TURNING DOWN THE HEAT

Emissions Trading and Canadian Implementation of the Kyoto Protocol

Chris Rolfe

West Coast Environmental Law
Research Foundation
Vancouver, Canada

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The views expressed are those of the author. Any errors and omissions are, of course, solely the responsibility of the author.

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Glossary

Absolute liability offences are offences in which the violator of a standard will be found liable for a penalty whether or not they intended the offence to occur or were negligent in allowing it to occur.

Accelerated vehicle retirement program is a program in which the program manager purchases high polluting vehicles and scraps them.

Activities implemented jointly or *AIJ* means emission reduction activities in a host country implemented or funded by companies or governments from other nations (investor nations) and approved under a pilot program established at the *FCCC* First Conference of the Parties. (See page 305)

Additional or *additionality* is the degree to which an emission reduction would not have occurred in the absence of a particular policy instrument or project. Unless otherwise noted, additionality in this report is used to refer to project additionality, i.e. whether or not a project would have occurred in the absence of a policy instrument (e.g. but for a regulation, credit trading, or a voluntary commitment). A project is not additional if it does not represent a change from business as usual. Sometimes additionality refers to emissions additionality, i.e. whether or not an emission reduction occurs due to a project. (See page 90 and pages 196 to 203).

Administrative penalties are penalties imposed by government officials or statute for non-compliance with permit, statutory or regulatory requirements. They are an alternative to penalties imposed by the courts. (See page 219 and page 273)

Allowance is the unit of trade in a cap and emission allowance trading program. (See page 227)

Annex 1 Nations are industrialized and former eastern bloc countries (listed in Annex 1 to the *Framework Convention on Climate Change*) that are committed to returning their greenhouse gas emissions to 1990 levels by 2000. Some countries have taken on commitments that exceed this commitment. (See page 60)

Atmospheric user fees are fees, dedicated to reducing emissions, paid by emitters who exceed a set standard. (See page 124)

Automatic administrative penalties are penalties which are automatically levied on an emitter based on emissions data from continuous emissions monitors or fuel meters. (See page 273)

Banking is the ability to hold a credit or allowance for use during a later time period. For instance, if an allowance is issued for use in 2000 but not used in that year it could be banked for use in future years. Rules governing banking vary for every trading program — ranging from no banking to unlimited banking. (See pages 210 and 256)

Berlin Mandate was the mandate given to the Ad Hoc Group on the Berlin Mandate at the First Conference of Parties to the Framework Convention on Climate Change in Berlin to negotiate stronger emission reduction commitments for the post 2000 period. (See page 60)

Borrowing is the ability to use an allowance allocated for one time period in an earlier time period. (See page 257).

Bubbles are a form of emission reduction credit trading, used under the US *Clean Air Act*. (See page 169)

Buyer Beware refers to trading program where the purchaser of a credit or allowances is liable for ensuring that the credit is validly created or that the allowance is surplus to the needs of the seller.

CAFC (Company Average Fuel Consumption) standards, the voluntary standards for motor vehicle fuel efficiency in Canada, call for manufacturers to sell a mix of vehicles which, on average, meet a minimum fuel efficiency for each vehicle weight class. The standards are generally equal to CAFE standards. (See page 105)

CAFE (Corporate Average Fuel Efficiency) standards, the American standards for motor vehicle fuel efficiency, require each manufacturer to sell a mix of vehicles which, on average, meets a minimum fuel efficiency for each weight classes. (See page 105)

Cap and emission allowance trading involves a market mechanism for trading pollution allowances. Government specifies a maximum total or cap of emissions from a specified class of emitters. It then distributes allowances to that class. The total of individual allowances is equal to the cap. All sources within the class must hold sufficient allowances for their actual emissions. The allowances are fully tradeable. (See page 162, and Chapter 9)

Cap and carbon coupon trading is similar to cap and emission allowance trading except that the allowances, or carbon coupons, represent rights to produce, import or distribute fossil fuel carbon, rather than rights to emit greenhouse gases. (See page 164, and Chapter 10)

Carbon dioxide or $C0_2$ is a long-lived greenhouse gas, and is the predominant cause of global climate change.

CCME or Canadian Council of Ministers of Environment, consists of the Ministers of Environment from the provinces, territories and federal government. This council has a permanent secretariat.

Clean development mechanism is the mechanism defined under the *Kyoto Protocol* whereby Annex 1 Nations can meet emission limitations by using certified credits for emission reductions in non-Annex 1 Nations. (See page 63 and pages 309 to 314)

Climate Change Task Group was a task group established under the auspices of the National Air Issues Coordinating Committee to develop options to reduce greenhouse gas emissions. The options were laid out in a September 1994 report. The group consisted of representatives of environmentalists, industry and provincial and federal governments. (See page 67)

Cogeneration means the simultaneous production of electricity and steam or hot water for industrial or commercial use.

Conservation management is the management of forests to slow deforestation and conserve existing sinks. (See page 324)

Cream skimming is a term used to describe situations where some energy conservation is obtained at low cost and the remainder of the economic potential is not pursued. While this potential could be pursued in the future, it may no longer prove economic when not bundled with other technologies or when it has to bear full installation cost alone. (See page 135)

Credit is the unit traded in a credit trading program. (See page 162)

Credit trading is a form of emissions trading used to make regulatory or voluntary standards less costly or onerous. For example, if the owner of a particular source is required by regulation to reduce emissions by x tonnes, the owner can then choose to have a second source reduce its emissions to x tonnes below a projected baseline. The credits generated from reducing the second source's emissions can be applied against the first source's emissions. (See page 162, and Chapter 8)

Demand side management is management of demand for a product (usually electricity) by the supplier or government as an alternative to simply increasing supply to meet demand. Demand can be reduced by improving energy efficiency and conservation, or the timing of demand can be shifted. The equivalent for transportation is transportation demand management. (See page 101)

DERs or *Discrete Emission Reductions*, are the name given to credits traded in the Open Market Trading Program. (See page 170)

District energy systems distribute thermal energy (hot water, steam or cold water) from a central plant to individual buildings to provide, heat, hot water or air conditioning. They tend to be highly efficient but require greater initial capital investments.

Economic potential is the level of financial investment in energy efficiency and low carbon technology which is most economically efficient (ignoring the cost of averting climate change). It is used in this report to mean the most efficient from a societal perspective rather than a private perspective. (See pages 74 to 76)

Emission factor is a defined estimate of the emissions associated with a particular activity used in calculating emissions and emission reductions, e.g. cars might have a lifecycle emission factor of 400 grams/km. (See page 205).

Emission Reduction Credit Trading is a credit trading program modelled on the program of the same name adopted under the US *Clean Air Act* in the 1970s. A source could avoid restrictions on new sources, processes for reviewing expansions or some prescriptive standards by arranging for a flow of emission reductions that would occur at another point or source. (See page 168)

Environmental multiplier is a factor added to the price of energy or other commodities to reflect externalities inherent in the production of the commodity. For instance, environmental multipliers can be added to the price of energy when lifecycle costing is used to set energy efficiency standards. The effect of the multiplier is to ensure that the level of efficiency reduces overall societal costs, not simply costs to the to consumer. (See page 106)

Externalities are the social costs of a product not included in the final price to the consumer. For instance, the cost of operating a car does not reflect environmental costs of air pollution, policing costs or diminution of land values due to roads and traffic.

FCCC or Framework Convention on Climate Change the international agreement governing actions to reduce emissions of greenhouse gases and avoid dangerous interference with the climate system. (See page 60)

Feebates a program where surcharges or fees imposed on undesirable products or activities are used to subsidize relatively desirable products or activities. For instance, a surcharge on gas guzzling cars is dedicated to subsidizing high efficiency cars. (See page 139)

Global warming potential (GWP) is an index of the relative climate change impacts of different greenhouse gases. The GWP of a gas represents the cumulative radiative forcing over a stated time period of a kilogram of that gas emitted now, and is expressed relative to the impact of a kilogram of carbon dioxide over the same period. Radiative forcing is a measure of how much the gas changes the balance between incoming solar radiation and outgoing solar and heat radiation, thus contributing to warming of the atmosphere. (See page 346)

Governor in Council means the federal cabinet with the approval (usually automatic) of the Governor General. Most federal regulation making powers are exercised by the Governor in Council.

International emission allowances are the portions of nations' emission quotas (or to use the language of the Kyoto Protocol "portions of assigned amounts" of allowable emissions) that are traded in international trading.

International trading refers to trading of international emission allowances between countries or firms in different countries where both countries are subject to internationally binding emissions targets. Where trades occur, the country from which an allowance is sold adjusts its target downward, and the country purchasing the allowance adjusts its target upward. (See page 62 and pages 314 to 319)

IPCC or the *Intergovernmental Panel on Climate Change*, was formed in 1988 by the World Meteorological Organization and the United Nations Environment Program to advise governments of the world on scientific, economic and policy issues related to climate change. (See pages 31 and 59)

Joint implementation or *JI* is used in several senses. It is sometimes to refer to all international cooperation to reduce greenhouse gas emissions. More often it has been used to refer to generation of credits from emission reduction projects in non-Annex 1 Nations that can be used to meet Annex 1 Nation emission limitations. The *Kyoto Protocol* refers to this process as the clean development mechanism and refers to joint project among Annex 1 Nations as joint implementation. (See page 305)

Kyoto Protocol is the *Kyoto Protocol to the United Nations Framework Convention on Climate Change* negotiated in Kyoto, Japan in December 1997. Once in force, the Kyoto Protocol will require Annex 1 Nations to reduce emissions of greenhouse gases. (See pages 61 to 66 for an extensive discussion.)

Leakage is the extent to which emission reductions achieved by an emission reduction project are offset by emissions that occur as a result of the project. (See page 90 and pages 203 to 206)

Less carbon intensive technologies, fuels or products refers to fuels, technologies or products which have lower net greenhouse gas emissions (actual end of pipe emissions may be equal).

Lifecycle emissions are the total net emissions associated with a project or process. For instance, the lifecycle emissions of burning natural gas include emissions at the burner tip, methane leakage from pipelines and distribution, carbon dioxide stripped from gas during processing, and emissions associated with exploration and development. (See page 205).

Lieutenant Governor in Council means the provincial cabinet with the approval (usually automatic) of the Lieutenant Governor. Most provincial regulation making powers are held by the Lieutenant Governor in Council.

Marginal costs are the costs for an incremental change. For instance a firm may be able to reduce daily emissions at a cost of \$10 per tonne for the first tonne, \$15 per tonne for the next ten tonnes, and \$50 per tonne for all its remaining emissions. \$10 per tonne is the marginal cost of abatement; however, once that emission reduction is made \$15 per tonne is the marginal cost of abatement.

Marginal sources are sources which supply incremental changes in demand. For instance, while large hydro electric dams dominate BC's electric generation, reduction or increases in demand for electricity are likely to be met by a mix of marginal sources such as the Burrard Thermal Plant, (which is often turned on and off depending on whether hydro dams can meet demand), energy imports and (to a much lesser extent than its overall contribution to generation) hydro. (See page 205)

Market Failures are the failures in the economic system which cause the market to work less efficiency than its full economic potential. (See pages 76 to 78)

Market potential is the level of investment in energy efficiency and less carbon intensive technologies which is financially cost-effective for a particular business given existing regulations, taxes, subsidies, etc. (See page 74)

Methane or CH_4 is a powerful, but relatively short-lived greenhouse gas.

National concerns refers to the federal government's constitutional powers to pass legislation regarding matters of national concern possibly including greenhouse gas emissions. (See pages 356 to 361)

Net greenhouse gas emissions means the actual lifecycle greenhouse gas emissions associated with a project, process or nation less any increase in carbon sequestration associated with the project, process or nation.

Netting is a form of emission reduction credit trading. (See page 169)

Nitrous Oxide or N_20 is a powerful, long-lived greenhouse gas.

Non-Annex 1 Nations are parties to the *Framework Convention on Climate Change* other than *Annex 1 Nations.* All Non-Annex 1 Nations are developing countries.

No-regrets measures are measures whose benefits, such as reduced energy costs and reduced emissions of local/regional pollutants, equal or exceed their cost to society, excluding the benefits of climate change mitigation. (See pages 76 to 79)

NOx are oxides of nitrogen which are precursors to ground level ozone, itself a greenhouse gas as well as a local pollutant They include NO and NO_2, but not the greenhouse gas N_20.

OECD or Organization for Economic Cooperation and Development, is an organization representing almost all developed market based economies.

Offset options are a contractual right to implement and claim credit for an emission reduction project at some time in the future. (See page 183)

Offset programs are programs where a source of emissions is required to, or commits to, offset its emissions by obtaining credits from another source. These credits are created by a firm reducing emissions, or potentially in case of carbon dioxide gases, enhancing sinks. (See page 168)

Ontario CO_2 Collaborative was a group of representatives from industry, environmental groups, labour and other interests which recommended a strategy for reducing greenhouse gas emissions in Ontario.

Open market trading programs are programs modelled on the US EPA's proposed model open market trading rule. Sources can avoid some prescriptive standards or restrictions on new sources by acquiring credits which represent Discrete Emission Reductions that have occurred at other locations. The validity of credits is primarily enforced by audits of credit use occurring after they are used (as opposed to government approval of credits prior to use). (See page 162, pages 170 to 171 and page 185 to 190).

Oregon CO_2 Standards are the legally binding CO_2 emission performance standards Oregon applies to new fossil fuel electric generating plants. For natural gas plants, the standard is 17% lower than the most efficient plant in operation in the US. Plants with emissions that exceed the standard must purchase credits to offset emissions or pay excess emission fees into a fund that finances emission reduction projects. (See pages 176 to 177)

Oregon Exemption refers to an exemption granted by the Oregon Facility Siting Council. The exemption permitted the establishment of a thermal generating facility and was granted largely on the basis of which of several competing project proponents had the best portfolio of emission reduction projects. (See page 176)

Ozone Transport Region is an area consisting of 13 eastern seaboard states (from the District of Columbia and part of Virginia to Maine). The OTR coordinates state implementation plans, and has the power to petition the US EPA to impose certain requirements among all states in the region.

Performance standards are requirements that equipment or buildings meet at least certain operating criteria such as emission rates, energy or fuel efficiency etc. Examples include Corporate Average Fuel Efficiency (CAFE) standards or utility standards based on x tonnes per megawatt hour.

Prescriptive standards includes technology standards, absolute emission limits, and performance standards which do not use credit trading as a compliance option.

QELROs or *Quantified Emission Limitation and Reduction Objectives* refers to binding national emission reduction targets negotiated under the *FCCC*.

The *range* of a program defines the sources (or sinks) at which emissions can be reduced (or sinks enhanced) to create credits. (See page 165)

Reliability is the likelihood that a project will be implemented or perform as intended. (See pages 211 to 214)

Retail wheeling is the sale of electricity from a producer directly to a consumer, with utilities providing access to their transmission and distribution lines at a price established by tariffs.

RECLAIM is an acronym for the Regional Clean Air Incentives Market, the cap and emission allowance trading program for $N0_x$ and sulphur dioxide in the Los Angeles area. (See page 231)

A revocable licence is a licence — in this report a credit, allowance or coupon — for which compensation is not available if its value is eliminated because of government action. (See page 255)

SCAQMD the South Coast Air Quality Management District is the agency which implements the RECLAIM program for the Los Angeles area.

Scope of a program defines what emission sources are required to hold allowances or are allowed to use credits as an alternative to compliance with regulatory standards. It is distinct from the range of a program, which defines where credits can be generated. (See page 165)

Secondary energy demand refers to all energy used by Canadians other than energy used to produce other forms of energy.

Seller Beware refers to trading program where the purchaser of a credit or allowances is has no responsibility for ensuring that the credit is validly created or that the allowance is surplus to the needs of the seller.

Sequestration is the process of removing carbon from the atmosphere and storing it in non-atmospheric reservoirs. This can involve planting trees in unforested areas, increasing carbon content of forests, increasing carbon stored in agricultural soils or increasing carbon stored in wood products. (See pages 324 to 329)

Sinks are reservoirs of carbon, for instance trees, soils and oceans, that are sequestering carbon dioxide from the atmosphere.

Split incentives are a type of barrier to cost effective emission reduction measures. Those that pay for a measure do not receive the benefits. For instance, it may be most profitable for the developer of an apartment block to install an inefficient but cheap source of heat, even though a larger investment would pay itself off to the tenants. (See page 77)

Storage management is the management of forests to increase the amount of carbon stored in vegetation, soil and durable wood products. (See pages 325 to 329)

Substitution management is the managing of forests to increase the transfer of carbon from trees and other vegetation into products that substitute for fossil fuels (e.g., producing ethanol to replace gasoline) or carbon intensive products (e.g., producing lumber to replace concrete). (See page 329)

Taranaki Plant is a New Zealand power plant which is required by its air emissions permit to offset greenhouse gas emissions. (See page 175)

Technology Standards are standards which prescribe a particular abatement, energy efficiency, monitoring or other technology. (See page 110)

Title IV Acid Rain Program is the cap and emission allowance trading program for sulphur dioxide developed under Title IV of the US *Clean Air Act, 1990.* (See page 230)

Transportation demand management is the reducing of demand, or shifting the timing for demand, for road space rather than simply providing more roads to meet demand. Demand is reduced by shifting people to more efficient modes (e.g., shifting people from single occupancy vehicles to buses) and reducing the need for trips by encouraging activities like telecommuting.

Executive Summary

Human induced climate change is one of humanity's greatest challenges. Over the coming century it is predicted that climatic changes caused by our emissions of greenhouse gases will have drastic environmental consequences, yet these emissions are closely tied to much of our economic activity. This report is intended to assist in the search for solutions and, in particular to examine the role of emissions trading in implementation of Canada's greenhouse gas emission reduction commitments under the *Kyoto Protocol to the United Nations Framework Convention on Climate Change*. The *Kyoto Protocol* commits Canada to reducing greenhouse gas emissions by six percent from 1990 levels during the period 2008 to 2012. This report looks at how a domestic emission trading program could help achieve that goal.

Under trading programs, individual polluters are given flexibility in how to reduce their emissions. Where an emitter can, at a low or negative cost, reduce emissions or energy use beyond what is required by regulation they can sell an emission reduction credit or an allowance to a polluter who cannot reduce their emissions as easily. The purchaser of the credit or allowance is then allowed to emit more. The theory of emissions trading assumes that by placing increased choice of control measures in the hands of emitters, emissions will be reduced at the lowest cost.

During the years prior to negotiation of the *Kyoto Protocol* policy makers have been daunted by the myriad of measures necessary to seriously reduce greenhouse gas emissions. Emissions trading was often discussed as a panacea, an alternative to regulation, a new way to reduce emissions at the lowest cost. This report finds that, while there is potentially a large role for emission trading, it is not a panacea. It is one — albeit a potentially very important one — tool among many to reduce greenhouse gases, and its effectiveness will depend to a very large extent on the details of how it is designed and the extent to which it is supported and supplemented by a number of other measures. This report provides an in-depth analysis of the pros and cons of different emission trading mechanisms, highlighting the crucial issues that will arise in the design of a domestic trading program.

Chapter 1 — Climate Change and the Enhanced Greenhouse Effect

Greenhouse gases such as carbon dioxide, methane, water vapor, and nitrous oxide allow solar radiation to penetrate the earth's atmosphere and heat the earth's surface, but when this heat is reradiated in the form of infrared radiation some of it is captured by greenhouse gases. This is the greenhouse effect. Without it, the earth would be far colder than it was at the height of the deepest ice age. However, human activities have upset the balance between greenhouse gases emitted into the atmosphere and those taken out of the atmosphere by natural processes. Increased greenhouse gas emissions have led to increased atmospheric concentrations of greenhouse gases.

Because of increased concentrations of greenhouse gases in the atmosphere, there is no longer a balance between the energy being received from the sun and energy escaping to space. The earth's average temperature has already increased by between 0.3°C and 0.6°C since the late 19th century, a change that is unlikely to be entirely natural in origin. The Intergovernmental Panel on Climate Change (IPCC), a body that represents international scientific consensus on climate change, predicts that, if strong policy actions are not taken, mean global temperature will increase by between 1.0°C and 3.5°C by 2100.

Perfect knowledge of impacts will only exist after we have, through inaction, committed ourselves to those impacts. We may pass the point of no return without realizing it.

Climate change means not only warming, but also sea level change, increased storm activity, more extreme droughts in some areas and more extreme floods in others. Its projected effects include massive changes in ecosystems, extinction of many species that cannot adapt to rapid climate changes, severe impacts on agricultural production (especially in countries where the world's poor and hungry are located), inundation of large areas of some countries, and the spread of diseases such as malaria far beyond their current range.

Immediate stabilization of greenhouse gas concentrations at today's levels would require immediate reductions in emissions of carbon dioxide from human activities of over 60%. Given the impossibility of reducing emissions immediately by 60%, our goal must be to work toward an acceptable atmospheric concentration level. From an environmental perspective, it is highly desirable to begin significant emission reductions early. Early reductions will result in a slower rate of change climate change, and will allow future generations to choose lower concentration levels as they gain a fuller understanding of climate impacts. Any delay in reducing emissions will necessitate future emission reductions that are much deeper and steeper, and may prove economically or politically unachievable.

Choosing an appropriate path to stabilization requires a cautious approach to avoid disastrous impacts. Perfect knowledge of impacts will only exist after we have, through inaction, committed ourselves to those impacts. We may pass the point of no return long before we realize it. The full effects of a given atmospheric concentration of greenhouse gases may not be felt for decades after that concentration is reached. Moreover, climate changes projected by scientists are based on an assumption that climate systems will react relatively slowly. However, because of our poor understanding of climate systems, there is a risk of unexpected, large and rapid climate system changes that would have catastrophic effects far more severe than the projected impacts.

Chapter 2 — Canadian and BC Emissions

The sources of greenhouse gases are ubiquitous but dominated by fossil fuel combustion and its inevitable byproduct, carbon dioxide. In Canada, 85% of our emissions are from fossil fuel production and consumption. Other sources of greenhouse gases include deforestation, industrial processes such as aluminum smelting and cement manufacture, use of nitrogen fertilizers, cattle production, and rotting garbage in landfills. To effectively reduce greenhouse gas emissions will require myriad changes in behavior and technologies.

Although, Canada contributes only a small portion of total global greenhouse gas emissions, we have the second highest per capita emissions in the industrialized world. Our high emissions per capita are the result of energy intensive lifestyles, cold climate, large geographic distances between population centres, low density suburban sprawl and our specialization in fossil fuels and energy intensive products for export. The fastest growing sources of emissions in Canada are the fossil fuel industries, followed by heavy industry and passenger transportation.

Chapter 3 — Responding to Climate Change: the International, National and Provincial Responses.

Propelled by the increasing scientific consensus on the risks posed by climate change, there has been a growing momentum at international, national and provincial levels toward emission reductions. At an international level, the first step was the 1992 *Framework Convention on Climate Change* which contained a commitment by industrialized nations to aim to stabilize greenhouse gas emissions at 1990 levels by the year 2000. Few countries took significant steps to meet this target. Recognizing the inadequacy of the stabilization target, nations negotiated the *Kyoto Protocol to the UN Framework Convention on Climate*

Change in 1997. The *Kyoto Protocol* establishes a commitment binding in international law, but the targets agreed to are only a small early step in the evolution of an international response.

Chapter 4 — The Cost and Timing of Emission Reductions

One of the barriers to implementation of greenhouse gas reduction programs has been different assumptions regarding the cost of reducing emissions. The estimated costs of reducing emissions vary greatly according to assumptions made as to how development of new low carbon technologies will respond to demand; the cost of low carbon energy; and the lifetime of existing carbon intensive consumer products, factories, transportation infrastructure, power generating plants and other capital stock.

One key factor differentiating the various economic analyses is the range of assumptions regarding the efficiency of the economy. Some economic analyses assume that our economy is as efficient as possible and that there are no emission reductions that do not involve a cost to society. This usually implies that even modest emission reduction goals will slow economic growth, and it implies that creation of economy wide price signals through emissions trading or carbon taxes are the most effective emission reduction measures.

Other analyses assume that a number of market failures inhibit the adoption of emission reduction measures and that major emission reductions could be made at no net cost to society. These market failures include:

- **Subsidies.** The current tax system subsidizes carbon and energy intensive industries;
- **Information Barriers.** Consumers, homeowners and businesses lack the information on products and services that reduce greenhouse gas emissions and save money;
- **Financial Barriers.** Consumers, homeowners and small businesses cannot afford energy efficiency measures that are profitable in the long run;
- **Externalities.** Goods and services do not incorporate the environmental costs of their production;
- **Split Incentives.** The market does not always reward a person that invests in energy efficiency or emission reductions with the cost savings that result from such investments;

- **Institutional Barriers.** Government regulation, the organization of a business or institutional cultures may inhibit the adoption of cost effective emission reductions.

These market failures create barriers to the implementation of so called "no-regrets" measures — measures that, from a societal perspective, are worth doing for reasons unrelated to climate change. Economic analyses that acknowledge these market failures and assume that they are curable by government find that emissions reductions can occur at no net cost to society. The corollary of these analyses is that government policy should focus on curing market failures as well as creating broad economic incentives to reduce greenhouse gas emissions.

Chapter 5 — Criteria for an Effective Emission Reduction Program

The choice of appropriate government policies and programs will depend on a number of different criteria including:

- **Environmental effectiveness.** Will the policy or program lead to global emission reductions which would not occur in the absence of the measure? Is the impact on atmospheric concentrations permanent? Are there other environmental benefits?

- **Cost effectiveness.** Is the policy or program cost effective given its long and short term impact on greenhouse gas emissions, its various positive side-benefits and side-effects, and the administrative costs to government and business? Is a policy or program flexible enough to accommodate unusual circumstances? Does it encourage technological innovation?

- **Equity.** Are impacts of a program equitable on different regions, businesses, socio-economic groups and sectors?

- **Feasibility.** Are implementation, enforcement and administration of the program or policy within the practical and legal capacity of government? Does the program or policy involve inherently contentious decisions that are politically difficult to resolve? Can a program be adapted easily if international law imposes more stringent emission reduction requirements on Canada?

Chapter 6 — Emission Trading: Alternatives and Complementary Policies

Since the economy sometimes responds efficiently to price signals and other times does not do so, the most cost effective means of reducing greenhouse gas emissions is likely to involve a mix of measures intended to create price signals and specific programs to cure market failures. Emissions trading can create price signals, but any strategy to reduce greenhouse gas emissions is likely to involve a portfolio of measures that are either supplements to or alternatives to trading. These include:

- **Prescriptive standards.** Although prescriptive standards are often seen as a drag on economic activity, flexible standards that provide long lead times and which anticipate worldwide trends can be a source of competitiveness. Also, minimum energy efficiency standards for new products can overcome the tendency among consumers to undervalue the future savings from energy efficiency. However, the effectiveness of prescriptive standards — especially energy efficiency standards — is circumscribed by: their limited ability to encourage early replacement of older, inefficient equipment; their limited ability to encourage energy efficient use of equipment; and governments' difficulty in determining the cost effectiveness of different standards due to the unpredictable nature of technological development and exaggeration of costs by businesses.

- **Changes to the tax system.** Tax measures to reduce greenhouse gas emissions include eliminating the biases in our current tax system which favour fossil fuel production and energy intensive industries. Also, imposing a carbon tax is the main alternative to emissions trading. Revenue from such a tax could be recycled back into the economy by reducing taxes on jobs, income or value added. This would create a more efficient tax system and create broad incentives to reduce greenhouse gas emissions wherever possible. However, a carbon tax fails to cure most market failures. And, in the absence of parallel action by other jurisdictions, governments are likely to fear unnecessary short term economic dislocation caused by impacts on the competitiveness of existing energy intensive industries.

- **Information, educational and outreach programs.** These are programs specifically aimed at overcoming institutional and informational barriers to no-regrets measures. They can range from programs that passively provide information services to interested parties, to programs that require firms to conduct extensive energy use audits. The effectiveness of these measures is limited because they do not encourage no-regrets measures if the measures are not profitable from an individual or corporate perspective. Nonetheless, they are particularly important adjuncts to programs where price signals are used to affect change.

- **Procurement programs.** These reduce the risk to business of introducing new, less carbon intensive technologies into the market place. Their success is dependent on the ability of program administrators to aggregate enough orders for new technologies to create economies of scale for manufacturers and reduce manufacturers' risk in introducing new products.

- **Financial incentives for specific behaviors.** These include a broad range of measures, including tax incentives for energy efficiency, road tolls and rebates on the purchases of energy efficient products. They can internalize some environmental costs and overcome financial and other barriers to cost effective measures. However, negative incentives are often politically unpopular, and positive incentives are difficult in an era of government fiscal restraint and energy market restructuring.

- **Voluntary Agreements and challenges.** The use of voluntary agreements and voluntary challenges to achieve environmental ends is new, and thus there are few experiences to draw on to assess effectiveness. Even where a strong regulatory threat exists, they likely have a limited ability to remove most of the barriers to cost effective emission reduction measures.

No single instrument will be most effective in reducing all the barriers to cost effective measures. Some measures are very effective at removing barriers to no-regrets measures in a narrow sphere of activity. Other measures have a much broader impact but are not fully effective in removing barriers to no-regrets measures.

Chapter 7 — Introduction to Emissions and Carbon Trading

As policies to cure market failures and realize no-regrets measures become progressively less obvious, measures such as emission trading and carbon taxes will become more important. The perception that business supports trading and environmentalists oppose it is simplistic and probably incorrect. Details of a program will determine its pros and cons and its political acceptability.

Three basic forms of trading are applicable to reducing greenhouse gas emissions:

- **Credit trading.** Credits are an alternative to complying with a prescriptive standard. If the owner of Source A is required by regulation to reduce emissions from that source by x tonnes/day, the owner can instead use credits generated by having Source B reduce its emissions by x tonnes/day below a projected baseline. Sources A and B may be different emission stacks within the same firm or completely different facilities with different owners.

- **Cap and emission allowance trading.** The government establishes a cap on total allowable emissions from defined sources during a defined time period. It then allocates allowances to emit greenhouse gases, with the total emissions permitted by all allowances being equal to the cap. Those sources that expect to emit less than permitted by their allowances may sell surplus allowances to other sources whose emissions would otherwise exceed the allowances allocated to them. Over time, the number of allowances in circulation can be reduced and thus total emissions are reduced.

- **Cap and carbon coupon trading.** This program is similar to cap and emission allowance trading; however, rather than trading an allowance to emit a given unit of greenhouse gases, coupons represent licences to produce or import carbon in fossil fuels. Since carbon in fossil fuels is a very close proxy for the carbon dioxide emitted by burning those fossil fuels, the limitations on carbon in fossil fuels reduces greenhouse gas emissions.

Each of these programs represents a distinct approach to emissions trading, and each has its distinct advantages and disadvantages from both economic and environmental perspectives. Moreover, each approach has innumerable permutations, and different approaches can be combined.

Chapter 8 — Credit Trading

Many American jurisdictions have used credit trading to reduce the costs of meeting prescriptive standards for local pollutants. The first programs were emission reduction credit trading programs in which government administrators attempted to project the flow of emission reductions that would result from an emission reduction project and predict whether these reductions would compensate for non-compliance with a local air pollution standard. More recently, the US federal government has promoted open market trading. Under open market trading, credits are generated by retrospectively measuring emission reductions. Compliance is secured by the auditing of firms to ensure that they hold enough credits to offset their excess emissions and to ensure that these credits were validly created. Both voluntary and mandatory credit trading programs specifically aimed at greenhouse gases have been established in British Columbia, New Zealand and Oregon.

The first step in designing a credit trading program is to establish the regulations that can be complied with through the use of credits. As greenhouse gas emissions are currently unregulated, it will be necessary to establish a number of new regulatory standards. Developing standards that apply to a wide variety of new and existing sources will be more cost effective and more environmentally effective than standards that just target new sources or very large sources. When standards have goals other than reducing greenhouse gases — e.g. protecting consumers from costly, energy wasting products — it may be necessary to restrict the use of credit trading.

An important design choice is the distinction between emission reduction credit trading and open market trading. Emission reduction credit trading has very high transaction costs and is less likely to be routinely used by business, but it may be appropriate if trading is only used in very limited circumstances or in the initial stages of trading, when businesses are unfamiliar with methodologies for calculating emission reductions and generating credits. Open market trading requires a greater degree of sophistication among users, and is more suitable to institutionalized credit trading.

Credit trading involves a number difficult methodological issues. Designers of a credit trading program must carefully balance, on the one hand, the need to ensure that credits accurately reflect actual global emission reductions with, on the other hand, the value of minimizing the costs of measuring and verifying emission reductions. Several elements of a credit trading program can help establish this balance: the general approach to setting baselines and measuring emission reductions can be defined; a process for government approval of measurement protocols can help ensure that credits are valid at a reasonable cost; and life-cycle emission factors can be established to reflect the impacts of a project on global emissions.

If too inclusive, there is a risk that credit for early action could create a reservoir of credits from projects that represent business as usual. This could delay real reductions in emissions, and if the use of such credits is concentrated in some sectors, it could increase the burden on other sectors.

Setting the baseline from which emission reductions are measured is the most difficult methodological issue in relation to credit trading. Credit trading will only be as environmentally effective as strict compliance with regulations if the credits represent emission reductions that would not have occurred in the absence of credit trading. It is, however, impossible to definitively determine whether or not a project would have occurred in the absence of trading. There are many greenhouse gas emission reduction projects that are not happening even though they are worthwhile for reasons unrelated to climate change. Thus, rejecting all projects which are profitable or should be happening for other reasons would lead to the rejection of many of the projects that society should be focusing on.

The problem of credit for non-additional projects can be controlled by requiring a portion of all credits to be retired or discounted, by ensuring that baselines represent good practices within a sector, and by regularly adjusting baselines to reflect trends within a sector or business. Even though the *Kyoto Protocol* sets a cap on national emissions, credit for non-additional projects can reduce effectiveness of regulatory regimes prior to 2008, possibly affecting Canada's ability to comply with the *Protocol.* There is a risk that "credit for early action" — i.e. credit for action prior to regulatory requirements being in place — is given to projects that do not represent a change from business as usual, it could create a reservoir of credits from non-additional projects. If the use of these and other credits for non-additional projects is concentrated in some sectors, it could have a distributional impact (increasing the emission reduction burden on other sectors).

A number of elements must be put in place to ensure compliance under a credit trading program:

- Programs need to clearly define when credit users, credit generators and brokers of credits will be liable for invalid or insufficient credits. In an open market trading program, making credit users responsible for the validity of credits will create incentives for compliance by all parties. Generators and brokers of credits may also be liable in some circumstances.

- Additional enforcement tools and administrative resources will be necessary. Credit trading creates added enforcement difficulties because of the methodological challenges facing enforcement staff and the larger number of sites and projects that must be monitored or audited. Both the tools and resources currently available to Canadian environmental enforcement staff are likely insufficient to create a credible enforcement threat in a credit trading program. A program can be designed to overcome some of these problems: for instance, establishing administrative penalty systems as an alternative to criminal prosecutions; requiring credit users to have third parties audit their compliance; and, requiring credit users to cover governments' incremental costs in relation to administering and enforcing a credit trading program.

- Programs need to define how ownership of credits will be determined. A few relatively simple rules are needed to ensure that emission reductions from a project are not double counted.

Although the exact pros and cons of a credit trading program will depend on its design, the following generalizations can be made:

- The main attraction to credit trading is that those firms that are required to reduce their emissions can generally seek out the most cost effective emission reduction opportunities, regardless of where they occur.

- On the other hand, participants' transaction costs and governments' administration and enforcement costs are likely to be far higher than other forms of trading.

- Credit trading requires government to develop a wide range of regulatory standards, a process which has in the past been slow, faltering and expensive. These standards will need to be continuously made more stringent to drive environmental improvements.

- Because credits will inevitably be given for projects that would have occurred in the absence of trading, credit trading will reduce the effectiveness of a regulatory standard. If emitters are allowed to use credits as an alternative to compliance with regulatory standards, either regulations will need to be more rigorous or credits will need to be significantly discounted.

- Compared to other forms of trading, credit trading is more likely to encourage projects specifically aimed at curing market failures. For instance, while a cap and carbon coupon trading program would encourage reduced emissions from passenger vehicles through price signals, it would not encourage a third party to offer rebates on energy efficient vehicles or undertake similar programs aimed at curing market failures.

- As compared to other forms of emissions trading, credit trading is more easily implemented in the short term because the driving force for environmental improvement under a credit trading program — prescriptive standards — can be implemented piecemeal.

- Since credit trading gives regulated parties an alternative to strict compliance with possibly expensive regulatory standards, credit trading should make implementation of regulatory standards easier. Projects used to generate credits may also demonstrate the feasibility of new standards.

Chapter 9 — Cap and Emission Allowance Trading

Cap and emission allowance trading programs have been used in several US jurisdictions for reducing local or regional pollutants and have been proposed in both the US and Canada for greenhouse gas emissions. The US trading program for sulphur dioxide has been successful in significantly reducing sulphur dioxide emissions from utilities at a much lower cost than was initially anticipated. The sulphur dioxide program was difficult to establish, but once established it proved to be very cost effective. The Los Angeles area cap and emission allowance trading program for oxides of nitrogen and sulphur dioxide from major point sources has been more controversial. Because of the political desire to appease various polluters, the cap was initially set at a level higher than actual emission levels from the sources within the cap. Critics believe emission reductions would have been faster if the local air quality district had stuck to its plan to reduce emissions through prescriptive standards. Supporters of the trading program believe that improvements to air quality from prescriptive standardsi would have likely been delayed by lobbying from industry. They argue that the momentum toward emissions reduction is greater under the allowance trading program.

The first step in designing an emission allowance trading program is to define the sources that will be within a cap. Defining the appropriate scope for a Canadian program is difficult because of lack of source specific information on emissions. Including greenhouse gases in Canada’s source specific pollution inventory would help remedy this problem. A cap and allowance trading program would likely be restricted to power generation and carbon dioxide from large industrial sources, thus capturing about 30% of Canadian emissions. The broader the scope of the program, the greater potential savings through trading, the more effective the program will be in reducing overall emissions, and the less chance of production shifting to sources outside the cap. However, these advantages have to be weighed against the disadvantages of imposing monitoring and administrative costs on small sources. In particular, monitoring emissions of greenhouse gases other than carbon dioxide and carbon dioxide emissions from fuels that have variable carbon contents will be expensive.

Economists sometimes argue that a market for emission allowances will work best where allowances represent legal property rights and where there is certainty as to the future supply of allowances. Government policy makers and environmentalists are, on the other hand, loath to tie the hands of future governments by giving individuals and firms a legal right to pollute in the future. This tension between classic economics and political responsibility can be best reconciled by denominating allowances as a right to emit in a particular year, passing regulations that set out government's intent as to cap reductions and formulas for allocating allowances, and issuing allowances annually.

Allowance trading should not tie the hands of future regulators by creating property rights to future emissions.

Emitters can be given flexibility as to when emissions occur by permitting allowances not used in a particular year to be banked for future use. In the early years, a trading program could include an escape valve in the form of excess allowances available at a cost significantly higher than the anticipated market value. This will reduce the risk that a tight cap might limit essential energy supplies before emitters have had an opportunity to accumulate a buffer of banked allowances. A program could also potentially allow emitters to make up short falls in allowances in one year by borrowing allowances from their future allocations, but the experience of other trading programs shows that, even when strictly limited, borrowing mechanisms can be administratively unwieldy and create enforcement difficulties. A better approach is to require emitters who exceed permitted amounts to retire a commensurate number of allowances from their next year's allocation as well as subjecting them to automatic penalties.

One of the most contentious aspects of designing a cap and emissions allowance trading program is determining how allowances will be allocated. The rules for allocating allowances will determine how the costs of emission reduction are shared. As is evident from the following options, no allocation method is ideal:

- Allocations based on historic emissions in a baseline year minimize information requirements, and minimize immediate impacts on competitiveness, but they punish companies who have invested in energy efficiency and renewable technologies, create barriers to new and expanding producers, and create perverse incentives to shift production to firms outside the cap.

- Allocations based on rolling average emission levels reduce the negative impacts of allocation on a historic emissions basis, but may also reduce the economic efficiency of the program.

- Allocating allowances according to a firm's annual production levels rewards firms that have invested in energy efficiency or renewables, does not create barriers to new firms and avoids rewarding firms that shift production to other jurisdictions. However, this method is difficult because of the huge variability in the carbon emissions associated with different products. Efforts to minimize windfall profits and major losses to different companies will make the program extremely complex. These efforts will also reduce the program's effectiveness in shifting production away from carbon intensive goods and processes.

- Allowances can be auctioned with revenues recycled to the economy. Revenue from allowances can be recycled into the economy in ways that will mimic the distributive and competitiveness impacts of any free allocation or any form of carbon tax. For instance, it can be used to reduce general taxes or returned to energy intensive sectors. Revenue neutral auctions can also be designed to recycle revenues according to companies' cost of reducing emissions.

A major drawback to emission allowance trading programs is that, in order to appease competing firms' demands for allowances, government may initially create a cap that is significantly higher than actual emissions. This can delay the timing of real emission reductions. Overall, the most promising methods of allocating allowances involve either revenue neutral auctions or allocation methods which involve a mix of different approaches. For instance, initial allocations may be on the basis of historic emissions. Overtime, allocations based on production of relatively generic units of production could be phased in. This minimizes initial redistributive effects while giving firms time to shift to less carbon intensive products and production methods.

An emission allowance trading programs would require changes to the Canadian regime for enforcement of environmental laws. A combination of continuous, tamper-proof monitoring systems and automatic penalties for non-compliance can create a system that, once established, is extremely efficient, putting few demands on government resources. However, in the absence of these measures, a cap and emission allowance trading program may prove far less environmentally effective and require far greater government enforcement resources.

Although many of the pros and cons of emission allowance trading programs depend on the details of program design, their advantages and disadvantages can be summed up as follows:

- A schedule of cap reductions creates a momentum in favour of reducing emissions that is far greater than exists in a program dependent on perpetually making a wide variety of regulatory standards more stringent. Experience shows that the speed of cap reductions can be accelerated in allowance trading programs.

- Cap and emission allowance trading programs can be very environmentally effective, provided that they include appropriate monitoring and enforcement mechanisms, and provided that caps are not initially set too high.

- The design of an allocation method will be politically contentious and, depending on what method is used, may require considerable administrative resources. However, once established, a cap and emission allowance trading program can have very low administration and transaction costs.

- Many low cost projects cannot be used to reduce emitter's compliance costs because they fall outside the range of a cap and emission allowance trading program.

Chapter 10 — Cap and Carbon Coupon Trading

A cap and carbon coupon trading program would capture emissions from millions of small emitters who are hard to include within other trading programs. While an emissions allowance trading program can probably only capture about a third of Canadian emissions, a cap and carbon coupon trading program could easily capture over 74% of Canada's greenhouse gas emissions. The limited supply of carbon coupons would allow producers and importers to charge a premium to their customers so that demand for fossil fuels does not exceed the limited supply. The premium will be higher for more carbon intensive fuels. To be socially acceptable, most or all of the windfall revenue from the premium would need to be captured by government. Government can capture the premium by auctioning allowances or taxing allowance holders. Although the effect of a carbon coupon trading program is very similar to that of a carbon tax, it has the advantage of avoiding a series of politically difficult adjustments to carbon taxes.

A cap and carbon coupon trading program could be applied to either production and import of fossil fuels or distribution of fossil fuels. It is best applied to production and import because this captures fuels used by fossil fuel producers. Exemptions would be necessary for carbon used as a feedstock in long lived products or carbon in fuel exports.

Carbon coupon trading, like carbon taxes, is often seen as politically inviable because of the unpopularity of measures that affect fuel prices. Carbon coupon trading would be particularly contentious because it affects fuel prices in an unpredictable way. This barrier could be reduced by clearly promoting the idea of using revenues to reduce general taxes. A portion could be also be channeled to carbon intensive industries. The effects on competitiveness, individual and corporate incomes and efficiency will depend on how revenues are recycled. Programs for recycling revenue can be devised that have the identical distributive effects as any of the allocation methods discussed for allowance trading. Border tax adjustments for energy intensive goods can defuse competitiveness concerns, but such taxes may be contrary to trade obligations and reduce the efficiency of carbon coupon trading.

Although a carbon coupon trading program may affect energy prices and thus emissions from all sectors, some sectors — especially individual consumers — are not particularly responsive to price signals because of the existence of market failures. Thus, a carbon trading program would need to be accompanied by a number of measures to cure market failures.

Chapter 11 — The Clean Development Mechanism and International Emissions Trading

Under the so called “clean development mechanism,” the *Kyoto Protocol* permits nations that are subject to international emission limits to gain credit for emission reduction projects in countries that are not subject such limits (due to their low per capita emissions, developing countries are not subject to emission limits under the *Kyoto Protocol*). Credit is given for emission reductions that are in addition to what would have occurred in the absence of a project, but there is no need to establish that a project would not have occurred without the incentive of clean development credits. Businesses in the developed world can claim credit for emission reduction projects that they invest in or undertake in the developing world. The mechanism is intended to reduce Canada and other developed nations’ emission reduction costs. It is also intended to demonstrate the potential for low carbon economic development, and reduce investments in technologies that lock developing countries into high emission rates.

Nonetheless, rather than Canadian private capital being used to reduce emissions in other nations, we may want to encourage investment in no-regrets measures domestically. More importantly, because credit is likely to be given for clean development projects that would have occurred in any event, recognizing clean development credits in a domestic program will reduce the effectiveness of Canadian commitments. In order to ensure that Canadian use of clean development credits does not undermine the effectiveness of Canada’s commitments under the *Kyoto Protocol,* Canada could work towards strong international rules for setting the baselines from which clean development emission reductions are measured.

The *Kyoto Protocol* also permits nations to trade portions (international emission allowances) of their assigned amounts of allowable emissions. The rules for such international emission allowance trading have not yet been developed. Allowing Canadian emitters to purchase international emission allowances from other nations could reduce Canada's costs of compliance. Depending on the evolution of international emission trading rules, Canada may need to restrict the use of international emission allowances and require users of international emission allowances to guarantee the continuing validity of the allowances they use. Canada may also wish to restrict use of allowances in order to ensure environmental protection goals are met. The major concern with international emission trading is that some nations' assigned amounts of allowable emissions far exceed their likely emissions during the 2008 to 2012 commitment period. Rules may allow nations to buy and use these surplus international emission allowances even though they do not represent real emission reductions.

There is also concern that trading rules may not place any responsibility on nations that purchase international emission allowances to ensure that the allowances they purchase are surplus to the needs of the seller nation. Without placing some responsibility on the nation buying emission rights, the increase in global emissions caused by one nation's non-compliance can spread to other nations and multiply.

Chapter 12 — Including Forest and Agricultural Soil Reservoirs in a Trading Program

When they are growing, forests remove or "sequester" carbon dioxide from the atmosphere, and when they are logged or burned, most of the carbon is re-emitted to the atmosphere. Globally, sequestering carbon in forests and other reservoirs such as agricultural soil is an important aspect of reducing greenhouse gas concentrations. Under the *Kyoto Protocol*, emissions and removals from some forest related projects are to be counted in national emission inventories. Future agreements may require nations to count a broader range of emissions and removals from agriculture, land use change and forestry sources.

If Canada adopts a domestic credit trading program, generating credits from afforestation, reforestation and possibly other projects would be feasible and would help Canada meet international commitments. However, to totally offset the atmospheric impacts of an emission source, a sequestration project has to store the carbon in perpetuity. Moreover, a sequestration project will only have the same atmospheric impacts as reducing emissions if the project would never, at any time in the future, have occurred in the absence of credit being given for it. These limitations in the value of sequestration projects, as well as uncertainty in measurements, suggest that credits for sequestration projects should be significantly discounted.

