of allowances to sources that cease to operate arises from *gratis* allocation rules that are based on historic emissions, input or output. As discussed in the NRTEE paper on *gratis* allocation (Issue 6) this is not a necessary feature of an allocation rule. Allocations can change over time to address intertemporal equity.

No other approach to allocation continues to allocate allowances to sources that no longer operate. The baseline for a non-operational source under a credit trading program would be zero. If the allowances were auctioned, a non-operational source would not need to buy any allowances, but also would be most unlikely to receive any of the auction revenue regardless of how it is distributed.

Continued *gratis* allocation of allowances to sources that cease to operate, then, arises from the use of allocation rules tied to historic emissions, input or output. Intertemporal equity suggests the use of rules that change the allocation over time in response to changes in the participant population. Such rules would eliminate allocations to sources that cease to operate, although perhaps not immediately. This is consistent with the treatment of non-operational sources under an allowance auction or credit trading program.

Allocation to New Sources

The converse to continued allocation of allowances to sources that cease to operate is the *gratis* allocation of allowances to new sources. The question applies only to trading programs with *gratis* distribution of allowances. Several of the existing programs require new sources that meet specific criteria to participate in the trading program and to purchase all of the allowances they need to cover their emissions. Other programs

incorporate specific allocations or other mechanisms to collect allowances or credits that can be given to new sources.³⁹

This is an issue of intertemporal equity. As discussed in the NRTEE paper on *gratis* allocation (Issue 6) allocation rules can be devised that change the allocations over time to include new sources. Such rules are consistent with the treatment of new sources under an allowance auction or credit trading program. With an auction, new sources must buy allowances like every other source, but they also benefit from the redistribution of the auction revenue in the same way as other sources. In the case of a credit trading program, the baseline for a new source would generally be the lower of its actual or allowable emissions.

In summary, some programs recognize, and attempt to address, the inequity of requiring new sources that are obligated to participate in trading program with *gratis* allocation of allowance to purchase allowances to cover all of their emissions when other sources get allowances equal to a substantial share of their emissions free. An allocation rule that changes the distribution of allowances over time in response to changes in the participant population is one way to address this problem. Special allocations for new sources, and other approaches, can also address the problem. Any of these approaches is consistent with the treatment of new sources under an allowance auction or credit trading program.

Expansion of the System

Questions concerning expansion of an emissions trading system apply only to allowance trading systems. In a credit trading system any eligible source can create credits if it wishes to do so provided this is allowed by the applicable regulations. Changing the regulations to facilitate trading could be considered an expansion of the system, but it involves no changes to the trading system.

In an allowance trading system, expansion could mean the addition of new sources similar to those already participating in the program or to incorporating new categories of sources into the program. Each of these situations will be addressed in turn.

Participation in an allowance trading program to meet an emissions limitation commitment is mandatory for specified sources. New sources that meet the criteria must participate or face penalties for non-compliance. Depending on the procedure used to distribute allowances, these new sources receive, or must buy, allowances. The overall cap does not change, so prices might rise. But if the domestic market is closely linked to the international market the addition of a new source in Canada is not likely to affect the

³⁹ The Sacramento Metropolitan Air Quality Management District (SMAQMD) SEED Project leases emission reduction credits (ERCs) to stationary sources. The availability of these ERCs for compliance with offset requirements benefits new and expanding businesses. Some other air quality management districts and states have established "community banks", which provide ERCs free or at a discount to new and expanding sources. The ERCs are obtained by withholding a fraction of the ERCs from each credit creation action, including plant shutdowns.

price.

It is assumed that sources of greenhouse gas emissions contribute to meeting the national commitment and that no category of sources is expected to bear an unfair share of the burden. Thus, if an allowance trading program exists and a new category of sources is to be added to the program, those sources will already be subject to some policies to limit their emissions. It should be possible, then, to calculate roughly the emissions limit for those sources and the implicit allocation for each individual source. If the emissions limit is added to the existing cap for the trading program it should not adversely affect achievement of the national commitment.

If the allowances are distributed by auction, the allocation to individual sources is not an issue. If the allowances are distributed *gratis*, the existing allocation rule could be applied to the new sources as well. This could conceivably lead to large changes to the allocations to some existing or new participants. The allocation to new participants could be based on their estimated allowable emissions under the previous policies. That should leave both the existing and new participants largely unaffected. That arrangement could be maintained, or a gradual transition to a common allocation rule could be implemented.