Chapter 13 — Trading Between Gases

The *Kyoto Protocol* sets emission reduction targets for a basket of four gases and two families of gases. A domestic trading program could be designed to achieve emission reductions among all these gases. Emission reductions or emission allowances could be expressed in terms of carbon dioxide equivalence that would allow program participants to trade off emissions in one gas against emissions of another gas. Although there is scientific uncertainty as to the carbon dioxide equivalence of some gases, a trading program could accommodate changes in scientific opinion and international rules. Nonetheless, uncertainty in measuring emissions of greenhouse gases other than carbon dioxide will constrain the inclusion of these gases in a trading program.

Chapter 14 — Putting Strategies into Law: The Constitutional and Legislative Basis for Action

Case law strongly supports the federal government having jurisdiction to unilaterally implement economic instruments such as emissions trading to reduce greenhouse gas emissions. In particular, the federal power over matters of national concern clearly applies to matters such as greenhouse gases, where failure of one province to regulate adequately has negative impacts outside that province. A court finding that climate change is a matter of national concern would have the effect of excluding provincial jurisdiction to pass laws predominantly aimed at regulating greenhouse gases. The courts may attempt to avoid this outcome by turning to the federal power over the criminal law (rather than the national concerns doctrine) to support federal greenhouse gas laws. However, this would require a very liberal interpretation of what laws can be characterized as criminal. Thus, as between provincial jurisdiction and federal jurisdiction, there is greater certainty that the federal government has jurisdiction to regulate greenhouse gases through measures such as emissions trading. The federal government also has more flexibility to affect greenhouse gases using tax instruments because of its powers to impose indirect as well as direct taxes.

Courts may also be willing to recognize concurrent federal and provincial jurisdiction to deal with matters which are normally well within the domain of the provinces, but which profoundly affect greenhouse gas emissions (for instance, urban growth management and utility regulation). Case law supports the notion that the federal government can deal with all matters necessary to deal effectively with a matter of national concern that transcends provincial or international boundaries. However, these cases also suggest that strategies will be needed to ensure that such far-reaching powers do not unnecessarily usurp provincial jurisdiction. One approach that could be adopted by the federal government would be to establish a federal action plan that will achieve certain emission reductions and request provinces to take additional steps in relation to matters which lie within traditional areas of provincial jurisdiction. If the provinces fail to implement necessary measures the federal government would be empowered to do so. This would provide the provinces with maximum flexibility, but it would give the federal government necessary powers if provinces are uncooperative.

Although various steps to reduce greenhouse gas emissions through regulatory measures can be taken under existing legislation, new legislation should be enacted to support any major greenhouse gas emission trading program. Federal and provincial governments should also consider amendments of existing legislation to ensure the effective and efficient delivery of other key elements of a greenhouse gas emission reduction strategy.

Chapter 15 — Conclusions

The characteristics of climate change create a series of unique problems for human political and economic institutions: the likelihood of devastating ecological change if major emission reductions do not occur; the uncertainty inherent in predicting climate change combined with the possibility of catastrophic outcomes; uncertainty regarding the economic and social impacts of reducing emissions; the ubiquity of climate change’s causes and the historic link between fossil fuel combustion and economic activity; the need for huge emission reductions just to mitigate the impact of climate change; the delay between when emissions occur and when their full ecological impact is felt; the need for global emission reductions combined with the inequity and impracticality of requiring least developed countries to reduce their emissions.

Yet the balance of evidence shows that humans are changing the climate and engaging in an uncontrolled, dangerous experiment with our planet. The more we emit today, the faster the rate of climate change will be in the near term. The more we emit today, the less opportunity future generations will have to choose greater levels of protection. The more we delay making these reductions, the deeper and more precipitous future reductions will need to be to achieve a given concentration level. Despite a body of evidence showing that we can reduce emissions at no cost to society, Canada has done little to slow our rapidly expanding emissions.

Current international emission reduction agreements fall far short of what is necessary to effectively reduce the rate of climate change. However, the chances that the nations of the world will subscribe to necessary emission reductions will be increased by demonstrations that emissions can be reduced through no-regrets measures or at low costs.

The domestic strategies which will demonstrate the acceptability or attractiveness of reducing greenhouse gas emissions are likely to include both broad market measures like trading or carbon taxes and narrowly targeted instruments aimed at correcting market failures and ensuring adoption of no-regrets measures. Because no-regrets measures may not always be in the best interests of individual companies, pursuing them will often require government intervention. The full potential of narrowly targeted instruments has not yet been realized.

While there is a large potential for narrowly focused measures, given the extent of greenhouse gas emission reductions which are necessary, these may not be enough. An effective strategy needs to achieve significant reductions from a huge range of sources. Moreover, due to the unpredictable nature of technological development and exaggeration of costs by businesses intent on deflecting regulatory requirements, governments will have difficulty in determining where least cost emission reductions lie and which measures constitute no-regrets measures.

Broad-based market instruments create an impetus for businesses to innovate and find solutions rather than argue that solutions are too expensive.

Broad-based market instruments such as carbon taxes and emissions trading potentially affect a broad range of decisions that are difficult to affect through prescriptive regulations. They create incentives to hasten the replacement of carbon intensive industrial plants and equipment with less carbon intensive capital stock. They encourage individuals and businesses to use carbon intensive equipment is a way that emits less. They create an impetus for businesses to innovate and find solutions rather than argue that solutions are too expensive. In sum, they should reduce emissions at relatively low cost.

Emissions trading has an advantage over the traditional forms of regulation in that it allows government to separate who pays for emission reductions from where emission reductions occur. This can help diffuse arguments that a business or sector has no low cost emission reduction measures available to them.

Yet trading will not overcome the difficult political issue of who pays for emission reductions. Who pays for emission reductions will depend on how revenue from carbon taxes or carbon coupon trading is recycled; how allowances are allocated; or where the regulatory standards in a credit trading program are imposed. Credit trading and allowance trading have historically provided free emission rights to existing polluters. Emission taxes and coupon trading are generally seen as imposing a tax on emitters that will be used to reduce general taxes. Despite these perceptions, all programs can be designed to spread the costs of emission reductions in different ways. Thus, allowance trading, carbon taxes or credit trading do not necessarily have different effects on how the cost of emission reduction is shared how the competitiveness of different companies is affected.

A market instrument could be a hybrid of different approaches. Possibilities for hybrids include the following:

- A carbon tax or cap and carbon coupon trading program could be combined with credits from forest projects, clean development projects or other projects to reduce emissions not affected by the cap or carbon tax. This hybrid has the advantage of providing broad coverage with generally low administration costs. It may reduce the cost of emission reductions from a simple carbon tax or coupon trading program. However, it introduces the administrative costs and methodological issues of credit trading, the clean development mechanism and forest sequestration projects. It would not encourage the generation of credits by undertaking domestic projects that cure market failures and reduce the demand for energy and fossil fuels in the sectors covered by carbon coupons or the carbon tax. Thus, it would be essential to combine the program with other efforts to cure market failures.

- A cap and emission allowance trading program could be combined with credits from projects outside the scope of the cap (i.e. from projects reducing emissions from the mobile, area and small point sources that are unlikely to come within a cap and allowance system). As compared to emission allowance trading alone this could reduce compliance costs by opening the full range of emission reduction projects. As compared to credit trading, the existence of scheduled cap reductions creates momentum in favour of emission reductions and removes the need to continually develop a huge range of regulatory standards. However, it also introduces the problems of credit trading into an allowance trading program, increasing administration and enforcement costs. Also, it reduces the environmental effectiveness of a given cap because, as compared to a cap and allowance trading program alone, there is a greater likelihood of emission reductions being achieved through projects that would have occurred anyway.

- Finally, a cap and emission allowance trading program for large point sources could be combined with carbon taxes or carbon coupons covering emissions from small point sources, area sources and mobile sources. If a carbon tax is imposed for these sources, there would still be potential for generating credits (for use by firms subject to the emission cap) from projects that reduce emissions from mobile and area sources. If a carbon coupon trading program is applied to the small point, mobile and area source; carbon coupons could be made tradeable with emission allowances; however, there would be no potential to generate credits by undertaking projects that reduce the demand for energy and fossil fuels in the residential, passenger transportation or other sectors.

The choice of appropriate market instruments will require discussions among many different interest groups, but because Canada has so far failed to take significant steps to reduce emissions it is essential to begin the process of working toward meeting international commitments.

While discussions on national market based instruments proceed, it is essential to begin implementation of many of the measures targeted at reducing market failures and achieving no-regrets emission reductions.

Introduction

As serious as the problems of acid rain, toxic waste, and depletion of the ozone layer are, the greenhouse effect looms over all of the them because it poses such a great potential damage to the environment and is by far the most difficult to solve.

— *Daniel Koshland, editor of the journal* Science

Climate change has always been a fact of life on earth. Most scientists attribute the extinction of dinosaurs to an asteroid which hit earth about 65 million years ago and threw up enough dust to reduce sunlight, reduce temperatures and collapse the food chain on which dinosaurs relied. According to another theory, human beings evolved when a drying trend forced the higher primates of Africa's Great Rift Valley to adapt to a shift in vegetation from trees to grassland. Primates responded by evolving to walk upright and by evolving a larger brain. Shifts in climate have shaped human destiny ever since. People have suffered under the whims of climate for millennia, responding with their wits.

Until now humans have been unable to influence these large events, but in the last century that has changed. Our success as a species, our burgeoning population, our industries, our transportation systems and our ways of providing shelter and food have changed the earth's atmosphere to a point where we are no longer simply reacting to the whims of climate, but are directly influencing it. Over the coming century it is predicted that climatic changes caused by human emissions of greenhouse gases will be larger than any since the dawn of human civilization, and will have drastic environmental consequences. Our challenge is to use our wits not only to react to climate change, but to minimize it.

This report is intended to assist in the search for solutions and, in particular to examine the role of emissions trading in implementation of Canada's greenhouse gas emission reduction commitments under the *Kyoto Protocol to the United Nations Framework Convention on Climate Change*. The *Kyoto Protocol* commits Canada to reducing greenhouse gas emissions by six percent from 1990 levels during the period 2008 to 2012. This report looks at how a domestic emission trading program could help achieve that goal.

Under trading programs, individual polluters are given flexibility in how to reduce their emissions. Where an emitter can, at a low or negative cost, reduce emissions or energy use beyond what is required by regulation they can sell an emission reduction credit or an allowance to a polluter who cannot reduce their emissions as easily. The purchaser of the credit or allowance is then allowed to emit more.

The theory of emissions trading assumes that by placing increased choice of control measures in the hands of emitters, emissions will be reduced at the lowest cost.

During the years prior to negotiation of the *Kyoto Protocol* policy makers were daunted by the myriad changes necessary to make significant reductions in greenhouse gas emissions. Emissions trading was often discussed as a panacea, an alternative to regulation, a new way to reduce emissions that would be politically easy and achieve emission reductions at the lowest cost. This report finds that, while there is potentially a large role for emission trading, it is none of the above. It is one — albeit a potentially very important one — tool among many to reduce greenhouse gases. To achieve emission reductions at the lowest cost to society, other tools will also need to be utilized. With or without emissions trading, policy makers will still need to grapple with difficult issues relating to how the burdens and benefits of greenhouse gas emission reductions are shared.

The report will of interest to various stakeholders, individuals and organizations concerned with climate change and how greenhouse gas emissions can be reduced:

- **Federal and Provincial Policy Analysts.** The report analyses the pros and cons to various approaches to reducing greenhouse gas emissions in Canadian jurisdictions; the demands different forms of emissions trading will place on enforcement and administration resources; the extent to which different forms of emissions trading send efficient price signals to business and individuals; the policy choices that will need to be made in developing trading programs; how elements of emission reduction programs can affect competitiveness; ways of overcoming weaknesses in different program designs; and the constitutional and legislative basis by which a national greenhouse gas strategy can be put into law.

- **Environmentalists.** The report analyses the environmental risks and advantages of different forms of emissions trading; the elements that are needed to make a emissions trading program environmentally effective; and the experiences of other jurisdictions in implementing emissions trading in the real world.

- **Industry.** The report discusses the impacts of different emission reduction strategies on competitiveness; the transaction and monitoring costs businesses will face under different emission trading programs; and the roles and limitations of voluntary emission reduction initiatives.

- **Academics, Students and Interested Public.** For those interested in understanding climate change the report gives an introduction to the science of climate change, its impacts, and different perspectives on the economics of reducing greenhouse gas emissions. It provides background on Canadian emission sources and the development of provincial, national and international response strategies to climate change. It analyses the pros and cons of using broad market based approaches to reducing greenhouse gas emission versus use of narrowly focused regulatory interventions.

The report is based on an extensive literature review; research into a number of specific topics; personal communications with numerous experts; and, a series of interviews with representatives of Canadian federal, provincial and regional governments, energy intensive industries and environmental groups. All interviews were conducted on the understanding that comments were not to be attributed. Interviewees are listed in the acknowledgements section.

The report is intended to be accessible to readers from all disciplines. A glossary is provided at the beginning. Numbering of footnotes begins at the beginning of each chapter.

The report begins by looking at the factors compelling reductions in greenhouse emissions, the factors that will determine the best strategies for reducing emissions, and how we have so far responded to the threat of climate change. Chapter 1 looks at why reducing greenhouse gas emissions is imperative; it reviews both the global and Canadian impacts of climate change. Chapter 2 reviews Canada's and British Columbia's emissions. Chapter 3 examines how we are responding to climate change at the international, national and provincial levels. Chapter 4 reviews the benefits and costs of reducing greenhouse gas emissions. All of these factors will determine how we choose to reduce emissions in the future. Chapter 5 looks at the criteria that need to be considered in choosing appropriate instruments.

Before turning to an examination of emissions trading it is necessary to consider the full range of instruments available to reduce greenhouse gas pollution. An effective emission reduction policy is likely to contain a portfolio of policy instruments. Emissions trading is one of many such instruments, and its strengths and weaknesses can only be understood in the context of alternatives. Chapter 6 reviews the range of instruments other than trading that are available to reduce emissions. These include voluntary challenges and agreements with industry, changes to our tax system, energy efficiency standards and other forms of regulation.

Next the report considers the various forms of emissions trading which could be used to reduce greenhouse gas emissions. Chapter 7 provides a brief introduction to emissions trading. Chapter 8 looks at credit trading, wherein firms can choose to simply comply with an emission standard or, as an alternative to compliance with regulatory standards, use credits generated by reducing emissions at other locations.

Chapter 9 looks at cap and emission allowance trading. In these programs the government establishes a cap on total allowable emissions from defined sources. It then allocates allowances to release that pollutant, with the total emissions allowed by all allowances being equal to the cap. All sources within the cap must hold sufficient allowances for their emissions, but are free to trade allowances among one another, letting the market determine where the actual emission reductions occur.

Chapter 10 looks at a variation on cap and trade programs, where a cap is placed on total carbon used in fossil fuels in Canada. All importers or producers of fossil fuel must hold carbon coupons for the fossil fuel carbon they import or produce. In order to regulate demand, producers and importers place a premium on the price of fossil fuels and this is taxed back by government. Essentially, carbon coupon trading is akin to a carbon tax in which the market sets the tax level.

Chapters 11 to 13 look at specific issues in relation to trading. Chapter 11 looks at whether a Canadian trading system should be integrated into the international trading mechanisms defined by the *Kyoto Protocol* and if so, how should this be done. Chapter 12 considers extending emissions trading to cover not only greenhouse gases released into the atmosphere, but also the processes by which greenhouse gases are removed from the atmosphere and stored in forests, soils and other greenhouse gas sinks. Chapter 13 examines the potential for trading in allowances or credits that cover more than one type of greenhouse gas.

Next the report considers how we can put policy choices into law. Chapter 14 considers which levels of government could enact different aspects of a national portfolio of emission reduction programs.

Finally, Chapter 15 discusses the portfolios of instruments which are likely best suited to reducing greenhouse gas emissions in Canada. It also discusses how different forms of emission trading could be combined to create hybrids that maximize benefits of different instruments. Ultimately, the choice of instruments will depend on many of the factors discussed initially: the outcome of international negotiations; assumptions regarding the benefits or costs of reducing greenhouse gas emissions; and our perceptions of the threat posed by climate change.

Chapter 1:

Climate Change and the Enhanced Greenhouse Effect

> *When we look into the sky it seems to us to be endless. We breathe without thinking about it, as is natural. We think without consideration about the boundless ocean of air, and then you sit aboard a spacecraft, you tear away from Earth, and within ten minutes you have been carried straight through the layer of air, and beyond there is nothing! Beyond the air there is only coldness, emptiness, darkness. The "boundless" blue sky, the ocean which gives us breath and protects us from the endless black and death is but an infinitesimally thin film. How dangerous it is to threaten even the smallest part of this gossamer covering, this conservor of life!*
>
> *— Vladimir Shatalov, Cosmonaut from the former USSR*

The purpose of this report is to examine a set of proposed tools for reducing greenhouse gas emissions, but first it is essential for readers to understand why those reductions are necessary. What is the "greenhouse effect"? What does it mean for life on earth? What does it mean for Canada? This chapter begins to answer those questions.

Since the industrial revolution humans have emitted increasing amounts of greenhouse gases into the atmosphere. As a result, the pool of greenhouse gases in the atmosphere — atmospheric greenhouse gas concentrations — has increased. It is widely believed that this increase in concentrations is affecting the earth's climate and will continue to affect the climate and the myriad of natural and economic systems which depend on it. This chapter discusses the potential effects of climate change.

In painting a picture of the potential impacts of human-caused greenhouse gas emissions, much is known, but many factors currently limit our ability to detect and predict climate change. While this chapter relies as much as possible on the best available scientific literature, it must be acknowledged that there is uncertainty regarding what will occur.

Uncertainty regarding impacts of climate change does not mean we should delay taking action to minimize those impacts. Many projections, especially those made at a global level, are made with some certainty. Also, the uncertainty of climate systems means that there is a chance that global climate systems will react in unexpected, but not necessarily unanticipated, ways. Unexpected, large and rapid climate system changes have occurred in the eons before human civilization, and could repeat themselves. The impacts of such changes could be far worse than changes predicted by scientists. The risks of such changes can only be minimized through reducing emissions.

Perfect knowledge of impacts will only exist after we have, through inaction, committed ourselves to those impacts. We may pass a point of no return long before we realize it. This is true because of inertia in climate systems; the full impacts of a given atmospheric concentration of greenhouse gases may not be felt for decades after that concentration is reached. Also, it will take time to reduce emissions to a level where atmospheric concentrations are stabilized. Our lack of understanding of climate and other natural systems combined with the time it would take to reverse trends are reasons for acting now.

Greenhouse Gases and the Greenhouse Effect

The greenhouse effect — the atmosphere's trapping of heat from sunlight — is essential to life on earth, but human enhancement of the greenhouse effect has the potential to cause one of the greatest ecological crises ever faced by humanity. Greenhouse gases such as carbon dioxide, methane, water vapor, and nitrous oxide allow solar radiation to penetrate the atmosphere and warm the earth's surface. Greenhouse gases trap some of this heat — or infrared radiation — and stop it from being reradiated into space. This allows life to thrive. Without the greenhouse effect, the earth would be far colder than it was at the height of the deepest ice age.

Without human intervention, there is usually a balance between the amount of carbon dioxide and other greenhouse gases released into the atmosphere by animals and decaying plants and the amount absorbed by trees, oceans and other sinks of greenhouse gases. The natural levels of greenhouse gas concentrations in the atmosphere maintain a balance between the sun's radiation hitting the earth and the heat being reradiated into space.

A century ago Svante Arrhenius, a Swedish scientist, calculated that the carbon dioxide released by burning fossil fuels would create an enhanced greenhouse effect, leading to an increase in global temperatures over time. At first Arrhenius's predictions were dismissed as absurd, but there is now clear evidence that human activities have upset the balance.

Carbon dioxide concentrations in the atmosphere are currently 30% above the levels that prevailed prior to the industrial revolution. Methane concentrations have increased by 146%, nitrous oxide by thirteen percent and extremely powerful greenhouse gases (which never existed prior to the industrial revolution) have been introduced into the atmosphere.[1] Moreover, greenhouse gases have atmospheric lifetimes ranging from decades to thousands of years. This means that increased concentrations are not easily reversed. Greenhouse gas concentrations will continue to grow even if emission rates are stabilized.

Because of increased concentrations of greenhouse gases in the atmosphere, the relationship between the energy received from the sun and energy escaping to space has changed. More infrared energy is trapped by the atmosphere. This imbalance between the sun's energy received and reradiated to space has the potential to not only warm the planet, but to increase the energy available to various climatic processes: intensifying evaporation, drought, rainfall and storms. Carbon dioxide from the burning of fossil fuels accounts for 75% of the enhanced greenhouse effect.

What Has Occurred?

One hundred years after Arrhenius, there is evidence that the warming he predicted is occurring. Although the unambiguous detection of human-induced climate change will always be difficult because of the complexity of climate systems, a number of observed changes consistent with human induced climate change have occurred. The Intergovernmental Panel on Climate Change (IPCC), representing an international scientific consensus agreed to by representatives of over 100 nations, states:

> Global mean surface temperatures increased by between 0.3 and 0.6° C since the late 19th century, a change that is unlikely to be entirely natural in origin. The balance of evidence . . . suggests a discernible human influence on global climate. . . . Global sea level has risen by

[1] Intergovernmental Panel on Climate Change, Working Group I, "Technical Summary of the Science of Climate Change" in *Climate Change 1995, the Science of Climate Change, Contribution of the Working Group I to the Second Assessment Report of the Intergovernmental Panel on Climate Change* (London: Cambridge University Press, 1995).

> between 10 and 25 centimetres over the past 100 years. Much of the rise may be related to the increase in global mean temperature.[2]

Although scientists face challenges definitively linking particular regional or local events to human induced climate change, a number of changes have occurred on a regional scale which are consistent with changes predicted by climate scientists. Temperatures in Canada have increased 1.1ºC on average in the last century.[3] The greater rate of warming in Canada is consistent with climate model predictions of greater temperature changes in higher latitudes.

What If We Do Not Reduce Emissions?

The changes to date pale in comparison to the changes which scientists predict will occur. The IPCC predicts that, if strong policy actions are not taken, mean global temperature will increase by between 1°C and 3.5°C between 1990 and 2100 with the best estimate being a 2°C increase. These numbers may seem low, but the Earth today is only four degrees warmer than at the height of the ice age 20,000 years ago,[4] a time when ice covered almost all of Canada. Even if global concentrations of greenhouse gases were stabilized by 2100, temperatures would continue to increase after 2100 possibly by an amount equal to the changes prior to 2100. A recent paper by leading American atmospheric scientists suggests that the climate may be more sensitive to increased greenhouse gas conditions than assumed in IPCC's best estimates.[5]

These changes represent not only a significant warming, but also an unprecedented rate of change. Even if the temperature increase is limited to the lowest of the IPCC projections (a 1ºC increase) the average rate of warming would probably be greater than seen in the last 10,000 years.

Canada is expected to warm at two to three times the rate projected for the planet as a whole. Climate modelling predicts average warming for central and northern

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2 Intergovernmental Panel on Climate Change, *Second Assessment Synthesis of Scientific-Technical Information Relevant to Interpreting Article 2 of the UN Framework Convention on Climate Change* (Geneva: Intergovernmental Panel on Climate Change, 1995) at 4.

3 Environment Canada, "Climate Change Indicator: Global and Canadian Temperature Variations" (Spring 1996) SOE Bulletin No. 96-4.

4 National Academy of Sciences, Committee on Science, Engineering, and Public Policy, *Policy Implications of Greenhouse Warming* (Washington, D.C.: National Academy Press, 1991) at 22.

5 Robert Webb *et al*., "Influence of Ocean Heat Transport of the Climate of the Last Glacial Maximum" (20 February 1997) 385 *Nature* 695. They suggest the best estimate of impacts should be 4°C rather than 2°C.

Canada of 4° to 6°C by 2050, and 3° to 4°C along the east and west coasts.[6] Warming will tend to be greater in winter with average winter temperatures rising by up to 10°C in southern Saskatchewan and the Arctic.[7]

If greenhouse gas emissions continue unabated, global temperature changes will lead to increases in sea levels of between 15 and 90 centimetres by 2100 with the best estimate being a 50 centimetre sea level change. Sea level rise would have negative impacts on a number of sectors, including tourism, freshwater supply and quality, fisheries and aquaculture, human settlements, financial services, and human health.[8]

The warmer temperatures will intensify the earth's hydrological cycle. Increased evaporation will mean more severe droughts in some places and floods in other places.

These changes will interact with one another with far-reaching consequences. They may affect human health, biodiversity and natural ecosystems (including forests, freshwater systems and fisheries), agriculture, human infrastructure, and political stability. A discussion of impacts in each of these areas is set out below.

Human Health Impacts

According to the IPCC, "climate change is likely to have wide ranging and mostly adverse effects on human health, with significant loss of life."[9] Direct health effects include increases in mortality and illness due to an anticipated increase in the intensity and duration of heat waves. In the absence of acclimatization, deaths due to heat waves are projected to climb — possible by 600 or more per summer in Montreal.[10]

Globally, the indirect health effects of climate change are expected to be more important than direct impacts of heat waves. These indirect effects include

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6 Canada, *Second National Report on Climate Change* (Ottawa: Supply and Services Canada, 1997).

7 Canadian Centre for Climate Modelling and Analysis, "Climate Change Scenarios for British Columbia and Yukon," 1997 [unpublished].

8 C.N. Ehler *et al*., "Coastal Zones and Small Islands" in Robert Watson *et al.*, eds., *Climate Change 1995, Impacts, Adaptations and Mitigation of Climate Change: Scientific-Technical Analyses, Contribution of Working Group II to the Second Assessment Report of the Intergovernmental Panel on Climate Change* (London: Cambridge University Press, 1996).

9 Intergovernmental Panel on Climate Change, above at footnote 2, at 10.

10 The toll would likely be lower as the population acclimatizes with several hundred deaths in Montreal, Toronto, and Ottawa predicted. See Laurence S. Kalkstein and Guanri Tan, "Human Health" in *As Climate Changes, International Impacts and Implications* ed. at 124-145.

increases in the transmission of infectious diseases such as malaria, dengue fever and yellow fever resulting from extensions of the range and season of these illnesses. Temperature increases in the upper part of IPCC projected ranges could lead to an additional 50 to 80 million cases of malaria worldwide.[11]

Although these diseases and the incidence of water-borne and food-borne diseases causing diarrhea largely impact the developing world, inner city areas of Canada could be affected.[12] Some mosquito-borne diseases that now occur sporadically in Canada, such as forms of encephalitis, may extend their range, and Lyme disease may become a bigger problem.[13] Canada may also face increased health risks due to immigration of ecological refugees from countries where diseases are endemic and may become more widespread.[14]

Biodiversity and Natural Ecosystems

Natural landscapes and biodiversity will be victims of global climate change. The speed of change will often be too rapid for plants to adapt. The composition and geographic distribution of many ecosystems will shift as individual species respond to changes in climate.

Islands of habitat that are hemmed in by water, geological obstacles or human development are particularly vulnerable.[15] For instance, in the Arctic, many species cannot react by simply migrating northward. Many Arctic species are either adapted to feeding over shallow continental shelves or feeding on ice-related organisms. As ice recedes species such as walrus, ring seal and polar bear would suffer an irreversible loss of habitat.[16] According to Vera Alexander of the Institute of Marine Science in Alaska, "[e]ssentially all the distinctive Arctic animals would disappear."[17] Similarly, the value of parks and other protected areas as pools of biodiversity in a stable climate system may be lost as the escape routes for the denizens of the protected areas are cut off by human activity.[18]

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11 Intergovernmental Panel on Climate Change, above at footnote 2.

12 Canadian Global Change Program, Health Issues Panel, *Implications of Global Change for Human Health* (Ottawa: The Royal Society of Canada, 1995) at 4.

13 *Ibid.*

14 *Ibid.*

15 Paul Griss, "Bio-diversity Conservation in Canada" (1995) 2 *Changes* 1.

16 Vera Alexander, "Arctic Marine Ecosystems", in Robert L. Peters & Thomas E. Lovejoy, eds., *Global Warming and Biological Diversity* (New Haven: Yale University Press, 1992) at 230.

17 *Ibid.*

18 J. Stan Rowe, "National Parks and Climate Change, Notes for a Talk given to Canadian Park Service Personnel" Occasional Paper No. 4, National Parks Branch, 1989 [unpublished].

Sea level rise could lead to loss of sensitive ecosystems and erosion of beaches. Wetlands have persisted in the past despite slowly changing sea levels, but global climate change could lead to rates of sea level rise that exceed response rates of ecosystems. According to the IPCC, "some ecosystems are particularly at risk, including saltwater marshes, mangrove ecosystems, coastal wetlands, sandy beaches, coral reefs, coral atolls and river deltas."[19] The United States Environmental Protection Agency estimates that a one metre sea level rise would result in loss of up to 80% of US coastal wetlands, thus harming fisheries and habitat for many species and migratory birds.[20]

Forests

The impact of climate change on forests is particularly important for Canada's forest-based economy and ecosystems. According to the IPCC, because of changes in temperature and water availability about a third of the globe's forests — as much as two-thirds in northern areas — will undergo major changes in vegetation types. Climate changes are expected to occur at a rapid rate relative to the speed at which forest species grow, reproduce and re-establish themselves. For mid-latitude regions, a warming of 1° to 3.5°C over the next hundred years would be the equivalent to moving a forest 150 to 500 kilometres northward. In the past, tree species have been able to adapt by migrating only four to 200 kilometres per century. The result of such warming may include loss of species and major changes to forest composition. Also, large amounts of carbon may be released into the atmosphere during transitions from one forest type to another because high forest mortality may not be offset by new growth.[21]

There is considerable uncertainty as to what the impacts of climate change would be on the forests of British Columbia and the Pacific Northwest. The impacts of drier summers, larger winter snowpacks and higher temperatures are likely to be significant in and of themselves; however, increased intensities of wildfires, storms and outbreaks of pests and pathogens may take a higher toll.[22] According to one report, extremely high rates of mortality are probable for sub-alpine fir — a

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19 Intergovernmental Panel on Climate Change, Working Group II, "Summary for Policymakers: Scientific-Technical Analyses of Impacts, Adaptations, and Mitigations of Climate Change" in Watson *et al*., eds., above at footnote 8, at 7.

20 Patricia Glick, *Global Warming: The High Costs of Inaction* (Washington, DC: Sierra Club, February 1996) at 10.

21 Intergovernmental Panel on Climate Change, Working Group II, above at footnote 19.

22 Jerry F. Franklin, *et al.*, "Effects of Global Climatic Change of Forests in Northwestern North America" in Robert L. Peters & Thomas E. Lovejoy, eds., above at footnote 16, at 253; see also Pam G. Krannitz, and Stephen Kesting "Impacts of Climate Change on the Plant Communities of Alpine Ecosystems" in E. Taylor and B. Taylor, eds., *Responding to Global Climate Change in British Columbia and Yukon* (Vancouver: Environment Canada, 1997).

species which characterizes the treeline areas of coastal British Columbia — due to the spread of pests to which this species is not adapted.[23]

Climate change is likely to have its greatest impact on boreal forests.[24] Increased fire frequency and pest outbreaks are likely to decrease the average age and biomass.[25] Indeed, the amount of carbon stored in soil, trees and other plants in Canada's boreal forests declined between 1970 and 1990, in part due to increased forest fires and disease.[26] Often the impact of climate change will be worse due to synergisms between climate change and other human-caused stresses to the environment. For instance, intensive management of the last 50 years may make BC forests more vulnerable to outbreaks of pests. By emphasizing efficient timber production through ecosystem simplification, these forests have reduced genetic and age diversity, making the forests less adaptable to additional stresses from climate change.[27]

Freshwater Systems

Altered weather patterns will impact streams and lakes of the world and thus impact fisheries and aquatic ecosystems in general. Mountain rivers and streams characterize most of British Columbia, and flow in these waterways depends on a variety of factors: precipitation levels, snow melt, and glacial melt. Each of these will be impacted by climate change. Most climate models predict milder, wetter winters and warmer, drier summers for British Columbia. Spring snow-melt and run-off would occur earlier; winter and spring streams would be higher; and summer stream flows would be lower.[28]

Between one-third and one-half of the earth's existing mountain glacier mass could disappear over the next hundred years. In southern British Columbia glaciers that are now 100 metres thick could disappear within twenty years.[29] At first the increased glacial melt would increase flow, increasing likelihood of

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23 Franklin, *ibid.* at 253.

24 M.G.R. Cannell *et al.*, "Climate Change Impacts on Forests" in Robert Watson *et al.*, eds., above at footnote 8.

25 *Ibid.*

26 Werner A. Kurz, and Michael J. Apps, "Retrospective assessment of carbon flows in Canadian Boreal Forests" in *Forest Ecosystems*, *Forest Management and the Global Carbon Cycle* (Heidelberg: Springer-Verlag, 1995).

27 Franklin, above at footnote 22. See also: Lee E. Harding and Emily McCullum "Ecosystem Response to Climate Change in British Columbia and Yukon: Threats and Opportunities for Biodiversity" in E. Taylor and B. Taylor, eds., above at footnote 22.

28 Hal Coulson, "Impact of Climate Change on Rivers and Stream Flow in British Columbia and Southern Yukon" in E. Taylor and B. Taylor, eds., above at footnote 22.

29 Melinda M. Brugman, Paul Raistrick and Alan Pietroniro "Glacier Related Impacts of Doubling Atmospheric Carbon Dioxide Concentrations on British Columbia and Yukon" in E. Taylor and B. Taylor, eds., above at footnote 22.

autumn floods, but as glaciers disappear, the flows in glacier-fed rivers and streams decrease. "If the glaciers in the alpine regions of the Columbia River basin ... disappear, then the monthly total discharge of the Columbia River from July through to October could fall by 20% to 90%."[30]

Fisheries

According to the IPCC, the principal impacts of changes in aquatic systems and ocean currents on fisheries will be felt on the national and local levels as species and centers of production shift. In Ontario, resident fish species could disappear from the Great Lakes.[31] The positive effects of climate change on fisheries — for example, lower winter mortality and faster growth rates in higher latitudes — may be offset by factors such as changes in established reproductive patterns and migration routes.[32]

On a regional scale it is difficult to predict impacts on fisheries. Factors that affect fish survival are not well known and abrupt shifts in fish populations can result from changes in climate and ocean.[33] Fraser River pink, chum and sockeye stocks — the core of the BC salmon fishery – may decline as a result of lower summer and fall stream flows and warmer water.[34] One study concludes that "it may be unfeasible to prevent the extinction of some local salmon stocks in the Fraser River watershed."[35] Some scientists have linked the prolonged duration and frequency of the warm Pacific El Nino current and related events during the period from 1970 to 1995 to human-induced climate changes.[36] Others have linked the collapse of several major BC salmon stocks to the unprecedented duration of El Nino from 1990 to 1995.[37]

Synergisms

The above impacts are taking place in the context of a series of other global threats to the environment. Depletion of the ozone layer, loss of wilderness due to

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30 *Ibid*.

31 Canadian Climate Program Board, *Climate Change and Canadian Impacts: The Scientific Perspective* (Downsview: Ministry of Supply and Services, 1991) at 22.

32 Intergovernmental Panel on Climate Change, Working Group II, above at footnote 19.

33 R.J. Beamish, M. Henderson and H.A. Regier, "Impacts of Climate Change on the Fishes of British Columbia" in E. Taylor and B. Taylor, eds., above at footnote 22, at 12-2.

34 *Ibid.* at 12-1.

35 Canada, Environment Canada, *Potential Impacts of Global Warming on Salmon Production in the Fraser River Watershed* (Ottawa: Climate Change Digest Series, 1994).

36 Kevin E. Trenberth, and Timothy J. Hoar "The 1990-1995 El Nino-Southern Oscillation event: Longest on Record" (January 1, 1996) 23:1 *Geophysical Research Letters* 57.

37 Beamish, above at footnote 33, at 12-7.

industrial forestry and land clearing, increasing degradation of the world's oceans will all magnify one another. As one researcher states,

> [i]f through economic incompetence and political chauvinism we bring to pass this pessimistic scenario, it will generate a super-sized synergism as the direct depletion of wildlife habitats interacts with the new and indirect depletion via the greenhouse effect. Degraded and destabilized ecosystems will enable climatic dislocations far greater than those expected among healthy ecosystems. Conversely, the dislocations would, through their aggravated effect, enable ecological instability to magnify the effects of global warming.[38]

Agriculture

The IPCC projects that overall global agricultural production can probably be maintained. However, this conclusion depends on taking into account beneficial aspects of increased carbon dioxide concentrations, but it does not take into account the potential impacts of agricultural pests or climatic variability. Also, the impacts of climate change may be particularly acute in the subtropical areas where many of the world's poorest and hungriest people live.[39] Thus, shifts in agricultural production increase risk of famine. This, in turn, could force increases in migration to wealthier northern countries.

Although Canadian prairie farmers may gain from longer growing seasons, they are also vulnerable to the mid-continental drying indicated by climate change models. The IPCC notes that the 1988 drought which caused dust storms and wind erosion on the Canadian prairies led to declines in production of 29% for grain and 94% for hay. Farm income dropped by 50% to 78%.[40]

Human Settlements and Infrastructure

If emissions continue unabated, climate change and the resulting rise in sea levels will have a number of negative impacts on human settlements and human infrastructure. An additional 46 million people would be at risk of flooding due to storm surges in the event of a 50 centimetre sea level rise.[41] This number will be higher if populations continue to grow. A one metre sea level rise would lead to a

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[38] Norman Myers, "Synergisms: Joint Effects of Climate Change and Other Forms of Habitat Destruction" in Robert L. Peters & Thomas E. Lovejoy, eds., above at footnote 16, at 351.

[39] Intergovernmental Panel on Climate Change, above at footnote 2, at 9.

[40] W. Baethgen *et al.*, "Agriculture in a Changing Climate: Impacts and Adaptation" in Robert Watson *et al*., eds., above at footnote 8, at 446.

[41] Intergovernmental Panel on Climate Change, Working Group II, above at footnote 19.

loss of 6% of Dutch territory, 18% of Bangladesh territory, and the virtual elimination of some islands in the Pacific. Approximately 70 million people each in China and Bangladesh may be affected by loss of land.[42] The most vulnerable human settlements are located in damage-prone areas of developing countries. Because these countries do not have resources to cope with such impacts, sea level rise could force internal and international migration of populations.

In general, infrastructure for energy, industry and transportation is less sensitive to climate change than are agricultural and natural ecosystems, and there is an ability to adapt during the normal replacement of infrastructure. Nonetheless, both globally and in British Columbia, the reduced extent of glaciers and depth of snow cover would also affect the seasonal distribution of river flow and water supply for hydro-electric generation and agriculture.[43] Paradoxically, flooding resulting from increased winter rains and spring run-offs will also threaten infrastructure.

Political Stability

Food shortages, increased disease, and flooding could affect political tranquillity in much of the world. According to the US National Academy of Sciences:

> [C]ountries outside the industrialized world may lack the institutions or resources to manage additional environmental crises. Difficulties of organizing coordinated, multi-lateral responses to problems such as hunger are already evident. Greenhouse warming could aggravate present economic, political and social problems, swamping national governments and international assistance activities and programs.[44]

Impacts in the Very Long Term

Most of the above predictions are based on either anticipated changes as of the end of the 21st century or anticipated changes that would be expected with a doubling of the pre-industrial carbon dioxide concentrations in the atmosphere. Doubling of carbon dioxide concentrations from pre-industrial levels could occur within 40 years.[45] Unfortunately, global climate change may not necessarily cease

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42 *Ibid.*

43 Intergovernmental Panel on Climate Change, Working Group II, above at footnote 19. See also Coulson, above at footnote 28.

44 National Academy of Sciences, above at footnote 4, at 40.

45 Environment Canada “Climate Change” SOE Bulletin 96-4 Spring 1996; Intergovernmental Panel on Climate Change, Working Group 1 “Technical Summary of the Science of Climate Change, Contribution of the Working Group I to the Second Assessment Report of the Intergovernmental Panel on Climate Change” in J.T. Houghton, *et al*., eds. *Climate Change 1995, the Science of Climate Change* (London: Cambridge University Press, 1995) at 22.

with doubling of carbon dioxide concentrations or by the end of the 21st century. In almost all cases analyzed by the IPCC, global mean temperature is predicted to be rising rapidly at the end of 2100. Both the carbon cycle and climate system have a large inertia factor, so even if carbon dioxide emissions were to decline dramatically after 2100, temperature would continue to increase for some time. Indeed, global mean temperatures may continue to increase for centuries after stabilization of atmospheric greenhouse gas concentrations.[46]

Unexpected but Possible Risks

The predicted impacts of climate change are based on the IPCC's best estimates of future emissions and modelling of climate and the carbon cycle. Future unexpected, large and rapid climate system changes (as have occurred prior to the dawn of human civilization) are, by their nature, difficult to predict. Because of this difficulty, future climate changes may include surprises. The experience of ozone depletion illustrates the risk of adverse surprises in assessing environmental risk. Depletion of the stratospheric ozone occurred much faster than initially anticipated by scientists. There are several catastrophic scenarios which, although not considered likely outcomes, would not come as a total surprise:

- Carbon could be rapidly released from areas when forests die. Estimates of this loss range as high as 200 gigatonnes of carbon (36 times the average annual global emissions from fossil fuels) over the next one to two centuries.[47]

- Increased run-off of fresh water from increased rainfall, and melting glaciers and polar ice could radically change major ocean currents and the weather patterns that determine much of the globe's climate.

What Reductions are Necessary?

What is required to avoid these impacts and possible risks? To stabilize climate it is necessary to stabilize atmospheric concentrations of greenhouse gases. Emissions could be stabilized at any level, but stabilization at lower levels will require more immediate emission reductions. Already, some future climate change is unavoidable because of the current level of greenhouse gases in the atmosphere and the impossibility of reducing emissions immediately to zero. According to the IPCC:

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46 A. Kattenberg, *et al.*, "Climate Models: Projections of Future Climate" in J.T. Houghton, *et al.*, eds. above at footnote 45. See Table 6.3 and 324-325.

47 Intergovernmental Panel on Climate Change, above at footnote 2, at 16.

> [t]he long-lived gases (e.g. CO_2, nitrous oxide and chloro-flourocarbons) would require immediate reductions in emissions from human activities of over 60% to stabilize the concentrations at today's levels; methane would require a 15 to 20% reduction.[48]

Stabilizing concentrations of greenhouse gases at a particular date requires limiting or budgeting total emissions prior to that date and eventually dropping emissions far below current levels. A stabilization goal higher than today's concentrations could be met by following different emission paths, i.e. different emission levels in different decades that achieve the same concentration goal. Emission paths could include immediately beginning significant but steady emission reductions or delaying reductions in emissions but making much deeper, faster cuts later.

While delaying emission reductions and making faster, deeper cuts in the future may achieve the same stabilization goal, it will mean a faster rate of climate change and removes future generations' ability to choose lower concentration levels as they gain a fuller understanding of climate change.

For instance, if the international community sets a stabilization goal of 450 parts per million of carbon dioxide, it is theoretically possible to delay reduction efforts until around the year 2025, but then dramatically cut emissions from about twenty gigatonnes per year in 2025 to around one gigatonne in 2080. On the other hand, if emission reduction activities begin immediately, world emission levels could drop less precipitously and would only need to drop to seven gigatonnes by 2100.[49]

While the end stabilization goal may be the same, the second emission path (significant emission reductions begin now) entails less environmental impact because the rate of change climate change will be slower. Moreover, making more significant emission reductions now keeps options open for future generations to choose lower concentration levels as they gain a fuller understanding of climate impacts. Limiting the rate of temperature increase to less than 0.1°C per decade would likely necessitate global emission reductions from 1990 levels of 20% or more by 2010.[50] Avoiding rates of temperature increase exceeding 0.15°C per decade would require stabilization of global emissions at close to 1990 levels by 2010.[51] Higher global emissions become acceptable in 2010 if a higher rate of warming is accepted in the next few decades.

48 J.T. Houghton, *et al. Climate Change, the IPCC Scientific Assessment* (Cambridge: Intergovernmental Panel on Climate Change, 1990) at xi.

49 Joseph Alcamo and Eric Kreileman, *The Global Climate System: Near Term Action for Long Term Protection* (Netherlands: National Institute of Public Health and the Environment, February 1996).

50 *Ibid.* See in particular table 2 which indicates that a decrease from current levels of 9.6 gigatonnes per year to between 6.9 and 7.3 gigatonnes per year would be necessary by 2010 (assuming mid range estimates as to climate sensitivity) to avoid violating climate parameters in any decade. In the first decades of the next century, the rate of change parameter is the determining parameter. The 7.3 gigatonne per year figure is determined by the maximum rate of temperature increase in early years.

51 *Ibid.* at figure 1(B) and figure 2.

Summary

Since the beginning of the industrial revolution, human activities, especially burning fossil fuels and deforestation have increased atmospheric concentrations of greenhouse gases above natural levels. Concentrations of the primary greenhouse gas, carbon dioxide, have risen by 30% above pre-industrial levels.

Despite the difficulty of detecting human induced changes to climate amidst natural variability, the balance of evidence suggests that these human-caused emissions are altering earth's climate. A consensus among most scientists has emerged that increases of average global temperature of between 1° and 3.5°C are likely by 2100 if strong policy actions are not taken. Temperatures would continue to slowly increase for decades or centuries after 2100 even if atmospheric concentrations are stabilized. Even the lowest projected rate of temperature change is faster than any temperature rate of warming seen in the last 10 000 years.

If trends continue unabated, they will lead to a more vigorous hydrological cycle, causing more severe droughts in some areas and more severe rainfall in others. British Columbia summers are likely to become drier, our winters wetter. Sea levels are projected to increase by 50 centimetres over the next century if strong action is not taken. If emissions continue unabated a number of impacts are projected:

- Increased summer heat wave deaths in Canada, and higher incidence of infectious diseases throughout the world.
- Rates of temperature change which exceed the range to which some ecosystems can adapt.
- Damage to important coastal wetland habitat because of sea level rise.
- Changing forest compositions. Some species of tree may be unable to grow, reproduce and re-establish themselves at a rate which keeps up with climate change.
- Increased forest fires are likely in British Columbia.
- Shifts in fisheries production. According to one study "it may be unfeasible to prevent the extinction of some local salmon stocks in the Fraser River watershed."[52]

[52] Environment Canada, above at footnote 35.

- Severe impacts on agricultural production in developing countries, putting greater numbers of people at risk from starvation.
- Inundation of large areas of some nations.
- Increased internal and international migrations.

The above projections are based on scientists' best estimates of how the climate and ecosystems will act and interact. They are based on linear changes; however, in the distant past, climate has sometimes changed in a non-linear fashion, with extremely rapid coolings or warmings. It is possible that the climate systems may react to increases of atmospheric concentrations of greenhouse gases in a non-linear fashion, with possibly catastrophic results.

Immediate global emission reductions of over 60% would be needed to stabilize greenhouse gas concentrations in the atmosphere at current levels. Stabilizing concentrations of greenhouse gases at a higher level by a particular date entails keeping total emissions prior to that date within a defined budget and eventually reducing emissions far below today's levels. In order to achieve a stabilization goal, delaying emission reductions will necessitate deeper, faster cuts in emissions at a later date, will entail greater environmental impacts prior to stabilization of greenhouse gas concentrations, and will reduce the options of future generations to choose greater levels of environmental protection.

Chapter 2:

Canadian and BC Emissions

> *Canadians have a responsibility to act, given that our per capita emissions are second highest in the industrialized world (15.4 tonnes compared to the world average of 4.1 tonnes, in 1992), and given that Canadians enjoy one of the highest standards of living. Canada cannot expect other nations to limit their emissions if Canadians do little to address our own.*
>
> — *former BC Minister of Environment, Paul Ramsey*[1]

The sources of greenhouse gases are ubiquitous, both globally and within Canada. Globally, the burning of fossil fuels emits over 22 billion tonnes of carbon dioxide into the atmosphere per year and deforestation adds roughly another one billion tonnes. In addition, one hundred million tonnes of methane are released every year from oil, gas and coal production and distribution; 145 million tonnes come from cows, livestock, and rice production; and, 40 million tonnes come from rotting garbage in landfills. Nitrous oxide concentrations are mainly due to artificial fertilizer use. Industrial activities such as aluminium smelting and refrigeration have introduced new greenhouse gases which never existed prior to the industrial revolution into the atmosphere.[2]

How have British Columbia and Canada contributed to these emissions? What are the sources of greenhouse gas emissions in Canada and British Columbia? This chapter describes the diverse sources and some of the trends in Canadian and BC emissions.

1 Paul Ramsey, Minister of Environment, Lands and Parks, "Addressing Global Change: British Columbia's Position" (statement to Energy and Environment Joint Minster Meeting, December 12, 1996) [unpublished].

2 Intergovernmental Panel on Climate Change, Working Group I, "Technical Summary of the Science of Climate Change" in *Climate Change 1995, the Science of Climate Change, Contribution of the Working Group I to the Second Assessment Report of the Intergovernmental Panel on Climate Change* (London: Cambridge University Press, 1995).

Canadian and BC Emissions in a Global Context

Canada contributes only two percent of total global emissions and British Columbians contribute only 0.2% of total emissions.

Our emissions, although small are still significant from a global perspective. Globally Canada is the ninth largest emitter of *carbon dioxide*.[3] In 1996 the 5.5% of the world's population residing in Canada, the United States and Australia were responsible for 28.4% of global carbon dioxide emissions.[4]

The Canadian responsibility to reduce emissions also stems from our historic contribution to the problem. Even if Canadian annual emissions per capita were reduced to a level equal to the global average, Canadians, along with the citizens of other industrialized countries, have historically relied on coal and oil to fire their industrial development. Although greenhouse gas emissions have become increasingly divorced from economic activity (or GDP) since the mid 1970s oil crisis,[5] Canada owes much of its current level of economic development to high historic greenhouse gas emissions.

Canadian and BC Sources of Greenhouse Gases

This section describes emissions from various sectors and includes a cursory discussion of emission reduction opportunities. Fossil fuel and other emissions come from every sector of the Canadian economy. A breakdown of these emissions is provided in figures 1 and 2. The emission reduction opportunities described are intended to be illustrative only. There is an immense range of emission reduction opportunities within any sector. No attempt is made in this report to evaluate opportunities for their emission reduction potential or cost effectiveness.

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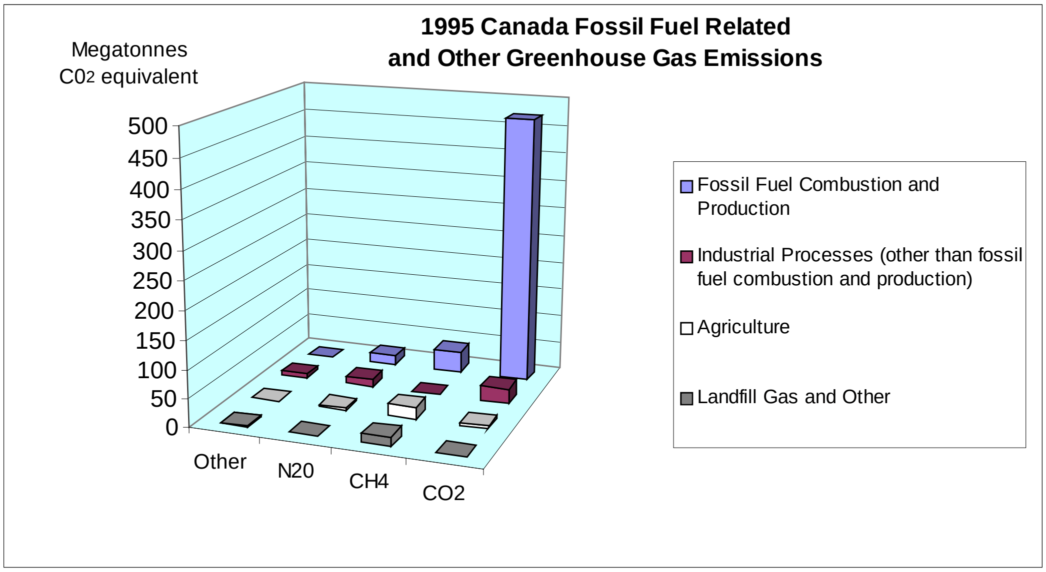
3 Christopher Flavin and Odil Tunali, *Climate of Hope: New Strategies for Stabilizing the World's Atmosphere* World Watch Paper 130 (Washington, DC: Worldwatch Institute, 1996) Table 2.

4 World Energy Council *WEC Survey of Carbon Dioxide Emissions 1990-96* as cited in "Latest Emissions Estimates Bode Poorly for Future Reductions" (25 July 1997) IX:14 *Global Environmental Change Report* 1.

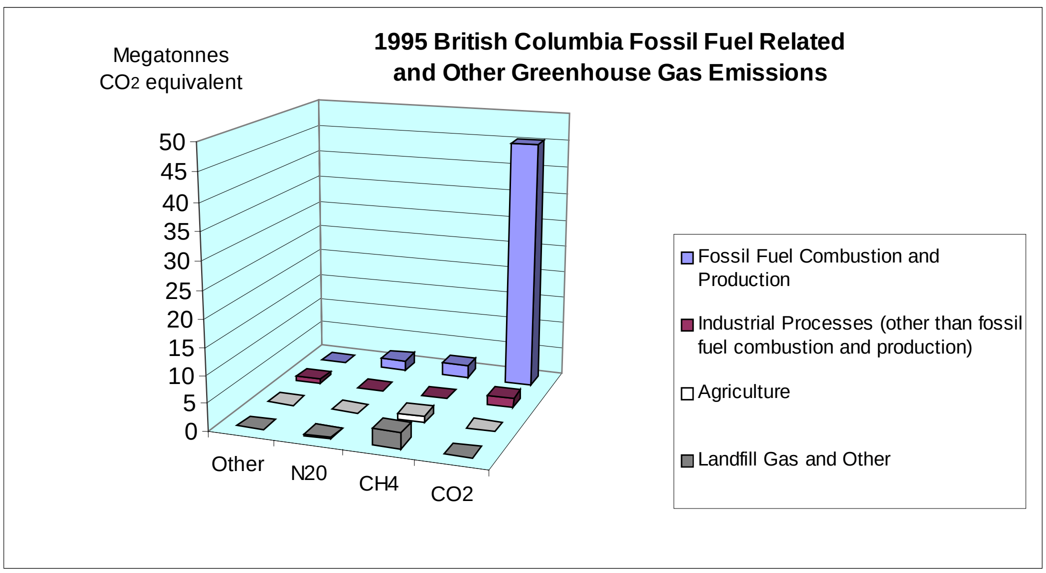
5 Ralph Torrie, Torrie Smith Associates, "Greenhouse Gas Emissions and the Promise of Trading" (Presentation to Workshop on Greenhouse Gas Offsets Trading, Vancouver, March 1997) [unpublished], Table 6, Energy, Economic and CO_2 Growth, 1958 to 1990.

Figure 1[6]



Total: 614 megatonnes CO_2 equivalent

Figure 2[7]



Total: 57 megatonnes CO_2 equivalent

Figures 1 and 2 indicate the extent to which Canadian and BC emissions are dominated by carbon dioxide from energy use. In 1995, 85% of Canadian

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6 Derived from Art Jaques, Pollution Data Branch, Environment Canada "Greenhouse Gas Emission Estimates in Canada for 1995" and "Greenhouse Gas Emission Estimates in British Columbia for 1995," [unpublished]. Emissions from greenhouse gases other than carbon dioxide have been converted into carbon dioxide equivalent using 1995 IPCC 100 year global warming potentials.

7 *Ibid*.

emissions and 88% of BC emissions were from fossil fuel production, processing, distribution and combustion. Eighty-eight percent of Canadian energy-related emissions and 82% of total emissions are carbon dioxide. Ninety-two percent of BC's energy-related emissions and 84% of total emissions are carbon dioxide. *Methane* and *nitrous oxide* account for most of the remainder.[8]

Figures 3 to 6 attribute emissions across different sectors. Figures 3 and 4 show, respectively, Canada and British Columbia's emissions from different sectors, with power generation as a separate category. Figures 5 and 6 attribute emissions from power generation to end users of electricity.

Commercial and Residential Energy Use

As shown in figures 3 and 4, the residential sector — houses and low rise apartments — contributes to greenhouse gas emissions directly through the combustion of fossil fuels for space and water heating (about seven percent of total greenhouse gas emissions in Canada and BC). As shown in figures 5 and 6, an additional five percent of Canada's greenhouse gas emissions and around one percent of BC emissions are from electrical generation for residential use.[9]

The commercial sector includes office and retail buildings, high rise apartment buildings, and institutional buildings. As shown in figures 3 through 6, About five percent of Canadian and six percent of BC greenhouse gas emissions are direct emissions from the commercial sector, and four percent and one percent respectively are indirect emissions.

Emissions reductions from commercial and residential energy use can mainly be achieved through increased energy efficiency. Emissions reductions are also possible through increased use of passive solar energy (i.e., designing buildings so that they are naturally heated by the sun) and *district heating*. Tree planting in urban areas can reduce energy use for both heating and cooling.

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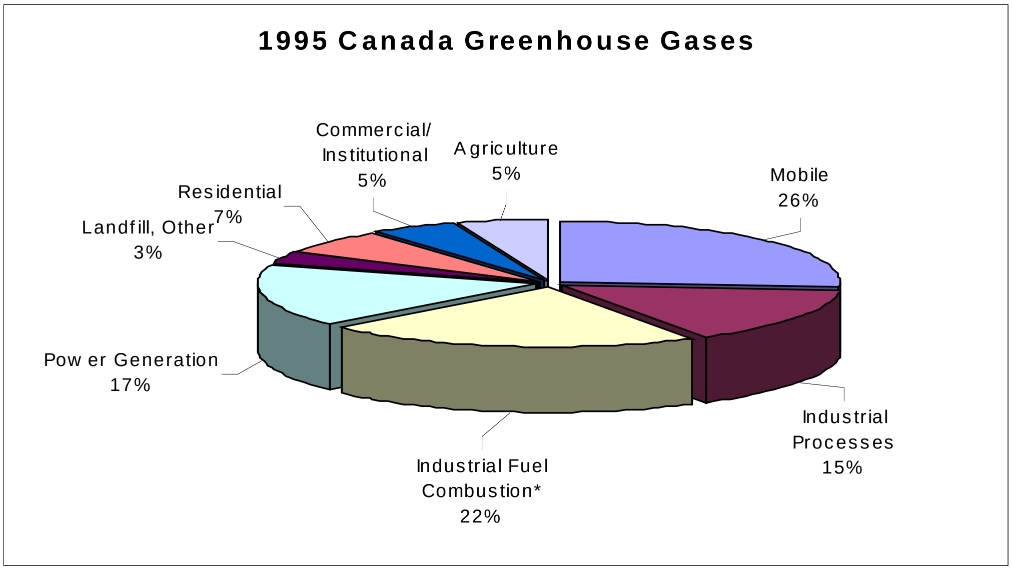
8 *Ibid*.

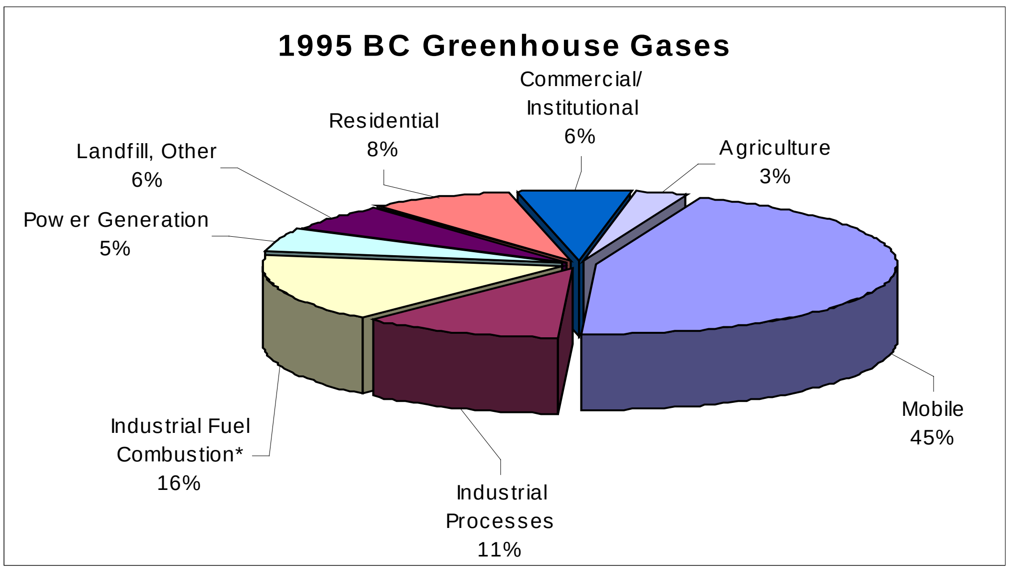
9 Where emissions from electricity production are included in the emissions for a sector these are derived by pro-rating the figures for power generation in Jaques, above at footnote 8, according to electricity use final demand figures in Canada, Statistics Canada, Industry Division, *Quarterly Report on Energy Supply-Demand in Canada, 1995-IV* (Ottawa: Statistics Canada, August, 1996).

Figure 3[10]



Total emissions: 619 megatonnes CO_2 equivalent

Figure 4[11]



Total emissions: 57 megatonnes CO_2 equivalent

* includes all stationary fuel combustion other than power generation, residential, commercial, institutional and agricultural

Note: totals may not add up to 100% due to rounding

10 *Ibid*, and Jaques, above at footnote 6.
11 *Ibid*.

Industry

Canada's industrial sector includes manufacturing, mining, and pulp and paper industries. It also includes the fossil fuel industry, but emissions from this sector are often treated separately. Industry-related emissions include electrical generation for industry, industrial fuel consumption and non-energy related emissions from industry. Figures 3 through 6 do not distinguish between industrial process emissions and industrial energy use in the fossil fuel sector and other industrial sectors. When emissions from fossil fuel combustion by the fossil fuel industry, upstream oil, gas and coal emissions and emissions from natural gas distribution are included industrial sources account for 44% of Canadian greenhouse gas emissions – 22% from fossil fuel consumption by industry, seven percent from electrical production for industry and fifteen percent from industrial processes.[12]

However, when emissions from the fossil fuel industry are excluded Canadian industry only accounts for about one quarter of total Canadian emissions. Slightly over twelve percent of Canadian emissions are from fuel consumption by industry, not including fossil fuel producers, seven percent from electrical production for industry and another seven percent of Canadian emissions are emissions from industrial processes other than fossil fuel production.[13] Industry accounts for a smaller proportion of emissions in British Columbia both because of significant reliance on hydroelectricity and energy from wood residue by the largest industrial energy user (pulp and paper).

Opportunities for reducing energy related emissions from the non-fossil fuel industries include improved energy efficiency, cogeneration (the simultaneous production of electricity and steam or hot water for industrial or commercial use), fuel switching to less carbon intensive fuels (fuels that have lower net greenhouse gas emissions per unit of energy) and shifts in production to inputs and products that are less carbon intensive (products that require less energy to produce or inputs that have lower lifecycle emissions of greenhouse gases). For instance, in the pulp and paper sector, fuel switching to wood residue fuels, shifting production from kraft pulp to other processes, and recycling of paper offer significant opportunities, especially as new mills replace older mills.[14]

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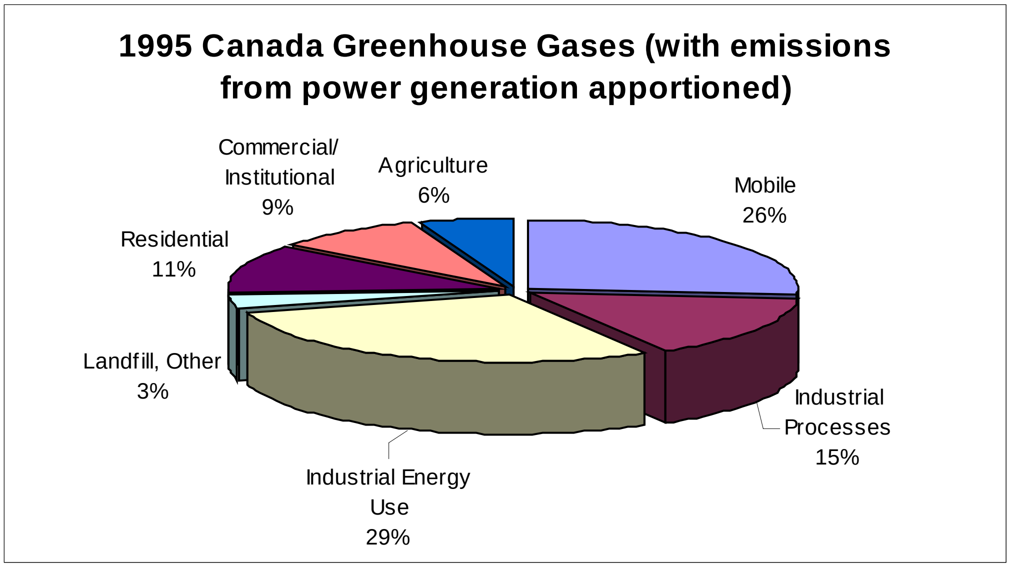
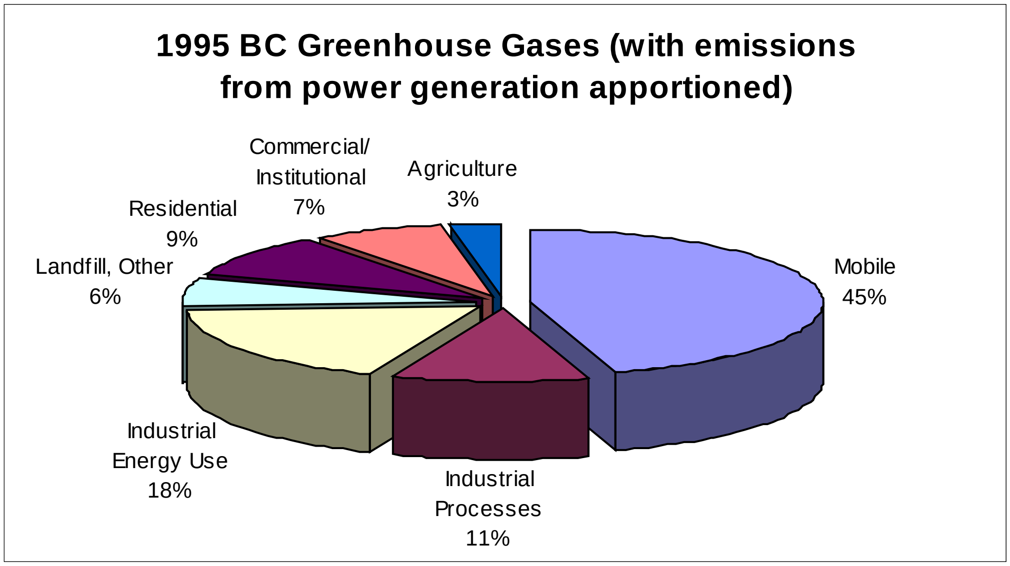
12 *Ibid*.
13 *Ibid*.
14 The ARA Consulting Group Inc., H.A. Simons Ltd., and IBI Group Inc., *Evaluation of CO_2 Management Measures,* (Victoria: Queen's Printer for British Columbia, 1992).

Figure 5[15]



Total emissions: 619 megatonnes CO_2 equivalent

Figure 6[16]



Total emissions: 57 megatonnes CO_2 equivalent

Note: totals may not add up to 100% due to rounding

Other than fossil fuel combustion, the industrial processes that cause industrial emissions include carbon dioxide from cement and lime production, non-energy

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15 Statistics Canada, above at footnote 9, and Jaques, above at footnote 6.
16 *Ibid*.

related emissions of carbon dioxide and nitrous oxide from chemical industries, and emissions of perflourocarbons from aluminum smelting and magnesium production. BC's largest single source of greenhouse gases is the Alcan aluminum smelter in Kitimat, which perflourocarbons, greenhouse gases which last thousands of years in the atmosphere and are over 5,000 times more powerful than carbon dioxide. Emission reduction opportunities from industrial processes vary from source to source. For instance, use of waste lime from other industries can reduce carbon dioxide emissions from cement manufacturing, and use of "pre-baked" anodes in aluminum manufacture can reduce perflourocarbons emissions.

Mobile Sources

Mobile sources account for about 27% of Canadian greenhouse gas emissions and 46% of BC emissions. In Canada fifteen percent and in BC twenty percent of total emissions are from light duty vehicles. Heavy duty trucks account for about five percent of total emissions in both BC and Canada.[17] Other transportation related emissions include air, ship and off-road diesel. The breakdown of emissions within the transportation sector is shown in figures 7 and 8.

Emission reductions can occur both as a result of improved technology (increased fuel efficiency), less carbon intensive fuels (e.g. natural gas, ethanol and bio-diesel) and *transportation demand management.* The latter includes not only changing passenger transportation patterns (e.g. shifting commuters from single occupancy vehicle use to transit and telecommuting), but also includes measures in the freight sector (e.g. shifting freight from trucks to rail, ship or intermodal systems).

Energy Supply and Generation Sector

Seventeen percent of Canada's 1995 emissions came from the fossil fuel industries.[18] A significant percentage of emissions are methane emissions from upstream oil and gas operations. Emissions from these industries climbed faster than any other sector between 1990 and 1995 —

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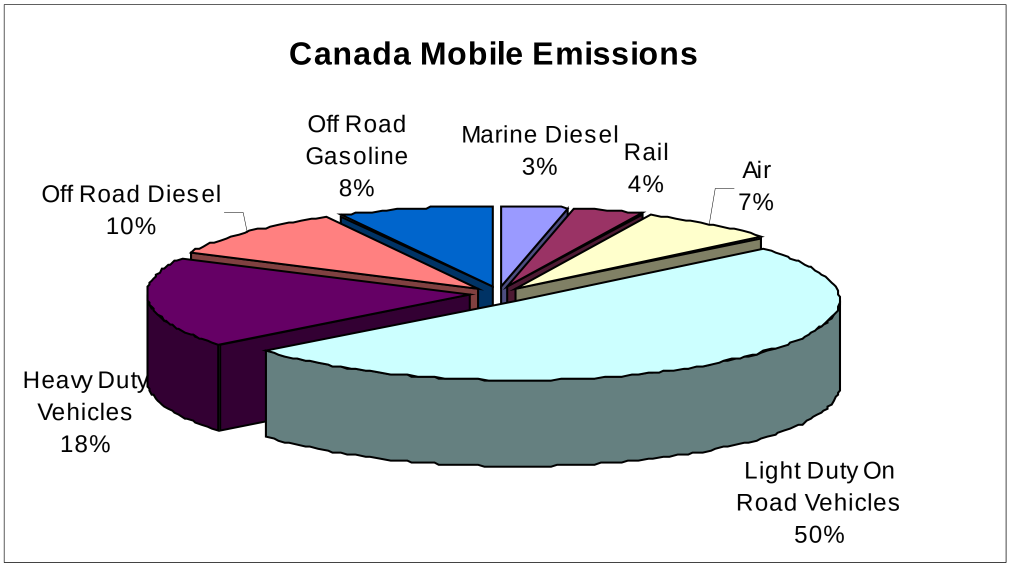
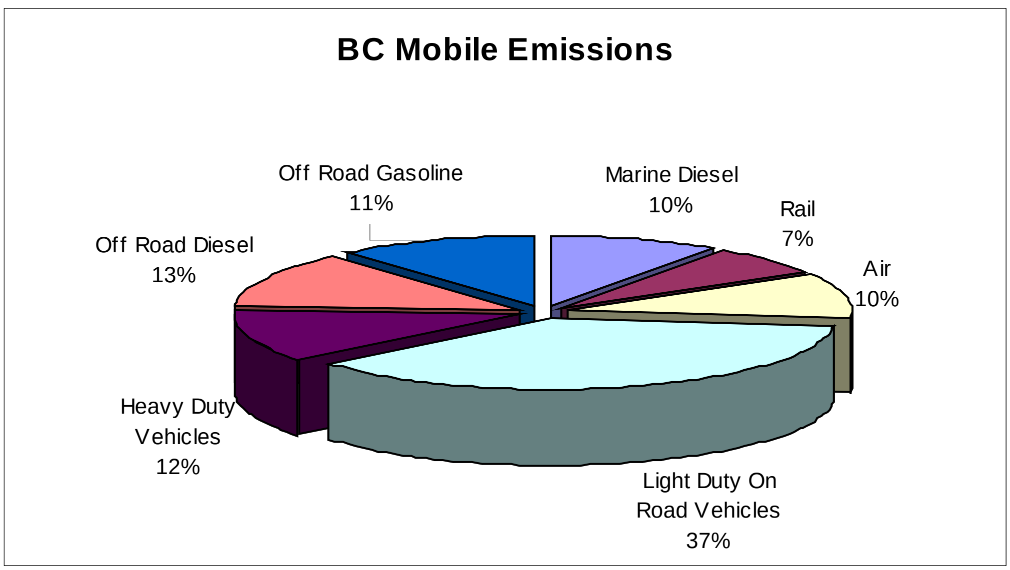
17 *Ibid*.
18 Torrie, Torrie Smith Associates, above at footnote 5.

Figure 7[19]



Total emissions: 164 megatonnes CO_2 equivalent

Figure 8[20]



Total emissions: 23.9 megatonnes CO_2 equivalent

Note: totals may not add up to 100% due to rounding

19 Derived from Jaques, above at footnote 6.

20 *Ibid*.

accounting for almost a third of the increase in emissions during this period. Continued growth is projected.

Emission reduction opportunities include increased capturing of methane from natural gas venting in the upstream oil and gas sectors, use of natural gas which is currently flared to produce electricity or transportation fuels, re-injection of carbon dioxide stripped from natural gas, and increased energy efficiency. Energy efficiency and switching to renewable energy in other sectors will also reduce upstream emissions from oil and gas production.

As shown in figures 3 and 4, in 1995, power generation accounted for about seventeen percent of Canadian and five percent of BC greenhouse gas emissions. However, 1995 was a high emission year for BC Hydro due to low water levels.[21] Although the amount of electricity derived from fossil fuels is fairly low in BC, electricity from natural gas, coal fired imports from Alberta and hydro are the major marginal sources of electricity (i.e. they are the sources which supply incremental changes in demand), and electricity from natural gas is likely to become more important in the future for BC Hydro supply plans. Thus, efforts to reduce electricity consumption in BC will tend to have a greater impact on greenhouse gas emissions than is suggested by the overall percentage of electricity coming from fossil fuels. On the other hand, simply reducing electricity production in British Columbia will not necessarily reduce greenhouse gas emissions if it entails greater electrical production in other jurisdictions, as BC's average marginal sources are generally less carbon intensive than those of other jurisdictions.

As well as reducing demand for electricity, emissions from power supply can be reduced by increased use of cogeneration, increasing the efficiency of power production, and switching to renewable sources of energy. Use of hydrogen fuel cells to produce electricity may also have a role, especially if hydrogen can be produced with minimal carbon dioxide emissions. Opportunities for reducing emissions through switching to less carbon intensive technologies are greatest in Alberta, Saskatchewan and Nova Scotia where coal is the predominant source of electricity.

Non-Energy Agriculture Emissions

As indicated in figure 3, six percent of Canadian emissions come from methane emissions from cattle, other livestock (mainly cattle), and manure, and nitrous oxide emissions from agricultural soils. Figure 4 indicates that agricultural emissions are only three percent of BC emissions. Both BC and Canadian

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21 In 1991, for instance, power generation accounted for less than two percent of BC emissions: Jaques, above at footnote 6.

emissions are dominated by methane from livestock and manure. Agricultural emissions could be reduced by improving agricultural management techniques, often through methods that will increase productivity.

Waste

As shown in figures 3 and 4, about three percent of Canadian emissions and six percent of BC emissions are methane from landfills. A tiny percentage of Canadian emissions are from waste water treatment and composting. Methane emissions from landfill can be captured and either flared or used to produce electricity. Capture and utilization of landfill gas can be profitable and reduce local air pollution and odour problems.

Factors Underlying Canadian Energy Intensity

Canadians' high emissions of greenhouse gases are a result of several factors: our affluence (or GDP per capita); our energy intensity (or secondary energy demand[22] divided by GDP) and our carbon intensity (or carbon emissions per unit of energy).

Our energy intensity is often blamed on Canada's cold climate and low population density. Although there is some validity in blaming these factors, it is also clear that high Canadian emissions result from factors such as low urban density, energy intensive lifestyles and increasing reliance on the motor vehicle. Gasoline consumption in Canadian cities is two or more times the per capita consumption in European cities.[23]

Canadian and BC emissions are also often attributed to our specialization in energy intensive industries, such as natural resource extraction and processing. Much of our energy intensive production is bound for export, allowing other countries to specialize in less energy intensive products, and thus have lower emissions of greenhouse gases per capita. For instance, the pulp and paper sector has the third highest emissions of carbon dioxide of any industrial sector in

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22 Secondary energy demand refers to all energy used by Canadians other than energy used to produce other forms of energy.

23 Peter Newman & Jeff Kenworthy "Winning Back the Cities" (Marrickville, NSW: Pluto Press, 1992) at 9.

Canada (and highest emissions in British Columbia), yet 82% of these emissions result from the production of pulp and paper for export.[24]

Seven industrial sectors in Canada — petroleum refining, steel, pulp and paper, cement, smelting and refining and non-metal mining — produced approximately 52% of all energy related industrial direct carbon dioxide emissions. These sectors exported 42% of their production, meaning that exports of embodied carbon dioxide from these seven sectors accounted for approximately 4.6% of the Canadian carbon dioxide emissions.[25] In addition, fifteen percent of Canadian emissions are from the oil and gas industries. Fifty-three percent of natural gas production was for export and net exports of oil equalled 28% of oil production.[26] Thus, although Canada's high per capita emissions of greenhouse gases are partially the result of exports of embodied carbon dioxide in these sectors, our emissions of greenhouse gases would continue to be much higher than the average for industrialized nations even if embodied carbon dioxide exports were not counted.

Trends in Canadian and BC Emissions

Our emissions are also among the fastest growing in the OECD. Canada's greenhouse gas emissions grew 9.4% between 1990 and 1995. The largest source of increases in emissions in Canada between 1990 and 1995 was the petroleum industry, which contributed 31% of the increase.[27] Much of this increase was due to increased export fuels. Exports of natural gas doubled from 1990 to 1995 as did net exports of oil.[28] Heavy industry contributed eighteen percent of the total increase.[29] Passenger transportation, especially light duty trucks and cars, contributed twelve percent of the increase.[30] Other contributors to the increase

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24 Canadian Institute Program for Energy Conservation, *1994 to 1995 Annual Report* (Toronto: CIPEC Secretariat, 1996).

25 *Ibid.* CIPEC figures do not include carbon dioxide from electrical generation or upstream emissions from fossil fuel industries.

26 Canada, Natural Resources Canada, *Canada's Energy Outlook, 1996 — 2020, Update, 1996*, (Ottawa: Supply and Services Canada, 1997).

27 Torrie, Torrie Smith Associates, above at footnote 5.

28 Canada, Natural Resources Canada, above at footnote 26.

29 *Ibid.* This includes indirect emissions from electrical production.

30 *Ibid.* See also Jaques, above at footnote 6, which indicates a 8.4 Mt increase (fifteen percent of national total) in greenhouse gas emissions from cars and light duty trucks between 1990 and 1995.

are residential energy use (eleven percent of increase) and commercial energy use (nine percent of increase).[31]

Although the federal government projects a drop in emissions so that emissions in the year 2000 are only an 8.2% increase from 1990 levels,[32] these projections have been criticized as being politically driven and based on overly optimistic assumptions regarding the effectiveness of current voluntary and other measures.[33] Earlier projections were for a thirteen percent increase from 1990 to 2000.[34] Most of Canada's industrialized trading partners are projecting much less significant increases or decreases.[35]

BC emissions climbed fifteen percent from 1990 to 1995. Most of the growth in BC emissions is the result of increased natural gas production, increased transportation emissions and hydro electric power generation being increasingly supplemented by fossil fuel generation. Although population growth accounts for some increased emissions, emissions from all these sources are expanding at a rate faster than population growth. For instance, emissions from light duty motor vehicles rose 23% between 1990 and 1995. This is the result of a trend towards higher per capita distance driven as well as greater population. Between 1970 and 1995, per capita distance driven doubled and total distance driven more than tripled.[36] Total BC emissions are projected to climb 23% above 1990 levels by 2000, and by 50% by 2020.[37]

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31 Torrie, Torrie Smith Associates, above at footnote 5. This includes indirect emissions from electrical production.

32 Canada, Natural Resources Canada, above at footnote 26.

33 Personal communication with Robert Hornung, Pembina Institute.

34 Canada, Natural Resources Canada, *Canada's Energy Outlook, 1992 — 2020, Update, 1994,* (Ottawa: Supply and Services Canada, 1995).

35 Projections for other nations' increase in CO_2 emissions (excluding forestry and land use) are as follows: US, 14.9% increase; Japan, two percent increase; France, four percent increase; Germany ten percent decrease. All figures except US are from Framework Convention on Climate Change Secretariat, *Second Compilation and Synthesis of first national Communications from Annex I Parties* (Geneva, Switzerland: FCCC Secretariat, July 1, 1996); US figures are for carbon dioxide from energy use projected by US Energy Information Agency, *Annual Energy Outlook, 1997,* (Washington: Department of Energy, 1997).

36 British Columbia, Ministry of Environment, Lands and Parks, State of Environment Reporting, "Greenhouse Gases in British Columbia" (Victoria: Ministry of Environment, Lands and Parks, Environmental Indicator Series, December 1996). See also, Greater Vancouver Regional District, "Greater Vancouver Travel Survey — Comparisons of Travel Demand by Mode, 1985-1992," (Greater Vancouver Regional District, 1992) [unpublished].

37 Canada, Natural Resources Canada, above at footnote 26.

Summary

Although Canada contributes only a small portion of total global greenhouse gas emissions, we are the ninth largest emitter in the world and have the second highest per capita emissions in the industrialized world. Our emissions come overwhelmingly from combustion of fossil fuels, and are overwhelmingly carbon dioxide.

Our high emissions per capita are partially the result of cold climate, large geographic distances between population centres, and specialization in energy intensive products for export. They are also the result of energy intensive lifestyles. This includes a high degree of dependence on the motor vehicle. BC emissions differ from the average Canadian profile in that they come more from transportation and less from power generation.

The fastest growing sources of emissions in Canada are the fossil fuel industries, followed by heavy industry and passenger transportation. This trend is reflected in BC where increased reliance on electricity from natural gas fired power plants is also increasing emissions substantially and where the rate of increase in transportation related emissions is much faster that the rest of Canada.

Chapter 3:

Responding to Climate Change: The International, National and Provincial Responses

[The IPCC Second Assessment Report is] a warning to humanity that we have gone beyond the point where the sustainable use of the atmosphere as a highly mobile dump for man's waste is possible without serious consequences.

— Godwin Obasi, World Meteorological Organization Secretary General

Increasing scientific concern in the 1980s regarding climate change and its likely future effects led governments at the international, national and provincial or state levels to undertake various actions to reduce emissions. This chapter first reviews the development of an international response. This is followed by a review of the development of a Canadian national action plan and a British Columbia plan of action.

The International Response

Concerned that human-caused emissions of greenhouse gases would result in global climate change, the World Meteorological Organization's Toronto Conference on Change Climate in 1988 recommended reducing carbon dioxide emissions to twenty percent below 1988 levels by the year 2005. This was quickly followed up by the World Meteorological Organization and the United Nations Environment Program establishing the Intergovernmental Panel on Climate Change (IPCC) in 1988. The IPCC was charged with assessing scientific information related to climate change, evaluating the environmental and socio-economic impacts of climate change, and formulating response strategies. Two years later the first IPCC *Assessment Report* was published. Attention to this report led the United Nations General Assembly to adopt a resolution to negotiate a Framework Convention on Climate Change.

The Framework Convention on Climate Change

The *United Nations Framework Convention on Climate Change* (FCCC) was one of the environmental documents tabled at the June 1992 Earth Summit in Rio de Janeiro. Almost 160 nations have ratified the FCCC to date. The ultimate objective of the FCCC is to stabilize "greenhouse gas concentrations in the atmosphere at a level that will prevent dangerous anthropogenic [human-induced] interference with the climate system. Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner."

The FCCC notes that the largest share of historic and current emissions originate in developed countries. It commits OECD nations to support climate change activities in developing countries by providing financial support above and beyond current levels of financial assistance. The primary means of delivering this assistance has been through the Global Environment Facility, a United Nations/World Bank organization that assists developing countries with the costs of activities that benefit the global environment.

The Convention also includes commitments by the nations listed in Annex 1 — i.e. all the developed, OECD nations except Mexico and South Korea, and former members of the Soviet bloc — to "seek to return" by the year 2000 to 1990 emission levels. The commitment was vague and fell far short of the Toronto target. However, as its name implies, the FCCC is largely a framework, i.e. it creates a process for agreeing to specific actions later on. It was intended to establish a framework of general principles and institutions and to set up a process by which more meaningful commitments could be developed.

The Berlin Mandate and Geneva Declaration

The Toronto target was endorsed by Association of Small Island States at the first meeting of parties to the FCCC, but received little support. However, based on work by the IPCC, the First Conference of Parties to the FCCC agreed that current commitments were inadequate to achieve the objectives of the Convention. The conference also initiated a process to strengthen the commitments on the part of industrialized countries to reduce greenhouse gas emissions beyond the year 2000 through the adoption of a protocol or other legal instrument. The mandate to negotiate a legal instrument is known as the "Berlin Mandate." A group, the Ad Hoc Group on the Berlin Mandate (AGBM), was charged with advancing the negotiation. A protocol or other legal instrument was the goal of the Third Conference of the Parties of December, 1997 in Kyoto, Japan.

The *Kyoto Protocol*

In December 1997, a protocol was successfully negotiated at Kyoto. While the *Kyoto Protocol to the United Nations Framework Convention on Climate Change* represents an important step forward, it will not by itself appreciably reduce the rate of climate change, and its effectiveness will depend on the resolution of a number of important issues. The key elements of the *Protocol* are described below.

Allowed Emissions and Differentiation

The *Kyoto Protocol* establishes a commitment period between 2008 and 2012 in which average emissions for Annex 1 Nations are to be 94.8% of 1990 levels. Individual allowable emissions targets or "assigned amounts" are set for different nations. In this report, portions of the assigned amounts are referred to as international emission allowances.

Although proposals had been made for differentiation of allowed emissions on the basis of criteria such as population, GNP, or carbon intensity of the economy, the differentiations agreed to at Kyoto were purely political. Canada is to reduce its emissions by six percent; the US by seven percent; European Union nations by eight percent. The Russian Federation is only required to stabilize emissions. Iceland is allowed to increase emissions by up to ten percent.

Treatment of Emissions for Land-Use Change and Forestry

Anthropogenic emissions of greenhouse gas emissions into the atmosphere are the total of gross emissions (i.e. emissions from energy, industrial process, agriculture and waste) and net emissions or removals from the forest and land use sector. At Kyoto, a number of nations objected to the inclusion of net emissions from the forest and land use sector because of uncertainty, because of unresolved methodological issues in measuring these emissions, and because inclusion would reduce the impact of any given emission limitation.[1] Other nations insisted on inclusion of emissions from land use change and forestry, because it would give them greater flexibility and possibly reduce costs of emission reduction.

The end result of negotiations was a compromise. Under the *Kyoto Protocol*, most nations calculate their allowed emissions for the first compliance period on the basis of 1990 gross emissions. However, compliance with allowed emissions is calculated on the basis of gross emissions minus (plus) net removals (emissions) during the period 2008 to 2012 if these removals or emissions result from reforestation, afforestation or deforestation since 1990. Other emissions or removals from forestry and land use change categories may eventually be included, pending resolution of methodological issues. The details regarding treatment of emissions and removals from land use change and forestry are discussed further in Chapter 12.

Emissions Trading, Hot Air and Buyer Beware

The *Kyoto Protocol* establishes a process for trading emission reduction units and commits the Parties to establish rules for emissions trading. These details of the *Protocol* are discussed in more detail in Chapter 11. In theory, trading allows nations who can reduce emissions at low costs to reduce their emissions below the level of their assigned amounts and sell the surplus allowances to other parties, thus reducing the overall cost of compliance but achieving the same end.

In practice, depending on rules for trading, trading could severely reduce the effectiveness of the *Protocol*. In particular the sale of “hot air” allowances — international emission allowances that in the absence of any effort to reduce emissions are surplus to the needs of the seller nation — could significantly reduce the effectiveness of the *Kyoto Protocol*. The sale of hot air allowances from Russia alone could allow a two or four percent increase in emissions from other Annex 1 Nations.[2] Similarly, there is a possibility that trading rules may create a “seller beware” system in which the environmental effects of one nation’s

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1 Net emissions from Annex 1 Nations in 1990 were eight percent less than gross emissions. Thus, if 1990 gross emissions were compared to net emissions in the compliance period, the end result would be to allow an eight percent increase emissions over the target agreed to for Annex 1 Nations.

2 See Chapter 11, under the heading "Design Issue 32: Recognizing and Generating International Emission Allowances," subheading "Hot Air."

non-compliance could multiply and reduce the effectiveness of the *Protocol* to a greater extent than if no trading occurred.[3]

The Inclusion of HFCs, PFCs and SF_6

The *Kyoto Protocol* applies to six[4] greenhouse gases: the three main greenhouse gases released by human activity (carbon dioxide, nitrous oxide and methane) and three gases that are released in small quantities but are both long lasting and extremely powerful (hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride). In calculating their assigned amounts, nations are allowed to use 1995 rather than 1990 emissions of hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride. This was in part necessary because of lack of data for 1990.

However, because hydrofluorocarbons were used as a replacement for ozone depleting chemicals that were being phased out in the early 1990s, emissions of these gases during the period 1990 to 1995 skyrocketed.[5] Although a 1995 baseline was preferable to the exclusion of the three trace gases, it reduces the effectiveness of the emission limitations. The use of a 1995 baseline will allow Annex 1 Nations to increase total emissions.[6]

The Clean Development Mechanism

The *Kyoto Protocol* allows Annex 1 Nations to gain credit toward their emission limitations through investing in projects or undertaking projects in nations that are not subject to emission reduction commitments (the non-Annex 1 Nations). Projects and the credits received will be approved by a new international entity known as the clean development mechanism. The process is intended to reduce emission reduction costs and encourage dissemination of technologies. The parties actually investing in and undertaking projects can include private sector firms.

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3 See Chapter 11, under the heading "Design Issue 32: Recognizing and Generating International Emission Allowances," subheading "Buyer Beware and Seller Beware."

4 Actually four distinct gases and two families of gases.

5 Subsidiary Body for Implementation, *First Compilation and Synthesis of Second National Communications from Annex 1 Nations* (Geneva: UNFCCC, 1997) table A-10 shows an increase in emissions of these gases from 130,290 gigagrams CO_2 equivalent in 1990 to 183,434 in 1995 for countries that had tabled second national communications.

6 For the eighteen Annex 1 countries for which data was available, the increase in emissions of the three trace gases from 1990 to 1995 is equal to 0.64 % of emissions of carbon dioxide: derived from Subsidiary Body for Implementation, *Ibid.* However, for some nations not included in available data the effect is more profound. For instance, the 1995 baseline may allow Japan to emit several percentage points above what it could in the absense of a 1995 baseline for the three trace gases.

The primary difficulty with this approach is that credit may be given for projects which would have occurred in the absence of the clean development mechanism. This will reduce the effectiveness of the *Kyoto Protocol.* The problem of credit being given for projects that would occur anyway is inherent in any system for generating credit outside of an emission cap. However, it is particularly acute in the case of the clean development mechanism because many greenhouse gas emission reduction projects are profitable or worth doing for other reasons. Many of these projects are happening already; they simply do not occur in the numbers to counteract the general trend to higher emissions. The extent of this problem is uncertain but is likely to be very substantial. It, and means to limit it, are discussed further in Chapter 11.

Legally Binding

The commitments included in the *Kyoto Protocol* are legally binding under international law. In comparison, the *Framework Convention on Climate Change*, signed in 1992, only committed nations to "aim" to stabilize emissions at 1990 levels by 2000.

Extension of Emission Limitations to Developing Countries

A final notable aspect of the *Kyoto Protocol* is what is not in it: there is no means for non-Annex 1 Nations to agree to emission limitations. The EU and the developing world had opposed anything aimed at including the developing world. While recognizing that successfully limiting climate change would eventually require placement of emission limitations on developing countries, these countries believed that it was appropriate for the wealthy nations that are responsible for increased atmospheric concentrations — the Annex 1 Nations — to prove their willingness to curb emissions.

The US and most other non-EU developed nations supported a mandate to negotiate post 2012 emission limitations for developing countries that reach a minimum level of economic development. Proposals were also made for a mechanism whereby developing countries could voluntarily agree to emission limitations. (This would be potentially attractive for countries that have low cost emission reduction opportunities and might be in a position to sell international emission allowances). Even though a number of developing countries supported a mechanism that would allow them to voluntary accede to emission limitations, both these proposals were defeated by the developing country bloc.

It is not clear how the US will respond to this defeat. The US Senate has been unequivocal in its demand for developing country commitments. Likely, the US will attempt to achieve some developing country commitment prior to ratifying the *Kyoto Protocol*. If US fails to get such a commitment, ratification will be politically much more difficult.

After Kyoto: Ratification, Resolution of Issues and Adequacy of Emission Targets

The *Kyoto Protocol* represents a step forward in international efforts to curb greenhouse gas emissions. However, it is a first step, and it is a small step in comparison to what is needed.

The emission limitations — as expressed as emission reductions from 1990 levels — are, for Canada and many other nations, significant. However, the numbers by themselves overstate the significance of the agreed emission limitations. Hot air, the clean development mechanism, seller beware trading, the treatment of emissions from forests, the use of a 1995 baseline for trace gases: all reduce the stringency of the agreement.

The Kyoto Protocol will not, by itself, significantly reduce the rate of climate change, but it represents a first step towards neccessary reductions.