In short, it should be possible to cope with the addition of new sources similar to those already participating in the program or of new categories of sources into an allowance trading program with relatively little difficulty.

Changes to GWP Values

Different greenhouse gases have different impacts on climate change. To compare the environmental benefits of reductions of different gases they need to be expressed in terms of a common denominator. Global warming potentials (GWPs) can be used to express quantities of other gases as CO₂ equivalents. GWP values are likely to change over time.

A voluntary emissions trading program for greenhouse gases could use published GWP values to convert other gases to CO₂ equivalents so that the credits or allowances could be defined as a quantity of CO₂ emissions. Rules would need to be developed to cope with changes to published GWP values.

Potential changes to GWP values should not be allowed to create undue uncertainty for entities investing in emission reduction or sequestration measures. The uncertainty can be reduced by adopting rules that provide substantial advance notice (2 to 5 years) of a change to the GWP values and that ensure past actions and trades are not affected by a change to the GWP values.⁴⁰ Sufficient advance notice allows investors to adjust the

⁴⁰ Since GWP values are an imperfect measure of the relative climate change impacts of different greenhouse gases and since the new value for a particular gas could be higher or lower than the existing value, continuing to use older values for a few years does not create a significant environmental concern.

plans for measures that have not yet been implemented and affects only the heavily discounted future returns of projects already implemented.

A domestic emissions trading program implemented to help comply with a national emissions limitation commitment would need to treat different gases in a manner consistent with the commitment. If the commitment applies to multiple gases some means of expressing them in common units would need to be specified. The Kyoto Protocol, for example, states in Article 5 that the Parties will adopt a set of GWP values for the gases covered by the commitment. The GWP values adopted apply for the entire commitment period. If scientific evidence suggests the values should be changed, the new values would only apply to the next commitment period.

In short, different gases need to be converted to a common unit using an agreed set of GWP values. Agreement on procedures for introducing changes to GWP values that minimize disruption to the market will also be needed.

Changes to the Emissions Cap as International Commitments Change

A change in the national commitment under an international agreement would require the federal and provincial governments to adjust the policies to limit greenhouse gas emissions to meet the new commitment. Depending on the policies adopted, this could involve more stringent regulations for various (or all) categories sources, higher carbon taxes, or a more stringent cap for the allowance trading program.⁴¹ If the allowances are auctioned, it simply means there are fewer allowances available. This presumably leads to higher prices, both domestically and internationally, since commitments in other countries would be more stringent as well.

The higher prices for allowances make more emissions reduction and sequestration actions economically attractive. These additional measures are implemented to meet the new commitment. Since it can take some time to implement emission reduction and sequestration measures, negotiation of new commitments should provide participants with reasonable lead time for implementation. The Kyoto Protocol provides (Article 3.9) that consideration of commitments for the second commitment period will be initiated no later than 2005.

If the allowances are distributed *gratis*, fewer allowances are available for distribution. The price in the secondary market will rise both domestically and internationally since commitments in other countries would be more stringent as well. The higher prices for allowances make more emissions reduction and sequestration actions economically attractive. These additional measures are implemented to meet the new commitment.

⁴¹ With a credit trading system, a more stringent commitment would require the regulatory authority to impose stricter standards on many or all sources. These stricter standards would define the baselines for credit creation.

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Banking also helps participants cope with a more stringent commitment, regardless of how the allowances are distributed. Banking encourages reductions before the more stringent commitment comes into force. These banked allowances can then be used to help meet the more stringent commitment when it comes into force. Thus, banking spreads the adjustment to the lower cap over a period of several years. The Kyoto Protocol allows a country whose actual emissions are below its national commitment to add the difference to its commitment for the next period. Thus early reductions can help meet the commitments in subsequent periods.

In summary, a more stringent national commitment would translate into a lower cap for an allowance trading program. That would mean fewer allowances for distribution to participants and higher prices. The higher prices stimulate investment in more emissions reduction and sequestration measures to meet the lower cap. Because of the lead times involved in implementing such measures, several years advance notice is desirable. Banking also facilitates adjustment to a lower emissions cap and so is desirable subject to the concerns relating to emissions of ancillary pollutants discussed earlier.

SUMMARY

A trading program should include as many sources as possible to provide the broadest possible range of emissions control costs and to ensure a competitive market.