The *Kyoto Protocol* will not, by itself, significantly reduce the rate of climate change. Prior to Kyoto, English researchers projected the effects of the EU's proposal for a fifteen percent emission cut by 2010. The EU proposal, although significantly stronger than what was agreed to at Kyoto, only limited warming to 1.1°C by 2050 and 1.7°C by 2100. By comparison, under the researchers' baseline scenario, global mean temperature would increase by about 1.2ºC by 2050 and 1.9ºC by 2100 if emissions remain uncontrolled.[7]

During the Berlin Mandate negotiations, Dutch researchers calculated various "safe landing" corridors of emissions that would avoid both changes in climate that are too extreme and unrealistically rapid emission reductions in the future. The most conservative definition of a safe landing involved avoiding, over the next century:

- global temperature increases of more than 1°C because of human interference,
- rates of change more than 0.1°C per decade,
- sea level increases of more than 0.2 metres, and
- emission reductions of greater than two percent in any year,

[7] Suzanne Subak, *et al.*, "The Implications of the 1997 FCCC Protocol Proposals for Future Temperature" (Centre for Social and Economic Research on the Global Environment and the Climate Research Unit, University of East Anglia, August 1, 1997 policy briefing) [unpublished].

This "safe landing" corridor still allows faster increases in temperature than seen in the last 10 000 years, projects that eleven percent of world nature reserves will be at risk, and predicts decreased yields in thirteen percent of the world's maize growing areas.[8] The Dutch researchers also defined a safe landing corridor with parameters that were half as stringent (temperature increase less than 2°C; rate of change less than 0.2°C per decade; sea level change less than 0.4 metres over the next century and rates of reduction less than four percent per year) as well as an intermediate scenario.

To reach the most conservative safe landing corridor, emissions from Annex 1 Nations would need to be reduced by between 37% and 64% of 1990 levels by 2010. Although emissions from Annex 1 Nations could increase to stay within the less stringent safe landing corridors, doing so would necessitate faster, deeper emission reductions in the long term. To reach the middle of the least stringent safe landing emission corridor would require nineteen percent cuts by Annex 1 Nations by 2010.[9]

Thus, after the *Kyoto Protocol* is ratified further, much larger steps will be needed. These will include both larger cuts from Annex 1 Nations and acceding to emission limitations by some developing countries.

Canadian Emission Reduction Strategy

At the 1989 Bergen Conference of the United Nations Economic Commission for Europe, and again at the Second World Climate Conference in May 1990, the federal government committed Canada to stabilizing emissions of greenhouse gases at 1990 levels by the year 2000.[10] Subsequently, the House of Commons Standing Committee on Environment recommended a commitment to a twenty

[8] Joseph Alcamo and Eric Kreileman, *The Global Climate System: Near Term Action for Long Term Protection* (Netherlands: National Institute of Public Health and the Environment, February 1996).

[9] Aiming for the middle of the safe landing corridor avoids imposing on future generations the need for more drastic emission controls, and provides a safety buffer to reflect uncertainty as to climate sensitivity. The safe landing analysis is based on the IMAGE 2 Global Climate Model. Other models predict greater sensitivity to increases in greenhouse gas concentrations. Aiming for the middle of the corridor gives future generations the flexibility to chose more stringent climate protection goals in light of increased understanding of climate change impacts.

[10] Canada, *Canada's Green Plan* (Ottawa: Minister of Supply and Services, 1990) at 100. The commitment referred to greenhouse gases other than ozone depleting substances controlled by the *Montreal Protocol*.

percent reduction by 2005.[11] Most recently, the Liberal "Red Book" said a Liberal government would work with provincial and urban governments with the aim of cutting emissions by twenty percent from 1988 levels by 2005.[12]

Despite these commitments, progress has been slow. From 1990 to 1993, federal and provincial governments were unwilling or unable to cooperate in reducing greenhouse gas emissions and were unwilling to take significant steps unilaterally. Finally, in 1993, the Climate Change Task Group of the National Air Issues Coordinating Committee was formed to suggest measures that could be included in a national action plan. Eighty-eight measures were developed and proposed for consideration by governments. The measures ranged across all sectors of the economy. They included increased density in urban areas, improving energy and fuel efficiency standards, creating an energy efficiency home retrofit program for low-income earners, enforcing highway speeds, promoting tree planting, and reducing methane emissions from ruminants through change to feed technology.

After years spent developing emission reduction options, Canada's 1995 National Action Program contained few new measures other than a challenge to industry to voluntarily reduce emissions.

Measures were grouped into five "modelling scenarios" and a Forecast Working Group was established to estimate the impacts of each modeling scenario. The Forecast Working Group analysis suggested none of the five scenarios could stabilize emissions at 1990 levels by 2000, although scenario five might stabilize emissions if slightly more optimistic assumptions were used, or if the analyses had been able to quantify the benefits of several measures.[13]

In February 1995, federal and provincial energy and environment ministers released Canada's National Action Program on Climate Change. Despite the time invested in developing different options, and despite results showing that stringent measures could have positive impacts on the economy, few of the 88 measures proposed by the Climate Change Task Group were included in the national program. Indeed, the national program had fewer elements than the least extensive modelling scenario. Rather than calling for concrete new measures, the national program mainly calls for more analysis of measures and reviews of subsidies to fossil fuel industry.

The mainstay of the National Action Program on Climate Change is the Voluntary Challenge and Registry Program (the VCR). The VCR is mainly targeted at the industrial and fossil fuel sectors, but is not expected to achieve stabilization in those sectors. Only one industrial subsector — pulp and paper — is committed to

11 Canada, House of Commons, Standing Committee on Environment, *Out of Balance, The Risks of Irreversible Climate Change* (Ottawa: Queen's Printer of Canada, 1991) at 45.

12 Liberal Party of Canada, *Creating Opportunity, the Liberal Plan for Canada* (Ottawa: Liberal Party of Canada, 1993) at 70.

13 Forecast Working Group of the National Air Issues Coordinating Mechanism, "Microeconomic and Environmental Assessment of Climate Change Measures" (FWG, April 1995) [unpublished].

reducing emissions. As noted in Chapter 2, Canadian emissions are projected to be 8.2% above 1990 levels by 2000.

Canada is not the only nation to do little in its efforts to reduce greenhouse gas emissions, but a number of European nations have taken significant steps. For instance, as discussed in chapter 6, Scandinavian nations have implemented carbon taxes, and Germany and the Netherlands have used a credible threat of stringent regulation to spur action in the private sector.

Because Canada's national program clearly fell short of what was necessary to stabilize emissions, the Canadian Climate Action Network proposed the Rational Energy Plan, a package of voluntary, educational, regulatory and fiscal measures which could with some certainty reach the stabilization target and reduce emissions by 6.5% or more by 2010.[14] The Rational Energy Plan was also projected to decrease energy related sulfur dioxide emissions by 24%, volatile organic compounds by thirteen percent, and nitrogen oxide by sixteen percent from base-case scenarios.

British Columbia and Quebec fare particularly well under the Rational Energy Plan, with a significant boost to their economies.

The economic impacts of the Rational Energy Plan along with the other modelling scenarios developed by the Forecast Working Group have been evaluated using a combination of Natural Resources Canada "bottom up" energy models and macroeconomic analysis by Informetrica, a leading Canadian economic consulting group.[15] Informetrica projected that the "overall size of the Canadian economy, and its growth, are unlikely to be significantly changed by" the different modelling scenarios or the Rational Energy Plan.[16] The Rational Energy Plan was projected to increase the total GDP by about one percent from 2000 to 2005 with a less significant decline subsequently. Canadian employment would increase 100 000 in the first four years of the program, increasing to 190 000 in the period of 2001 to 2005 with less significant but positive impacts thereafter. Government borrowing was projected to be slightly lower until 2005 but would increase by about five billion dollars thereafter.

British Columbia and Quebec fare particularly well. The most stringent set of measures modelled by the Forecast Working Group was projected to lead to a $413 000 000 increase over base line projections in the size of the British Columbia economy. Construction, trade and community business sectors would

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14 Sierra Club of Canada, *Climate Action Network Rational Energy Plan: Analysis of Measures Impact to 2020* (Sierra Club of Canada, September 1995) [unpublished].

15 For discussion of macroeconomic and bottom up analysis see Chapter 4. See also C.A. Sonnen and M.C. Justus, *Impact of GHG Initiatives on the National and Provincial Economies, Final Report* (Ottawa: Informetrica Limited, April 1995), and C.A. Sonnen, and M.C. Justus, *Impact of GHG Initiatives on the National and Provincial Economies, Final Report — Volume II Appendixes A-G* (Informetrica Limited, April 1995) [unpublished].

16 C.A. Sonnen and M.C. Justus, *Ibid*.

enjoy the most positive impacts while growth in the pipeline sector would be slowed by approximately four percent. Alberta's economy would experience some marginal negative impacts. Although the economy would continue to grown its size would be reduced by 0.8% below what it would otherwise be in 2010.[17]

The accuracy of the economic impact analysis depends, like all economic impact analyses, on the accuracy of assumptions. As discussed in the next chapter, the bottom up analysis used to evaluate the Rational Energy Plan has some weaknesses. Indeed some peer reviews of the Forecast Working Group's report suggested costs were underestimated. Nonetheless, the analysis is particularly interesting because it assumes Canada adopts the strategies unilaterally. Although multilateral cooperation on reducing greenhouse gas emissions will be most effective, the analysis belies the argument that Canada cannot act in the absence of coordinated international action.

Other forums have also tried to define strategies which would help reduce emissions. In September 1996, the Ontario CO_2 Collaborative released a CO_2 Strategy for Ontario[18] which proposed a number of measures which could reduce greenhouse gas emissions. The collaborative represented a consensus of prominent industry, labour, local government, and environmental representatives.

The measures included in these various proposals reflect the complexity of the task of reducing greenhouse gases. Measures range across all sectors of the economy. They range from increasing density in urban areas to changes in cattle feed. They include regulated standards, adjustments to current tax structures, government education programs and programs to facilitate voluntary energy efficiency changes. Few of the programs involve the sort of "end of pipe" emission limits that characterize traditional pollution control regulation.

Development of a British Columbia Response

The British Columbia government has been a strident advocate of stronger national action on climate change, but has yet to follow through with implementation of measures that will reverse or slow provincial trends. In

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17 C.A. Sonnen and M.C. Justus, *Impact of GHG Initiatives on the National and Provincial Economies, Final Report — Volume III Appendixes H-K* (Informetrica Limited, April 1995) [unpublished] Appendix K.

18 Ontario CO_2 Collaborative, *A CO_2 Strategy for Ontario: A Discussion Paper* (Toronto: Canadian Institute for Environmental Law and Policy, 1996).

November 1995, the provincial government released its Greenhouse Gas Action Plan.

The BC government has deferred evaluation of many of these measures.[19] Even where firm commitments were made, progress appears to have stalled on several initiatives. For instance, the Province appears to be backing away from commitments to adopt the National Energy Codes for buildings and houses into law.

The BC government's two primary greenhouse gas initiatives at this time are a voluntary pilot project for credit trading, and the BC Greenhouse Gas Forum. The pilot project creates a framework under which companies can voluntarily carry out emission reduction projects which generate credits. These can then be sold to other parties. Other companies can use them to meet voluntary commitments and possibly future regulatory commitments. As discussed in Chapter 9, the likelihood of many new actions occurring under the pilot project is low. The main value of the pilot is to increase familiarity with the credit trading concept.

The BC Greenhouse Gas Forum is a multistakeholder forum charged with advising the Province regarding measures to reduce greenhouse gas emissions over a two-year time-frame and to facilitate implementation of emission reduction measures. It is not, at the time of writing, clear whether or not there is any significant potential for reaching consensus on meaningful actions.

Summary

From 1988 to the current time there has been a growing momentum towards adoption of binding emission reduction protocols for developed nations including Canada. This has been propelled by the increasing scientific consensus on the risks posed by climate change.

The *Kyoto Protocol* is a step forward, but fails to resolve a number of key issues and falls far short of what is needed to significantly slow climate change. Under the *Protocol*, Annex 1 Nations as a whole are required to reduce their emissions, in the period 2008 to 2012, five percent below 1990 levels.

Taken out of context the emission limitations are significant, but their significance is reduced by a number of weaknesses in the *Protocol*. Emission limits for Russia and nations of the former Soviet bloc are much higher than their likely actual emissions. Trading mechanisms may allow these surplus allowable

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[19] For instance, the action item with the greatest impact on emissions was requiring that ten percent of motor vehicle fuel come from renewable biomass sources. The current government has stated that it is not reviewing this option at this time.

emissions to be used by other nations to meet their commitments. Nations may also be able to purchase emission rights from other nations, regardless of whether the seller nation is in compliance or has any reasonable chance of being in compliance. Also, the Clean Development Mechanism allows Annex 1 Nations to earn credit for emission reduction projects in developing countries. This will likely reduce the effectiveness of emission limitations due to credit being given for projects that would have occurred in any event.

Most of all, the *Kyoto Protocol* falls far short of what is needed to actually significantly reduce the rate of climate change. Estimates of what is needed to avoid rates of climate change faster than anything in the last 10,000 years suggest that emission reductions of 37% or more are necessary. By itself, the best estimate of the *Kyoto Protocol's* impact on climate is that it will reduce total warming by around 0.1ºC to 0.2ºC (from a best estimate of 2.0ºC average global warming for 2100). It is clear that further emission reduction commitments will be necessary, both from the developing world and the developed world. The experience with ozone depleting substances is instructive: international agreements were made increasingly stringent in a series of iterations as scientific warnings regarding ozone depletion became increasingly strident.

Although Canada has been committed to stabilizing emissions of greenhouse gases at 1990 levels by the year 2000 since the beginning of the decade, progress has been slow. Despite considerable work on developing a number of possible measures to reduce greenhouse gas emissions, the mainstay of Canada's National Action Program on Climate Change is the Voluntary Challenge and Registry Program. The National Action Program is not expected to meet Canada's emission reduction commitments.

A number of programs have been proposed to meet the national commitment and achieve significant emission reductions by 2010. The Rational Energy Plan developed by the Canadian Climate Action Network would have with some certainty, met the stabilization target and reduced emissions by 6.5% or more by 2010. A combined bottom-up and macroeconomic analysis of the Rational Energy Plan suggests that it would not have significantly affected the overall size of the Canadian economy or its growth, although some provinces, in particular British Columbia and Quebec, would fare well under the Plan.

Although the British Columbia government has been a strong advocate of stronger national action on climate change, it has implemented few new measures for the purposes of reducing greenhouse gas emissions. The provincial Greenhouse Gas Action Plan will only lead to significant changes in emissions if measures proposed in the Plan are fully implemented.

Chapter 4:

The Cost and Timing of Emission Reductions

Choices of instruments to be used to reduce greenhouse gas emissions and the extent and timing of emission reductions will depend on differing views of the costs of these reductions. In our efforts to model the economic impacts of different emission reduction strategies, we must make different assumptions. The choice of assumptions will determine the outcome of economic analyses on the impacts of different measures. To use these analyses effectively in choosing emission reduction strategies, we must understand their limitations and their relation to reality.

At the risk of oversimplifying, one can assume that the economy is perfectly efficient and that all emission reduction activities will entail a net economic cost. If this is true, the cost of reducing emissions will be high and the most cost effective solution to greenhouse gas emissions will result if emitters of greenhouse gases (or users of energy derived from greenhouse gases) are simply required to internalize the environmental costs of their emissions through market based instruments such as carbon taxes and tradeable allowances.

If, on the other hand, one assumes that people and firms do not always act as perfect profit maximizers and that our economy includes barriers to the adoption of cost effective emission reductions, the costs of emission reductions will be much lower. Emission reduction strategies will tend to focus on both economic incentives to energy efficiency and the removal of barriers to cost effective emission reductions.

Similarly, if one assumes that emission reductions can be achieved at little cost, there is no reason for delaying the reduction in emissions. Policy initiatives will attempt to reduce emissions in the short term from all sources. If one assumes that emission reductions are expensive, one may still favour rapid emission reductions because of the environmental costs of delaying action. However, if one assumes that emissions can be reduced most cost effectively as long term capital turnover allows adoption of efficient technologies that evolve in the future, the range of policy initiatives will focus more on improving technological development and ensuring the adoption of best possible technologies during capital turnover.

This chapter examines differing perspectives of the costs of emission reductions and the costs of achieving given concentrations of greenhouse gases in the atmosphere along different time paths. The implications of each perspectives on emission reduction strategies is then discussed.

Different Approaches to Estimating Emission Reduction Costs

The different perspectives of the economy discussed above are captured in the differences between “top-down” and “bottom-up” economic analyses. Top-down analyses are based on aggregate economic analysis which looks at historic relations between energy supply, energy demand and the economy. These studies generally conclude that emission reductions are costly. Bottom-up analyses are based on engineering studies of specific technologies, and tend to conclude that emission reductions can be achieved at very low or even negative costs.

Top-Down Analyses

Top-down analyses look at the response of the economy in the past to increases in energy prices and extrapolate from this the economic impacts of increasing the price of fossil fuels or limiting the supply of fossil fuels. Businesses and individuals are generally assumed to be perfectly rational profit seekers who will take advantage of any opportunity to reduce costs. If an energy efficient technology exists it will be adopted so long as higher initial costs are justified by the present day value of future savings in energy bills. The current level of energy efficiency is assumed to be the optimal level for a particular business (the market potential). The market potential is close to the level of investment in energy efficiency which is most efficient for society as a whole (the economic potential).

An example of top-down analysis that has been widely used throughout the world is the International Impact Assessment Model developed by Charles River Associates. The model was commissioned by the American Petroleum Institute (a trade association of large US oil companies). The Charles River Model has been used by Imperial Oil to argue that Canada’s GNP would decline by almost four percent below baseline levels by 2020 if OECD countries reduce emissions to ten percent below 1990 levels by 2010. In other words, the Canadian economy would grow by 67% rather than 71% by 2020.[1] Depending on assumptions used in top-down analyses, they can provide very different results. For instance, while the Charles River model says the Canadian economy will be the most adversely affected of all OECD nations, analysis by the Australian Government suggests Canada will be able to reduce emissions at far less cost than many other nations.[2]

Critiques of Top-down Modelling

A number of criticisms have been leveled at this and other top-down models. In particular they have been criticized for:

- Ignoring the benefits of reducing the ecological and economic impacts of climate change or the social, environmental and economic benefits of reduced reliance on fossil fuels (e.g. less local air pollution, reduced security needs);

- Ignoring the potential to stimulate new technologies and correct imperfections in the energy market through well-structured policies;

- Not allowing for gains in competitiveness or higher GDP from fuel switching;

- Using overly negative assumptions regarding the economic competitiveness of alternate renewable technologies. For instance, the Charles River Associates model's default "backstop technology factor" (representing the cost of renewable energy) is six times the world oil price; and

- Not accounting for shifts in the economic structure.

Top-down modelling is also problematic because of its equation of GDP — simply a measure of how much money changes hands — and social well being. For instance, it counts sales of fossil fuel or other non-renewable resources as income without acknowledging that these activities also involve a depletion of capital stock. Reductions in consumers' fuel or electricity bills tend to reduce GDP, while increased spending on health care due to air pollution from fossil fuel consumption increases GDP.

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1 At time of writing the Charles River modelling results were not being made available to the public; however, Imperial Oil's position paper "Global Climate Change, Time for a Reality Check" shows a drop of less then four percent in GDP from baseline levels between 1995 and 2020. Natural Resources Canada projects a 71% increase in real domestic product over the same time period (measured in constant dollars): Canada, Natural Resources Canada, *Canada's Energy Outlook, 1996 —- 2020, 1996 Update* (Ottawa: Supply and Services Canada, 1997).

2 Australia Bureau of Agricultural and Resources Economics, "MEGABARE" (1997) [unpublished].

Policy Implications of Top-down Analyses

If one assumes that no cost-free emissions reductions are available, the impact of reducing emissions will be to raise the costs of energy intensive Canadian products, possibly leading to consumers substituting Canadian goods with goods manufactured in countries with less aggressive emission reduction measures. Those who believe that top-down analyses depict economic reality will tend to dismiss the potential for Canada or British Columbia to undertake a unilateral emission reduction strategy. They will even question the efficacy of unilateral actions by all OECD nations, arguing that emission reductions in BC, Canada or the OECD may be largely undercut by leakage through increased production in nations that do not adopt emission reduction strategies.[3]

The range of tools used to reduce emissions may also be different. Carbon taxes and tradeable allowances will be seen as particularly effective in reducing emissions because of the promptness with which the economy is assumed to react to price signals.

Bottom-Up Analyses

Bottom-up analyses looks at different technological opportunities to save energy and reduce greenhouse gas emissions. By adding all these initiatives together, total energy improvements are estimated. Analyses using this approach tend to show huge potential reductions in greenhouse gas emissions with positive or at most slightly negative impacts on the economy. The bottom-up camp says there is a large gap between actual investment in energy efficiency and low carbon technologies and the economic potential. They note the very high emissions per dollar of GDP in the notoriously inefficient economies of the former eastern bloc.[4]

The bottom-up camp explains the "achievability gap" between economic potential and current investments in energy efficiency by the existence of various barriers:

- **Subsidies.** As discussed in Chapter 6, Canada and many other nations subsidize the fossil fuel industry and energy intensive industries. Subsidies include both direct subsidies, guarantees to reduce the risk of investment in high risk projects and tax breaks that benefit these sectors.

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3 John Pezzey, "Analysis of Unilateral CO_2 Control in the European Community and OECD" (1993) 13:3 *The Energy Journal* 159.

4 Among the top twenty emitting nations, those nations with the highest emissions per dollar of GNP were Russia, the Ukraine, Kazakhstan, and North Korea. See Christopher Flavin and Odil Tunali, *Climate of Hope: New Strategies for Stabilizing the World's Atmosphere* World Watch Paper 130 (Washington, DC: Worldwatch Institute, 1996) at 34.

- **Information Barriers.** Information is lacking on energy efficiency technologies. People don't invest in energy efficiency because they don't know the potential cost savings, and suppliers of energy efficient technologies are unfamiliar with how to market the technologies.

- **Financial Barriers.** Consumers and businesses are unwilling to make the upfront investments in energy efficiency necessary to save money in the long run. Financially strapped consumers are usually unwilling to go into debt for energy efficiency investments even when their return on investment may be much higher than the interest they pay. In other cases, they may demand a return on their investment which is much higher than competing investments or what other institutions would consider a healthy return. Individual consumers, for example have been shown to demand payback on energy efficiency investments of less than one year; commercial operations two to three years; and, industrial consumers from three to five years.[5]

- **Split Incentives**. Those that pay for energy efficiency do not receive the benefits. For instance, it may be most profitable for the developer of an apartment block to install an inefficient but cheap source of heat, even though a larger investment would pay itself off to the tenants.

- **Externalities.** The costs to the consumer of energy and products or services that use energy do not incorporate "externalized" social and environmental costs. These costs can be significant; for instance, estimates of the costs of motor vehicle transport not paid for by the driver range from two to ten percent of GDP.[6] A Greater Vancouver Regional District study estimates that each driver in the GVRD is subsidized by $2 600 annually.[7]

- **Institutional Barriers.** In some cases regulations or the way a business is organized may inhibit cost saving investments. For instance, energy utilities' profits that are determined by rate of return regulation rather than by market forces have limited incentives to increase efficiency. Institutional barriers can also include the "institutional cultures" within government and industry that see large energy intensive projects as more "sexy" or having greater political impact than numerous small energy efficiency projects

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5 John Robinson *et al.*, *Canadian Options for Greenhouse Gas Emission Reduction (COGGER): Final Report of the COGGER Panel to the Canadian Global Change Program and the Canadian Climate Program Board* (Ottawa: Canadian Global Change Program Secretariat, September 1993) at 11.

6 "Living with the Car: A Hundred Years on the Clock" (June 22, 1996) *The Economist.*

7 Van Seters *et al., The Cost of Moving People in the Lower British Columbia Mainland* (Vancouver: KPMG; Transport 2021, 1993).

The best known Canadian analysis of the potential for no-regrets emission reduction measures was by a panel of experts known as the COGGER panel.[8] The panel reviewed bottom-up and top-down studies, but focussed on bottom-up to determine the potential for cost effective reductions. The panel concluded that it would be feasible and cost effective to achieve a stabilization of greenhouse gas emissions at 1990 levels by 2000 and to achieve an absolute reduction of about 20% by 2010 purely through no-regrets measures.[9]

Similarly, the modelling done by Natural Resources Canada and Informetrica estimating the economic impacts of the Forecast Working Group scenarios and the Rational Energy Plan[10] indicates overall positive impacts on the Canadian economy from greenhouse gas emission reduction measures.

According to a 1993 Royal Society of Canada panel, it would be feasible using no-regrets measures alone to stabilize emissions at 1990 levels by 2000 and reduce emissions by 20% by 2010.

American studies have yielded similar results. The United States Office of Technology Assessment has predicted that emission reductions of well over 50% could be made at no cost to the economy and considerable net benefit.[11] Similarly the National Academy of Sciences found that emission reductions of between 5% and 25% were possible with positive net costs to the economy (assuming the policies were implemented early enough to provide sufficient time for capital stock turnover), and reductions of between 10% and 40% of 1990 levels could be achieved at negative or very low cost.[12] The American Council for an Energy Efficient Economy used similar methods to determine that carbon dioxide emissions could be cut by 25% from 1988 levels by 2005 and more than 70% by 2030 saving consumers $2.3 trillion dollars,[13] and creating 1.1 million jobs by 2010.[14]

Critiques of Bottom-up Modelling

Top-down economists have pointed to several weaknesses in bottom-up analyses:

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8 Robinson *et al*., above at footnote 5. COGGER is an acronym for Canadian Options for Greenhouse Gas Emission Reduction.

9 *Ibid*.

10 See Chapter 3 under heading "Canadian Emission Reduction Strategy".

11 United States, "Analysis of Emissions Reduction Proposals" (Presentation to Climate Change Workshop, Springfield Virginia, June 6-7, 1996) [unpublished] Figure 4.

12 National Academy of Sciences, Committee on Science, Engineering, and Public Policy, *Policy Implications of Greenhouse Warming* (Washington, DC: National Academy Press, 1991) at 63.

13 American Council for an Energy Efficient Economy *et al., America's Energy Choices: Investing in a Strong Economy and a Cleaner Environment* (Cambridge, MA: Union of Concerned Scientists, 1991).

14 Howard Geller, John deCicco and Skip Laitner, *Energy Efficiency and Job Creation: The Employment and Income Benefits from Investing in Energy Conserving Technologies* (Washington, DC: American Council for an Energy-Efficient Economy, October 1992).

- The market imperfections that lead to the gap between current investments in low carbon technologies and economic potential may not always be corrected through policy interventions;

- Bottom-up analyses sometimes assume faster rates of equipment stock turnover than actually occur;[15] and,

- Bottom-up analyses sometimes ignore less tangible differences between more and less efficient technologies. They may ignore transactional costs such as the cost of getting more information on new unfamiliar technologies, the difficulty installing new technologies, or risks associated with new technologies.

Policy Implications of Bottom-up Analyses

The policy implications of bottom-up analyses are different from those flowing from top-down analyses. First, because of the recognition of no regrets emission reductions there is greater potential for Canada going beyond the emission reduction protocols agreed to under the FCCC. For instance, the Informetrica review of the Rational Energy Plan study assumed unilateral Canadian action.

Although market based instruments such as tradeable emission allowances or carbon taxes will have a role in providing incentives to reduce emissions, there will be more of a focus on reducing the barriers to adoption of greater energy efficiency. The COGGER panel, for instance, recommends the elimination of policies that distort energy prices (e.g. tax disadvantages to energy efficiency); development of regulations to set efficiency standards; development of urban planning requirements for energy efficiency; development of retrofit programs to increase energy efficiency of houses and commercial buildings; and, support for demonstration of energy efficient technologies.

Towards a Resolution

Criticisms of both top-down and bottom-up analyses have validity, but there is a substantial body of theory and anecdotal evidence suggesting major emission reductions are available through no regrets measures. According to the IPCC:

> Despite significant differences in views, there is agreement that some energy efficiency improvements (perhaps 10-30% of current consumption, depending on baseline assumptions and the implementation time frame) can be realized at negative to slightly

[15] Mark Jaccard and W. David Montgomery, "Costs of Reducing Greenhouse Gas Emissions in the USA and Canada" (1996) 24:10/11 *Energy Policy* 889.

> positive costs. The existence of such a no-regrets potential depends on the existence of substantial market or institutional imperfections that prevent cost-effective emission reduction measures from being taken. The key question is whether such imperfections can be removed cost effectively by policy measures.[16]

There is considerable anecdotal evidence that policy measures can capture no regrets measures cost-effectively. For instance, BC Hydro needed to offer rebates on the cost of new, energy efficient refrigerators in order to increase their penetration in the marketplace. The cost of the rebate program was less than one-fifth of the cost of electricity saved. United States EPA data on energy saving lighting upgrades by companies that took part in its Green Lights Program shows that 80% of upgrades had paybacks of two years or less, yet the upgrades only occurred after the companies had been cajoled and provided with information by the EPA.[17]

For the US and Canada, sound economic analysis shows that there are policy options that would slow climate change without harming North American living standards, and these measures may in fact improve productivity in the longer run.

Experience has shown that energy use and economic growth are not indivisible. Until the OPEC crisis of the early 1970s, economic well being appeared to be closely tied to energy use. However, after the 1973 oil price shock energy use and affluence have become increasingly decoupled. Between 1973 and 1985 per capita energy use fell five percent in the OECD while per capita gross domestic product grew by a third.[18] A similar decoupling has occurred in Canada.

As is discussed at greater length in Chapter 6, experience shows that where government sets clear goals while providing businesses with flexibility, innovative technologies tend to emerge and costs tend to fall well below initial projections. In 1989, industry in the US projected that it would cost them $1500 per short ton to reduce emissions of sulphur dioxide from power plants. Innovations have reduced the actual price to as low as $66.[19] Similarly, the automobile industry estimated the cost of replacing CFCs in car air conditioners would be from $800 to $1500; the actual cost of retrofits ranges from $200 to

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16 J.C. Hourcade *et al.,* "A Review of Mitigation Cost Studies" in James Bruce *et al.*, eds, *Climate Change 1995: Economic and Social Dimensions of Climate Change: Contributions of Working Group III to the Second Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge: Intergovernmental Panel on Climate Change, 1996) at 301.

17 Michael E. Porter and Claas van der Linde, "Toward a New Conception of the Environment-Competitiveness Relationship" (Fall 1995) 9:4 J*ournal of Economic Perspectives* 99.

18 A.M. Gilles, *Protecting the Environment and Reducing Canada's Deficit: Where to Start* (Winnipeg: International Institute for Sustainable Development, 1994) at 16.

19 United States, above at footnote 11, at 11. The figures referred to are estimated prices for sulphur dioxide allowances allowing the emission of a tonne of sulphur dioxide. These should equal the marginal cost of reducing emissions. Prices for allowances have since increased to around $100.

$800.[20] Replacement of CFCs in other uses which were initially forecast to be very expensive, have been profitable.[21]

While estimating the cost of reducing emissions is difficult, there is some middle ground between the bottom-up and top-down economists. Recently a number of leading American and Canadian economists, including two Nobel Laureates, signed a statement concluding that

> [e]conomic studies have found that there are many potential policies to reduce greenhouse-gas emissions for which the total benefits outweigh the total costs. For the United States and Canada, sound economic analysis shows that there are policy options that would slow climate change without harming North American living standards, and these measures may in fact improve productivity in the longer run.[22]

A similar statement (not referring to Canada) was endorsed by over 2500 economists in the United States and eight Nobel Laureates. The statement is being endorsed as a "non-partisan consensus statement on the economics of climate change" that will can be used to supplant "misleading claims by special interest groups".[23] Support for the statement cuts across the various schools of economic thought.[24]

Finally, there is increasing recognition that assumptions – assumptions that are often untested and often incapable of being tested – underlie most of the variance in economists' estimates of the costs of emission reductions. A 1997 review of most of the economic models that have been used to project economic effects of reducing greenhouse gases found that 80% of the differences in outcomes was based on different assumptions inserted into the models. Many of these assumptions – for instance, the responsiveness of technology to price signals and government policy or the ability of government to realize no regrets measures – are impossible to determine.[25]

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20 *Ibid.* at 15.

21 Porter, above at footnote 17.

22 Kenneth Arrow *et al*., "Economists' Statement on Climate Change" (San Francisco: Redefining Progress, 1997).

23 *Ibid*.

24 The signers of the statement, for instance, include 13 economists from the University of Chicago, a school generally viewed as representing the right wing of world economic thought.

25 World Resources Institute, *The Costs of Climate Protection: A Guide for the Perplexed* (Washington, DC: World Resources Institute, 1997).

The Timing of Emission Reductions

Closely related to the issue of costs of emission reduction is the question of when emission reductions should take place. Although decisions regarding the timing of Canada's greenhouse gas emissions may be imposed on Canada by the outcome of international negotiations, there is also some chance that Canada may have flexibility in when it achieves its emission reductions. As discussed in Chapter 3, the United States has been advocating a position in international negotiations that nations should be given a budget of emissions which can be emitted over a long time frame, i.e., nations can choose to immediately begin reducing emissions, or can allow emissions to increase for some time, and follow that by making much greater emission reductions.

If the US position is adopted, Canadian policy makers will need to decide which path of emission reductions Canada should take. This section discusses the arguments regarding timing of emission reductions and the policy choices that will flow from each option.

The Argument for Delay

Organizations such as the Canadian Business Council on National Issues[26] and Imperial Oil[27] have been arguing that achievement of specific atmospheric concentrations can best be achieved by making fewer reductions in the short term and more reductions in the long term. Those favouring longer term emission reductions argue that it will cost less to reduce emissions in the future. They argue, for instance, that global concentrations of greenhouse gases equivalent to what would be achieved by holding emissions at levels 20% below 1990 levels from 2005 on can be achieved at half the cost by delaying the timing of emission reductions.[28] They assume lower future costs for reducing emissions because:

- Future costs are discounted to present day values.[29] (Discounting reflects the higher value accorded to money available today than the same amount available in the future. It is based partly on the fact that money not spent on greenhouse gas emission may be spent on productive capital. If this yields

26 John Dillon, "The Climate Debate Heats Up" (December 1997) *Opinions.*

27 Imperial Oil, "Global Climate Change: Time for a Reality Check: A Perspective by Imperial Oil Limited" (October 1996, circular).

28 Jaccard and Montgomery, above at footnote 15, at 892.

29 *Ibid.* at 893.

greater returns in the future, future generations may be in a better position to invest in greenhouse gas emission reductions.)

- The most cost effective emission reductions occur when capital stock is retired and replaced with more energy efficient, less carbon intensive technologies. (This is also an argument for an immediate adoption of policies to reduce emissions from new capital. Otherwise emission reductions will be more costly.)

- Future technologies will evolve that make possible carbon free energy sources at lower costs than exist now.

The Argument for Immediate Action

Environmental groups as well as many European and developing nations favour short-term emission reductions. They raise a number of objections to longer timeframes for emission reduction. First, they note that the passing of time alone will not necessarily yield technological improvements that make emission reductions less expensive. Technological development does not occur in a vacuum, but responds to present day financial or regulatory incentives. The prospect of future regulations and financial incentives will provide some incentive to technological development, but the possibility of future developments is unlikely to be as effective an incentive to technological development as current regulations. In particular, private investors will discount the profits that flow from new technologies in the context of future regulatory regimes. Various examples noted above and in Chapter 6 underline the effectiveness of flexible regulations and economic instruments in engendering technological development.

Second, the argument in favour of delayed action is based on the discount rates used. These may be too high. According to William Cline, a leading climate change economist, policy actions will largely reduce levels of consumption rather than reducing private investment. The appropriate discount rate for costs that reduce consumption is much lower than the discount rate applied to costs that reduce investments in capital.[30] Some economists have questioned whether any discounting is appropriate.[31]

Third, those favouring later reductions assume that there is no climate change benefit of achieving a given atmospheric greenhouse gas concentration by

[30] William R. Cline, *The Economics of Global Warming* (Washington, DC: Institute for International Economics, June 1992) at 237.

[31] Herman E. Daly and John Cobb, *For the Common Good: Redirecting the Economy Toward Community, the Environment, and a Sustainable Future* (Boston: Bacon Press, 1994) at 15.

reducing emissions sooner rather than later.[32] In fact, if emission reductions are delayed global concentrations would be higher in the interim before stabilization occurs.[33] Modellers of the impacts of using a delay strategy to achieve a given concentration versus taking immediate action found that:

> While these two cases of stabilization of greenhouse gases accomplish the same level of climate protection in the end, in the meantime the delay of emission reductions has greater environmental impact and requires much higher rates of emission reductions.[34]

Probably more important, delaying emission reductions reduces the flexibility future generations will have in selecting climate goals. As scientific understanding of climate change develops future generations may recognize much greater risks and decide to work towards lower stabilization targets. Their opportunity to do so is reduced by delaying emission reductions. The IPCC sums up the problem as follows:

> Policy makers are faced with responding to the risks posed by anthropogenic emissions of greenhouse gases in the face of significant scientific uncertainties. It is appropriate to consider these uncertainties in the context of information indicating that *climate induced environmental changes cannot be reversed quickly, if at all, due to the long time scales associated with the climate system* [reference to time scales of decades to millennia for stabilization of atmospheric concentrations and climate systems]. *Decisions taken during the next few years may limit the range of possible policy options in the future* because high near-term emissions would require deeper reductions in the future to meet any given target concentration. *Delaying action* might reduce the overall costs of mitigation because of potential technological advances but *could increase both the rate and eventual magnitude of climate change, hence the adaptation and damage costs*.[35] [*emphasis added*]

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32 See, for instance Imperial Oil, above at footnote 1, and Jaccard and Montgomery, above at footnote 15.

33 Intergovernmental Panel on Climate Change, Working Group 1 "Technical Summary of the Science of Climate Change, Contribution of the Working Group I to the Second Assessment Report of the Intergovernmental Panel on Climate Change" in *Climate Change 1995: The Science of Climate Change* (London: Cambridge University Press, 1995) at Figure 7(a).

34 Joseph Alcamo and Eric Kreileman, *The Global Climate System: Near Term Action for Long Term Protection* (Netherlands: National Institute of Public Health and the Environment, February 1996) at 6.

35 Intergovernmental Panel on Climate Change, Working Group II, "Summary for Policymakers: Scientific-Technical Analyses of Impacts, Adaptations, and Mitigations of Climate Change" in *Climate Change 1995: Impact, Adaptations and Mitigation of Climate Change: Scientific-Technical Analyses, Contribution of Working Group II to the Second Assessment Report of the Intergovernmental Panel on Climate Change* (London: Cambridge University Press, 1996) at 4.

Finally, delaying emission reductions has been compared to a diet where caloric intake is unlimited for ten or fifteen years followed by a requirement to fast for the following ten or fifteen years: it is not healthy for the dieter and the ability to keep to the diet may be limited. The argument for delay is based on the assumption that delay will give time for the evolution of highly cost-effective technologies that will allow reductions in emissions far below what would otherwise be necessary. If these assumptions are wrong, delay gives future governments a choice between drastic, dislocating emission reductions and breaking emission reduction commitments.

Policy Implications

If Canada is given the flexibility to choose between reducing greenhouse gas emissions now or allowing them to increase followed by much greater cuts in emissions, there are compelling reasons to choose faster emission reductions:

- Short term emission reduction requirements will be the most effective means of encouraging technological development.
- Damage from climate change can be reduced, albeit any impact will likely be undetectable.
- Canada may develop technologies, such as fuel cells, that can be exported as other nations seek to reduce their emissions.
- Future governments will retain the flexibility of seeking lower levels of human interference on the climate system.
- Canada avoids the potential need to take drastic, economically dislocating emission reduction measures.
- Canadian leadership will be an incentive for other countries to meet their emission reduction commitments.

If Canada chooses to pursue immediate greenhouse gas emissions, a broad based emission reductions strategy will be required.

However, even if Canada chooses a path of delayed emission reductions, policy changes will still be required. First of all, the argument in favour of delayed emission reductions is partially based on the need to switch to more energy efficient, less carbon intensive technologies during the natural turnover of capital. Thus, it is necessary to affect capital investment decisions which will impact on emissions for long periods.

Shifting decisions regarding land use, urban density, transit routes and the mix of roads and other transportation corridors has been identified as the most important step for reducing emissions cost effectively over the long term.[36] Decisions made now affect the carbon intensity of a city or region for periods ranging from 75 to hundreds of years, and limit the ability of future decision makers to shift to less carbon intensive transportation modes. Once established, urban form is very difficult to change without enormous costs.[37] Thus, increased growth management should be one of the first orders of business if Canada chooses a delayed emission reduction path.

Similarly, the natural rate of turnover for the capital stock of industrial facilities and buildings is relatively slow — 25 to 75 years. Prematurely retiring capital stock is expensive (although not as expensive as trying to change urban form). This suggests that policies which affect investment decisions in major industrial processes should be a priority, because decisions now will effect energy use and emission reductions over a long timeframe. These policies would include price signals through carbon taxes, tradeable allowances for industrial emissions and environmental assessments of the energy efficiency of new industrial facilities.

Summary

Choices of instruments to be used to reduce greenhouse gas emissions depend on differing views of the costs of reducing greenhouse gas emissions. Top-down analyses assume that the current economic equilibrium is perfectly efficient and that all emission reduction activities will entail a net economic cost. Top-down analyses assume that the cost of reducing emissions will be high. The most cost-effective solution to greenhouse gas emissions will result if emitters of greenhouse gases (or users of energy derived from greenhouse gases) are simply required to internalize the environmental costs of their emissions through market based instruments such as carbon taxes and tradeable allowances.

Bottom-up analyses do not assume that people and firms always act as perfect profit maximizers. They recognize a variety of barriers to the adoption of no regrets emission reduction measures. Barriers include subsidies to fossil fuel industries;[38] the failure of fossil fuels to incorporate the environmental costs of fossil fuel production, distribution and consumption; lack of information on cost effective emission reductions; and, attitudes towards investments in energy efficiency compared to other investments. If these barriers can be removed

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36 Jaccard and Montgomery, above at footnote 15.

37 *Ibid*. Estimates that the costs of premature transformation of the urban form from carbon intensive to non-carbon intensive will cost eight times more than the incremental cost of replacing urban form at its natural turnover time.

38 See Chapter 6 under heading "Refining the Tax System".

through regulatory action and government policy, major emission reductions can be achieved at little or no cost to the economy.

Despite the disagreements in these two approaches, most economists agree that there are policy options that would slow climate change without harming North American living standards, and these measures may in fact improve productivity in the longer run. This consensus suggests that emission reduction strategies will tend to focus on both creating economic incentives to energy efficiency and removing the barriers to cost effective emission reductions.

Emission trends in the next decade will limit the range of possible policy options in the future because high near-term emissions would require deeper reductions in the future to meet any given target atmospheric greenhouse gas concentration. Delaying action might reduce the overall costs of mitigation because of potential technological advances. However, even if the atmospheric concentrations are eventually stabilized at the same level, delays in emission reductions will increase the magnitude of climate change, adaptation costs and damage costs. They will also foreclose the opportunity of future generations to pursue greater environmental protection, and may make meeting international commitments extremely difficult.

Even if Canada chooses a delayed emission reduction path it is essential to begin adoption of renewable and energy efficient technologies during natural capital turnover. The focus of greenhouse gas emission strategies should be to increase the energy efficiency of community design through strong growth management regimes, and increase the energy efficiency of new building stock and new industrial facilities.

Chapter 5:

Criteria for An Effective Emission Reduction Program

> *In principle, of course, everyone wanted an equitable resolution of the issue, but "equity" turns out to be a most ambiguous quality to define .... Contrary to the cliché characterization of public policy development as a trade-off between efficiency and equity, the ... debate was really about trade offs between competing notions of equity.*
>
> *— Nancy Kete, US Acid Rain Program*[1]

Later in this report, different approaches to greenhouse gas emission reductions will be evaluated according to the criteria set out below. These criteria include environmental effectiveness, cost-effectiveness, equity and feasibility.

Environmental Effectiveness

Environmental effectiveness is the main criterion by which a greenhouse gas emission reduction program will be measured. The primary test of environmental effectiveness of a greenhouse gas emission reduction program is whether it reduces concentrations of greenhouse gases in the atmosphere below what they would be in the absence of the program. In doing so, however, the program should not cause other environmental problems and, if possible, should maximize secondary environmental benefits. The efficacy of a program will depend on several factors including additionality, leakage, permanency and multiple environmental benefits.

1 Nancy Kete, US EPA, on development of the US Acid Rain Program.

Additionality

A greenhouse gas emission reduction program will only be successful if it reduces net greenhouse gas emissions beyond what would occur in the absence of the program. If the program only ensures the adoption of emission reductions which would have occurred in the absence of the program, the program has no value. Additionality is the measure of whether emission reductions which occur under a program are the result of the program or other factors. It represents the change from the “business as usual” baseline.

For some individual emission reduction projects, projecting a business as usual baseline may be easy, but in other cases it will involve unraveling a Gordian knot of intangible factors. Institutional and informational barriers, regulatory hurdles, and different degrees of risk adversity or expectations as to profit, are all intangibles that factor into emissions under business as usual. There will often be a tension between using programs to ensure something beyond business as usual and targetting the most cost effective emission reduction opportunities. Programs which require a specified amount of emission reductions from a limited range of sources are more likely to involve additional emission reductions. Programs which allow parties to achieve the same emission reduction targets through emission reductions anywhere in the world, are, in the absence of a focus on ensuring additionality, less likely to achieve improvements on business as usual.

Leakage

Programs should be designed to reduce leakage. Leakage is the extent to which the emission reductions achieved by a program are undercut by increases in emissions that occur elsewhere. Leakage can result from many different dynamics. First, a program can reduce demand for fossil fuels, lowering prices for fossil fuels and leading to increased consumption in countries not undertaking emission reduction programs. This form of leakage is likely to be significant in the short term but less significant as oil, gas and coal producers react to lower prices by reducing production. Although potentially significant, this form of leakage is largely ignored in this paper because the only effective way of controlling it is through extending emission reduction controls to all countries.

Second, an emission reduction program which imposes high costs on some sectors may shift economic activity to sources or jurisdictions which are subject to no or less costly emission reduction regimes. This is often used as a rationale for Canada not aggressively pursuing emission reductions in the absence of broad multilateral commitments. Macro-economic analyses which assume a carbon tax as the primary tool for emission reduction put the leakage rate at around 70 tonnes per 100.[2] On the other hand, a unilateral emission reduction measure that makes Canada more competitive will draw production from high emission locales, resulting in negative leakage. Studies showing that there are numerous no-regrets emission reduction measures suggest that this form of leakage can be largely avoided by focussing on those measures. Bottom-up analyses suggest that for every 100 tonnes of emissions reduced in the OECD, emissions will increase elsewhere by 10 tonnes.[3]

Third, specific emission reduction measures may directly cause increased emissions elsewhere. For instance,

- Purchase and protection of a tract of tropical forest may stop deforestation of that tract, but it will have no impact on the global balance of biomass sinks if slash and burn farmers simply move to an adjoining tract.

- A project involving sale of ultra-efficient natural gas vehicles may cause drivers to drive more because of lower fuel bills.

- The stack emission benefits of switching to natural gas may be negligible if natural gas producers meet the increased demand by increasing production at a sour gas well with a high dissolved carbon dioxide.[4]

Project specific leakage can be up to 100% of the projected reduction emissions.[5] On the other hand, some projects may have negative leakage. For instance, projects to sell energy efficient lights may have spin-off effects as consumers gain familiarity with alternate technologies.

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2 John Pezzey, “Analysis of Unilateral CO2 Control in the European Community and OECD” 13:3 *The Energy Journal* 159..

3 *Ibid*.

4 Until recently there was concern that methane leakage from American natural gas production and distribution would completely offset burner tip emission reductions from switching from coal or oil to natural gas. See David G. Victor, “Limits of market-based strategies for slowing global warming: The case of tradeable permits” (1991) 24 *Policy Sciences,* pp 199-222. Although this concern appears to be resolved recent studies of methane leakage show emissions were over 50% higher than previously estimated: US Environmental Protection Agency and Gas Research Institute, *Methane Emissions from the Natural Gas Industry* 1997. This concern may still be valid in some areas, especially the former Soviet Union, where methane leakage is much greater.

5 Trexler and Associates, Inc., *Considerations in the Construction of a CO_2 Mitigation Cost Curve for the Next Northwest Power Plan* (Oak Grove, Oregon, Trexler and Associates, Inc., August 14, 1996).

Permanency

Any energy efficiency project which reduces current consumption of fossil fuels will have a very long term effect on atmospheric concentrations of carbon dioxide even if the increase in efficiency lasts only a short time. If the increase in efficiency saves a litre of oil it means an additional litre of oil in the ground until such time as the world's oil runs out. Similarly, emission reductions from short-lived fuel switching, nitrous oxide or methane emission control projects will have a long-term impact on concentrations. On the other hand short-lived sequestration projects will only have short lived impacts on atmospheric concentrations. This does not negate the importance of a temporary increase in sequestration; it may help buy time for the development of new technological solutions. Nonetheless, sequestration projects will only contribute to permanent solutions to the extent that the increase in sequestration is permanent.

Multiple Environmental Benefits

All things being equal, programs should maximize other environmental benefits. Measures to reduce greenhouse gas emissions and increase carbon sequestration can have a variety of different effects on other environmental values. Reducing carbon dioxide emissions from fossil fuel combustion will also reduce local pollution levels as other pollutants are likely to be reduced in the process. Some elements of program design may maximize positive side-benefits.

Cost Effectiveness

Cost effectiveness of a particular measure is simply a measure of how much the measure costs per tonne of net emissions reduced. Cost effective measures will cost less per tonne than other measures. Cost effectiveness of a program is measured by dividing the cost of the program by its environmental effectiveness. Thus, an assessment of a program's cost effectiveness needs to consider not only the cost of measures taken under the program but also the costs of implementing the program and whether or not emissions reductions under the program would have occurred anyway, and whether they result in leakage.

It is in our environmental interest and our economic self-interest to develop emission reduction programs which impose the least cost for the greatest emission reduction. International and domestic targets for emission reduction will reflect a political balancing of perceived costs of emission reduction versus perceived costs of climate change. The more cost effective current emission reduction programs, the more likely governments will accept significant emission reduction targets in the future. Also, higher cost solutions can lead to leakage and less environmentally effective programs in the present. There are a number of aspects to cost effectiveness: will it yield high emission reductions for low cost; is it flexible; does it encourage technological innovation; and does it have low administrative and transaction costs.

Low Cost — High Benefit Measures

As discussed in the introduction, many studies indicate that major greenhouse gas emission reductions can be achieved through measures that have cost savings or very low costs to individuals, businesses and society. A program will be most cost effective if it can ensure the adoption of measures which have low or negative costs.

One issue that will affect the priorities placed on different measures is the extent to which decisions today will affect emissions over the long term.[6] Some decisions made today will impact greenhouse gas emissions for hundreds of years and are difficult to reverse without incurring huge costs through the premature retirement of capital stock. For instance, allowing urban sprawl will only impact emissions slowly as land is redeveloped, but it will effect emissions for a hundred or more years and is not easily undone. Measures that affect these decisions are particularly important for cost effectively reducing total emissions over the long term. Delays in adopting these measures will impose unnecessarily high costs on future generations trying to reduce their emissions.

On the other hand, decisions regarding investments in products or capital that is rapidly turned over — for instance, decisions regarding ethanol in gasoline — will have immediate effects on emission levels. Delays in implementing these "fast acting" measures will necessitate the later adoption of more stringent measures to achieve a given impact on atmospheric concentrations, but they do not lock future generations into higher emission levels.

Flexibility

Typically, the less a program mandates how and where an increase in energy efficiency occurs, the more cost effective the program will be. For instance, giving large industrial facilities maximum flexibility in how they increase energy efficiency is likely to be more cost effective than a "one size fits all" government mandated approach. However, if increased flexibility increases administrative

6 Mark Jaccard, "Heterogeneous Capital Stocks and Decarbonating the Atmosphere: Does Delay Make Cents?" (School of Resource and Environmental Management, Simon Fraser University, Vancouver, 1997) [unpublished].

costs or requires individuals to make decisions for which they are poorly equipped, flexibility may decrease cost effectiveness.

Technological Innovation

Programs which spur technological innovation will reduce costs of emission reduction over the long term. They may also give Canadian businesses a "first mover" advantage as Canada is able to sell new technologies abroad.

Administrative Costs

The costs of emission reductions achieved by a program include not only the costs of the person or firm reducing emissions, but also government's costs to implement, enforce and monitor the program.

Transaction Costs

The costs of reducing emissions not only involve direct costs of implementing a measure, but also the costs of finding out about the measure. In a trading program, the cost savings offered by trading's flexibility has to be weighed against the cost of finding purchasers or sellers for tradeable credits or allowances and the cost of ensuring that an allowance or credit is valid. Transaction costs — ranging from less than 1% to over 40% of compliance costs in different trading programs — can negate many of the theoretical cost savings offered by trading.[7]

Equity

No program will be perceived as fair to all people and firms. There are many aspects to equity — equity among individuals, firms, regions and nations. Within each of these aspects there are many competing notions of what is fair.

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7 John P. Dwyer, "California's Tradeable Emissions Policy and Its Application to the Control of Greenhouse Gases," *Climate Change: Designing a Tradeable Permit System* (Paris: Organization for Economic Co-operation and Development, 1992), and Randolph M. Lyon, "Equilibrium Properties of Auctions and Alternative Procedures for Allocating Transferable Permits" Vol. 13 (1986) *Journal of Environmental Economics and Management* 129.

Social Equity

Equity among individuals can be conceived as every person bearing an equal cost of emission reductions; every person bearing costs in relation to their contribution to the problem; every person bearing costs in relation to the extent to which they can reduce their impact with relative ease; and, minimizing costs imposed on low income individuals. Generally this report focuses on every person bearing costs and sharing benefits commensurate with the extent to which they can reduce their impacts with relative ease. Where low income individuals would pay a proportionately larger portion of costs or receive less benefits this is addressed.

Regional Equity

The costs and benefits of emission reduction should be spread among communities and regions. Some methods to minimize impacts on communities that are home to energy intensive industries are discussed later in this report. On the other hand, communities dependent on coal and tar sands will inevitably see a decline in their mainstay industries. Experience in the US Northwest suggests that clean industries often fill the gap left by departure of resource industries.[8] This report does not consider means to ensure the continued economic vibrancy of communities now based on fossil fuels. Transition strategies may be necessary.

Industrial Equity

There are a number of competing notions of equity among firms. Generally depending on what is in their interest, firms will argue that all they should face

- equal marginal costs of control;
- equal total costs in relation to their size; or,
- costs proportional to their contribution to the problem.

Each of these conceptions of equity conflicts with the other. Also, in the absence of emissions trading, imposition of costs based on ability to pay or contribution to the problem conflicts with achieving least cost emission reductions. This report considers all these aspects of equity.

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[8] Ed Whitelaw, Professor of Economics, University of Oregon found that throughout Washington and Oregon, clean industry has tended to move into communities whose mainstay forest industries have shut down due to lack of timber supply. Clean industries were attracted by amenities available in such communities, especially with the departure of heavy industry: personal communication, June 25, 1997.

Feasibility

Feasibility is the extent to which a program meshes with existing institutions and prejudices and the extent to which it can adapt to future needs. The political feasibility of any program will depend on a number of different factors including their cost effectiveness, equity and environmental effectiveness, but a number of other factors affect both political and administrative feasibility.

Flexibility

A program should not tie future governments to an inflexible emission reduction schedule. Time will provide better understanding of the risks climate change poses, increased understanding of costs and side-benefits of emission reduction, and changing environmental values. As discussed in Chapter 3, there is a very significant chance that internationally negotiated emission targets will be revised as a better understanding of climate change develops. Although the entrenched factors that underlie society’s production of greenhouse gas emissions are likely to make reducing greenhouse gases a much longer term issue than reducing ozone depleting substances, a program should not foreclose the potential for stronger action.

Institutional Compatibility

Programs which can be easily grafted onto existing institutions and regulatory structures and which do not conflict with existing institutions have advantages over programs which require development of elaborate new institutions or major modifications to existing structures.

Contentiousness

Some programs require government to reconcile a large number of competing interests before program implementation can begin. For instance, in a *cap and emission allowance trading program*, the allocation of allowances will create winners who will benefit from trading and losers who do not benefit. Although regulatory programs also create winners and losers, the process is incremental, with government being able to tackle one sector at a time. These differences may make the cap and emission allowance trading more difficult to implement initially, but easier to run in the long term.

Perception

Some programs, whatever their actual distributional effects, may be more likely to perceived in a negative perspective. For instance, a carbon tax may be perceived as a tax grab, even if revenue is recycled into the economy by reducing other taxes. Within the business community, regulations which achieve *no-regrets* measures in a highly cost effective manner may still be perceived as inefficient "command and control regulations".

Constitutional/Legislative Context

Does a program require major amendments to legislation and high levels of cooperation between different levels of government? Can the federal government implement a program unilaterally, or is the cooperation of provincial/regional governments necessary? In the case of emissions trading, lack of express authority is likely to make regulated entities reluctant to engage in trading.

Technical Capability

Different programs will place different demands on government agencies. Governments will need to have the planning, scientific, and economic expertise to design and implement a program.

Enforcement Capacity

Programs will differ from one another in terms of the difficulty of monitoring and enforcing compliance. Governments must be able to ensure that prescriptive standards are followed and that taxes are paid. For programs involving trading, government must be able to ensure that credits represent real emission reductions and that emission sources do not exceed their permitted emissions.

Chapter 6:

Emission Trading: Alternatives and Complementary Policies

> *Mitigation depends on reducing barriers to the diffusion and transfer of technology, mobilizing financial resources, supporting capacity building in developing countries, and other approaches to assist in the implementation of behavioural changes and technological opportunities in all regions of the world. The optimal mix of policies will vary from country to country, depending on political structure and societal receptiveness. ... Policies to reduce net greenhouse gas emissions appear more easily implemented when they are designed to address other concerns that impede sustainable development (e.g. air pollution and soil erosion).*
>
> *— Working Group II, IPCC (1995)*

Although the focus of this report is analysis of various forms of emissions trading, it is important to begin with an understanding of the alternatives to trading and the extent to which a portfolio of measures can supplement or be an alternative to trading. A range of instruments and policies which affect greenhouse gas emissions are already in widespread use throughout North America. These programs include educational programs, integrated resource planning for utilities, technology procurement, financial incentives for efficient technologies, energy efficiency standards and pollution prevention planning. They also include preliminary efforts to redress biases within the tax system which favour fossil fuels and energy consumption over renewables and energy efficiency. Although most of the programs currently in force are aimed at curing social, economic and environmental ills other than greenhouse gas emissions, they could be broadened, strengthened and refocussed so that they are more effective in reducing greenhouse gas emissions.

Proposals for the use of emissions trading for greenhouse gas emission reductions sometimes assume that the choice is between prescriptive standards and either a carbon tax or emission trading.[1] In fact, policy makers will need to adopt a portfolio of emission reduction strategies which is likely to include a mix of regulations, voluntary programs, changes to the tax system and broad based economic instruments such as emissions trading and carbon taxes. Indeed, some types of economic instruments such as credit trading are based on a foundation of prescriptive standards.

The focus of this chapter is on instruments which might supplement or be alternatives to trading. In particular, the focus is on prescriptive standards and changes to the tax systems because these are the leading alternatives to trading. It also considers other instruments which affect private sector decision making. There are a number of instruments which are essential but not discussed because they fall outside the parameters of this report. For instance, no matter what instruments are used to effect private sector decision making, it is essential for government decision makers to consider greenhouse gas implications in their own investment decisions. It is important, for instance, for transportation planners to consider not only the cost of building roads versus transit, but also other, often indirect, social and environmental costs.

Unlike subsequent chapters which assess the many design options for emissions trading, this chapter is not intended to assess design options, but simply to give an overview of possible instruments that could be included in a portfolio of emission reduction measures. The pros and cons of different instruments are discussed generally.

A Portfolio Approach

A portfolio of instruments will be necessary because different instruments fulfill different purposes. For instance, energy efficiency can be improved by accelerating capital turnover rates (e.g. rebates encourage consumers to replace inefficient technologies at an earlier date), eliminating least efficient technologies from the market place, encouraging most efficient technologies and changing the use of technologies. Instruments may be very effective in affecting some of the above changes but have no effect, or even contradictory effects, on others. For instance, minimum energy efficiency standards are very effective in eliminating least efficient products from the market place, but will not accelerate capital turnover or improve use patterns.

A portfolio of educational, tax, regulatory and other measures will likely be most successful in overcoming the institutional, informational and financial barriers

[1] National Economic Research Associates Inc., *Market Based Approaches to Managing Air Emissions in Alberta* (Alberta: Alberta Energy, Alberta Environment and Canadian Petroleum Association, 1991) at 158.

that block use of energy efficient technologies. This chapter considers some of the potential instruments other than trading that could be included in a portfolio of measures. Although the description of measures is segregated into different types of instrument, often different instruments will be closely linked. Often there is a synergy between different instruments.

The goal of many of the instruments discussed in this chapter is to transform markets so that continued intervention is no longer necessary to support a desirable technology or practice. A combination of measures is usually most successful in this regard. For instance, Bonneville Power Administration (BPA) subsidized Washington State home builders that built efficient homes in municipalities which had adopted BPA's model energy code. The program was effective in increasing the penetration of energy efficient housing to a point where there was little resistance to state government mandating energy efficiency standards. One set of instruments (financial incentives and education) transformed the market to a greater level of energy efficiency, and another instrument (energy efficiency standards) consolidated the transformation. This process can be repeated to ensure a stepwise progression in energy efficiency.

Demand Side Management

This chapter draws extensively on the lessons learned from utility demand side management programs. In the last decade, more than 2000 demand side management programs have been operated by over 500 utilities.[2] These programs have been mandated by utility commissions interested in ensuring customers needs for heat, light and other energy services are met at the lowest financial cost and least environmental damage.

Although potentially cost effective, these programs are threatened by recent developments. Because programs are intended to overcome market failures, they often save money. In many cases the cost of reducing energy consumption through demand side management, including all transaction costs, is far below the cost of producing additional electricity. Costs of North American programs range from \$0.001 per kWh saved to \$0.25 per kWh saved.[3] Competitive bids for reducing electricity demand suggest that the cost for improving energy efficiency are in the range of \$0.04 to \$0.07 per kWh, decreasing over time.[4] This compares

2 Steven Nadel, Miriam Pye and Jennifer Jordon, American Council for Energy Efficient Economy, in "Achieving High Participation Rates: Lessons Taught by Successful DSM Programs" (January 1994) *Electricity Conservation Potential Review, 1988-2010: Phase II — Achievable Conservation Potential through Technological and Operating Change* (Vancouver: BC Hydro, 1994).

3 *Ibid.*

4 These estimates may also overestimate the cost of DSM because they represent bids from small under-capitalized firms which charge a relatively high risk premium. Joel Swisher,

to consumer prices for electricity of around $0.07 per kWh. BC Hydro estimates that it can provide 17% of power for British Columbia's needs in 2014 through demand side management.

Instruments in the Portfolio

Whether or not a trading program is implemented a greenhouse gas emission reduction strategy is likely to include alternative measures including;

- prescriptive standards.
- fine tuning taxes and green taxes,
- information, education, outreach and auditing programs;
- procurement programs; and
- narrow financial incentives.

Prescriptive standards

Prescriptive standards are regulations which prescribe a technology, a certain level of performance (e.g. maximum emissions or minimum efficiency), or impose absolute limits on emissions or other practices. Prescriptive standards that reduce greenhouse gas emissions include energy efficiency standards, greenhouse gas emission limits, and regulations that have the effect of reducing greenhouse gas emissions, though they are primarily aimed at other environmental, safety and health issues.

Prescriptive standards can be highly environmentally effective as demonstrated by improved air quality in many cities in the last thirty years. The key issue with prescriptive standards is whether or not they achieve emission reductions in a cost effective way. Prescriptive standards are criticized for applying "one size fits all" standards across broad heterogeneous classes of energy users and emission sources that have very different marginal costs of abatement, resulting in high cost solutions being implemented, and low cost solutions missed.[5] American studies have shown that the costs of prescriptive standards have been from seven percent

"Regulatory and Mixed Policy Options for Reducing Energy Use and Carbon Emissions" in *Mitigation and Adaption Strategies for Global Change* (Netherlands: Kluwer Academic Publishers, 1996) at 37.

5 Merete Heggelund, *Emissions Permit Trading: A Policy Tool to Reduce the Atmospheric Concentration of Greenhouse Gases* (Calgary: Canadian Energy Research Institute, 1991) at 22; National Economic Research Associates Inc. above at footnote 1, at 158.

to 600% higher than the lowest cost means of achieving a emission reduction.[6] Prescriptive standards can create perverse incentives. There are anecdotes of companies incurring higher costs so that they could pollute for fear that if they lowered their emissions, they would be required to continue to lower emissions in the future even if it was no longer profitable.[7] There is often a tendency among media, business and government to see prescriptive standards as a drag on economic activity — at best a necessary cost of doing business.

Regulations which are flexible, anticipate world trends and focus on outcomes can create pressures that motivate innovation, overcome corporate inertia and improve competitiveness.

Despite this, there is evidence that prescriptive standards and other regulations can be a source of competitiveness by breaking through various barriers to cleaner, more energy efficient, practices. Michael Porter, a Professor of Business Administration at Harvard, argues that properly crafted regulations create pressure that motivates innovation, overcomes organizational inertia, and improves corporations' competitiveness. Stringent regulations are more effective in this regard than others, because they force companies to rethink their processes, not simply tinker.[8]

In arguing that regulations increase competitiveness, Porter stresses that regulations can be poorly designed and well designed. Well designed regulations that increase competitiveness focus on outcomes (e.g. total emissions) rather than technologies, flexibility and long lead times, and they anticipate world trends so that domestic innovators can market their innovations abroad. Because of the increasing international focus on climate change and because climate change is not something which can be solved overnight, regulations to reduce greenhouse gas emissions fit the criteria established by Porter particularly well. A theme which runs throughout this chapter is the extent to which prescriptive standards that have been proposed to reduce greenhouse gas emissions also meet the first two criteria, i.e. they are focused on outcomes rather than technologies and they provide flexibility.

The following sections look at various types of prescriptive standards used to reduce greenhouse gas emissions. These are followed by an evaluation of prescriptive standards in general.

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6 Alan Carlin, *The United States Experience with Economic Incentives to Control Environmental Pollution* (Washington, DC: Office of Policy, Planning and Evaluation, July 1992).

7 The anecdote referred to is a utility who did not use low-sulphur coal, even when it was available and less expensive, because they feared that regulators would begin requiring low-sulphur coal and prices might shift so that it was significantly more expensive: Carlton Bartels, Cantor Fitzgerald-Environmental Brokerage Services, "How does the Sulphur Market Work?" (Presentation to workshop on Controlling Carbon and Sulphur International Investment and Trading Initiatives) [unpublished].

8 Michael E. Porter and Claas van der Linde, "Green and Competitive: Ending the Stalemate" [September-October 1995] *Harvard Business Review* 120. See also, Michael E. Porter and Claas van der Linde, "Toward a New Conception of the Environment-Competitiveness Relationship" (Fall 1995) 9:4 J*ournal of Economic Perspectives* 97.

Energy Efficiency Standards

Energy efficiency is a measure of how much energy is used by a particular product or service. Because most greenhouse gas emissions result from fossil fuel combustion for energy, energy efficiency standards are a powerful way of reducing greenhouse gas emissions. Indeed, of all the measures evaluated in various proposed Canadian greenhouse gas emission reduction plans, the one with the greatest greenhouse gas emission reduction impact is improved energy efficiency standards for cars and trucks.

Energy efficiency standards have already been widely implemented in North America for reasons ranging from avoiding the need for costly electrical generation to avoiding air pollution and minimizing risks to American national security posed by dependence on overseas oil sources. British Columbia was the first Canadian jurisdiction to impose energy efficiency standards for appliances. Although this was done to avoid the need for new hydroelectric dams, energy efficiency standards will also reduce greenhouse gases because natural gas and imports of coal generated electricity from Alberta are currently major marginal sources of power in BC.

There are a number of different types of energy efficiency standards:

- **Minimum energy performance standards.** These standards remove the least efficient products from the market place, but do little to encourage improvements above the standard. They guard against consumers unwittingly purchasing equipment which will cost them dearly in the future. Most energy efficiency standards are minimum performance standards. They require a combination of product testing and labelling to ensure compliance.

- **Average energy performance standards.** Prescriptive standards can also specify average levels of efficiency that a producer must meet for all its products. This is the approach taken for motor vehicle fuel efficiency in North America. Average standards are well suited to heterogeneous products such as cars. They give manufacturers flexibility while encouraging all products to become more efficient, but, they are more expensive to administer and enforce because they require tracking of all sales.

- **Technology Standards.** Technology standards specify specific energy efficient technologies, for instance, requirements for double-pane windows on new houses. This is especially useful for home builders or other manufacturers who prefer standards that can be simply applied. For instance, the National Energy Codes mandate specific building techniques, but to provide flexibility, builders can choose alternative compliance paths that are shown through computer modelling to give equal efficiency performance.

Experience with energy efficiency standards suggests they are environmentally beneficial, cost effective, and result in savings to consumers. American energy efficiency standards for refrigerators have lowered energy use by as much as 60% and their total costs, including administrative overhead, are estimated as being under half the cost of energy saved.[9] The cost of refrigerators has dropped since the standards came into effect. It is estimated that much greater savings are possible with net savings to the consumer.[10] The Rational Energy Plan calls for Canadian Company Average Fuel Consumption (CAFC) standards which would add $6 billion to the price of cars over a 12 year period; however, the present value of the gasoline savings would be over $10 billion.[11] Adoption of high standards may also be necessary for purposes of international competition. European environment ministers have recommended a vehicle fuel efficiency standard equal to that in the Rational Energy Plan and the environment committee of the European Parliament may recommend even higher standards.[12]

Experience also suggests that many of the improvements in energy efficiency would not have occurred in the absence of regulation. Fuel efficiency of new cars roughly doubled from the time the US introduced Corporate Average Fuel Efficiency (CAFE) standards (the equivalent of Canadian CAFC standards) in 1978 until they reached their present level in 1985; they have not improved significantly since then.[13] Nor did fuel efficiency improve in Europe where no standards were in force.[14] The environment committee of the European Parliament is currently recommending a move from voluntary industry commitments to legislated fuel efficiency standards more stringent than those proposed in the Rational Energy Plan.[15]

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9 The price of refrigerators in real dollars has dropped. The estimate of total costs of the standards are three cents per kilowatt hour saved (compared to a retail cost of at least seven cents): Joel Swisher, "Regulatory and Mixed Policy Options for Reducing Energy Use and Carbon Emissions" in *Mitigation and Adaption Strategies for Global Change* (Netherlands: Kluwer Academic Publishers, 1996) at 29.

10 *Ibid.* at 29.

11 Canada, Natural Resources Canada, Energy Sector, "Model Simulations of the Climate Action Network Program for Energy Demand, GHG Emissions & Investment" (June 1995) [unpublished]. This assumes increases in the price of gasoline.

12 A draft report calls for the Commission to adopt legally binding average efficiency standards of 5 litres per 100 km by 2005 (same as in the *Rational Energy Plan* and the standards recommended by European environment ministers), increasing to 3 litres per 100 km by 2007.

13 Canada, Natural Resources Canada, "U.S. and Canadian Approaches to Vehicle Fuel Efficiency Standards," (background paper for CCME Task Force on Cleaner Vehicles and Fuels, August 1995) [unpublished] at 9-10. Statistical analysis of fuel efficiency patterns strongly suggests that CAFE standards, not increased fuel prices were the prime motivator of better fuel efficiency. See Swisher, above at footnote 9.

14 See Swisher, above at footnote 9, at 27.

15 "Parliament Pushes for EU Action on Car CO_2 Emissions" [14 March, 1997] *Global Environmental Change Report*.

Often energy efficiency standards are specifically intended to minimize net or lifecycle costs for energy and energy consuming products to the person purchasing a product. Environmental and social effects of energy use not included in the price of energy — externalities — are excluded from the calculation of what is in the purchaser's best interest. However, these costs can be reflected in energy efficiency standards by adding an environmental multiplier to energy prices. The US EPA uses a low environmental multiplier in setting energy efficiency standards for appliances; Manitoba is considering doing the same when it adopts the National Energy Code for Houses.

Fuel efficiency roughly doubled from the time the US adopted mandatory standards in 1978 until the standards reached their present level in 1985. Since 1985, fuel efficiency has not improved.

In the absence of measures which increase energy prices, the use of environmental multipliers is increasingly important because of declining energy prices. During the development of BC's 1997 draft energy standards for houses, a number of standards were downgraded because of a trend to lower energy prices. Although lifecycle costing usually supports much more stringent standards, this will less often be the case as standards improve or energy prices drop.

Energy efficiency standards do have some inherent limitations. They do not encourage shifts to less carbon intensive energy sources. Nor do they encourage energy conservation — e.g., using less of an energy intensive product or service. Indeed, increasing energy efficiency can increase demand for energy services. For instance, studies indicate that energy efficiency standards for cars have a "rebound effect." For every ten percent decrease in the price of driving due to improved fuel efficiency, car use will increase about 1.0 to 1.5%.[16] Energy efficiency standards will be most effective where the demand for energy using services is inelastic, i.e., demand varies little with the total cost of energy. This is true for many energy services.

Finally, efficiency standards are most suited to relatively homogenous products but not industrial processes. Industrial processes vary significantly making the setting of energy efficiency standards difficult. Although it would be administratively feasible to disaggregate industrial processes into standard units (such as boilers of a specific capacity, dryers etc.) for which efficiency standards could be specified on new and old equipment, doing so may not result in the least cost emission reductions. In its 1994 report on electricity conservation potential, BC Hydro found that, for the industrial sector, pure reliance on regulation, although highly cost effective in the industrial sector, was less successful in achieving greatest percentage of cost effective emission reductions than pure reliance on education, pricing or reliance on utility demand side management programs such as rebates, efficient equipment leasing programs and utility

16 David L. Greene, "Vehicle Use and Fuel Economy: How Big is the "Rebound" Effect?" (Oak Ridge, Tennessee: Oak Ridge National Laboratory, March 1991) [unpublished].

sponsored education and certification.[17] The reason for this was the difficulty in setting standards for industrial equipment and processes.

Although energy efficiency standards have been highly cost effective, they can create perverse incentives and are poorly suited to heterogeneous industrial processes.

Although standards such as CAFE have been extraordinarily effective, the use of average efficiency standards may fail to encourage better efficiency among some manufacturers and encourage others to market products subject to less stringent standards. For instance, uniform average efficiency standards for different weight classes of motor vehicles have no effect in encouraging improved technologies among manufacturers who specialize in smaller cars and may encourage manufacturers of larger cars to shift consumers into higher, less fuel efficient weight classes.[18] Regulations should be carefully designed to avoid such problems.[19]

Emission Limits

Both environmentalists and governmental officials have recognized the problems inherent in prescribing standards for heterogeneous sources such as industrial processes and power generation. The Climate Change Task Group, for instance, found that "the heterogeneity and greater technical complexity of [the industrial] sector make the analysis of energy use and potential savings much more difficult than for other sectors."[20] The Rational Energy Plan does not propose any prescriptive standards for industrial processes.

The Ontario CO_2 Collaborative proposed a system of regulatory emission limits or quotas for all industrial and power generation sources in Ontario if these sources

17 Collaborative Committee for the 1991-1994 Conservation Potential Review *Electricity Conservation Potential Review, 1988-2010: Phase II — Achievable Conservation Potential through Technological and Operating Change* (Vancouver: BC Hydro, 1994), Table II-2, p. II-5, V-11.

18 Most Asian vehicle manufacturers appear totally unaffected by CAFE standards and fuel efficiency of their products has decreased. Domestic manufacturers may have an incentive to shift consumers from luxury cars that have high profit margins, but are subject to relatively stringent standards, to sport utilities that have equally high profit margins but less stringent standards. The last ten years have seen a major shift in this direction.

19 West Coast Environmental Law Association has recommended eliminating the differentiation of CAFE standards according to weight class. Instead WCELA recommends separate CAFE standards for each manufacturer. This would, however, stratify the vehicle market making it difficult for manufacturers of small cars to increase their share of the large vehicle market.

20 Similar conclusions have been reached with regard to specific industries, such as the BC pulp and paper industry: The ARA Consulting Group Inc., H.A. Simons Ltd., and IBI Group Inc., *Evaluation of CO_2 Management Measures*, (Victoria: Queen's Printer for British Columbia, 1992) at 4-7 to 4-8. This report avoided recommended ending specific energy efficiency measures for the BC pulp and paper industry because "data on the multitude of options is either not available or cannot be reliably manipulated." ARA also noted that costs associated with specific measures depend heavily on location and application specific measures.

failed to make sufficient emission reductions pursuant to voluntary commitments. In order to ensure that power producers did not simply import electricity from out-of-province sources, power importers would need to hold quotas for the emissions embodied in imports. Companies exceeding their quota of emissions would be charged an atmospheric user fee earmarked to funding emission reduction projects.[21]

The Ontario CO_2 Collaborative proposed giving companies flexibility through use of corporate emission caps rather than limits on emissions from particular plants or processes. For regional pollutants, providing this degree of flexibility in how large firms reduce their emissions has yielded major cost savings over regulations that specify particular technologies or more specific limits. For instance, although the US Title IV Acid Rain Program allows trading of emission allowances between companies, most of the cost savings that have been attributed to that program are due to a switch from regulating emission rates and control systems to regulating total emissions. With corporate caps, firms could simply switch to low sulphur fuels which were less reliable for achieving a given hourly emission rate, but far more cost effective for reducing total emissions.[22] Similarly, Ontario Hydro and New Brunswick Power have been given aggregate emissions caps for sulphur dioxide from their thermal generating plants, with flexibility on where emissions are reduced. Both utilities have reduced emissions far below aggregate permissible levels by a range of methods.[23]

Many of the design issues and challenges raised with regard to cap and emission allowance trading programs are also pertinent to the quota program advocated by the collaborative. For instance:

- It would be necessary to define the scope of what emissions are included within the quota, weighing factors such as whether or not a particular source can be accurately monitored at reasonable costs, and whether creating thresholds for small emissions will lead to a proliferation of small sources.

- Without perfect information on the costs different corporations face in reducing their emissions — information which will never exist in a world of evolving technologies — allocation of quotas will never ensure equal marginal

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21 See below under the heading "Fine Tuning Taxes and Green Taxes," subheading "Dedicated Taxes and Atmospheric User Fees."

22 United States, General Accounting Office, *Air Pollution: Allowance Trading Offers an Opportunity to Reduce Emissions at Less Cost,* (United States General Accounting Office: Washington, 1994), 37. This report estimates that $2.6 billion per year is saved if firms restrict themselves to intra-utility trading, but another $1.2 billion could be saved through inter-utility trading. However, inter-utility trading was limited in the early years of the program with only 3% of utilities engaging in trading with other firms.

23 Canada, Environment Canada, "Annual Report on the Federal-Provincial Agreements for the Eastern Canada Acid Rain Program 1995" (1995) [unpublished].

costs of emission reduction, i.e., it will not be the most economically efficient solution.

- Distribution of quotas on the basis of historic emissions will penalize new companies or companies with expanding production levels. Distribution of quotas on the basis of production levels may be viewed as inequitable for companies that produce energy intensive products or have older, less efficient plants. Requiring all companies to reduce emissions equally from a particular baseline year will penalize companies that have invested heavily in energy efficiency prior to the baseline year.

The collaborative's proposals may also cause some unique difficulties:

- Quotas will need to be set in a manner which allows overall emission reduction targets to be adjusted to reflect increased understanding of climate change threats. At the same time, industries investing in processes that emit significant amounts of greenhouse gases will want some predictability of what their future quotas will be. This problem is particularly acute in a non-tradeable quota system because companies will not be able to purchase more quotas.

- The requirement that electricity importers hold quotas for the carbon content embodied in imported electricity (a necessity if the program is to be effective and the electricity market is deregulated) may be challenged under world and interprovincial trade rules.[24]

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[24] Applicable international trade rules include the national treatment rule in GATT and its incorporation into the *Canada — U.S. Free Trade Agreement* (s. 9.02) and the *North American Free Trade Agreement* (art. 301 and 603). In the opinion of the author, the proposed quota system would be consistent with the *Internal Trade Agreement* due to the exceptions in Chapter 15. However, several commentators on that agreement have interpreted it more restrictively. Trade dispute resolution tribunals under the *General Agreement on Tariffs and Trade* have held that the national treatment principle prohibits discrimination against products on the basis of how they were produced, and that exceptions to this rule for the purposes of environmental protection did not apply: *United States — Restrictions on Imports of Tuna,* Panel Report, June 1994; *United States — Restrictions on Imports of Tuna,* Panel Report, 3 September 1991. These panel decisions have not, however, been adopted by the parties to GATT and some analysts suggest these decisions are contrary to the intent of GATT as well as being incompatible with concepts of sustainable development: Steve Charnovitz, "Exploring the Environmental Exceptions in GATT Article XX" (1991) 25 *Journal of World Trade* 37 at 55. Nonetheless, the issue of production and processing measures is still ambiguous under GATT, other trade agreements administered by the World Trade Organization, and regional trade agreements such as the North American Free Trade Agreement. There is a strong possibility that requiring electricity importers to have quotas for embodied carbon would be found contrary to trade law. See Paul Demaret and Raoul Stewardson, "Border Tax Adjustments under GATT and EC Law and General Implications for Environmental Taxes" (1994) 28 *Journal of World Trade* 4 and Pierre Marc Johnson and Andre Beaulieu, *The Environment and*

- The requirement that electricity importers hold quotas for the carbon content embodied in imported electricity may be practically difficult to implement because of the problems inherent in determining carbon content embodied in a product such as electricity.[25]

In summary, corporate limits on total emissions rather than maximum emission rates offer firms a high degree of flexibility in how they achieve a given emission target. This flexibility can be extremely cost effective. However, even if combined with atmospheric user fees, corporate limits may prejudice new entrants or expanding firms, possibly more than is the case under emission trading programs. The specific proposal for imposing corporate quotas on carbon embodied in imports raises significant practical trade law concerns.

Technology Standards

In most cases the prescriptive standards which are promoted as means to reduce greenhouse gases provide maximum flexibility in how a particular end is met; however, in some cases regulations require specific technologies. For instance, the Rational Energy Plan calls for a requirement that all gasoline include a minimum ethanol content.

Technological standards are usually reserved for measures that are viewed as cost effective and cannot be practically imposed through other means such as emission limits or performance standards. For instance, specifying the use of woodwaste as the source for ethanol in gasoline may be necessary to ensure that lifecycle emissions of greenhouse gases are reduced, while specifying a particular reduction in net lifecycle emissions would be administratively cumbersome.

Other Prescriptive Standards

In addition to energy efficiency standards, technological standards and emission limits that are directly aimed at greenhouse gas emissions, there are a range of other prescriptive standards that have a part in reducing greenhouse gas emissions.

NAFTA, Understanding and Implementing the New Continental Law (Washington, DC: Island Press, 1996) at 50.

25 Even if electricity is purchased from a clean source, it may simply displace users of that clean source to dirtier sources. Moreover, there have been considerable problems with false and fraudulent "green power" claims made for electricity sold to consumers in New England. Edward A. Holt, "Disclosure and Certification: Truth in Labelling for Electric Power" (Issue Brief No. 5 from the Renewable Energy Policy Project, January 1997) [unpublished]. Until a mandatory disclosure and certification program is in place in the United States, it may be impossible to determine carbon content embodied in imported electricity. Such a disclosure and certification requirement is under active discussion in the United States at the present time.

These are often regulations primarily aimed at other problems, the application of which can be made more stringent to maximize their effectiveness in reducing greenhouse gas emissions. Many of the regulatory proposals advocated in the Rational Energy Plan and similar proposals are initiatives aimed at other problems. For example, the Rational Energy Plan advocates expanding or increasing the stringency of the following initiatives:

- **Mandatory Landfill Gas Recovery.** British Columbia requires landfills with estimated emissions of non-methane organic compounds exceeding 150 tonnes per year to install landfill gas collection systems.[26] The regulation is aimed at reducing ground level ozone formation, odour, and potential liability for explosions, but the collection systems also capture methane. This methane is usually flared (converting it to the less potent greenhouse gas, carbon dioxide), and, where it is profitable, it is used to generate electricity or displace fossil fuels.[27]

- **Vehicle Inspection and Maintenance.** (I&M) programs such as the Lower Fraser Valley's AirCare program. The Rational Energy Plan includes I&M programs for Toronto and Montreal. The AirCare Program is estimated to reduce carbon dioxide emissions by 28,000 tonnes as well as causing major reductions in local pollutants.[28]

- **Highway Speeds.** Lower and better enforced highway speed limits are components of the Rational Energy Plan.

- **Standards for HFCs.** Improved technology standards for capturing hydrofluorocarbons and other substances that both deplete stratospheric ozone and cause climate change.

The prescriptive standards referred to above are often seen as cost-effective means of pursuing various environmental or social ends. Enhanced inspection and maintenance, has, for instance, been identified as the most cost effective emission reduction measure for reducing local pollutants from cars.[29] Greenhouse gas emission reductions are a fortuitous side effect. Adjusting or expanding the above

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[26] BC is currently the only province with landfill gas recovery requirements. BC follows US EPA guidelines for landfill collection and may move to a more stringent 75 tonne per annum threshold.

[27] Fourteen of the 27 landfills in Canada with collection systems flare 100% of the gas collected. Others recover some, but not necessarily all of the energy. Electrical generation from landfill methane can be very profitable, depending on the amount collected. Toronto sells over $1 million per year of electricity generated from landfill methane.

[28] S.J. Stewart, "Technical Review of the AirCare Program, Program Year Three, September 1994 to August 1995" (BC Ministry of Transportation and Highways, March 1996) [unpublished].

[29] See Sierra Research Inc., "Cost Effectiveness for Further Regulating Mobile Source Emissions" (Sacramento, February, 1994) [unpublished].

programs to reduce greenhouse gases may be a particularly advantageous way of reducing greenhouse gases because the programs are often worth doing for reasons unrelated to greenhouse gas emissions and because there is already considerable experience with these programs.

Evaluation of Prescriptive standards

Cost Effectiveness

Prescriptive standards to reduce greenhouse gas emissions can not only achieve significant emission reductions, but can potentially do so at a negative economic cost to society, and in some cases may be economically beneficial to regulated parties. This contrasts with the often held assumption that prescriptive standards are inherently expensive and are a drag on the economy. On the other hand, the conclusion that regulations have net benefits to society and often make industry more competitive, does not mean that they achieve emission reductions at the lowest cost or could not have even greater net benefits. Studies often show that the costs of emission reduction using prescriptive standards are much higher than the lowest cost means of reducing emissions.

One reason for the economic attractiveness of prescriptive standards for greenhouse gas emission reduction is their focus on correcting market failures. For instance, energy efficiency standards overcome manufacturers limited incentives to reduce car buyers' fuel costs. Regulations for reducing greenhouse gas emissions are also cost effective because of their ability to "piggyback" on other environmental regulations and the ability to provide industry with flexibility that might be inappropriate for local pollutants.[30]

It is also often assumed that regulations do not encourage improvements to technology, a significant issue for the long term reduction of greenhouse gases. While most environmental regulations in Canada simply require compliance with good operating practices and offer no incentive to improve technologies, regulations can be technology forcing. The United States has been a leader in technology forcing standards: CAFE standards were opposed by the automobile industry as being technically impossible. US efficiency standards for refrigerators exceeded the best technology available in the market place at the time the standards were adopted.[31] Rapid improvements in battery technologies in the last ten years are largely the result of California's adoption of a requirement that manufacturers sell zero emission vehicles. In many cases prescriptive standards requiring "the impossible" have forced companies to find solutions that end up

[30] For instance, corporate limits on emissions for local pollutants would be inappropriate if it allowed emissions to concentrate in a particular area.
[31] Swisher, above at footnote 9, at 31.

saving them money.[32] Moreover, the California experience with low emission vehicles shows that a market roughly the same size as Canada can unilaterally impose technology forcing standards for consumer goods.

Simply because prescriptive standards often save money, improve the environment and stimulate competitiveness, does not mean that regulations can not be made more cost effective.

Prescriptive standards' ability to encourage technological innovation is, however, limited. Energy efficiency standards, technology standards or emission limits provide no encouragement to improve efficiency or reduce emissions beyond what is required by regulation. Moreover, they do not encourage technological innovation outside of the scope of the regulation.

While regulations can be cost-effective they may not always reduce emissions at the lowest possible cost. While regulations can correct market failures, they can also impose unnecessarily high costs. Reducing emissions most cost effectively requires accurate information on how much a particular regulatory requirement will reduce emissions and how much the requirement will cost. If regulatory standards do not accurately reflect the marginal costs of reducing emissions or improving efficiency, one company may be forced to reduce emissions or increase efficiency at high costs while another ignores low cost alternatives. Equalizing marginal costs becomes more important as we move to emission reduction measures that have positive costs. Whether or not a measure has net costs and how high those costs are is likely to be an issue in developing emission limits, energy efficiency standards or technology standards.

Generally, the energy savings and emission reductions from energy efficiency standards and emission limits will be relatively certain. However, the effectiveness of some measures will be uncertain. For example, the effectiveness of fugitive emission control in the oil and gas industry,[33] inspection and maintenance programs,[34] and ethanol blending requirements are subject to very different estimates.[35]

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[32] Porter and van der Linde, "Toward a New Conception of the Environment-Competitiveness Relationship" above at footnote 8.

[33] See B.H. Levelton & Associates Ltd., *An Inventory and Analysis of Control Measures for Methane for British Columbia* (Victoria: Province of British Columbia, April 1992) at 124.

[34] The Forecast Working Group forecast that fuel savings attributable to a vehicle inspection and maintenance program like AirCare would be 10%: See Measure 5.2, Forecast Working Group of the National Air Issues Coordinating Mechanism, "Microeconomic and Environmental Assessment of Climate Change Measures" (April 1995) [unpublished]. Fuel savings under AirCare have been less than 1% although this may be improved as the program becomes more stringent: S.J. Stewart, above at footnote 28.

[35] Estimates of emission reductions from an ethanol blending requirement vary by 500% depending on assumptions regarding competitiveness of different ethanol technologies and whether or not certain sources of ethanol are required: see British Columbia, Ministry of Energy, Mines and Petroleum Resources, *Cleaner Fuels for Cleaner Air, The Role of Alternative Transportation Fuels in BC* (Victoria: Queen's Printer, 1994). Generally ethanol from woodwaste appears to yield the greatest reductions, with ethanol from grain having lower emission reductions and ethanol from high input corn having negligible reductions.

Despite these uncertainties, the cost effectiveness debate is more likely to be fought over differing estimates of costs of a particular prescriptive standard. Regulation making exercises tend to be frustrating processes in which wildly different estimates of costs and environmental effectiveness are used, usually for the purpose of avoiding or delaying regulation. Estimates of methane leakage in the US natural gas industry vary widely with recent best estimates almost twice previous estimates.[36] Differences in cost estimates are often even greater. Estimates of the cost effectiveness of reducing local pollutants through zero emission vehicles range from $50 to $2.60 per pound.[37]

Although high end estimates of cost from industry can often be dismissed as posturing intended to avoid standards (the author is unaware of any examples where businesses have underestimated the cost of regulations affecting them) governments will often have difficulty estimating actual costs. First, industries have an incentive to exaggerate costs to avoid prescriptive standards and are often unwilling to provide government with full access to the sorts of confidential information which determines cost effectiveness.[38] During the 1990 US *Clean Air Act* debate, industry estimated the average cost of reducing emissions of sulphur dioxide at $800 per short ton; government estimated the costs at around $500; the actual cost in 1996 dropped to $69 per short ton.[39] Second, cost effectiveness depends on technological improvements. General improvements in technology throughout the economy may be predictable, but they are much less predictable for a specific process or business. Third, regulatory agencies seldom have the capacity to examine all emission reduction measures at the same time. This results in cost effective measures being ignored simply because they are not on the regulators' agenda.

These difficulties in predicting the cost effectiveness of prescriptive standards make it likely that the standards will not reduce emissions at the lowest possible

36 See US Environmental Protection Agency, *Methane Emissions from the Natural Gas Industry, 1997*. Estimates of leakage were 1.4% of production, almost twice the 0.8% previously used.

37 The high end estimate represents the estimate of the auto industry's consultant; estimates of cost by auto manufacturers were even higher: Sierra Research Inc., above at footnote 36. The California Air Resources Board, Mobile Source Division, suggested a much narrower range of cost estimates, from $2.60 to $9.00 per pound: See California Environmental Protection Agency, Air Resources Board, "Technical Support Document for Zero Emission Vehicle Update" (April 1994) [unpublished].

38 The wide discrepancy in prices of emission reductions through ZEV standards has in part been unresolvable because of auto manufacturers unwillingness of to provide California Air Resources Board with business information.

39 The costs referred to are costs for a one short ton allowance, which should reflect marginal costs. $785 was the estimated cost developed by a consultant employed by the Ohio Coal Development Office Consultancy. $69 per short ton was the cost of a permit in March 1996: John Palmissano, "How Can the Lessons Learned from Joint Implementation Help Construction of an International Carbon Offset Regime?" [December 1996] *World Energy Council Journal* 37.

cost. This is less of an issue if measures being pursued are no regrets measures, worthwhile because of the saving they will generate for consumers or because of their other positive environmental effects, but it will become an increasingly significant issue as we move beyond no regrets measures. Regulatory requirements which impose emission reduction costs as much as five times higher than alternate, unmandated, measures are a source of considerable frustration for regulated industries.[40]

Environmental Effectiveness

In the realpolitik world, there are innumerable instances where prescriptive standards are deferred or left unenforced. This difficulty in making progress has to be considered when evaluating prescriptive standards.

Prescriptive standards are generally most effective in eliminating worst practices or least energy efficient technologies. Minimum energy efficiency standards, for instance, are very effective in eliminating the least efficient products from the market. Average efficiency standards are also effective in encouraging a shift in the entire market of products available. On the other hand, prescriptive standards seldom encourage turnover in capital, and may even slow capital turnover if they add significantly to the cost of new products. With a few exceptions, such as emission limits, speed limits and energy audits, regulations seldom affect how technologies are used.