The *geographic scope* of an emissions trading program for greenhouse gases could be global based on economic and environmental considerations. Jurisdictional considerations suggest federal and/or provincial regulation with a national market.

The *basket of gases and sources* should be as broad as possible to increase the range of emissions control costs.

Creating a competitive market is unlikely to be a problem for a domestic greenhouse gas trading program unless the policies adopted to meet a national commitment severely restrict the scope of trading program.

The regulatory authorities should *incorporate all trading programs into a single market*, (a trading program being a specific set of participants under the jurisdiction of a given regulatory authority) by agreeing to accept allowances or credits from any domestic trading program, or from any international mechanism.

Credible *emissions monitoring* is critical to the integrity of an emissions trading system. The regulatory authority or administrator will need to decide which monitoring systems offer sufficient accuracy and reliability given the cost for each source/gas.

The regulatory authority or administrator will need to decide on a suitable *reporting* system for each source. This includes: the information to be reported, the format in which

it is to be reported, whether reporting should be electronic or paper or both, the frequency of reporting, and the deadlines for reporting.

Administrative simplicity and tradition suggest seller liability for a domestic allowance trading program. Either *seller liability or buyer liability* could work for a domestic credit trading system. Buyer liability transfers more of the administrative burden from the regulatory authority to the participants.

Audit and verification is essential to the integrity of a domestic allowance or credit trading program to help meet a national commitment. All, or only a sample, of participants in the trading program could be audited.

A greenhouse gas emissions trading market in Canada would attract brokers but probably would not need regulatory bodies, centralized trading, or other *market institutions* initially.

A domestic emissions trading program for greenhouse gases will require a *registry*. The registry for an allowance program will differ somewhat from the registry for a credit trading program. In either case the registry could be operated by the regulatory agency or be contracted out.

Price disclosure is more important if the volume of trading activity is low. For a credit trading program or an allowance trading program with *gratis* distribution of allowances, participants could be required to report prices for subsequent release in a way that does not reveal the identity of the buyer or seller.

Minimizing *transactions costs* should be an important consideration in the design of an emissions trading program. In doing so it is important to remember that transactions costs include both specific expenditures and opportunity costs.

Some emissions trading programs levy *fees* on participants and/or transactions to help cover administrative costs. If such fees allow more efficient administration of the program, overall transactions costs may be reduced. But the impact of the fees on behaviour and the appropriateness of relying on this source of funds for the administrative budget of a regulatory program need to be considered.

Banking should be allowed in a domestic emissions trading program for greenhouse gases since it gives participants greater flexibility to achieve compliance provided that the regulations governing associated pollutants do not allow emissions of these gases to increase to unacceptable levels.

Allowance or credit life for a domestic greenhouse gas emissions trading program should be no less than 5 to 10 years.

Borrowing is undesirable because it reduces the effectiveness of regulatory enforcement and weakens the market for allowances.

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A multi-year *compliance period* offers participants no advantages over a one-year compliance period with banking and a small over-allocation in the first year followed by under-allocations in subsequent years. A multi-year compliance period may reduce the administrative costs of establishing compliance, but it increases the enforcement difficulties for sources that cease to operate.

The *penalty for non-compliance* with the criteria for credit creation is disallowance of some or all of the credits claimed. Credit creators and users must comply with the applicable regulations to limit their emissions. Participants in an allowance trading program must hold at least equal to their emission to comply. The typical penalty for non-compliance is loss of allowances or credits equal to the excess emissions plus fines and possible criminal penalties.

Allocation of allowances to sources that cease to operate raises issues of intertemporal equity and international challenges of *gratis* allocation as an unfair subsidy. Eliminating allocations to sources that cease to operate, although perhaps not immediately, is consistent with the treatment of non-operational sources under an allowance auction or credit trading program.

Some programs with *gratis* allocation include provisions for the *allocation of allowances to new sources* that are obligated to participate in trading program, to address the inequity of requiring new sources to purchase allowances to cover all of their emissions when other sources get allowances equal to a substantial share of their emissions free.

Expansion of the system to cope with the addition of new sources similar to those already participating in the program or of new categories of sources into an allowance trading program should be possible with relatively little difficulty.

GWP values are used to convert different gases to a common unit. Procedures for changing GWP values that minimize disruption to the market need to be agreed.

Because of the lead times involved in implementing *changes to the emissions cap as international commitments change*, several years advance notice is desirable. Banking also facilitates adjustment to a lower emissions cap.