Prescriptive standards may have an advantage over other instruments for greenhouse gas emission reductions in that they can be designed to minimize the shifts in production to other jurisdictions which could undercut emission reductions in Canada. First, many prescriptive standards are aimed at alleviating market failures. A strategy that relies on price signals to increase energy efficiency but does not tackle problems that currently inhibit cost effective emission reductions will be very expensive for sectors that are already adopting cost effective energy efficiency. Prescriptive standards, on the other hand, can be targeted at sectors where cost effective improvements exist. Second, prescriptive standards tend to be debated extensively prior to adoption. It is unlikely that significant areas of leakage will remain unidentified. Third, many of the greenhouse gas emission sources that are targeted by regulation, such as consumer energy use or municipal landfills, are unlikely to shift to other countries. On the other hand, if technological standards or emission limits prove more costly than expected, and do not represent the lowest cost means of reducing emissions, some shifts in production could occur. For instance, representatives of the natural gas industry said they will shift production and transmission to Alberta if BC takes aggressive unilateral action in regulating greenhouse gas emissions. In the absence of effective limits on greenhouse gas emissions in other jurisdictions, leakage is likely to be very significant if emission quotas are applied to a

[40] See David Roodman, *Getting the Signals Right: tax reform to protect the environment and the economy*, (Washington, DC: Worldwatch Institute, 1997) at 28, describing an EPA study which found regulatory requirements which were over five times the cost of unmandated measures.

deregulated electricity sector but not to the carbon content embodied in electricity imports.

Any evaluation of plans to reduce emissions through regulatory means needs to consider the extent to which plans of regulatory action will be implemented. There are innumerable instances where prescriptive standards are imposed on emitters only to be deferred, rolled back or left unenforced when they prove difficult to implement in practice. Few air quality improvement plans relying on multiple regulatory initiatives are implemented according to schedule. Air quality plans are often based on optimistic estimates as to the effectiveness of control technology and regulatory actions may fall short of expectations. These practical and realpolitik problems with prescriptive regulation were a major factor in the South Coast Air Quality Management District concluding that their proposed trading program would achieve air quality goals with greater certainty than the alternative regulatory plan.[41]

Administrative Feasibility

A major advantage to prescriptive standards is the extent to which they represent the familiar. Provincial and federal governments have a proven capacity to implement most of the measures discussed above. Prescriptive standards do, however, impose some very significant administrative costs. For each standard that is introduced, costs include consultations, estimating cost effectiveness, ensuring that the details of regulations can be complied with, monitoring, and enforcement. These costs may be significant, although often far lower than the cost savings that result. Nonetheless, in an era of fiscal restraint, concerns regarding costs are sufficient to block progress. In British Columbia, municipal concerns regarding the costs of enforcing energy codes for buildings appear to have blocked progress on adoption, and government cutbacks have slowed development of energy efficiency standards for appliances.

To some extent these governmental costs can be reduced through regulatory innovations. The cost of monitoring and enforcing a corporate emission cap on carbon dioxide from fuel combustion could be very low if emissions are monitored using tamper-proof fuel meters and automatic administrative penalties.[42] Costs of municipal enforcement of energy codes can be reduced through the use of certification processes by independent licensed inspectors.

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41 California Environmental Protection Agency, Air Resources Board, "Public Meeting to Consider Approval of the SCAQMD's Regional Clean Air Incentives Market" (February 8, 1994) [unpublished] at 10.

42 See Chapter 9, "Design Issue 21: Monitoring Equipment, Enforcement and Liability of Good Faith Purchasers." Government monitoring and enforcement costs could also be very low if non carbon dioxide emissions are capped and can be monitored using continuous

Political Feasibility

In many ways a major reliance on prescriptive standards to reduce greenhouse gas emissions is politically feasible as it would largely be an addition to the existing regulatory structure not requiring development of any new elaborate institutions or any major changes to legislation. On the other hand, it depends on there being a continuous political will to update regulations and runs counter to the "small government" ethos which currently dominates Canadian politics. To effectively reduce greenhouse gas emissions through regulations will require constant vigilance in ensuring regulations are meaningful improvements on the status quo. This is distinct from some other instruments, such as carbon taxes or cap and emission allowance trading, which may potentially require far less ongoing effort to ensure continuing reductions in emissions.

Equity

There will often be a tension in regulatory standard setting between various conceptions of equity and achieving the lowest cost emission reductions. Achieving emission reductions at lowest cost (and thus equalizing marginal costs of abatement) may mean ignoring the emissions from a firm with high marginal costs of abatement while imposing relatively high total costs (but low marginal costs of abatement) on another firm. Similarly, the difficulty of imposing performance standards for the industrial sector may mean that manufacturers of relatively homogenous goods such as appliances, vehicles, electric motor and homes feel unfairly penalized.

Equity is likely to be less of an issue if regulations are targeted at changes that are within the market potential for a firm. It will become more of an issue as we move to measures that impose net costs on some parties.

To summarize, energy efficiency standards and other prescriptive standards to reduce greenhouse gas emissions can reduce costs for consumers and businesses as well as achieving desirable environmental ends. Well designed prescriptive standards provide flexibility. Their ability to achieve cost effective emission reductions depends on the ability of governments to accurately estimate compliance costs and potential for technological development. The process of estimating costs can be expensive. Accurate estimates of costs are hindered by the nature of technological change and businesses' propensity to exaggerate costs in order to avoid prescriptive standards.

emissions monitoring. However, continous emissions monitoring are costly for the businesses installing them.

Fine Tuning Taxes and Green Taxes

Consumers' and investors' decisions to purchase or invest in energy efficient technologies, energy intensive products, renewable energy and fossil fuel energy are affected by a number of factors. One of the most important of these is the tax system. Canada, like most nations, has a tax system which favours consumption of fossil fuel and penalizes investments in energy efficiency. Adjustments to our current tax system, and potentially more importantly a shift of taxes from taxes on jobs and value added industry to taxes on greenhouse gas emissions and other forms of pollution, have the potential to dramatically shift investments in energy efficiency and energy sources.

Removing Subsidies to Fossil Fuels and Energy Intensity

Canada and other OECD countries subsidize energy by approximately US $67 billion per year. These subsidies are overwhelmingly in favour of nuclear energy and fossil fuels. A 1996 study estimates that Canada subsidizes the fossil fuel industry with $5.9 billion in tax breaks per year: $3.1 billion to natural gas and $2.8 billion to oil.[43]

In 1996, the Canadian Department of Finance and Natural Resources Canada published a study comparing the tax treatment of various energy related investments and expenditures.[44] The value of each expenditure or investment under our current system was compared to its value under a neutral tax system that has no tax credits, tax exemptions or preferential tax rates.[45] The report concluded that:

- Investments in energy efficiency for commercial buildings — for instance district heating, solar space heating or building retrofits — are less attractive (up to ten percent less attractive in the case of retrofits) than they would be in a neutral tax system. Although the 1997 federal budget announced a willingness to examine use of tax mechanisms to promote energy efficiency investments, it is not clear whether this barrier to efficiency will be removed.

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43 Andre de Moor, Institute for Research on Public Expenditure, and Peter Calamai. *Subsidizing Unsustainable Development, Undermining the Earth with public funds* (Costa Rica: Earth Council, 1996).

44 Canada, Natural Resources Canada and the Department of Finance, *The Level Playing Field: The Tax Treatment of Competing Energy Instruments* (Ottawa: Natural Resources Canada and the Department of Finance Canada, September 1996).

45 The study measured the "uplift" given by the tax system. The uplift is equal to [(net present value of tax paid under neutral system — net present value of taxes paid under Canadian system) x 100]/net present value of capital investment.

- Conventional oil and gas investments are five to ten percent more attractive under the current system than a neutral system. On top of this, oil and gas companies that do not have sufficient taxable income can transfer write-offs for exploration expenses to shareholders. This can make a conventional oil and gas project up to twenty percent more attractive than it would be in a tax neutral system.

- Large oil investments such as oil sands projects and the Hibernia offshore development are made up to 21% more attractive by the current tax system. In the 1996 federal budget, the tax subsidies for oil sands were increased by making all oil sands projects subject to the same beneficial rules.

A 1996 study estimates that Canada subsidizes the fossil fuel industry with $5.9 billion in tax breaks per year: $3.1 billion to natural gas and $2.8 billion to oil.

The report also found that the tax system favoured cogeneration and renewable energy projects such as wind and small hydro by between six percent and 22%; however, investors in renewable energy were less likely to be able to take advantage of available deductions than oil and gas companies. Changes in the 1996 and 1997 federal budgets have helped put investments in renewable energy on par with investments in fossil fuel, but the absolute level of subsidization to fossil fuels far outweighs subsidization to renewables. Also, energy as a whole is still subsidized. Removing the tax breaks enjoyed by the fossil fuel industry would thus be a much more significant and important measure than simply giving renewable energy equal tax advantages. Similarly, it is essential to put investments in energy efficiency — generally the most cost effective solution to greenhouse gas emissions — on par with energy production.

The primary barrier to removing subsidies for fossil fuels is political opposition from powerful interest groups. While the advantages of tax breaks are concentrated in a few industries, the costs are borne by all society, but are not widely recognized. This barrier will be difficult to overcome without increased public awareness of fossil fuel subsidies.

Elimination of Canadian subsidies is also complicated by the fact that the United States offers similar subsidies,[46] and regions dependent on fossil fuel exploration and development fear transfer of oil and gas development to the US. As a result of these barriers, it has proved easier for the federal government to offer similar subsidies to renewable energy rather than leveling the playing field by eliminating fossil fuel tax advantages. Nonetheless, Canada could move unilaterally in removing subsidies. It could ease concerns regarding the diversion of exploration and development to the US by phasing in subsidy removal over time and supporting European proposals for coordinated removal of subsidies to fossil fuels.

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46 See Jeff M. Hammond, *et al.*, *Tax Waste, Not Work: How Changing what We Tax Can Lead to a Stronger Economy and a Cleaner Environment* (San Francisco: Redefining Progress, April 1997) at 69; see also de Moor, above at footnote 43, at 33.

Ecological Tax Reform

> A Liberal government will establish a framework in which environmental and economic policy signals point the same way.
>
> — *Liberal Party of Canada,* 1993 Election Red Book

Making environmental and economic policy signals point the same way goes beyond removing current subsidies to fossil fuels. An ideal tax system internalizes environmental costs, so that polluters and consumers of polluting products pay the costs they impose on society. Ecological tax reform involves replacing current taxes with taxes on pollution and environmentally destructive behavior.

A core element of ecological tax reform is likely to be taxation of carbon emissions. A tax on carbon dioxide pollution internalizes some or all environmental costs of fossil fuel combustion; encourages energy users to switch to less carbon intensive fuels; encourages investment in renewable energy and efficient technologies; encourages consumers to choose less carbon intensive products; and, drives development of new technologies.

Revenue from ecological tax reform can be used to reduce existing taxes that discourage job creation, thus aiding economic expansion. While few doubt the need for public spending, conventional taxes exact a toll on the economy not only because of how much money is taken from the economy, but also because desirable activities are discouraged. Income tax, payroll deductions, and taxes like the Goods and Services Tax are taxes on work, jobs and value added industries. According to Working Group III of the IPCC:

> If the revenues are distributed by reducing distortionary taxes in the existing system, they will help reduce the excess burden of the existing tax system, potentially yielding an additional economic benefit (double dividend). For example, those European studies which are optimistic regarding the potential for tax recycling show lower and, in some instances, slightly negative costs.

Thus, some macroeconomic studies indicate that shifting revenue generation from existing taxes to a carbon tax allows the economy to grow. One US study shows that the if revenue from a $36 per tonne carbon tax were recycled to reduce distortionary taxes, GNP would increase by 3.8%.[47] Other models show minor losses to the economy. For instance, the Charles River Study referred to in Chapter 4 shows that the impact in Canada of using a carbon tax to reduce emissions by ten percent below 1990 levels by 2010 would be to limit growth in

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[47] Roger C. Dower and Mary Beth Zimmerman, *The Right Climate For Carbon Taxes: Creating Economic Incentives to Protect The Atmosphere* (Washington, DC: World Resources Institute, August 1992) at 15.

the Canadian economy to 67% rather than 71% by 2020. Given macroeconomic models' failure to value avoidance of climate change and failure to consider the potential for no regrets emission reductions, a fair conclusion may simply be that carbon taxes will have limited impacts on overall economic growth.

A major barrier to acceptance of ecological tax reform is the perception that it would be inherently politically unpopular. Political advisors are often quick to point to the unpopularity of recent tax reforms such as Canada's replacement of the manufacturers' sales tax with the GST and the American administration's proposed energy or "BTU tax". In the US case, the tax would have yielded less revenue than the value of American energy subsidies, but major manufacturers and energy producers launched a successful multi-million dollar lobbying campaign against the tax.[48]

Faced with a choice between taxing jobs and work versus taxing pollution, most people choose to tax pollution.

Despite these experiences there may be significant support for ecological tax reform if the public understands the concept. Faced with a choice between taxing jobs and work versus taxing pollution, most people choose to tax pollution. Polling in both the United States and Europe shows that 70% of those surveyed favour ecological tax reform once they understand the concept.[49] In Germany, Greenpeace has developed a powerful coalition in favour of a tax that would push energy prices up roughly seven percent per year over at least fifteen years. The tax has been made popular by the fact that the amounts raised would be pooled and returned by mailing "eco-bonus" cheques to every home in Germany.[50] Under the plan, industries that use the most energy and least labour would see their costs rise, but labour intensive industries would save money. The proposal has won the support of major business and labour groups.[51]

Also, there appears to be a surprising level of support for a carbon charge within various sectors.. The National Roundtable on the Environment and the Economy's multistakeholder Economic Instruments Collaborative — made up of representatives from utilities, the fossil fuel sector, government and environmental organizations — considered a number of economic instruments to reduce greenhouse gas emissions. Although divided on the extent of emission reductions which should be pursued, the collaborative urged consideration of a tax on carbon dioxide emissions from large point sources and on fossil carbon content of fuel

48 A.M. Gilles, *Protecting the Environment and Reducing Canada's Deficit: Where to Start* (Winnipeg: International Institute for Sustainable Development, 1994) at 31.

49 See Roodman, above at footnote 40, at 53. As discussed below, recycling carbon tax revenues through lump sum payments as opposed to reductions in distortionary taxes loses the opportunity to reduce negative consequences of such taxes.

50 *Ibid.* at 51.

51 *Ibid.* at 52.

sold to other sources combined with tax credits for enhancement of carbon sinks and, to a limited extent, clean development or joint implementation projects.[52]

A major barrier to ecological tax reform is the fear that it will reduce competitiveness in some sectors. The countries that levy a stiff carbon tax may redirect investment in local energy intensive industries abroad. The local economy may lose while the global environment gains nothing. American studies show that a $40 per tonne carbon tax would add, on average, slightly under one percent to the US manufacturing value of shipments and that this would decline as industry becomes more energy efficient. This figure would likely be higher in Canada due to our specialization in energy intensive products, and in some export-oriented sectors, it will be much higher.[53]

On the other hand, while a unilateral shift towards carbon taxes will reduce the competitiveness of some industries, if carbon taxes are used to reduce other taxes, a shift to carbon taxes can increase the competitiveness of other industries. Often growth in the sectors that benefit from carbon taxes is particularly attractive because they are sectors that have a higher multiplier effect on the domestic economy — i.e. they create more local economic spin offs. Only about fifteen percent of Canada's industrial GDP comes from the major energy using industries

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52 Economic Instruments Collaborative, "Limiting Greenhouse Gas Emissions" *Achieving Atmospheric Quality Objectives through the Use of Economic Instruments: A Final Report of the Economic Instruments Collaborative* (Ottawa: The National Round Table on the Environment and the Economy, October 1993).

53 See Dower, above at footnote 47, at 28, for cost of $40 carbon tax on US manufacturers. The energy value embodied in a dollar's worth of goods generated in the US is only 1.9 cents, and this figure is about four cents in some sectors such as pulp and paper, primary metals: Howard Geller and Neal Elliot, *Industrial Energy Efficiency: Trends, Savings Potential, and Policy Options* (Washington: American Council for an Energy Efficient Economy, June 1994). The author was unable to find information on energy costs as a percentage of the value of goods shipped from Canada. Energy costs as a percent of industrial GDP are available for some sectors, but they tend to exaggerate the effect on competitiveness because they give energy costs per dollar of value added in Canada, not per dollar of shipment value. In Canada, Statistics Canada estimates that, on average, energy costs represent about four percent of total production costs for Canadian industry, and for most manufacturing sectors it is less than one percent. However, for some sectors that compete on a global market energy is a significant portion of costs. For instance, energy represents about seventeen percent of production costs in the pulp and paper sector, and may be higher for some products: Canada, Statistics Canada, *Manufacturing Industries of Canada* Annual Catalogue 31-203, Ottawa (1991). Note, however, that in many cases these energy costs are unrelated to fossil fuel. In the United States energy costs embodied in every dollar of product was 1.9 cent , but 1.2 cents of this was for electricity (See Geller and Elliot). In Canada, and especially in BC a high percentage of electricity comes from hydro. Some sectors such as aluminum, which have high energy costs, would be unimpacted by a carbon tax due to their reliance on hydro power.

while over half of Canada's GDP comes from low energy intensity manufacturing sectors that account for only seventeen percent of industrial energy.[54]

Concerns regarding competitiveness are why the trade-dependent countries of Scandinavia and the Netherlands provide full or partial exemptions from carbon taxes for industry and why, worldwide, most energy taxes fall primarily on consumers.[55] Sweden, for instance, has a carbon tax equal to 323 Skr per tonne of carbon dioxide ($57 Canadian per tonne carbon or $0.14 per litre of gasoline). However, the tax is only applied to the industrial sector at one quarter the rate charged to households and non-manufacturing industries. In Denmark, if a carbon tax adds more than three percent to the value added to a product by a particular company, the company can apply for a total tax refund if it has undertaken reasonable energy efficiency investments (as determined by a certified energy auditor). Unfortunately, exemptions for industrial sectors will reduce the effectiveness and economic efficiency of carbon taxes.

Some analyses show that carbon taxes dedicated to funding greenhouse gas reduction programs would be lower and more cost effective than a tax dedicated to general revenue.

Some economists have suggested that competitiveness concerns could be addressed by — in a few energy intensive sectors such as steel, autos, pulp and paper and chemicals — rebating taxes on exports and placing taxes on imports to compensate for a carbon tax's effects on competitiveness.[56] Industry would still have an incentive to pursue energy efficiency in order to reduce taxes payable for their domestic production.

Similarly, taxes could be rebated on the basis of production of energy intensive products. For instance, Sweden charges a tax on sulphur dioxide emissions from utilities, but the revenue is returned to utilities based on the amount of electricity they generate. Rebating carbon taxes paid by energy intensive sectors would remove the ability to use revenue to reduce distortionary taxes. It would also be administratively and politically difficult because of the heterogeneity of different products involved.

Many analysts argue against rebates, border corrections or industry exemptions, noting that there will be winners and losers in any tax reform, and efficiency gains for the whole economy will be greatest if taxes are applied uniformly.[57] All the measures that have been suggested to reduce impacts on energy intensive industry would reduce the efficiency of a carbon tax. For instance, rebates would

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54 Ibid. Canada, Natural Resources Canada, *Energy Efficiency Trends in Canada* (Ottawa: Supply and Services Canada, 1994). Other manufacturing accounts for 51.2% of industrial GDP, construction accounts for 19.2%, mining 14.8%. The major industry using industries represent less than 15% of industrial production in total. Pulp and paper accounts for 6.1% of industrial GDP, smelting and refining, 1.5%, forestry 1.8%, chemicals 1.7%, iron and steel 1.7%, petroleum refiing 1.4% and cement 0.2%.

55 Roodman, above at footnote 40, at 34.

56 James M. Poterba, "Global Warming Policy: A Public Finance Perspective" (1993) 7:4 *Journal of Economic Perspectives* 47, at 57.

57 Hammond, above at footnote 46, at 97.

encourage improvements in how energy intensive products are produced, but they would not encourage the substitution of such products with less energy intensive alternatives. Moreover, if carbon taxes spur technological developments in carbon intensive sectors, those sectors will be able to benefit from increased efficiency.[58] Regardless of whether or not they are good policy, border adjustments may be found contrary to the General Agreement on Tariffs and Trade.[59]

Another concern regarding carbon taxes is the assumption that they would be regressive, i.e., poor families would pay a higher portion of their income in taxes.[60] This would be true if carbon taxes were simply used to reduce the amount of tax raised through income taxes without any changes to taxation rates. However, the regressive nature of carbon taxes can be overcome by reducing regressive taxes such as the GST or making income tax more progressive. Alternatively, lump sum distribution of tax revenues, as in the German Greenpeace proposal, benefits poor households, which spend less than average on energy.

Dedicated Taxes and Atmospheric User Fees

Classic economic theory suggests that the most cost effective means of reducing greenhouse gas emissions would be to apply a carbon tax with revenue being utilized to reduce distortionary taxes. However, some analyses show that taxes on fossil fuels that are dedicated to funding greenhouse gas reduction programs would be more cost effective than a carbon tax that simply goes to general revenue. By devoting the tax to policy measures that break down barriers to cost effective solutions, a dedicated tax could be both lower than an undedicated tax and more economically efficient.

For instance, the New York State Energy Office compared alternative policies to reduce New York emissions ten percent below 1988 levels. The study found that to meet the desired levels, an undedicated carbon tax would have to be $418 per tonne of carbon, whereas as a dedicated trust fund tax could achieve emission reductions at $31 per tonne of carbon.[61] Slightly over ten percent of the emission reductions achieved by Rational Energy Plan in 2010 are as a result of a relatively

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58 Dower, above at footnote 47.

59 Paul Demaret and Raoul Stewardson, above at footnote 24, examine this issue in detail and conclude that GATT is uncertain as to how it would treat a border adjustment.

60 If tax burdens are analyzed relative to lifetime income, fossil fuel taxes are less regressive. See Poterba, above at footnote 56, at 56.

61 Similarly, a 1992 study by DRI Canada and Marbek Resource Consultants found that policy instruments would be much less costly means of reducing carbon emissions than a carbon tax: see Stephen Bernow, Bruce Biewald, Michael Lazarus and Robert Margolis "Greenhouse Gas Emissions: Targets and Control Costs" (Boston: Tellus Institute, August 1994) [unpublished].

low carbon charge applied at least in part to cost effective emission reduction policies.[62] Although the Rational Energy Plan carbon tax is not fully dedicated, (some of it is used to reduce other taxes such as employer-paid employee benefit taxes) it calls for expenditures on a number of new or expanded programs to ensure greenhouse gas emission reductions.

Proposals have also been made to combine regulatory limits with dedicated fees, by requiring companies which exceed permitted emission levels to pay dedicated fees. The Ontario CO_2 Collaborative suggested dedicated taxes or atmospheric user fees on industrial and power generation sources which exceed their quota of allowable emissions. The Oregon CO_2 Standard allows emitters who exceed the standard to either offset emissions or pay a fee per tonne of emission exceedances.

Dedication of fossil fuel taxes to a greenhouse gas reduction fund may both make the taxes politically more acceptable and more cost effective. British Columbia, Germany, France and the Netherlands already earmark revenue from industrial pollution permit fees and BC earmarks the levies it collects on several environmentally hazardous products. A large part of the revenue from Denmark's carbon tax is used to subsidize energy efficiency, district heating projects and demonstration projects.[63]

Funds could be earmarked to an agency which would invest them in projects which reduce emissions. The role of the agency could be simply to purchase credits for emission reductions at the lowest possible cost. The methodology for generating and evaluating credits is discussed at length in Chapter 8.

Substantial emission reductions could be achieved through a modest fund. Currently the costs of a credit for a one tonne reduction in carbon dioxide is between US \$0.03 to \$23.[64] If a conservative price of \$10 per tonne figure is used, the cost of offsetting 100% of the carbon dioxide from natural gas

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62 The Rational Energy Plan calls for a \$20 per tonne charge on carbon being implemented in 2000, rising to \$25 by 2005 and remaining at that level. This amounts to less than \$0.06 per liter of gasoline and relative to anticipated price increasing the average price of electricity by two percent in 2010, gasoline prices by three percent, heating oils by five percent, and natural gas prices by six percent: Canada, Natural Resources Canada "Model Simulations of the Climate Action Network Program for Energy Demand, GHG Emissions and Investment," June 1995 at 8. Price increases are relative to the reference baseline case. Electricity prices would increase by twelve percent in Alberta, and remain almost unchanged in Quebec and BC. See: Sierra Club of Canada, *Climate Action Network Rational Energy Plan: Analysis of Measures Impact to 2020,* (September 1995) [unpublished].

63 International Energy Agency, *Climate Change Policy Initiatives, 1994 Update, Volume I OECD Countries* (Paris: Organization for Economic Co-operation and Development, 1994) at 59.

64 Trexler and Associates, Inc., *Considerations in the Construction of a CO_2 Mitigation Cost Curve for the Next Northwest Power Plan* (Oak Grove, Oregon, August 14, 1996) [unpublished].

combustion would add less than ten to fifteen percent to the cost of natural gas.[65] The premium to completely offset carbon dioxide from electricity production would be in the range of three to thirteen percent of costs.[66]

Alternatively, a fund could invest equity into projects that have the potential to reduce emissions. Under the Oregon Exemption, the Klamath Falls plant was required to place $1,000,000 in a fund that financed methane recovery and electrical generation projects at sewage treatment plants and coal mines. The fund will invest in projects and in return receive a portion of revenue generated. The money returned will be spent to finance more projects.[67] This sort of "revolving fund financing" will help ensure that the projects which are funded are additional to what would occur in any event.[68]

Funds can also be dedicated to narrower purposes than simply reducing greenhouse gas emissions. For instance, Greater Vancouver drivers pay a cent per litre of gasoline which is dedicated to local transit. The BC Energy Coalition and Association for the Advancement of Sustainable Energy Policy has promoted a dedicated surcharge on electricity consumers to fund demand side management.

Dedication for specific purposes can help overcome political resistance; for instance, surveys of Greater Vancouver residents show a willingness to pay additional gasoline taxes or road tolls as long as they are assured that the taxes are dedicated to improving the transit and other aspects of the transportation infrastructure.[69] Limiting the sorts of emission reductions which will be funded by a dedicated tax will likely necessitate an increased taxation level to meet a given greenhouse gas emission reduction; however, narrowly dedicated taxes may still be highly cost effective if they achieve other desirable social or environmental goals which might be ignored if tax is dedicated simply to least cost greenhouse gas emission reductions.

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65 This is based on a cost of $6 per MMBtu. See Ralph Torrie, *Municipal Building Energy Retrofits and Carbon Offsets: Opportunities and Challenges* (Toronto, International Council for Local Environmental Initiatives, December 15, 1996) at 27.

66 *Ibid.* at 27.

67 Oregon, Energy Facility Siting Council, "Order: In the matter of the 500 Megawatt Exemption from the Demonstration of Showing Need for a Power Plant," 1 August 1996 [unpublished].

68 Many carbon dioxide emission reduction projects have a rate of return; indeed, companies currently purchasing credits from such projects often consider a rate of return as essential to investing. If investments are in the form of equity investments rather than simply grants or low interest loans, non-additional projects will likely have greater rates of return. If that rate of return is appropriated to a revolving fund, it is more likely to yield additional emission reductions in the long run.

69 Viewpoint Research Limited, *A Comprehensive Overview of Transportation Demand Management Public Opinion Research* (Vancouver: Greater Vancouver Regional District, 1995) at 55.

An advantage to creating a fund specifically for pursuing least cost emission reductions is that the criteria for what is purchased can be relatively clear, avoiding the danger that funds will be used for partisan patronage, or subsidizing other government priorities.[70] To be credible, cost effective and accountable, clear criteria for selecting proposals and a transparent and accountable structure are essential.[71] The criteria that would need to be considered in accepting projects would be essentially the same as those involved in evaluating credits in a credit trading program. These criteria are discussed extensively in Chapter 5.

Evaluation of Tax Reform to Reduce Greenhouse Gas Emissions

Environmental Effectiveness

All of the tax measures discussed can potentially lead to significant emission reductions. The extent of the emission reductions will depend on the extent to which biases in the tax system toward energy consumption and fossil fuels are leveled or reversed, the responsiveness of the economy to price signals, and the extent to which dedicated taxes are spent on projects that are most effective in reducing greenhouse gas emissions.

Provided that ecological tax reform and earmarked taxes are applied across all sectors they will change price signals across the economy, inevitably ensuring the adoption of additional emission reduction measures across all sectors. Unfortunately, because of concerns regarding competitiveness, carbon taxes have often provided exemptions for the industrial sector. Ironically this is the sector where a carbon tax is likely to be most effective because there is a relatively high degree of responsiveness to price signals.

One concern regarding the environmental effectiveness of a carbon tax is the extent to which a carbon tax would lead to leakage. Leakage is an issue because, even if a carbon tax leads to emission reduction measures which are far more cost effective than regulation, for carbon intensive industries the combined cost of a

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70 See Kernaghan Webb, "Thumbs, Fingers, and Pushing on String: Legal Accountability in the use of Financial Incentives" (Report for the Law Reform Commission of Canada, 1990) [unpublished]. The BC Auditor General criticized the use of SEF environmental levies ostensibly levied for ensuring recycling or disposal of problem products for purposed unrelated to the purpose: Auditor General of BC, *1995/96 Report* 3.

71 Programs such as the Canadian Exploration Incentives Program could serve as models for structured, credible programs. See also Webb, *ibid.* Webb discusses poor accountability in distribution of government subsidies. Forest Renewal BC also includes a relatively public process for choosing among competing proposals, but the political nature of the Forest Renewal Board combined with broadly defined goals limits effectiveness in delivering a specified goal.

tax plus the emission reduction measures that result from a tax may be higher than less cost effective prescriptive standards.[72] Leakage can be minimized if measures are adopted in conjunction with other nations, but even if coordinated action is taken among all Annex 1 Nations, there will be leakage to non-Annex 1 Nations. Estimates of leakage range from very low to very high if a carbon tax were applied across the OECD.[73] So long as government can target cost effective emission reduction projects, dedicated taxes may be the best means of minimizing any leakage because the tax tends to be lower for a given level of emission reduction and funds can focus on curing market failures. In the absence of coordinated action, leakage may be minimized by border adjustments but doing so reduces the strength of price signals created by a tax and makes a tax less cost effective in the long run.

Cost Effectiveness

According to classic economic theory, a level playing field and ecological tax reform should be highly cost effective because the price signals will ensure the adoption of the lowest cost measures. Tax measures have the advantage of providing a high degree of flexibility in how industries and businesses respond to price signals. They encourage technological innovation, and the transaction and the administrative costs of these measures are among the lowest of any measure considered in this report. Although there are some adjustment costs inherent in removing subsidies and internalizing externalities associated with fossil fuel consumption, these measures will, in the long run, potentially make the economy more efficient because the revenue raised can be used to reduce taxes on jobs and other positive behavior.

Nonetheless, because of the existence of market failures not accounted for in classic economic theory, a dedicated tax may be a more efficient means of reducing greenhouse gas emissions. The extent to which this is true depends on the extent to which government can cost effectively identify emission reduction opportunities that are cost effective but are not occurring due to market failures. As discussed in Chapter 4, there is evidence that government can effectively intervene in curing at least some market failures.

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72 This is based on studies comparing the cost to industries of a auctioned tradable permits (similar in effect to a emission tax) and prescriptive standards: Randolph M. Lyon, "Auctions and Alternative Procedures of Allocating Pollution Rights" (February 1982) 58:1 *Land Economics* 16.

73 Estimates of leakage range from 2.5% to 90%. Note, however, that the latter figure assumes a carbon tax sufficient to reduce OECD emissions by 20% lasting for the next century with no additional measures being taken in the OECD and no emission limits applicable to non-Annex 1 nations prior to 2100: see John Pezzey, "Analysis of Unilateral CO_2 Control in the European Community and OECD" (1995) 13:3 *The Energy Journal* 159.

Equity

Assuming particular sectors are not exempted from carbon taxes, the taxes discussed above will impose equal marginal costs on all firms and individuals and will impose costs in proportion to their contribution to the problem. However, taxes may be inequitable in the sense that they will impact on some individuals and firms that are unable to reduce their emissions at relatively low cost. For instance, residents in rural areas may not have the option of using public transit. Depending on how revenue is recycled, tax measures may have a regressive impact because a greater portion of low income earners' income is devoted to fossil fuels. These inequities can be mitigated through use of recycled revenue. For instance, carbon tax revenue can be used to remove other regressive taxes, make income tax more progressive, or offer tax credits to rural residents.

Although dedicated taxes applied to fossil fuels or electricity are regressive in that low income earners tend to spend a higher proportion of their income on energy, they can be made progressive by dedicating a portion of the earmarked funds to emission reduction projects that benefit low income earners such as low income housing retrofits.

Unless carbon taxes are applied by the United States and other competitors in energy intensive goods, a tax may have an unnecessarily high impact on communities that are dependent on energy intensive industries. There may be some potential to mitigate these impacts through border adjustments on energy intensive goods, but doing so reduces the efficiency of the price signals created by a carbon tax.

Feasibility

All of the tax measures discussed are feasible, but face political hurdles. They are flexible in that tax levels can be adjusted as experience is gained on the economic and environmental impacts of a tax. They are easily enforced, although without coordination with the United States, there may be some tax avoidance through the purchasing of motor fuel south of the border. Although the political climate for a carbon tax is often perceived as being very cold, there appears to be some latent support when the concept of ecological tax reform is explained.

Moreover, in at least one case it may be relatively easy to implement an earmarked tax. As the electrical industry is deregulated, it may be possible to implement a charge on electricity earmarked to demand side management programs.

Given greater public understanding of the extent of subsidies to the fossil fuel industry, there is also likely to be support for removing these subsidies although doing so would be fiercely resisted by that sector, other sectors dependent on cheap fossil fuel energy and associated communities.

Information, Educational Outreach and Auditing

Information, educational outreach and auditing programs include a range of measures. Relatively passive programs include media campaigns, equipment labelling and home energy efficiency certification aimed at residential consumers. Training programs may target home builders and outreach programs may be developed for industry. Such measures are intended to communicate the benefits of energy efficiency and emission reductions and thus increase market acceptance of energy efficient alternatives. More aggressive programs include mandatory energy audits, pollution prevention planning with an energy component, or mandatory greenhouse gas emission inventories.

Passive Information and Education Outreach

Within Canada, Natural Resources Canada has focused much of its efforts on education and information programs. Much of the focus of information programs has been in the residential and passenger transportation sector. Although there have been some notable success stories in these sectors,[74] information programs by themselves generally do not appear to stimulate significant changes in technology or practices.[75] They may, however, complement other approaches. They will tend to work better where energy prices are higher.[76]

Energy efficiency labelling is mandatory for a broad range of prescribed household appliances under the *Energy Efficiency Act* and Natural Resources Canada has worked with a number of manufacturers and trade associations to introduce energy efficiency labeling on a voluntary basis in other sectors. Most experience with labelling programs indicates that are not very effective by themselves.[77] Early reviews of the Canadian appliance labelling program showed

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74 See Paul C Stern, "What Psychology Knows about Energy Conservation" (October 1992) 47:10 *American Psychologist* 1228.

75 Swisher, above at footnote 9, at 28.

76 William Kempton, John M. Darley and Paul C. Stern "Psychological Research for the New Energy Problems: Strategies and Opportunities" (October 1992) 47:10 *American Psychologist* 1213 at 1217.

77 Nadel, above at footnote 2, at 1.

that few consumers read the labels.[78] Similarly, most of the public appear to be oblivious to a Natural Resources Canada program intended to encourage the driving public to consider fuel efficiency in driving, maintaining and purchasing vehicles.[79]

Proactive outreach programs also have a significant role in increasing the adoption of energy efficient practices. For instance, trip reduction programs can increase levels of carpooling and encourage practices such as telecommuting. Ridesharing programs to match commuters with similar hours, origins and destinations can reduce peak vehicle trips by up to three percent, although this is dependent on the existence of other transportation demand management measures.[80] These programs are also cost effective in that they reduce many currently externalized costs such as congestion, noise and local pollution.[81]

Training programs for suppliers can remove market barriers to penetration of efficient technologies, but may not be sufficient. For instance, although Natural Resources Canada has succeeded in doubling the number of house builders trained in the R2000 standard since 1990, the penetration of the R2000 among new housing starts remains low, at 0.61% of new housing starts in 1995.[82]

Education and information may be significantly more effective in the industrial sector, where more attention is applied to how firms can cost effectively reduce energy costs. Generally, energy efficiency investments in these sectors are less demanding of immediate paybacks. A comparison of cost data for North American demand side management programs by utilities shows that industry programs tend to be much more cost effective than their residential counterparts.[83]

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78 Stern, above at footnote 74, at 1225. The labelling program did, when initially brought in, succeed in encouraging some manufacturers to change product mix toward more energy efficient models.

79 A 1994 Natural Resources Canada survey on the awareness of the motoring public indicated that nearly 70% of respondents stated that they had not heard any information on how to improve road transportation and fuel efficiency: Canada, Natural Resources Canada, "Improved Fuel Efficiency in Road Transportation and Advanced Technology Vehicles" (Paper prepared for Canadian Council of Ministers of Environment, draft, September 25, 1995) [unpublished].

80 Greater Vancouver Regional District and BC Transportation Financing Authority "Greater Vancouver Regional Transportation Demand Management Project" (Vancouver, BC Transportation Financing Authority, September 1996).

81 Todd Litman, "Transportation Cost Analysis: Technologies, Estimates and Implications" (Victoria Transportation Policy Institute, 1995) [unpublished].

82 Canada, Natural Resources Canada, *Influencing Energy Use in Canada* (Ottawa: Queen's Printer, 1996).

83 A comparison of scenarios for improving efficiency in British Columbia found that, for educational programs, the ratio of cost to energy savings was far higher in the industrial sector than other sectors. Collaborative Committee for the 1991-1994 Conservation Potential Review, above at footnote 17, Table II-2, page II-5.

As discussed in Chapter 4, 80% of the energy saving lighting upgrades under the EPA's Green Lights Program had payback periods of two years or less.

Energy Audits, Pollution Prevention Planning and Emission Inventories

Mandating energy auditing, inventories and pollution prevention planning is a more proactive approach than simply providing education, information and outreach services to reduce informational barriers to energy efficiency. These measures can be effective in ensuring that businesses identify cost effective ways of reducing emissions or energy use.

Mandatory energy auditing or pollution prevention planning with an energy component may help overcome organizational inertia and lead to discovery of emission reduction and energy efficiency improvements that would not otherwise be found. Mandatory pollution prevention planning laws in twenty US states are intended to force companies to rethink processes and products.[84] Companies are also required to develop pollution prevention plans that meet minimum criteria. Technical assistance and guidance on how to carefully examine all industrial and other processes, and find cost saving ways of reducing emissions is provided. Other states provide regulatory incentives to firms that conduct pollution prevention planning or auditing.

Most of these laws are focused on minimizing production and use of toxic substances, but the same concept could be applied to energy use and greenhouse gases. Although industry has traditionally been unsupportive of mandatory pollution prevention planning,[85] a number of industry representatives interviewed for this report were supportive of mandatory energy auditing, believing it could lead to a number of cost effective emission reductions.

Canadian and US experiences also show that companies which audit their energy use find savings that they did not expect. For instance, TransAlta Utilities encouraged energy audits of all its operations by applying an internal $2 per tonne carbon tax.[86] This motivation to find energy efficiency lead to over a million tonnes of emission reductions, most of which were profitable in the absence of the internal carbon tax. Energy audits by the Ontario Ministry of Environment suggest potential energy savings from the industrial sectors of twelve percent

84 Waste Reduction Institute for Training and Applications Research, Inc. "State Legislation Relating to Pollution Prevention," (WRITAR, April 1992) [unpublished].

85 See Federal Pollution Prevention Legislative Task Force, *Report of the Pollution Prevention Legislative Task Force*, (Ottawa: Environment Canada, October 1993).

86 Personal communication with John Hastie, TransAlta Corporation, Calgary.

simply using adjustments to existing processes with pay back periods of up to ten years.[87]

Some analyses of pollution prevention planning in the US conclude that every dollar spent on pollution prevention planning yields $5 to $8 in savings to industry.[88] Experience with pollution prevention planning in the United States indicates that industry support for mandatory pollution prevention planning increases once planning exercises produce noteworthy benefits in terms of waste reduction and cost savings. Seventy-eight per cent of firms required to submit plans under California's legislation found the process worthwhile.[89]

Corporate awareness of greenhouse gas emissions can also be improved by the inclusion of greenhouse gas emissions and energy use in Canada's National Pollutant Release Inventory (NPRI). The NPRI collects facility data on a number of pollutants, but does not include greenhouse gases. As is discussed further in Chapter 9, these data are often essential for informed policy making and are much less developed in Canada than the United States. Porter suggests that the NPRI's American equivalent, the Toxic Release Inventory, has been useful for raising corporate awareness and reducing emissions.[90]

In 1992, Germany proposed a regulation requiring energy audits for industrial facilities and mandatory implementation of measures that would pay back over the fiscal life time of a facility.

Although mandatory energy audits and inventories may be useful means of identifying cost effective ways of reducing energy use or emissions, implementation of these measures will depend on whether or not they meet the profitability standards for industry. Studies in Ontario indicate that industry is often unwilling to invest in energy efficiency improvements that have paybacks of over two years.[91] Carbon taxes and changes to tax treatments of energy efficiency standards can increase investments in energy efficiency. Alternatively, mandatory energy auditing could also be tied to mandatory implementation of energy efficiency improvements. In 1992, Germany proposed a regulation on heat management which included mandatory heat audits for the majority of industrial facilities and mandatory implementation of measures if they would pay back over the "fiscal life time" of the facility.[92]

87 L.D. Danny Harvey, *Carbon Dioxide Emission Reduction Potential in the Industrial Sector*, Background Report for Ontario Select Committee On Energy, (Ottawa: The Royal Society of Canada, 1990): see also ARA report, above at footnote 20, at 4-8.

88 Ken Geiser, "Pollution Prevention and Waste Reduction Planning, A Quick Look at Initial State Experience" (Massachusetts Toxic Use Reduction Institute, November 1992) [unpublished].

89 *Ibid*.

90 Toxic Release Inventory reported emissions declined by 11% from 1989 to 1990, and similar declines have been reported under NPRI, but much of the decline was due to changes in how emissions are measured: See "Right to Know Reports Show Changes" *Working Notes on Community Right to Know* [March-April 1993].

91 Harvey, above at footnote 87, at 94.

92 Personal Conversation with Wolfgang Weil, Umweltbundesamt (German Department of Environment).

While there may be some support within industry for mandatory energy audits, mandatory implementation of measures identified by energy audits is likely to be unpopular even if requirements are only imposed where they meet minimum criteria for economic viability. Industry in Germany was strongly opposed to mandatory implementation of measures identified in heat audits, arguing that changing economic conditions and changes to available technologies necessitated some degree of flexibility. There may also be some opposition to mandatory pollution prevention planning or energy auditing on the basis that they have a high administrative burden. Many within the BC Ministry of Environment, Lands and Parks believe that the use of facility-wide pollution prevention plans will increase burdens to ministry staff,[93] and experience with American pollution prevention planning indicates that, at least in the first years of mandatory pollution prevention, there is a steep learning curve both for industries and regulators.[94]

Another means of requiring energy efficiency improvements is to include energy audits in the environmental permitting process for major industrial facilities. A number of Canadian provinces are using integrated facility permits and are working with industry to prepare pollution prevention plans. Under the BC pollution prevention program, large industrial facilities cooperate with the Ministry of Environment, Lands and Parks in development of pollution prevention plans. Some of the plans include an energy audit.[95] Once plans are developed, the Ministry and companies negotiate over which components will be legally binding obligations and which will be left as voluntary measures. Although the current process is an alternative to normal permitting, legislative amendments may require large industrial facilities to develop approved pollution prevention plans. If the energy/greenhouse gas component of plans is expanded, significant emission reductions may be possible.

Evaluation of information, education and auditing programs

Environmental Effectiveness

The environmental effectiveness of information, education and auditing programs is difficult to assess, especially due to limited information available on labeling, training and information programs.[96] Of the various measures discussed, energy auditing is likely to be the most effective, although its effectiveness will depend

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[93] John Holdstock *et al.*, "Evaluation of the Waste Management Permit System" (Victoria: Project Report KPMG, October 19, 1995) [unpublished] at 37.

[94] Geiser, above at footnote 88.

[95] Personal conversation with Brad Wylynko, BC Ministry of Environment, Lands and Parks.

[96] Nadel, above at footnote 2, at 24.

on whether estimates of potential cost savings are accurate and the extent to which identified measures are implemented.

Leaders in environment, government, labour and industrial sectors generally recognize the effectiveness of audits and pollution prevention planning, but disagree over whether or not mandating these audits and plans would increase their use by industry.[97] Nonetheless, the experience of the US EPA's Green Lights Program, where companies often had to be cajoled into allowing the EPA to audit their energy use, and the US experience with pollution prevention planning, suggest that it is essential to overcome the resistance of firms to audits. Mandating audits is likely the simplest means of ensuring audits among all companies.

A difficulty with educational, outreach and auditing programs where implementation of cost saving measures is not mandatory is the potential for cream skimming. Cream skimming is a term used to describe situations where some energy conservation is obtained at low cost and the remainder of the economic potential is not pursued.[98] While this potential could be pursued in the future, it may no longer prove economic when not bundled with other technologies or when it has to bear full installation cost alone. This is a significant concern when trying to maximize the conservation potential. Cream skimming can occur under many different programs but it may be particularly problematic in educational and audit programs (that do not include mandatory implementation) because the goal of programs is to identify all cost saving measures, while leaving it to individuals to choose which to adopt.

Leakage resulting from education and auditing programs will tend to be low because of the focus on cost saving measures.

Because all the measures identified focus largely on reducing energy use and reducing emissions, the impacts tend to be permanent and associated with environmental benefits.

Cost Effectiveness

All information, education and auditing programs focus on measures that are cost effective under existing and anticipated market conditions. They thus tend to be cost effective. However, in the case of audits where implementation is made mandatory, measures may be less cost effective than initially anticipated. Programs need to be designed to provide flexibility if initial feasibility analysis proves faulty.

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97 Legislative Task Force on Pollution Prevention "Report to the Minister of Environment" (Ottawa: Environment Canada, 1993).

98 Collaborative Committee, above at footnote 17, at VI-31.

Information, education and auditing programs will complement any program, but are especially important where price signals are the primary means of reducing emissions, because they will help all sectors identify measures that are cost effective in the light of changing energy prices. They are therefore an especially important complement to carbon taxes, cap and emission allowance trading or cap and carbon coupon trading.

While information, education and auditing programs are unlikely to lead to adoption of non cost effective measures compared to, for example, poorly implemented prescriptive standards, overall cost effectiveness needs to consider administrative costs. There is little information on the administrative costs of labeling programs, but the information that does exist suggests they are cost effective.[99] In some cases, however, efforts may be wasted because of poor implementation. For instance, under Natural Resource Canada's voluntary vehicle fuel efficiency labeling program, government is incurring administrative costs and manufacturers are incurring labeling costs, but car dealers appear to be removing most of the labels prior to vehicles being displayed.[100] The programs' overall cost effectiveness would likely be greater if removal of labels were prohibited.

Equity

Because they are either voluntary or intended to identify low cost emission reductions, information, education and auditing programs raise few equity issues.

Feasibility

Educational, informational and trading programs generally appear to be well within the existing capability of government agencies. Auditing programs may put a greater strain on government resources than more passive programs, but, in British Columbia the move towards pollution prevention planning in facility permitting offers an opportunity to ensure auditing while minimizing new demands on government administration.

None of the programs discussed are likely to be adversely received by the public at large, although the industrial community is likely to resist mandatory

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99 Nadel, above at footnote 2, at 24.

100 Close to 75% of automobile dealerships received between 85 to 100% of vehicles from manufacturers with labels affixed, but close to 39% of dealerships surveyed by NRCan had no labels on the vehicles in their car lot and only 21% of the dealerships had labels on all vehicles in their lot: Canada, Natural Resources Canada, "Improved Fuel Efficiency in Road Transportation and Advanced Technology Vehicles" (Background paper for Canadian Council of Ministers of Environment, Clean Vehicles and Fuels Task Force, September 25, 1995) [unpublished] at 5.

implementation of measures identified in energy audits. There may also be some resistance to mandatory auditing from the industrial sector, although many representatives of industry interviewed for this report were open to the idea of mandatory auditing.

Procurement Programs

While information programs or audits may help energy users identify cost effective technologies, they are unlikely to be effective if the cost effective technology is not available on the market. Similarly, minimum energy performance standards or technology standards seldom force improved technology or improve the availability of highly efficient technologies. Technology procurement programs, on the other hand, can be effective means of encouraging manufacturers and suppliers to introduce efficient or low emission products, by ensuring that manufacturers have sufficient orders for improved products.

In some programs, government commits to directly purchasing a certain number of new products; in other cases government or other organizations organize buyers to purchase new technologies at costs that would be impossible without large orders. Often the products purchased under procurement programs enter the market with a price premium, but sufficiently sized procurement plans have often been successful in reducing the premium to near zero or lower.[101]

One of the best examples of procurement programs is the “Greenfreeze” program in Europe. In the early 1990s, European refrigerator manufacturers were reluctant to change to refrigeration technologies that were energy efficient and did not use ozone depleting substances. Greenpeace was able to get one company to commit to the new technology if it received sufficient pre-orders. It then campaigned to get tens of thousands of pre-orders for the refrigerator, thus allowing the company to secure capital investment in the new technology. Since then, the alternative technology has become the norm among all European manufacturers. Other examples of successful procurement programs include programs for lighting ballasts, computers and windows.[102]

Procurement programs have an ability to increase the penetration of leading edge technologies in a cost effective manner. The potential effectiveness of procurement programs will vary according to the extent to which buyers can be aggregated to purchase new technologies and the level of aggregation needed to motivate industry. For instance, the effectiveness of the Greenfreeze program and similar programs introduced by North American utilities are based on these programs’ ability to guarantee a large market for new technology. On the other

[101] Swisher, above at footnote 9, at 32.
[102] *Ibid.* at 32.

hand, a BC program to increase penetration of natural gas, propane and other "clean technology vehicles" appears to be running into difficulty because of a lack of purchasers and a resistance from the auto industry to make any clean technology vehicles available in the absence of large demand. Procurement programs raise few equity issues or feasibility issues beyond the ability of program administrators to aggregate sufficient demand.

Financial Incentives

Financial incentives to reduce demand for energy include deferred payment loans for retrofits or the purchase of energy efficient equipment, rebates for the purchase of energy efficient equipment, or taxes on inefficient equipment.

Rebate Programs

The high returns on investment needed to motivate consumers to invest in energy efficiency indicate a potential for using rebates and low interest loans to encourage cost effective investments.[103] Both loan programs and rebates can make energy efficient equipment more attractive by lowering capital costs. However, rebate programs appear to be more effective, especially among residential customers who are generally unwilling to assume debt to save energy.[104] Using rebates on energy efficient equipment to reduce demand for energy is often less expensive than increasing supply. BC Hydro's Industrial Motors Program cost only $0.010/kWh saved and its refrigerator rebate program cost only $0.013/kWh saved.[105]

Several rebate programs have been very effective in achieving major market transformations to greater levels of efficiency. The Industrial Motors Program increased the market share of efficient motors from four to 64% in four years, allowing BC Hydro to reduce rebate payments and impose even higher standards for qualifying motors.[106] BC Hydro's refrigerator program, by increasing the market share of efficient fridges, allowed the province to impose efficiency standards for fridges that would have been politically difficult in the absence of the rebate program. Bonneville Power Administration's subsidies to home

103 Analysis of energy users decisions regarding investment in energy efficiency suggest consumers want a return on investment of twenty to 200 percent per annum: see Swisher above at footnote 9 at 34. This is a far greater return on investment than individuals or companies expect when making other investments.

104 Swisher, above at footnote 9, at 34

105 Nadel, above at footnote 2, at 35.

106 Swisher, above at footnote 9 at 39.

builders and municipalities similarly eased adoption of BPA's model energy code into state law.[107]

Negative Incentives and Feebate Systems

One means of overcoming the fiscal constraints on government is to rely more on taxes specifically applied to inefficient equipment or inefficient use of equipment, possible earmarking the resulting revenue to rebates on efficient equipment or practices. Taxes discouraging consumption of a particular product have been highly effective in some circumstances; for instance, they were an effective means of phasing out leaded gasoline use in Canada and phasing out use of ozone depleting substances in the United States.

Financial incentives may be particularly effective in changing use patterns (as opposed to patterns of energy efficient equipment purchasing) in the transportation sector. Parking management, i.e., pricing parking to discourage single occupancy vehicle use, road tolls and insurance payable per kilometre driven have all been advocated to reduce single occupancy vehicle use in urban areas. Greater Vancouver's Regional Transportation Plan calls for the implementation of all these measures over the next five years; however, their implementation has been repeatedly deferred because of fear of public backlash. Although there is greater public support for tolls that fund a particular infrastructure development (e.g. tolls to pay for a new bridge) this sort of tolling is likely to be far less effective in reducing use patterns than tolling used to support improvements to the overall transportation system, including transit. Political resistance to tolls is likely to be a significant issue in North America.

Taxes on energy wasting products appear to be effective, although their effectiveness has been limited by their design. For instance, in the United States, a gas guzzler tax of between $1000 and $7700 is applied to gas guzzling passenger cars, but the tax applies to less than two percent of sales and is hidden in the purchase price.[108] Nonetheless it appears to have had some impact on improving fuel economy of luxury cars.[109]

Similarly, despite low taxation levels and mishandled implementation, the Ontario Tax for Fuel Conservation or feebate system appears to have improved average fuel efficiency. Under the feebate scheme, purchasers of inefficient cars pay a

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107 Nadel, above at footnote 2, at 20.

108 Greene, above at footnote 16, at 119. Cars are subject to the tax if their efficiency is below 22.5 miles per US gallon (10.6 litres per 100 km).

109 John M. DeCicco and Deborah Gordon, "Steering with Prices: Fuel and Vehicle Taxation as Market Incentives for Higher Fuel Economy" in *Transportation and Energy: Strategies for a Sustainable Transportation Systems* (Berkeley, California: American Council for Energy-Efficient Economy, 1995) at 183.

surcharge and purchasers of efficient cars receive a subsidy. Several factors limit the effectiveness of the feebate system: 90% of cars are not subject to either the surcharge or the subsidy; the maximum surcharge or subsidy is a small fraction of the purchase price; and most consumers only learn of the tax after they have decided to buy a car.[110] Nonetheless, while fuel efficiency has remained fairly static in most of Canada, the sale of cars qualifying for the subsidy increased from 2.6% in 1990 to 7.4% in 1992.

While the Ontario feebate system is politically unpopular, this was partially as result of mismanagement. There was no effort to garner environmental support beforehand, and the subsidy aspect was only added after political outcry about applying a new tax on cars (many of which were made in Ontario) in the middle of a recession.

Feebate systems could be made significantly more effective by increasing consumer awareness and making the fees variable across the whole range of fuel efficiencies. A 1993 analysis showed that a feebate system alone could stabilize passenger vehicle emissions, leading to a more fuel efficient vehicle stock more quickly and at less cost than a gasoline tax.[111] Applied at a national level, most of the improvement would come from improved technology rather than shifts to smaller cars. Although there may be increases in vehicle costs, consumers would save due to reduced energy costs.[112]

Evaluation of Financial Incentive Programs

Financial incentives and disincentives have a clear potential to change a variety of patterns that effect energy use and greenhouse gas emissions. Rebates have proven effective in accelerating capital stock turnover and encouraging adoption of most efficient technologies, especially where they are targeted to consumer purchases in equipment where consumers tend to undervalue long-term energy cost savings in relation to immediate capital costs. Analysis of feebates shows that they tend to be more effective than taxes in shifting purchasers to more efficient vehicles.[113] Disincentives — for instance, tolls and parking management

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110 International Institute for Sustainable Development *Making Budgets Green, Leading Practice in Taxation and Subsidy Reform* (Winnipeg: IISD, 1994) at 10-11. The rebate available to the most fuel efficient cars ($100) is a small fraction of the price of a car. The system raised $30 million in 1992.

111 Greene, above at footnote 16, at 124.

112 Greene, *ibid.* predicts increased costs of $300 per car to increase average fuel efficiency to 33 mpg by 2000. Canada, Natural Resources Canada, above at footnote 11, estimates net savings of 2 billion dollars by 2010 from a feebate system.

113 Robin Myles-McLean *et al.*, "Designing Incentive-Based Approaches to Limit Carbon Dioxide Emissions from the Light Duty Fleet" in Transportation and Global Change (Washington DC. American Council for an Energy Efficient Economy, 1993).

— may be particularly effective in changing behavior patterns related to the use of equipment.

The dynamics of a market — in particular issues of leakage and additionality — have to be carefully considered when evaluating rebates or feebate programs. For instance, rebate programs are best suited for products where the rebate is unlikely to increase the use of an energy consuming service. Rebates on refrigerators are unlikely to increase use of fridges, but rebates on fuel efficient vehicles will reduce barriers to car ownership and may lead to slight increases in vehicle kilometres traveled.

Non-additional energy efficiency investments or "free ridership" tend to be greatest for rebates on efficient equipment purchased during normal capital stock turnover. However, since adoption of energy efficient equipment during the normal course of capital stock turnover is usually more cost effective than retrofits, it may be worth accepting a significant degree of free ridership in order to ensure that cost effective additional investments in energy efficiency are realized.[114]

As discussed above, rebate programs for energy efficient equipment purchases have often been less expensive than producing additional electricity and thus decrease overall energy costs, even though they may increase prices per unit of energy. The cost effectiveness of revenue neutral feebates and negative incentives will depend on the extent to which they are appropriately targeted. They are thus similar to prescriptive standards in that they require government to be able to cost effectively identify low cost emission reduction opportunities. Nonetheless, given the tendency of many sectors to under invest in energy efficiency, there appears to be a large unrealized potential for the development of financial incentives which are no regrets measures.

Rebates raise few equity issues although the measures used to fund them may raise such issues. Feebates and negative incentives may be viewed as unfair to those paying increased costs, although public polling shows a greater acceptance of user fees such as tolls and parking charges to pay for costs of transportation infrastructure than through general revenue.[115] Given public support for measures such as increased transit, dedication of tolls to improving the general transportation system may be a means of overcoming public resistance while ensuring effectiveness, but the politics of negative incentives applied to behaviors such as driving will continue to be an issue in North America.

Two trends — government fiscal restraints and deregulation in the electric market — have reduced use of rebate programs in recent years. For instance, government

114 Swisher, above at footnote 9, at 37. The percentages of free-riders in some programs may be as high as 80%: also Nadel, above at footnote 2.

115 Viewpoint Research Limited, above at footnote 69.

cutbacks have lead Natural Resources Canada to phase out grants for conversions of vehicles to natural gas. Deregulation in the electricity market has reduced reliance on rebate programs because competition for retail electricity sales is largely based on price per unit of electricity. Even though rebate programs can reduce the cost of an energy service (e.g. reduce lighting or refrigeration costs), consumers tend to focus on lower costs per kilowatt hour. Since rebate programs increase costs per kilowatt hour, utilities are phasing out the programs. New means of delivering rebate programs will need to be developed. As discussed previously, one such means is to use funds from earmarked taxes to finance rebate programs.

Voluntary Agreements, Challenges and Covenants

During the 1990s, a number of countries have pursued reductions in greenhouse gas emissions by issuing challenges to industry to voluntarily reduce their emissions, and by entering voluntary agreements with industry to reduce emissions. The voluntary approach has attracted attention as a flexible, easily implemented tool for achieving reductions in the manner which best suits the economic circumstances of individual companies. The nature of voluntary approaches range from relatively informal nonbinding statements of intent to structured agreements with measurable goals, monitoring procedures and consequences in the event of failed implementation. This section briefly reviews different programs.

The main issue in relation to voluntary approaches is the extent to which emission reductions credited to these programs would have occurred in the absence of policy intervention. The extent of additional emission reductions is likely to vary depending on the nature of the program and the extent to which it is combined with other tools.

Voluntary Challenge Programs

The Climate Change Voluntary Challenge Registry (VCR) program is the mainstay of Canada's 1995 National Action Program on Climate Change. Under that program, participants submit letters of intent confirming their commitment to take action to address climate change. This is supposed to be followed by the development and submission of an action plan, and then regular progress reports on implementation.

As of September 1996, 587 letters of intent or action plans had been received. Although the sectors that represent Canada's biggest emitters have relatively high levels of participation, only twenty percent of Canada's largest companies have registered.[116]

Of the 587 submissions received in September 1996, most were simple letters of intent. Unfortunately, participating companies have been slow in moving from the letter of intent stage to the action plan stage: of 381 organizations that had submitted a letter of intent in October 1995, only 38% had submitted an action plan by September 1996.[117] Of the 274 action plans received by the VCR, 201 either did not include emissions inventories or did not commit to considering or implementing specific actions to reduce greenhouse gas emissions.[118]

The Voluntary Challenge and Registry has been widely criticized both by environmentalists and by some industry participants for failing to elicit changes to greenhouse gas emissions. Although some of the industry representatives interviewed for this report believed that the VCR was a factor in investment decisions, all believed a large majority of projects registered under the VCR were projects that would have occurred in any event.[119] Several industrial representatives, though supporters of voluntary approaches to reducing greenhouse gas emissions, referred to the VCR as a debacle or an embarrassment.

There may be some potential to increase the rigor of the Voluntary Challenge Program by providing more guidance on creation of credible baselines and through the suggestion that well-documented emission reductions which could go beyond "business as usual" may be recognized if future regulations mandate emission reductions. For instance, the *United States Energy Policy Act, 1992,* section 1605(b) provides extensive guidance on developing baselines, dealing with problems such as leakage and encouraging corporations to document emission reductions by holding out the possibility of well documented emission reductions being recognized under future regulatory programs.[120] Despite this potential for improving Canada's program, the experience of other jurisdictions supports the notion that voluntary challenge programs have minimal impact in ensuring adoption of additional emission reductions. One US EPA official estimated that only about two percent of projects registered under the section 1605(b) program were additional.

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116 Ranked by revenue: Pembina Institute, *Corporate Action on Climate Change 1996: an Independent Review* (Drayton Valley, Alberta: Pembina Institute, April 1997).

117 *Ibid.*

118 *Ibid.* Appendix E.

119 Trexler and Associates, Inc., above at footnote 64.

120 See United States Department of Energy, *General Guidelines: Voluntary Reporting of Greenhouse Gases under Section 1605(b) of the Energy Policy Act of 1992* (Washington, DC: Department of Energy, 1994) at 10.

Voluntary Agreements

An alternative to simple challenge and registries are voluntary agreements with industry. In 1996, the OECD program's Environment Directorate examined the potential to use voluntary agreements with industry as a means of motivating demand-side efficiency.[121] They divided voluntary agreements as follows:

- monitoring and reporting agreements;
- cooperative research and development agreements;
- performance based voluntary agreements; and,
- target based voluntary agreements.

Monitoring and Reporting Agreements

Monitoring and reporting is often an aspect of voluntary agreements, but can also by itself be a form of voluntary agreement, ensuring greater rigor, greater verification or some auditing of the claims made under voluntary challenges or developing information bases to plan future initiatives. As discussed above, facility specific information on energy use and greenhouse gas emissions can provide an incentive to emission reductions if published publicly in a way that allows comparisons between facilities.[122]

Cooperative Research and Development Agreements

> I am inaugurating a program to marshall both government and private research with the goal of producing an unconventionally powered, virtually pollution free automobile within five years.
>
> *— United States President, Richard M. Nixon, February 10, 1970.*

Voluntary cooperative research and development agreements focus on advancing the best practices frontier. They may include both agreements regarding research and development of technologies and agreements regarding demonstration of technologies not in widespread use.

This type of agreement can have potential where it is combined with procurement incentives. For instance, several large utilities in the United States offered

121 Mark Storey, *Policies and Measures for Common Action Demand Side Efficiency: Voluntary Agreements with Industry* (Paris: OECD Environmental Directorate, Second Draft, 3 June 1996) [unpublished].

122 See above under heading "Energy Audits, Pollution Prevention Planning and Emission Inventories".

refrigerator manufacturers a reward if they developed and then sold in the utilities' service areas refrigerators that met specified energy efficiency requirements.

Research coordination agreements mesh research activities of government and businesses. Little information is available on the extent to which cooperative research and development agreements have succeeded in pushing the research frontier. Typically research and development under cooperative agreements shifts research from technological advances that are likely to lead to radical technological advances in long time frames, to research where the emphasis is on incremental or near-term technological improvements.[123] This shift in priorities, although more likely to reduce emissions in the short term, is not necessarily the best mechanism for reducing greenhouse gases in the long term.

One of the best known cooperative research and development agreement is the US Partnership for a New Generation of Vehicles (PNGV). PNGV, launched in 1993 by the US Department of Commerce, is a partnership of the US Government and major American auto manufacturers. The goal of the program is to develop automobiles with three times the current average fuel economy, without sacrificing attributes such as price, size and performance. A production prototype is to be developed by 2004. PNGV is also intended to improve manufacturing technologies and make short term improvements in fuel efficiency.

The PNGV goals are significant. In the last decade, improvements in fuel efficient technology have been used to provide more power and accessories rather than improve fuel economy. As a result fuel economy has remained stable or even worsened.[124] Natural Resources Canada and the National Energy Board forecast that in the absence of regulatory intervention, there will be no to very slow improvements in energy efficiency of North American vehicles over the next 15 to 25 years.[125] The existence of clear, significant, quantifiable goals bodes well.

Operators who were not signatories to the vountary agreement, but would have been bound by statutory provisions, appear to be deliberately subverting the intent of the voluntary agreement.

On the other hand, will PNGV lead to new technologies and increase the fuel efficiency of the fleet? It is not clear the extent to which recent automotive technology developments have been brought about by PNGV. Other initiatives such as California's zero emission vehicle mandate are forcing technology, and many of the most significant steps in automotive technology have been at companies not involved in PNGV. Also PNGV does not promise to increase the

123 *Ibid.* at 22.

124 Although average fuel efficiency within weight classes has remained stable, a shift to less efficient sport utility vehicles has reduced overall efficiency of passenger vehicles.

125 The National Energy Board projects new car fleet efficiencies to be stable at 10.0 *l*/ 100 km until 2010 or later: Canada, National Energy Board *Canadian Energy, Supply and Demand, 1993-2010, Technical Report* (Ottawa: National Energy Board, December 1994) at 4-30. Natural Resources Canada projects an increase in efficiency from new cars from 9.7 *l*/100 km in 1995 to 8.3 in 2020: Natural Resources Canada, *Canada's Energy Outlook, 1996-2020* (Ottawa: Supply and Services Canada, April 1997) at 32.

actual sales of high efficiency cars and some experts suggest that the PNGV goals could be exceeded using existing tested technologies.[126] The only conclusion that can be drawn is that the progress resulting from voluntary research and development agreements is uncertain.

Performance Based Voluntary Agreements

Performance based voluntary agreements involve performance goals that are not legally binding or explicitly designed to preempt future regulatory requirements. In some cases, participants determine goals, while in others, goals are set by the program. Participation is primarily motivated by corporate credibility associated with being viewed as environmentally responsible or direct economic benefits that are expected to accrue from emission reduction measures.[127] Under the Canadian Industrial Program for Energy Conservation (CIPEC), and the Canadian Industrial Energy Innovators Initiative, companies from energy intensive sectors are encouraged to make nonbinding commitments to energy efficiency. Thirteen sectors have committed to one percent energy improvements per unit of production from 1995 to 2000.[128] Corporations set different goals within the different sectors.

Although incremental improvements in energy efficiency are important to reducing Canadian emissions, it is not clear whether improvements under CIPEC go beyond the improvements in energy efficiency that are a normal aspect of capital turnover but which still lead to higher emissions rates because of increased production. Between 1975 and 1990, the 700 companies participating in CIPEC had average improvements of 1.6% per year per unit of output.[129] The one percent energy efficiency improvement commitment is also similar to projections for improving energy intensity and energy efficiency projected by Natural Resources Canada.[130] Although CIPEC committed to stabilizing emissions at 1990 levels by 2000 provided growth is less than two percent per annum, industrial output is projected to grow by 3.1% per annum, meaning an increase in overall emissions from the CIPEC sectors.[131]

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126 Such technologies may not yet be production ready. See: Timothy Moore and Amory Lovins "Vehicle Design Strategies to Meet and Exceed PNGV Goals" (Society of Automotive Engineers Paper 951906, presented to SAE Future Transportation Technology Conference, Costa Mesa, CA, 4 August 1995) [unpublished] at 40.

127 Storey, above at footnote 121, at 22.

128 Canadian Industrial Program for Energy Conservation, *CIPEC 1994-1995 Annual Report* (Toronto: CIPEC, 1995) at 51.

129 Storey, above at footnote 121, at 36.

130 See Canada, Natural Resources Canada, *Canada's Energy Outlook 1992-2020*. These projections were made prior to CIEPEC refocussing on reduced greenhouse gas emissions.

131 Canada, Natural Resources Canada, *Canada's Energy Outlook 1996-2020* (Ottawa: Ministry of Supply and Services, 1997).

Voluntary Commitments and the Auto Industry

The effectiveness and problems of the voluntary agreements approach is exemplified in the history of voluntary agreements between the auto industry and governments.

The history of reliance on voluntary agreements between Ottawa and the auto industry began in 1981, when Parliament passed the *Motor Vehicle Fuel Consumption Standards Act.* If that *Act* had been proclaimed, it would have required manufacturers to meet an average fuel efficiency standard and provide fuel efficiency labels on new cars. In order to avoid the testing and reporting requirements of the *Act*, manufacturers committed to fuel efficiency labelling and to abiding by the Company Average Fuel Consumption (CAFC) standards equivalent to American CAFE standards.

In some ways this agreement was a success. Manufacturers have usually complied with Company Average Fuel Consumption standards.[132] On the other hand, improvement in efficiency would likely have occurred in any event because of American Company Average Fuel Efficiency (CAFE) standards and the integrated nature of the North American market. Moreover, in several years the average CAFC for all domestic manufacturers exceeded the agreed standard. Also, automotive dealers who were not signatories to the initial commitment, but would have been bound by the labelling provisions in the *Act*, appear to be deliberately subverting the intent of the agreement.[133]

Voluntary agreements often involve compromises to government positions in order to secure industry cooperation. In an effort to resolve problems with fuel consumption and labelling, and to achieve further improvements to fuel efficiency, Natural Resources Canada signed a 1995 letter of understanding on fuel efficiency with the Motor Vehicle Manufacturers' Association (MVMA).

MVMA agrees to encourage its members to make fuel consumption data available to purchasers and encourage retention of fuel consumption labels. The commitments tend to be vague and the few relatively specific commitments are measures that are being required by US law. In exchange, NRCan appears to promise to advocate positions favourable to the MVMA, promising to develop policies that enhance "flexible and comprehensive solutions, including gaining

...continued

132 Canada, Natural Resources Canada, "US and Canadian Approaches to Vehicle Fuel Efficiency Standards" Background Paper for Canadian Council of Ministers of Environment Clean Vehicle and Fuels Task Force, August 1995 [unpublished] at 4.

133 See above at footnote 100.

acceptance and recognition of sink measures, joint implementation and appropriate market-based policies".[134] Although these and other commitments cannot legally fetter government's ability to adopt different regulatory approaches, it may be inappropriate for a government to agree with an industrial sector to support specific policy directions that have broad implications and have not been discussed in public fora.

Lack of content and imbalance in commitments in agreements with the auto industry are not unique to Canada. Draft agreements between auto manufacturers and US states for the introduction of alternate technology vehicles (ATVs) involve government incentives programs and procurement of ATVs to the greatest extent possible. Manufacturers simply agree to work with states to supply alternate technology vehicles in a timely manner if states meet their commitments.

The difficulty with performance based voluntary agreements is that expectations and commitments are often left extremely vague. Although this can provide desirable flexibility, it can also mean the commitments have little substance. An example of the vagueness in commitments is provided in the box on the next pages.

Target Based Voluntary Agreements

Target based voluntary agreements comprise negotiated targets that are legally binding, which preempt future regulatory requirements or are tied to a strong regulatory threat. Targets are specific.

Germany, Denmark and the Netherlands have the greatest experiences in target based agreements to improve energy efficiency and reduce greenhouse gas emissions. By threatening to use industrial permits to reduce greenhouse gas emissions, the Dutch government was able to secure agreements with companies responsible for 90% of industrial primary energy consumption in the Netherlands. The average target for the agreement is a twenty percent increase in energy efficiency by the year 2000 from 1989 levels. Individual firm's targets are based on an inventory of economically viable measures developed by government. Government supports the program through tax rebates on investments in energy efficient technologies, some subsidizes and auditing support. The agreements are contracts under Dutch civil law and include detailed long-term reporting requirements. The Dutch program appears to be accelerating the adoption of

134 The text of the MVMA-Natural Resources Canada letter of understanding is in Appendix 1. The reference to reducing "to the maximum extent possible" regulatory barriers to implementation of voluntary actions appears to be an attempt to enlist NRCan's support in manufacturers debates with the Province of BC over motor vehicle emission regulations. The MVMA has argued these might reduce fuel efficiency.

energy efficacy within the Netherlands, although government and industry estimate that at least half of the twenty percent energy improvement would likely have taken place in the absence of agreements.

In Germany, industry has committed to voluntarily making a “special effort” to reduce industrial carbon dioxide emissions or energy consumption by up to twenty percent from 1987 levels by 2005. This commitment was motivated by threatened introduction of a carbon tax and regulation on waste heat use.[135] Although the German voluntary commitments are significant, the biggest share of the future reductions proposed under the commitment will likely be achieved simply through collapse of inefficient industries in East Germany. According to one analysis, the twenty percent reduction from all industry is less than could be expected under business as usual baseline trends.[136]

As discussed above,[137] Danish businesses categorized as using energy in “heavy processes” can secure reduced taxes if they commit to an agreement with the Danish government to follow a negotiated, company-initiated energy management plan. Little information is available on the impacts of this process.

The Ontario $C0_2$ Collaborative proposed enforcing voluntary commitments to corporate emission quotas through the threat of legislating quotas if companies fail to agree to sufficient emission reductions or fail to meet their commitments.

Evaluation of Voluntary Agreements and Challenges

Environmental Effectiveness

The use of agreements and voluntary challenges to achieve environmental ends is new, and thus there are few experiences to draw on to assess effectiveness. For those few programs with which there is familiarity — most notably the Voluntary Challenge Program and the US section 1605(b) program — the experience does not bode well. Although some positive actions occur under these programs, there is little evidence that they are pushing businesses to go beyond what they would do in the absence of agreements or challenges.

The difficulty in using voluntary approaches to secure improvements from business as usual patterns is that they have limited ability to remove the barriers to

135 See above under heading "Energy Audits, Pollution Prevention Planning and Emission Inventories".

136 Storey, above at footnote 121, at 40.

137 See above under the heading "Fine Tuning Taxes and Green Taxes," subheading "Ecological Tax Reform".

no regrets measures discussed in Chapter 4. They do not change the market potential for an individual measure. They do not alter the financial rate of return to an individual or firm under existing market conditions, conditions replete with barriers to no regrets measures such as split incentives and externalities, financial barriers and institutional barriers. They also do not create the sort of pressure that motivates innovation, overcomes organizational inertia and, according to Michael Porter and others, improves corporations' competitiveness.[138] Surveys of Canadian firms have repeatedly shown that while compliance with regulations, director liability and cost savings are top factors in influencing companies to take action on environmental issues, voluntary agreements are seldom rated as a top motivator.[139]

Agreements may be a useful means of delivering education, outreach and auditing programs, but they also suffer the weaknesses of outreach and auditing programs. For instance, they may lead to cream skimming as companies only adopt the most lucrative changes.

The only exception to this limited ability to move companies beyond their market potential is where there is a regulatory threat. If one assumes that companies have achieved their market potential, then a company acting in a rational, profit maximizing manner will only enter a voluntary agreement if it fears that the alternative to voluntary action is government intervention which it perceives as entailing a relatively high cost. Unfortunately, a number of factors work against companies going beyond their market potential. First, companies will be aware that, for many policy instruments, their individual action or inaction is unlikely to be decisive in whether government proceeds with a change to the tax system or an industry wide measure. Second, delaying regulatory action through the promise of action can be almost as profitable as stopping regulatory action.

Cost Effectiveness

The cost effectiveness of voluntary agreements is difficult to assess. On the one hand, they are unlikely to lead to firms adopting unnecessarily expensive emission reduction measures. On the other hand, they may not be effective in achieving some measures which are extremely cost effective from a societal perspective but not from an individual firm's perspective. For instance, in the absence of a strong regulatory threat, they are likely to be ineffective in securing efficiency

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138 See above under the heading "Prescriptive Standards".

139 KPMG, *Canadian Environmental Management Survey 1996* (Toronto: KPMG, 1996) and KPMG, *Canadian Environmental Management Survey 1994* (Toronto: KPMG, 1994); 95% and 93% in 1994 and 1996 of respondents respectively said compliance with regulations was a motivating factor influencing their organizations to take action on environmental issues, 49% and 53% respectively said cost savings were a factor, only 16% and 25% said voluntary government programs were a top motivating factor.

improvements that save consumers money but are unprofitable for manufacturers. Also, it is not clear whether government administrative costs incurred in developing registries and negotiating agreements are high or low in comparison to the additional emission reductions that result from the programs.

Equity

Voluntary challenge and agreement measures raise few equity issues. The only exception is that companies that go beyond their market potential, or that perceive themselves as having voluntarily taken significant action to reduce energy use and emissions, are often aggrieved by companies that do not take action. These companies often call for backstop regulation to ensure that their competitors do no gain an unfair advantage.

Feasibility

Voluntary programs are generally well within the existing capability of government agencies and are generally popular among industrial sectors. They are, however, politically unpopular with environmentalists and others who distrust their ability to realize real additional improvements. Their political acceptability is typically less of an issue where they are transparent, well monitored, and used in combination with regulatory and fiscal approaches.

Summary And Conclusions

Prescriptive Standards

- Any strategy to reduce greenhouse gas emissions, whether or not it uses economic instruments, will rely on a portfolio of instruments that includes prescriptive standards, changes to the tax system, education, outreach and auditing programs and other tools. No single instrument will be most effective in reducing all the barriers to implementation of no regrets or other cost effective measures. Some measures are very effective at removing some barriers to no regrets measures, but have no effect on other barriers or are very effective in changing some but not all of the decisions that collectively effect greenhouse gas emissions.

- Prescriptive standards will be a component of any portfolio. Although prescriptive standards are often seen as a drag on economic activity, they can also be a source of competitiveness by breaking through various barriers to cleaner, more efficient practices. Those that are best in this respect are those that are stringent yet flexible, focus on outcomes rather than mandating technologies, provide long lead times and anticipate worldwide trends. Many regulations aimed at greenhouse gas emissions fit this profile.

- Prescriptive standards can be technology forcing. There are numerous outstanding examples of regulations leading to environmental breakthroughs and increasing the competitiveness of companies that initially resisted them.

- Minimum energy efficiency standards or greenhouse gas emission performance standards are one of the most important means to reduce greenhouse gas emissions. They have proven to be very cost effective because of a tendency among consumers to undervalue the savings from energy efficient equipment. However, energy efficiency standards only target one aspect of the emission reduction equation. They generally only apply to new equipment or equipment being retrofitted for other purposes and have no impact on the rate at which older equipment is replaced with more efficient equipment or the efficient use of equipment. Also, energy efficiency standards and performance standards are relatively difficult to develop for highly specialized or heterogeneous products and processes. This is a particularly difficult problem in the industrial sector. Finally, the full potential of energy efficiency standards has not been realized because they have normally only been used to eliminate least efficient products from the market, rather than improve efficiency among all products. Like other prescriptive standards, energy efficiency standards have been contentious or politically difficult to implement where they are technology forcing or eliminate many products from the work place. These political barriers can, in some cases, be removed. For instance, other instruments, such as rebates, can encourage the penetration of new, cleaner or most efficient technologies, and then the resulting progress can be consolidated through adopting minimum standards. Also, average energy efficiency standards, such as CAFE standards, may be able to shift all new products to a higher level of energy efficiency.

- Other prescriptive standards also may have a role in reducing greenhouse gas emissions. Corporate limits on emissions rather than performance standards or source specific limits offer firms a high degree of flexibility in how they achieve a given emission target while at the same time limiting emissions regardless of economic growth. This flexibility can be extremely cost effective. However, corporate limits need to be carefully designed. If corporate limits are absolute and are not periodically reallocated, they will likely, especially in the long term, lead to leakage as firms with expanding production move to other jurisdictions. If flexibility is provided through atmospheric user fees and the fee is greater than the cost of an equivalent allowance or credit in a trading program, greater leakage may occur than is the case in an emissions trading program.

- Technological standards may be very useful in targeting hard to measure emissions, and many cost effective emission reductions can be achieved by considering greenhouse gas emissions in the development of other laws and regulations, ranging from speed limits to regulations aimed at protecting the ozone layer.

- Despite the potential for prescriptive standards, the implementation of many plans to reduce emissions through prescriptive standards have faltered when difficulties in implementation arise. And, while many prescriptive standards are highly cost effective and yield savings to consumers as a whole, they may not necessarily lead to the least cost emission reductions. Studies comparing the cost of emission reductions under prescriptive standards versus the least cost method shows that costs under prescriptive standards may be anywhere between six and 600% higher.

- The key to achieving least cost emission reductions through prescriptive standards is to equalize marginal costs of emission reduction; however, governments have difficulty in determining the costs given unpredictable technological developments and exaggeration of costs by businesses intent on deflecting regulatory requirements. Moreover, even if prescriptive standards could be targeted at the most economically efficient emission reductions, they will not necessarily lead to an equitable distribution of costs. Some companies with very high marginal costs of emission reduction may escape regulation while others, with low marginal costs pay a disproportionate amount.

Fine Tuning Taxes and Green Taxes

- In part because of the limited ability of government to identify and mandate lowest cost emission reduction measures, many economists have advocated changes to the tax system as a means of reducing greenhouse gas emissions. A number of changes to the tax system could be used. These include giving energy efficiency investments tax treatment comparable to investments in energy supply. More importantly, they involve eliminating the large biases in our current tax system in favour of energy production and energy intensive industries. An even more important step is to internalize environmental costs of production and consumption through taxing environmentally damaging activities.

- In the case of climate change, internalizing environmental costs means a carbon tax. A carbon tax could be used to either to fund emission reduction activities or to reduce taxes on jobs, income or value added.

- A concern with all aspects of green tax reform is the impact on competitiveness and possible leakage as energy intensive production shifts to other locations. Measures which internalize costs and reduce distortions in the tax system will, according to classic economic theory, lead to a more efficient economy. However, even though energy costs are only a small portion of value added for most sectors, most governments that have adopted significant carbon taxes have feared the impacts on their energy intensive sectors.

- Ideally, competitiveness concerns can be reduced by coordinated action in different jurisdictions, but this may not be feasible. Alternatively, exempting industries that are sensitive to competitiveness concerns also exempts those sectors that are most responsive to price signals. Attempts to use border adjustments — rebating taxes embodied in exports and applying duties to carbon embodied in imports — may be contrary to trade law.

- In the absence of interjurisdictional cooperation it may be more feasible to impose lower taxes, but dedicate these to funding emission reduction activities. Although this means that the opportunity to lower distortionary taxes is lost, dedicated taxes may not need to be as high as undedicated taxes because government agencies can target expenditures to no regrets measures. Depending on the extent to which government can target no-regrets measures, it may be also be more economically efficient to dedicate a carbon tax or similar charge to reducing greenhouse gas emissions.

- The political viability of tax measures is dependent on increased public recognition of subsidies to energy and energy intensive sectors and increased understanding of the concept of an ecological tax reform shift. Dedicated taxes may be made more politically viable if they are targeted at measures that will benefit tax-payers. For instance, gas taxes may have greater acceptability if they are spent on upgrading the transportation system, including transit.

Information, Education Outreach and Auditing

- Information and educational programs will play a part in any emission reduction strategy. They can range from programs that passively provide information services to interested parties to programs that require firms to fully consider all measures to reduce greenhouse gas emissions or energy use. They are particularly important adjuncts to programs such as carbon taxes or cap and emissions allowance trading where price signals are used to effect change.

- Experience with educational, outreach and auditing programs suggests they are cost effective, but mandatory energy audits may have a greater overall impact because they break through resistance to fundamental innovations. Overall impact and cost effectiveness will depend on whether or not potential cost savings are accurately identified and whether identified measures are implemented. The effectiveness of educational, outreach and auditing programs measures is still limited in that these programs only reduce one of the barriers to no regrets emission reduction measures.

Procurement Programs

- Procurement programs can be cost effective means of ensuring the introduction of new, less carbon intensive technologies into the market place. Even though they may be cost effective on a societal basis, they can impose costs on the businesses or governments procuring the technology if it is initially introduced at a premium. Whether or not they are successful will also depend on the ability to aggregate sufficient demand to create economies of scale for manufacturers or to reduce manufacturers risk in introducing new products.

Financial Incentives

- Financial incentives — including rebates, feebates and negative incentives such as road tolls all have the potential to effect a variety of behaviors, accelerate capital stock turnover and shift purchasing decisions to more efficient technologies. They can internalize some costs and overcome financial and other barriers to no regrets measures. Negative incentives and the fee portion of feebates are often politically unpopular although resistance to measures such as road tolls may be surmountable through dedication to transportation infrastructure or reduction of other fees. Rebates are popular although difficult in an era of government fiscal restraint and electrical market restructuring. Some of the latter problem may be overcome by using line charges to fund rebate programs.

Voluntary Agreements, Challenges and Covenants

- The use of agreements and voluntary challenges to achieve environmental ends is new, and thus there are few experiences to draw on to assess effectiveness. The difficulty in using voluntary agreements and challenges to secure improvements from business as usual patterns is that they have a limited ability to remove the barriers to no regrets measures discussed in Chapter 4. The only exception to this limited ability to move companies beyond their market potential is where there is a strong regulatory threat, but even where a strong regulatory threat exists, it is not clear that it will be a sufficient incentive to action because companies will be tempted to free ride on the actions of others and the costs of no action may be too far in the future to affect action in the immediate term.

- Although voluntary approaches are unlikely to lead to firms adopting unnecessarily expensive emission reduction measures, it is not clear whether government administrative costs incurred in developing registries and negotiating agreements are high or low in comparison to the additional emission reductions that result from the programs.

Appendix 1

Extract from Motor Vehicle Manufacturers' Association — Natural Resources Canada Letter of Understanding

a. MVMA agrees to

i) act as a focal point to assist its member companies in their efforts to reduce greenhouse gas emissions where coordinated action is appropriate;

ii) work with NRCan to identify information requirements .. necessary to enhance the understanding of transportation factors and its impact on greenhouse gas emissions;

iii) work with NRCan on behalf of MVMA members to develop a comprehensive strategy for the motor vehicle manufacturing industry to contribute to greenhouse gas limitation, including:

- identifying ways to help drivers realize the benefits of fuel savings,

- influencing on-road energy efficiency (e.g. through promotion of centralized enhanced inspection and maintenance programs and use of on-board diagnostic (OBD II) equipment on new vehicles as permitted by the availability of compatible fuels necessary for emissions certification and in-use performance compliance),

- influencing vehicle purchase decisions towards energy efficient products through the distribution of educational materials,

- promoting technological progress in the fuel efficiency of new vehicles, while meeting the needs of consumers.

b. MVMA agrees to encourage its members to:

i) submit data to the federal government on the fuel consumption ratings and sales of new light duty motor vehicles (VFEES data) on a consistent and complete basis;

ii) work with NRCan on the development of effective consumer information programs;

iii) provide information on vehicle fuel consumption to dealers for prospective new vehicle purchasers;

iv) work with their dealer networks to improve retention of fuel consumption labels attached to new vehicles while on their lots and in their showrooms;

3. NATURAL RESOURCES CANADA ACTIONS

a. NRCan will work with other federal departments and provincial governments to:

i) identify, recognize, and reduce to the maximum extent possible any barriers to implementation of voluntary and cost-effective actions to limit greenhouse gas emissions, including government regulatory or non-regulatory actions which impede, counter or retard automotive industry reduction efforts; and

ii) develop policies at domestic and international levels, that enhance flexible and comprehensive solutions, including gaining acceptance and recognition of sink measures, joint implementation and appropriate market-based policies required to influence consumer behaviour.

Chapter 7:

Introduction to Emissions and Carbon Trading

At both the international and national levels, the economic literature indicates that instruments that provide economic incentives, such as taxes and tradable quotas/permits, are likely to be more cost-effective than other approaches.

— IPCC, Working Group III (1995)

Emissions trading has been proposed as a means for overcoming the weaknesses of prescriptive standards. Although energy efficiency standards, energy auditing, emissions limits and technology standards can in many cases be used to ensure implementation of no regrets measures, as we move towards more difficult measures, regulations are unlikely to lead to the most cost effective emissions reductions if regulators are unable to accurately estimate the cost of different abatement opportunities.

Prescriptive standards are also often ineffective in spurring innovation. For instance, if the regulated community fears that it may be forced to undertake an emission reduction measure which it would not voluntarily choose to do, emitters are encouraged to exaggerate abatement costs rather than finding the innovations that lead to cost effective abatement. In some cases, prescriptive standards, especially technology standards, may hamper adoption of innovative technologies.

These weaknesses have lead to calls for emissions trading as an alternative to extensive reliance on prescriptive standards. Under trading programs, individual emitters who are most familiar with their processes are given greater flexibility in choosing control measures. Where an emitter or energy user can, at a low or negative cost, reduce emissions or energy use below what is required by regulation they can sell a credit or an allowance to an emitter who cannot reduce their emissions as easily. The theory of emissions trading assumes that by placing increased choice of control measures in the hands of emitters, the energy users and emitters will find lower cost means of making their reductions than would be achieved by regulators. This reduces the costs of emissions reduction to society as a whole.

The emissions trading discussed in the report is emissions trading between firms and individuals rather than nations. As discussed in Chapter 3, the *Kyoto Protocol* calls for some form of trading between countries. Although the focus of this report is domestic trading, Chapter 11 discusses how trading among nation states can be integrated with a domestic trading program.

Political Acceptability of Emission Trading

An overarching issue in relation to trading is the political acceptability of the concept of trading. The US Title IV Acid Rain Program experience shows that an unusual coalition of business and environmental interests can be built around an effective trading program that reduces emissions. The US sulphur dioxide trading program was supported by a number of national environmental organizations, market advocates and businesses who foresaw potential profits through trading.[1] Nonetheless, there is a perception among many politicians and senior bureaucrats that businesses generally favour “market based approaches” such as trading, whereas environmentalists are generally opposed to such measures. From the interviews conducted in preparation of this report, neither assumption is particularly accurate.

Environmentalist Perspective

In discussions with environmentalists involved in the global climate change issue, few were found who opposed trading on the ground that it was wrong to grant the right to emit carbon dioxide or other greenhouse gases. There was recognition that trading in greenhouse gases does not raise the spectre of local hot spots of pollution as it does in the context of local or regional pollutants. Rather than pointing the finger of moral culpability at the ubiquitous causes of climate change, environmentalists were focused on finding solutions that would work. And, finally, they recognized that a regulatory emissions trading system involves greater limitations on the “right to pollute” than currently exist for greenhouse gases.

Concerns tended to be pragmatic. Environmentalists were universally concerned about how trading would work in practice, whether it was efficient, what its distributional effects would be, whether it would dilute the environmental impact

1 Nancy Kete, "The US Acid Rain Control Allowance Trading System," in *Climate Change: Designing a Tradeable Permit System* (Paris: Organization for Economic Co-operation and Development, 1992) at 101.

of regulations, and whether some types of emission reduction projects should or should not be allowed. They also were concerned that trading could have the practical effect of locking society into a level of emissions that is too high.

Some also expressed concerns that trading would privatize the decision making process of how emissions are reduced. In particular, a combination of regulations, carbon taxes and climate funds would give the public a greater role in determining where emissions reductions occur, potentially giving the public an opportunity to focus on no-regrets emission reduction measures that have multiple social and environmental benefits. While this concern is fundamental, its cogency is closely related to what additional programs exist to realize no-regrets measures.

Business Support for Trading

Although Canadian and British Columbian businesses often call for “market based solutions” to environmental problems, business support for regulations which give emission reductions a market value is lukewarm. Market based solutions, as the term is used by business, may be something of an oxymoron. Unlike most consumer markets, the pollution market is created by government regulations. In the absence of regulations, at most there would be a limited market for credits or allowances. As discussed in Chapter 8, any demand for reductions would be for the purposes of demonstrating corporate goodwill, forestalling regulation, and possibly for hedging against future regulation.

On the other hand, most business stakeholders favour trading over prescriptive standards, although they recognize the importance of some prescriptive standards such as energy efficiency standards. The US experience in trading for local pollutants is that, while nominally in support of more cost effective regulations, industry’s enthusiasm is tempered by the possibility that it may have to pay for a privilege which had previously been free. Some firms prefer prescriptive standards because they believe they will be better able to minimize regulatory costs in the political arena than in the market.[2] Business support for trading will, however, increase as the cost of prescriptive standards increases. In the US, emissions trading approaches were only attempted after many of the relatively low cost fixes for controlling pollution had been implemented.[3] To the extent prescriptive standards offer low or negative cost means of reducing emissions, there may not be a willingness to accept the uncertainty and transactional costs involved in market based solutions.

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[2] John P. Dwyer, "California's Tradeable Emissions Policy and Its Application to the Control of Greenhouse Gases" in *Climate Change: Designing a Tradeable Permit System* (Paris: Organization for Economic Cooperation and Development, 1992) at 51.

[3] Robert Hahn and Roger Noll, "Environmental Markets in the Year 2000" (1990) 4 *J. Risk & Uncertainty*, 351 at 364.

Categorizing Trading Programs

Trading programs have been in place in the United States since the 1970s. During that time they have evolved in a number of different forms.

Credit Trading

Credit trading refers to a program in which credits created by an emission reduction measure can be used as an alternative to compliance with a regulatory or voluntary standard. The first trading programs in the United States were simply a means of making regulatory standards less onerous. Trading was an alternative to complying with the normal regulatory standard. If the owner of Source A was required by regulation to reduce emissions from Source A by x tonnes/day, the owner could instead choose to have Source B reduce its emissions by x tonnes/day below projected baseline emissions. The credits generated from reducing Source B emissions could be applied against Source A emissions. Sources A and B may be different emission stacks within the same firm or completely different facilities with different owners.

This form of trading has been used several times in relation to greenhouse gas emissions. As discussed in Chapter 8, Oregon has only allowed fossil fuel burning electrical generation projects to proceed if a portion of the emissions from these projects are offset by emission reductions elsewhere. Also, many corporations in the energy sector have voluntarily purchased credits to offset their emissions, and British Columbia is leading a pilot credit trading program. The activities undertaken to generate credits range from projects such as treeplanting, composting municipal waste, and improving cattle nutrition, to increasing the penetration of energy efficient technologies in households, and fuel switching projects.

Credit trading in the United States initially relied heavily on administrative oversight. In the emission reduction credit trading program under the US *Clean Air Act*, government administrators tried to evaluate the flow of emission reductions that would result from an emission reduction project and to determine whether the reduced emissions were equal to the increased emissions that occurred from not complying with a regulatory standard. The difficulty of forecasting whether or not an emission reduction project would offset the increased emissions from not complying with a regulated standard, and the associated administrative costs of approving trades, proved to be the central weakness with the US emission reduction credit trading program. The cost of estimating emissions and getting trades approved was high, yet in many cases projects with little or no emission benefit were approved as an alternative to compliance with a regulated standard.

These problems lead to the proposals for open market trading programs. Rather than prospectively trying to forecast if a project would sufficiently offset emissions, emitters can retrospectively measure the reductions that occur from an emission reduction project. Each discrete emission reduction that results from an emission reduction measure can be applied against the increased emissions that result from not complying with a regulated standard. Although government provides guidance on how to measure emission reductions, in most cases government pre-approval is not necessary before an emitter uses a credit as a compliance option. Governments instead audit companies to make sure their increased emissions are matched by credits, and to ensure that the credits are valid. The emitter must be able to document that credits are based on accurate measurements and haven't been used by other sources.

Credit trading is discussed in Chapter 8.

Cap and Emission Allowance Trading Programs

In the simplest form of cap and emission allowance trading program, the government establishes a limit, or cap, on total allowable emissions during a time period. It then allocates allowances to release that pollutant, with the total emissions allowed by all allowances being equal to the cap set by government. Allowances can be allocated by auction or can be free of charge. All sources of a specified class (e.g., all point sources with emissions greater than y) must hold sufficient allowances for their emissions.

Those sources that emit less than their allocation may sell surplus allowances to other sources whose emissions would otherwise exceed the allowances allocated to them. Those with the lowest abatement costs reduce emissions and sell their allowances. Those with high abatement costs, and under most allocation methods, new and expanded sources, buy allowances. Over time, either the number of allowances in circulation can be reduced or the emissions allowed per allowance can be reduced so that the overall cap is reduced.

Cap and emission allowance trading programs have been used in the US to reduce sulphur dioxide emissions from utilities, to reduce sulphur oxide and nitrous oxide emissions in the Los Angeles area, and are now being developed to reduce local pollutant emissions in Illinois and the northeast states. Cap and emission carbon dioxide allowance trading programs have been proposed for large point sources in Canada, the US, and internationally.

Cap and emission allowance trading is discussed in greater detail in Chapter 9.

Cap and Carbon Coupon Trading

Trading systems are usually thought of as involving trades of emission rights between point sources. However, trading can also involve trading coupons that permit the holder to produce, import, distribute or use a substance. A report prepared for the Clean Air Strategy for Alberta proposed controlling carbon dioxide emissions by government distributing carbon coupons that limit the total distribution or production and importation of carbon in fossil fuels.[4] This would allow a trading system to capture emissions from millions of small emitters such as motor vehicle owners which would be difficult to regulate using emissions trading. Cap and trade systems for the import and production of substances have been used in both the US and Canada to phase out various ozone depleting substances.

Cap and carbon coupon trading is discussed in more detail in Chapter 10.

Performance/Product Standard Trading

A final form of trading is where regulations create a standard, but firms that exceed that standard (i.e., “over-comply”) can trade credits with firms that do not meet the standard. For instance, under the US Corporate Average Fuel Efficiency (CAFE) standards for cars, car manufacturers that exceed the average fuel efficiency standard can sell credits to manufacturers who would otherwise be out of compliance. This form of trading was used by the US EPA to phase out lead from gasoline,[5] and is part of the vehicle emission standards of British Columbia,[6] California[7] and several other US states.

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4 National Economic Research Associates Inc., *Market Based Approaches to Managing Air Emissions in Alberta* (Alberta: Alberta Energy, Alberta Environment and Canadian Petroleum Association, 1991).

5 The US lead trading program is often analogized to a cap and carbon coupon trading program, but since the operative limit was not a cap on total lead that could be used in leaded gasoline, but instead a limit on lead per gallon of gasoline it was in fact a performance or product standard trading program. See Barry D. Nussbaum, "Phasing down lead in gasoline in the US: mandates, incentives, trading and banking" in *Climate Change: Designing a Tradeable Permit System* (Paris: OECD, 1992) at 25.

6 Section 5(12), *Motor Vehicle Emission Reduction Regulation,* B.C. Reg. 517/95.

7 Title 13 *California Code of Regulations* s. 1960 1.

Open vs. Closed Systems

Trading in a cap and emission allowance trading program involves trading within a closed system. Trading can only occur between sources within the scope of the program, i.e., sources to whom allowances have been allocated. The range of emission reduction projects which can be used to comply with emission limits is limited. Most likely the scope of a cap and emission allowance trading program would be limited to industrial sources. A cap and carbon coupon trading program's scope is broader, but still limited to carbon dioxide from fossil fuel combustion. This can mean that some low cost emission reductions are not pursued because they fall outside the scope of the program.

On the other hand, credit trading is usually not closed. The range of emission reduction projects which can be pursued is broader than the scope of sources that are allowed to use trading as a compliance option. For instance, a gasoline refiner wanting to avoid the costs of an ethanol blending regulation could buy credits generated from a project involving planting trees to sequester carbon. The advantage to this sort of trading is that it allows emitters to find the lowest price means of reducing emissions.

The disadvantage to an open system is that, where there are few or no limits to the sources from which a credit can be generated, a larger percentage of the credits generated will be from projects that would have occurred in any event. This is simply because, if a project would have proceeded in any event, the credit generator can offer its credits at extremely low prices that will out-compete credits from projects that would not have occurred in the absence of revenue from credits — i.e., from additional projects. If credits from non-additional projects are used to comply with regulatory standards, the effect of trading is to negate the impact of regulatory standards. This is discussed more in Chapter 8.

The False Distinctions Between Allowance and Credit Trading

Often, credit trading is distinguished from cap and emission allowance trading or cap and carbon coupon trading on the basis that cap and trade programs will effectively cap total pollution, whereas programs in which credit trading is used as a compliance option to performance standards allow emissions to grow with economic activity. In theory this is true, if the cap and trade program applies to all emissions and trading as a compliance option is applied to regulatory standards that are static. However, cap and trade programs usually do not include all emissions within the scope of the program, and credit trading can cap emissions if regulatory standards are continuously made more stringent.

Combined Systems

None of the systems described above are mutually exclusive. Participants in a cap and emission allowance trading program may also be given the option of buying credits from emission reductions sources outside the scope of the program. A cap and emission allowance trading program may apply to industrial point sources while a cap and carbon coupon trading program applies to fossil fuels used by mobile and area sources. Allowances could be used as coupons and vice versa. Similarly, a credit trading may be very restricted so that most trades occur in a closed system.

Emissions and Carbon Trading

The subsequent chapters review the basic forms of trading and issues that arise in relation to specific types of projects. Chapter 8 reviews credit trading. Chapter 9 looks at cap and emission allowance trading and Chapter 10 looks at cap and carbon coupon trading. Each of these chapters begins with a discussion of the experience to date with these types of trading.

Chapters 11 to 13 discuss several issues that cut across all forms of trading. Chapter 11 looks at the creation of credits through activities in other countries and trading of emission allowances or carbon coupons between entities in different countries. Chapter 12 discusses the generation of credits through forestry and other sequestration activities. Chapter 13 examines inter-pollutant trading, e.g., whether or not allowances and credits should be simply denominated credits or allowances for a tonne of carbon dioxide or its equivalent.

Chapter 8:

Credit Trading

> *Only the most naive gamblers bet against physics, and only the most irresponsible bet with their grandchildren's resources.*
>
> *— William Calvin*

Credit trading programs are essentially a means of making regulatory standards less onerous. Trading is an alternative to complying with the normal regulatory standard. If the owner of Source A is required by regulation to reduce emissions from Source A by x tonnes/day, the owner can instead choose to have Source B reduce its emissions by x tonnes/day below a projected baseline. The credits generated from reducing Source B emissions could be applied against Source A emissions. Sources A and B may be different emission stacks within the same firm or completely different facilities with different owners.

Under the US *Clean Air Act* credit trading programs, the term "offsets" initially referred to credits used to offset the emissions from new or expanding facilities. However, in the context of greenhouse gases, offsets are often used to describe either projects that reduce net greenhouse gas emissions and are used to offset the emissions from another firm or the credits generated by such a project. In this report, a company which undertakes a project to sell credits is referred to as the "credit generator". A firm, community or nation which is the site of such a project but does not undertake it is the "project host". A firm using the credit as an alternative to reducing its emissions is the "credit user".

There is a broad range of greenhouse gas emission reduction projects which could be potentially used to generate credits: reduced energy demand, switches to less carbon intensive fuels, cogeneration projects, and enhanced sinks for greenhouse gases (for instance, trees planted on agricultural land).

Credit trading is an attractive alternative to cap and emission allowance trading because the driving force for environmental improvement — more regulatory standards – can be developed in a piecemeal manner, allowing for the gradual implementation of a program. Also, the range of emission reduction projects which can be carried out and used to meet regulatory requirements is broader than in a cap and emissions allowance trading program, potentially offering greater cost savings.

This chapter reviews the experience in Canada and the United States with credit trading programs for pollutants other than greenhouse gases. The more limited experience with credit trading for greenhouse gases is then reviewed. Various design issues that must be considered in setting up a credit trading program are discussed. Throughout the chapter there are many references to clean development projects, sequestration projects and projects involving greenhouse gas emissions other than carbon dioxide. These examples are used because they illustrate issues that are relevant to all projects. Issues related specifically to sequestration, the clean development mechanism and trading in gases other than carbon dioxide are discussed in Chapters 11, 12, and 13.

Credit Trading Programs

Credit trading was pioneered in the United States as a result of complaints from business that environmental standards were becoming too costly and were limiting economic growth. Credit trading programs were initially used for a number of local air pollutants, but have more recently been used to reduce emissions of greenhouse gases.

Credit Trading for Local Pollutants

The 1970 US *Clean Air Act* tried to bring all areas of the US rapidly into "attainment" with ambient local air quality objectives by relying on prescriptive standards. Although successful in improving air quality, the *Clean Air Act* failed to bring all areas into attainment, and by the mid 1970s there was a growing perception that environmental controls were expensive and inhibiting economic growth.[1]

Clean Air Act Emission Reduction Credit Trading

The first emission trading policy in the world — the US Environmental Protection Agency offset policy — was motivated by the *Clean Air Act* prohibition on firms constructing new facilities or significantly modifying existing facilities in non-

1 An excellent discussion of the various policies can be found in Robert Hahn and Gordon Hester, "Marketable Permits: Lessons for Theory and Practice" (1989) 16 *Ecology Law Quarterly* 360 at 361.

attainment areas, and by the concern that this would hinder growth. In 1976, the EPA passed a rule stating that firms could build new polluting facilities in non-attainment areas if they met stringent prescriptive standards[2] and offset all emissions with emission reduction credits from other facilities. The offset policy was also intended to spur the design of more efficient pollution control technologies. Applications for emission reduction credits would be approved by regulatory agencies if they were real (i.e., the result of an actual reduction and not a "paper reduction" which did not truly exist), surplus to regulatory requirements, quantifiable, enforceable and permanent.

Since 1976, the EPA has revamped its trading program several times, but the offset program has remained a constant feature. Other elements include "netting" where a firm wanting to modify its facilities can avoid the most burdensome elements of pre-construction approval and stringent regulatory standards if the modifications do not increase net emissions. "Bubbles" allow a firm or group of firms to vary levels of emission control at different sources so long as emissions are not expanded in aggregate. Offsets, bubbles and netting all involve balancing a forecast stream of emissions against a forecast stream of emission reductions. "Banking" allows a firm to generate credits and, at a later date, sell the credits or use them for purposes of complying with regulations. The awkward distinctions between netting, offsets, banking and bubbles are largely historic[3] and there is no reason any Canadian program would continue with these distinctions.[4]

The results of the US emission reduction credit trading programs[5] have been mixed. For bubbles, trading volumes have been low, partly because of high transaction costs of trades.[6] Bubbles and offsets require a heavy investment of state, federal and private resources for prospective creation of credits and trade approval. Netting has been by far the most frequently used form of emission

2 In non-attainment areas Lowest Achievable Emissions Rates are mandated.

3 John P. Dwyer, "California's Tradeable Emissions Policy and Its Application to the Control of Greenhouse Gases," *Climate Change: Designing a Tradeable Permit System* (Paris: Organization for Economic Co-operation and Development, 1992) at 44.

4 The ARA Consulting Group Inc. and Bovar-Concord Environmental, *Potential Economic Instrument Approaches to Air Quality Management in the GVRD* (Greater Vancouver Regional District, 1995).

5 State agencies and local air quality authorities created by states are primarily responsible for implementing the US *Clean Air Act*. Thus, the exact rules used to implement EPA trading policies vary from state to state and even among areas within larger states like California.

6 United States, Environmental Protection Agency, "Model Open Market Rule for Ozone Smog Precursors" Federal Register, July 26, 1995. See Dwyer, above at footnote 3, at 44.

reduction credit trading. The cost savings from netting are estimated at between $500 million and $12 billion between 1974 and 1989.[7]

Emission reduction credit trading programs have also sometimes been incorrectly promoted as a means of improving air quality. In non-attainment areas the credits used in bubbles and offsets were discounted, so that emissions reduction credits would theoretically more than compensate for new or expanded sources. Credits would be discounted by as much as 1.8:1 if the reduction occurred in another area, but under some programs credits would be discounted by some small amount in all cases. In fact, despite discounting credits, emission reduction credit trading has had no significant impact on environmental quality,[8] and there have been a number of transactions in which aggregate emissions increased as a result of the trade.

Also, numerous projects have slipped under the thresholds that trigger offset requirements.[9] While offsets generally maintained aggregate emissions from large sources, emissions from smaller sources increased. This is not a fault of trading *per se*, but a result of the levels at which thresholds are set.

Clean Air Act — Open Market Trading

In 1995, the EPA issued a proposed rule on how states could use a new form of credit trading — open market trading— to meet *Clean Air Act* goals. Open market trading programs are significantly different from the original emission reduction credit trading programs. In particular, credits (referred to as Discrete Emission Reductions or DERs in the open market trading rule) are based on a retrospective measurement of the difference between lowest allowable emissions or emissions that would have occurred given normal operation, and actual emissions during the generation period.[10]

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7 Hahn and Hester, above at footnote 1, at 374; savings for offsets and bubbles have been much lower.

8 Ernst Mohr, "Tradeable Emission Permits for controlling Greenhouse Gases and Complementary Policies" *Climate Change: Designing a Tradeable Permit System* (Paris: Organization for Economic Co-operation and Development: Paris, 1992) at 43; Hahn and Hester, above at footnote 1, at 375.

9 Dwyer, above at footnote 3. Between 1976 and 1986 the California South Coast Air Quality Management District allowed 3 956 sources to release an additional 200 000 pounds per day of hydrocarbon emissions because they were below threshold levels. Offsets in the same period we only 27 000 pounds per day: See James Tripp and Daniel Dudek, "Institutional Guidelines for Designing Successful Transferable Rights Programs" (1989) 6 *Yale Journal of Regulation* 369-391.

10 EPA, Model Open Market Trading Rule for Ozone Smog Precursors, s. IV (A), above at footnote 6.

Under the EPA's proposed rule, emission reductions from shutdowns or production curtailments cannot be used to generate DERs and ten percent of emission reductions are discounted or "retired" for the benefit of the environment. The EPA provides guidance on how DERs are measured. The process involves significant monitoring and statistical analysis of emissions, ensuring that less certain emission reductions are discounted. The need for monitoring equipment and statistical analysis in the creation of credits will likely mean that most DER generators will be large sources with the necessary monitoring and analytical capability.[11]

DERs are not preapproved prior to use. Those involved in the environmental industry expect that, because of uncertainty in whether or not a DER will be approved, firms will compensate by purchasing an oversupply of DERs to cover shortfalls if any DERs are found invalid. In this way uncertainty of not having a preapproval process could work to the advantage of the environment. DERs can be used to meet emission standards for existing sources, but cannot be used to avoid the tight standards applicable to new sources.[12]

Since EPA's issuance of a proposed open market trading rule in 1995, concerns have been raised regarding the prescriptiveness of the proposed rule. As a result, the EPA currently intends to issue less prescriptive guidelines for open market trading. In the meantime, some states are moving forward with their own versions of open market trading.

Proposals for Trading as a Compliance Option in British Columbia

In 1993, BC Hydro explored the possibility of credit trading as an alternative to reducing emissions of oxides of nitrogen from its Burrard Thermal Generating Plant. A study identified several leading offsite emission reduction opportunities including funding of transportation demand management programs and funding an accelerated vehicle retirement program. However, the study found that the cost of off site emission reductions to meet oxides of nitrogen standards would be higher than installing on site control technology.[13] That, combined with public concern

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11 EPA "Meeting Summary of the October 19, 1995 Proposed Open Market Trading Rule Stakeholders Meeting on Quantification Protocols, Research Triangle Park, North Carolina" [unpublished].

12 DERs can be used to avoid "Reasonably Available Control Technology" requirements applicable to existing sources, but not "Lowest Achievable Emission Rates" or "Best Available Control Technology" standards applicable to new sources.

13 On the other hand, offsite measures were more effective in reducing other pollution problems, and thus more cost effective overall: Concord Environmental Corporation and

over hotspots of pollution in the Port Moody area, lead to BC Hydro withdrawing its proposal.

Recently, West Coast Energy and BC Ministry of Environment, Lands and Parks discussed an informal trading arrangement in relation to West Coast Energy's proposal to expand production at its Pine River natural gas processing plant. If it expanded, West Coast Energy would not be able to meet Ministry of Environment guidelines for sulphur recovery unless it completely replaced the existing plant. BC Ministry of Environment, Lands and Parks did not see the added emissions as being environmentally problematic, and accepted the principle of offsetting the difference.[14] However, there has been no agreement as to acceptable credit generating projects. West Coast Energy subsequently shelved plans to expand the Pine River plant.

Pilot Open Market Trading Program in Canada

Currently, the Pilot Emission Reduction Trading ("PERT") program is underway for emissions trading in the Windsor-Quebec Corridor. The focus of PERT is trading nitrous oxide and volatile organics, but it has been expanded to include other pollutants, including greenhouse gases. Several trades have occurred, some involving purchases of DERs created under American open market trading program rules. Purchases have been motivated by two factors: a corporate commitment to reduce nitrous oxide emissions by 40% in the case of Ontario Hydro; and, the expectation that, if trading programs are adopted in the future, PERT credits will be recognized for the purposes of compliance if they meet the criteria established by future programs. The latter expectation is based on a letter of understanding being drafted for the Ontario Ministry of Environment.

Offsets Under the US Clean Water Act

Under the US *Clean Water Act*, credit trading has been established for several watersheds. New and expanded sources or sources that are unable to meet permitted levels of emissions are required to offset their excess or expanded emissions. Emission reductions are discounted at a 2:1 ratio to reflect uncertainties in measurement and impact of non-point source reductions.[15]

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the ARA Consulting Group *Offsite Mitigation Opportunities Discussion Paper* (BC Hydro Environmental Resources, February 1993) [unpublished].

14 Personal communication with Robin Fairservice, BC Environment, Prince George Region.

15 Hahn and Hester, above at footnote 1, at 391-395.

Carbon Dioxide Emission Reduction Projects

A number of greenhouse gas emitters have been either required to, or have volunteered to, offset their emissions of greenhouse gases by carrying out emission reduction projects at other locations.

Voluntary Emission Reduction Projects

Since the late 1980s a number of corporations around the world have voluntarily undertaken emission reduction or sequestration projects to offset emissions of greenhouse gases.

Applied Energy Services

The first project initiated to offset carbon dioxide emissions began in 1988 when Applied Energy Services, an independent power producer, asked World Resources Institute to develop a project to offset the lifetime carbon dioxide emissions from Applied Energy's new coal fired generating plant in Connecticut. The World Resources Institute developed a sustainable agroforestry project in Guatemala with an estimated ability to sequester 16.3 million tonnes of carbon over 40 years. Although Applied Energy received all the credits from the project, its $2 million investment leveraged an additional $10 million in funds and in-kind service from CARE, the Guatemala government and the US Peace Corps.[16]

Since then a number of power producers around the world have helped fund emission reduction projects. Most of the projects are carbon sequestration projects involving either reestablishing forest cover on land that has not been recently forested or planting trees in urban areas. Most of the projects have been located in developing countries.

GEMCo

In Canada, a consortium of natural gas utilities, pipeline companies, electric power producers and other energy companies has recently formed the Greenhouse Emissions Management Consortium, more often known as GEMCo. The primary functions of GEMCo are to promote the credit trading concept, engage in research and develop potential credit generation projects, manage credit generating

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16 Paul Faeth, *et al.*, *Evaluating the Carbon Sequestration Benefits of Forestry Projects in Developing Countries* (Washington, DC: World Resources Institute, February 1994) at 3.

projects, provide policy advice to members, and demonstrate alternatives to government regulation of greenhouse gases. GEMCo's focus will be on domestic emission reduction projects rather than clean development or joint implementation projects. Several members of GEMCo have undertaken emission reduction projects independent of GEMCo. For instance, TransAlta Corporation has invested in a project to improve cattle nutrition in India resulting in reduced methane emissions.

The primary motivation for these voluntary investments in emission reduction projects in the US and Canada has been a desire to promote corporate goodwill and to stave off regulation. Large emitters and business associations in both the United States and Canada have enthusiastically promoted registration of emission reduction projects in the voluntary challenge and registry programs of both countries as an alternative to regulation, and a means of showing corporate responsibility.

Also, investment in emission reduction projects and offset options (contractual rights to implement and claim credit for an emission reduction project at some time in the future) have been promoted as a speculative investment which will increase in value if government takes regulatory action or adopts carbon taxes. Under future regulatory or tax programs, credits for emission reduction projects or options for projects may become valuable commodities. In the United States there is some expectation that emission reduction projects carried out and registered now may form the basis for credits against any carbon tax that is imposed in the future.[17]

BC Greenhouse Gas Emission Reduction Trading Pilot

In British Columbia, the BC Ministry of Environment, Lands and Parks and BC Ministry of Employment and Investment are leading a greenhouse gas emission reduction trading pilot that involves a number of other provinces, the federal government and representatives from industry and environmental groups. The program is similar to the PERT Program. Credits will be generated in a manner similar to the US open market trading program, and it is anticipated that the government participants will recognize credits for the purposes of compliance with future obligations.

Mandatory Emission Reduction Projects

On several occasions projects to offset emissions have been necessary to secure government approval for electrical generating facilities.

New Zealand Taranaki Plant

Using the *Resource Management Act, 1991,* the New Zealand government required developers of the 400 MW Taranaki combined cycle/cogeneration natural gas fired generating plant (the Taranaki Plant) to completely offset increased emissions from the New Zealand electricity generation system that

[17] *Ibid.*

resulted from the plant.[18] A Board of Inquiry determined that the plant's 1.5 million tonne per annum discharge constituted an adverse effect that needed to be mitigated if possible, and recommended that increases in emissions from the New Zealand power system be offset by emission reductions at other locations or establishment of carbon sinks that would store the plant's emissions in perpetuity. The Board of Inquiry's recommended requirements were adopted in the plant's air discharge permit.

Oregon Exemption

In 1995, the Oregon legislature approved an exemption (the Oregon Exemption) for a 500 MW thermal electric generating facility from regulatory requirements that virtually prohibited new generating facilities. The Oregon Energy Facility Siting Council granted the Oregon Exemption to the facility that had the lowest environmental impacts, including carbon dioxide. The carbon dioxide emission reduction and sequestration packages offered by each proposal were the focus of the hearings that determined who would receive the exemption.[19] Because the Oregon Exemption process analyzed issues in more detail than any other credit trading program or project it is referred to repeatedly throughout this chapter.

Oregon combines regulatory performance standards for carbon dioxide with credit trading and atmospheric user fees.

CO_2 Offset Policy Efficiency Act

In 1991 draft legislation calling for mandatory offsets of emissions from major new sources was introduced into the US Senate and House of Representatives. Despite some bipartisan support the *CO_2 Offset Policy Efficiency Act* did not proceed past the committee stage in either the Senate or the House.

Oregon CO_2 Standard

In June 1997, Oregon passed legislation requiring new electricity producers to offset their greenhouse gas emissions.[20] The Oregon Energy Facility Siting Council is required to develop carbon dioxide emission standards for new fossil fuel burning energy plants. The initial standard for new natural gas burning plants requires seventeen percent less carbon dioxide per kilowatt hour than the most

18 New Zealand, Ministry of Environment, "Air Discharge Permit for Taranaki Combined Cycle Power Station" (Decision of Honourable Simon Upton, 23 March 1995) [unpublished].

19 Trexler and Associates, Inc., "First-of-Its-Kind Regulatory Proceeding to Result in Significant Global Warming Mitigation in Oregon" [July 1996] *The Mitigation Monitor*, at 1: Oregon, Energy Facility Siting Council, *Order: In the matter of the 500 Megawatt Exemption from the Demonstration of Showing Need for a Power Plant*, 1 August 1996 [unpublished].

20 69th Oregon Legislative Assembly, 1997 Regular Session, House Bill 3283.

efficient natural gas plant operating in the US. As more efficient plants are established the standard will become tighter. Electricity generators can meet the standard by not using fossil fuels, by making technological breakthroughs in efficiency or by offsetting their emissions through emission reductions at other locations.

Facility operators can either choose to carry out an approved program of emission reduction projects themselves, or pay into a fund which will finance emission reduction projects. The fund will be administered by a nonprofit organization set up to perform carbon dioxide mitigation functions. The organization will be governed by three appointees of the Oregon Energy Facility Siting Council, three Oregon environmental group representatives approved by a well-known environmental funding foundation, and an industry representative. The projects can include renewable energy projects, energy efficiency projects or projects to increase the carbon stored in forests.

Designing a Credit Trading Program

The environmental effectiveness, cost effectiveness, political acceptability and equity of a credit trading program will depend on a number of design issues. The key issues are:

- **Design Issue 1:** The purpose of credits;
- **Design Issue 2:** Open Market or Emission Reduction Credit Trading;
- **Design Issue 3:** Measuring Emission Reductions;
- **Design Issue 4:** Baseline Setting and Additionality;
- **Design Issue 5:** Leakage;
- **Design Issue 6:** Compatibility with Other Goals;
- **Design Issue 7:** Timing of Emission Reductions;
- **Design Issue 8:** Banking and Credit Lifetime;
- **Design Issue 9:** Monitoring and Enforcement in an Emission Reduction Credit Trading Program;
- **Design Issue 10:** Regulatory Liability in an Open Market Trading Program;

- **Design Issue 11:** Enforcement; and
- **Design Issue 12:** Who has the Right to Claim Credits?

Design Issue 1: The Purpose of Credits

Issues:

a) If credit trading is used as a compliance option for some regulations, should it be available as a compliance option for all regulations that affect greenhouse gas emissions?

b) If credit trading is used as a compliance option, what regulatory standards should be developed?

c) Are voluntary corporate commitments that can be met through credit trading likely to be an effective alternative to regulations and credit trading?

Discussion:

Credits have no inherent value. They only have value when they can be used to meet voluntary commitments or as an alternative means of meeting regulatory requirements.

Regulations as a Source of Demand

Regulations will create demand for credits unless regulators are successful in consistently mandating the lowest cost means of reducing emissions. As discussed in Chapter 6, they are unlikely to be successful in this regard.

Strict regulations have been the motivator for credit trading programs in the United States, but both programs limit the regulations for which credits can be used as a compliance option. Typically the programs limit the use of credits as a compliance option to emission performance standards or technology standards which have well known or predictable emission reduction results. Chapter 6 noted that many regulations already impact on greenhouse gas emissions and that there is potential for others which would reduce emissions further. Could credits be used as an alternative to compliance with these regulations?

For many of the regulations discussed in Chapter 6, it may be inappropriate to allow use of credits as a compliance option. In many cases, a credit compliance option is inappropriate because the regulation has multiple goals. For instance, allowing car manufacturers to avoid energy efficiency standards by purchasing credits may be as effective a way to reduce greenhouse gas emissions as relying on standards by themselves. However, even if credit trading is the least cost option for the auto industry, it may not be the least cost solution on a broader level. One of the barriers to energy efficient vehicles is the split incentive that exists between car manufacturers and car owners. Efficiency standards are typically intended to protect car drivers from unnecessarily high energy bills and initially to conserve petroleum resources. The value of reducing car drivers' fuel bills will not be fully reflected in manufacturers' choices of meeting a standard or purchasing credits.

A credit compliance option may also be inappropriate because the number of credits needed would be very uncertain. For instance, the emission reductions that will occur as a result of fugitive emission control requirements will, for instance, be very difficult to measure or predict, depending to a large extent on highly debatable assumptions.

Credit trading without regulation is like having a cart but no horse. Voluntary trading may help design the cart, but the sight of the horse coming down the road is unlikely to move the emission reduction cart very far.

Finally, it may be inappropriate to use trading as an alternative to compliance with standards for new facilities where doing so would lock in higher emission levels for a long period.[21] For instance, a program might measure emission reductions from a baseline reflecting the regulatory standards in effect when the emission reduction project is first implemented. In this situation, a cement plant with a fifty year lifetime may choose to use a more carbon intensive technology than required by regulation, and achieve compliance through credits generated by blending ethanol in gasoline. This would make it more difficult for subsequent governments to cost effectively reduce emissions. The ethanol blending emission reduction opportunity has been appropriated to compensate for the higher emissions from burning coal, so this option is not available to regulators. At the same time, cost effective retrofits of the cement plant may be impossible. Both US open market trading programs and emission reduction trading programs restrict the use of credits as an alternative to compliance with technology standards for new facilities.

The problem is less acute in open market trading programs where credits are based on emission reductions that are in excess of regulatory requirements in effect at the time of the emission reduction. The company using credits as an alternative to compliance bears the risk that low cost credits will not be available

21 See David Hawkins, "Providing Economic Incentives in Environmental Regulation" (1991) at 8 *Yale J. of Regulation* 463 at 490.

if government mandates ethanol blending. Also, activities funded by credits may smooth the way to ratcheting up of standards.[22]

Nonetheless, credit trading could be used as a compliance option for many regulations. Regulations could be made more compatible with trading by defining whether credits can be used to completely or partially avoid compliance with the regulated standard, and by defining the number of credits necessary to avoid compliance with the standard. For instance, an electrical appliance efficiency standard could require efficiency levels to be met to the extent they are intended to lead to lower costs for the consumer, but allow the level of efficiency required by an environmental multiplier to be met through the use of credits. Regulations can define what assumptions manufacturers must use when calculating how many credits they require (for instance, defining assumptions as to the source of electric power used).

Manufacturers of goods subject to efficiency standards should not be allowed to completely avoid efficiency standards by purchasing credits because of these standards have a consumer protection aspect. They are intended to overcome informational barriers and split incentives that lead to under-investment in energy efficiency. If unlimited credit trading were allowed, the manufacturer's least cost solution may not be society's least cost solution.

While it may be inappropriate to provide a credit compliance option for many of the regulations discussed in Chapter 6, there are many regulations which become more feasible when credit trading is available as a compliance option. Credit trading will affect the types of regulations adopted by government.

Emission Performance Standards

Chapter 6 noted that greenhouse gas emission performance standards, e.g., limits on greenhouse gas emissions per unit of production, may not reduce these emissions at lowest cost because government will have difficulty determining abatement costs at different sources. This problem is particularly acute for industrial sources whose heterogeneous nature makes setting of performance standards or emission limits particularly difficult.

However, if a regulation allows use of credits as a compliance option, concerns about burdening emitters with unduly expensive requirements will be much less persuasive. Indeed, it is possible to set standards for which compliance is only possible with credits. For instance, the Oregon CO_2 Standard is more stringent than the cleanest fossil fuel technology in commercial production.

22 See under the heading "Design Issue 2: Open Market or Emission Reduction Credit Trading" under the sub-heading, "Prospective credit generation vs. retrospective credit generation."

Absolute Limits

If credit trading programs are adopted it also becomes more feasible to place strict limits on emission sources. The main users of credits under US programs are facilities locating in non-attainment areas. These facilities are given a choice: limit emissions to some threshold (sometimes zero) or offset all emissions above the threshold.

A greenhouse gas trading program could create a number of absolute emission limits. For instance:

- Any new or modified point source could be required to offset some or all of its emissions. The *CO_2 Offset Policy Efficiency Act* proposed using modification or construction as a trigger for offset requirements. A threshold could be set below which sources would be exempt from the standard.

- All new or modified point sources could be required to offset some or all of their emissions if they are "reviewable projects" as defined in the *BC Utilities Commission Act* or the BC *Environmental Assessment Act.* (The Oregon CO_2 Standard will require emission reduction projects to offset emissions for all new fossil fuel burning power plants.)

- Plants which reach a set age could be required to offset their emissions. (Under the *CO_2 Offset Policy Efficiency Act*, after 2005 any utility plant reaching 65 years would be required to carry out emission reduction projects to offset its emissions.)

- Corporate quotas could be established in the manner suggested by the Ontario CO_2 Collaborative.[23]

The above requirements have the advantage of relative simplicity as compared to establishing performance standards for new and existing emitters. However, they are generally similar in that the burden of purchasing credits is placed on new or modified sources or firms with expanding emissions.[24] There are a number of draw backs to this approach:

- Focusing the burden of emission reductions on new or modified sources may impose a relatively high burden on companies which are efficient but nonetheless energy intensive. If the effect is to decrease the competitiveness

[23] See Chapter 6, under the heading "Prescriptive Standards," subheading "Emission Limits."

[24] The Ontario CO_2 Collaborative did not define how emission quotas would be allocated, but appears to assume allocation of future emission quotas within the industrial sector on the basis of past emissions or production. Other possible methods of allocation are discussed in Chapter 9, Design Issue 19.

of the efficient company, production could shift to other jurisdictions with standards that spread the burden of compliance more equitably.

- Focusing the burden of emission reductions on new or modified sources will not encourage existing facilities to make cost effective modifications unless the emission reductions are sufficiently large to justify their marketing as credits.

- Requiring new or modified point sources to only offset emissions if they are over some threshold may exclude most sources. For instance, the *C02 Offsets Policy Efficiency Act* only applied to new or modified utilities and point sources that emitted more than 100,000 short tons of C02 per annum. This would seldom be triggered in British Columbia,[25] and there is a danger projects may be designed to avoid such a requirement. Emission performance standards, on the other hand, will encourage all emitters to improve their efficiency.

- Thresholds can encourage emitters to design projects to avoid offset requirements. In the early 1990s eighty percent of new emissions in the Bay Area Air Quality Management District did not trigger offsets because emitters carefully designed projects to avoid triggers.[26] Thresholds have since been reduced to zero.

Credits in the Absence of Regulation

Although the demand for credits is normally driven by regulation, there may be some demand for credits even in the absence of regulations.

Some Canadian businesses, in particular GEMCo member companies, are investing in emission reduction projects which will have real impacts on the environment. Companies may seek out credits for three reasons:

- To improve their corporate image.

- To avoid or delay regulation which they perceive as imposing net costs on them. Regulation can be avoided or delayed by showing voluntary progress toward environmental objectives.

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25 Source specific emissions numbers from other sources are not available, although Environment Canada’s Pollution Data Branch is considering developing this sort of data in the future. Burrard Thermal is the largest carbon dioxide emitter in the province. At full capacity it would emit about 3 million tonnes per year.

26 Dwyer, above at footnote 3, at 47 to 50.

- To provide a hedge against future regulation. Companies may wish to invest in credits with the hope that they can use them to comply with future regulatory requirements.

Unfortunately, in the absence of regulation, demand for credits will likely be insufficient to cause significant changes to net global emissions of greenhouse gases. Companies will make decisions on whether to invest in emission reduction projects by weighing a number of factors: the public image value of the credit; the cost of a credit which represents real improvements to global emissions; the cost of a credit which does not represent real improvements from the baseline emissions; the cost of a credit in the future discounted to present day values; the cost of purchasing an offset option; the probability that a credit generated now will be recognized under a future regulatory program; and, the probability that investing in an emission reduction now will avoid future regulation. These factors are unlikely to support major investments in emission reduction projects under a voluntary trading program:

- The public image value of a credit is likely to be minimal although it may be greater for larger, high profile companies. In the absence of public controversy, the technical validity of a credit is unlikely to affect its public image value significantly.

- The cost of generating a credit in the future will be discounted and tend to be lower than the cost of generating a credit now.

- If companies can purchase offset options to pursue emission reductions at a later date, the purchase of the option will allow companies to secure low cost emission reduction opportunities without actually reducing emissions.

- The promise of taking voluntary action now, without actually delivering on the promise, may be an effective way to defer costs.

- The likelihood that purchasing a credit will avoid future regulation is small.

- The probability that a credit generated now will meet future regulatory requirements is less certain than in the case of a credit generated with full knowledge of regulatory criteria.

At a recent conference on credit for emission reductions in developing nations, a leading advocate of credit trading from one of the world's largest energy corporations summed up the likely demand for joint implementation credits succinctly: "Only one thing will make joint implementation happen: if there is a problem, regulate!"[27] Experience with other voluntary programs also suggests

[27] John Palmisano, Enron Corporation, London, UK, as reported in Nicola Ross "Global Change and Joint Implementation: Industry Enters the Fray"[June 23, 1997] *Enviroline* 1.

that regulations are needed to drive demand for credits. Trading under the PERT program has been very limited, and the most commentaries on the Voluntary Challenge and Registry have suggested that the VCR leads to few emission reductions that would not have occurred in the business as usual scenario.

Unless demand for credits is fairly high, most of the emission reduction projects are likely to be projects that would have occurred in the absence of any voluntary credit program, i.e., if they will not be additional. As is discussed below, additionality can be achieved by a demand for credits which overwhelms the supply of non-additional emission reduction projects. Voluntary trading is very unlikely to create that level of demand for credits. Instead, companies will seek out the most cost effective emission reduction projects that yield the best rates of return. This behaviour is understandable, but in the absence of stronger demand for credits created by regulation, it is unlikely to yield many additional emission reduction projects. This does not negate the value of pilot projects like PERT and the BC Greenhouse Gas Emission Reduction Pilot — they are valuable learning exercises — but voluntary credit trading is unlikely to have a significant impact on emissions.

Conclusions:

Using regulation with credit trading as a compliance option would involve a different mix of regulations from what would be used if trading was not a compliance option. Use of credits as a compliance option is incompatible with many of the types of regulation discussed in Chapter 6. However, if credits can be used as a compliance option, a number of forms of regulation which would otherwise be unfeasible and possibly expensive become more feasible and cost effective. If a program allows the use of credits as a compliance option, it would be necessary to specify those regulations for which credits could be used as a compliance option.

Although performance standards with trading as a compliance option involve the development of standards for numerous sources — a process which is expensive — they are likely more cost effective, environmentally effective and equitable than requirements that focus the brunt of emission reduction requirements on new or expanding sources. Many of the drawbacks to performance standards when trading is not available as a compliance option are less significant if trading is a compliance option.

It is unlikely that voluntary trading programs will create significant demand for credits and lead to significant numbers of additional projects.

Design Issue 2: Open Market or Emission Reduction Credit Trading?

Issues:

a) Should credits represent a discrete emission reduction which has been retrospectively measured, or a flow of forecast emission reductions which will come from an emission reduction project?

b) If credits are used as an option for compliance with regulations, what process should be used to ensure credits are valid? Should government be required to approve a credit before it can be used?

c) Should credits be applied against discrete emission exceedances that have been measured retrospectively or a flow of emission exceedances that is forecast at the time an emitter decides not to comply with a regulatory standard?

Discussion:

The above issues have been grouped together because they tend to be linked. In open market trading programs emission reductions are measured retrospectively, and credits represent discrete emission reductions (i.e., a credit represents a tonne of emissions avoided at a particular time rather than a flow of future emission reductions). These discrete emission reductions are used to offset discrete emission exceedances rather than a flow of future emission exceedances. Open market trading programs also tend to rely on after-the-fact government auditing of credit use and credit validity rather than government pre-approval of credits and credit use. Open market trading programs include not only US programs modelled on the proposed EPA rule, but the PERT program, the program proposed under the *CO_2 Offsets Policy Efficiency Act*, the BC Greenhouse Gas Emission Reduction Trading Pilot and the New Zealand Taranaki Plant offset requirements.

On the other hand, in emissions reduction credit trading programs a flow of future emissions is prospectively forecast, and is applied against a flow of future emission exceedances. Government normally approves credits before their use. Programs modeled in this way include not only the US *Clean Air Act* emission reduction credit trading program, but also the Oregon exemption requirements and the offset requirements in the Oregon CO_2 Standard.

Prospective Credit Generation vs. Retrospective Credit Generation

Credits represent the difference between estimates of emissions with an emission reduction project and a baseline of estimated emissions without the project. If credits are generated by retrospectively estimating the impact of a project, estimates of both the emissions with the project and the baseline will be more accurate. For instance, if credits are generated by subsidizing the cost of highly efficient compact fluorescent lights in a community, it will be possible to measure actual penetration of that technology as well as penetration of the technology in communities that do not have subsidies.

If credits are generated by a prospective forecast of future emission reductions, it will be necessary to forecast both the baseline and actual emissions. Actual emission forecasts can be tricky, having to factor in intangibles such as the reliability of a project. If emission reductions are measured retrospectively, many of these intangibles can be ignored: the impacts of a project can be measured.[28]

In many cases it will also be harder and more complicated to forecast a baseline (to estimate what emissions will be if this project is not implemented) than to estimate one retrospectively (to estimate what emissions would have been if this project was not implemented). For example, California mobile emissions reduction programs give emission reduction credits for plans to make yearly purchases of low emission buses. However, the credits generated have to factor in the likelihood of future regulatory change.[29] If credits were measured retrospectively, the baseline can simply be changed if there is a change to legal standards or other circumstances that affect the baseline.

Also, because the baseline shifts to reflect actual regulatory standards, an Open market trading program does not allow an emitter to permanently appropriate cost effective emission reductions to offsetting its emissions. The purchaser of credits bears the risk that a cost effective emission reduction measure will be mandated and its source of low cost credits ended.[30] Indeed, if there is sufficient demand, credits may increase the penetration of an alternate technology to a point where it is relatively easy for government to mandate the technology. Just as utility rebates

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28 Subject to problems related to sequestration projects discussed in Chapter 12.

29 Credits from buses purchased after 2002 are discounted by 50% because of the likelihood that bus emission standards will be more stringent after that year: See also, California Environmental Protection Agency, Stationary Source Division and Mobile Source Division, “Mobile Source Emission Reduction Credits: Guidelines for the Generation and Use of Mobile Source Reduction Credits” (El Monte, Air Resources Board, February 1994) [unpublished] at 42.

30 See above, under the heading “Design Issue 1: The Purpose of Credits," subheading "Regulations as a source of demand”.

or subsidies for energy efficient equipment have dramatically shifted markets toward more efficient equipment and thus allowed government to impose higher energy efficiency standards with little opposition,[31] credits may help ensure the penetration of a new technology, and regulatory standards can then consolidate that improvement.

The uncertainty of emission forecasts was a problem which bedeviled the US emissions reduction credit trading program. In some cases projects undertaken to generate credits actually increased emissions.[32] The certainty of emission reduction projects can be improved by making the establishment of a contingency fund or deposit of an emission reduction bond a condition of credit approvals. A contingency fund or emission reduction bond involves placing money in trust to make up for shortfalls in the performance of approved emission reduction projects. After the projects are completed and their success evaluated, any money remaining in the fund reverts to the credit user or generator. For instance, in the Oregon exemption proceeding the successful project was required to put $300 000 in a contingency fund. This can be drawn on to fund more emission reduction projects if the performance of the approved projects is less than 90% of what is anticipated. Similarly, bonding is required in some Canadian environmental legislation to ensure compliance with environmental requirements.[33]

Although contingency funds will help ensure certainty of emission reductions, they rely on adequate project monitoring and are limited by the amount in the fund. Also, they represent a financial burden on emitters which may be acceptable for major, heavily capitalized projects, but could be problematic in general use. Greater uncertainty is likely inherent in emission reduction credit trading.

Pre Credit Use Approval or Post Credit Use Auditing

Open market trading and emissions reduction credit trading also differ in how trades are approved. Programs which generate credits by prospectively forecasting emission reductions could rely on either after-the-fact audits as to the validity of credits, or pre-approval of credits and their use. However, they mostly rely on pre-approval of a package of emission reduction measures to be applied against forecast emission exceedances at another location. These programs rely on permits that waive a regulatory standard that is forecast to yield certain emission reductions and impose alternative requirements to implement emission

31 See Chapter 6, under the heading “A Portfolio Approach”.

32 In one example emission reduction credits were claimed for a supposed twenty percent reduction in emissions from prescriptive emission standards. After the credit was approved by regulators, re-examination found that actual emissions had increased by 36%: see Richard A. Liroff, *Reforming Air Pollution Regulation: The Toil and the Trouble of EPA’s Bubble* (Washington D.C.: The Conservation Foundation, 1986).

33 See, for instance *Mines Act*, S.B.C. 1989, c. 56.

reduction projects which are forecast to yield an equal flow of emission reductions. The provisions of the Oregon CO_2 Standard are typical:

> The applicant ... will implement particular offsets, in which case the council may adopt site certificate conditions ensuring that the proposed offsets are implemented, but shall not require that predicted levels of avoidance, displacement or sequestration of carbon dioxide emissions be achieved. The council shall determine the quantity of carbon dioxide emissions reduction that is reasonably likely to result from each of the proposed offsets.[34]

Pre-approval of forecast emission reductions will often be necessary from the regulated party's viewpoint to resolve the huge uncertainty inherent in forecasts of emissions under different scenarios.[35] Although it is theoretically possible to define protocols for forecasting future emission reductions, these are likely to involve much greater judgment than protocols for retrospective measurement. For instance, a factory generating credits from fuel switching would not only have to estimate changes in emissions per unit of production but also production levels, a highly judgmental forecast. (By comparison production levels can be counted in retrospectively measured credits).

Case by case pre-approval of prospective forecasts is far from a simple administrative task. A common complaint from government agencies about the *Clean Air Act* emission reduction credit trading was the greatly increased administrative burden as compared to single source, single emission limit programs.[36] The Oregon Exemption proceeding involved hearings with formal submissions. The Oregon Facility Siting Council grappled with a range of issues and eventually rendered a 100 page decision that carefully reviewed various aspects of three proposed greenhouse gas emission reduction and sequestration packages. Although protocols and precedents could be developed which would define many of the difficult issues that consumed the Siting Council, and less cumbersome, more streamlined processes (e.g., processes like the BC *Waste Management Act* permit issuance and appeal process) could be used, the experience of programs relying on pre-approval of credits suggests that pre-approval is often expensive. Transaction costs are likely to remain high. Transaction costs under the South Coast Air Quality Management District's emission reduction credit

A credible enforcement threat combined with auditting of credits after they have been used encourages emitters to "over comply" — to use extra credits as a buffer against enforcement.

[34] Oregon Revised Statutes 469.503 (1)(c)(B) as amended by Oregon HB 3283.

[35] See, for instance, California Environmental Protection Agency, Stationary Source Division and Mobile Source Division, "Mobile Source Emission Reduction Credits: Guidelines for the Generation and Use of Mobile Source Reduction Credits" (El Monte, Air Resources Board, February 1994) [unpublished] at 16.

[36] See, for instance, Donald Theiller "Transferable Discharge Permits: An Implementor's View", *Buying a Better Environment: Cost-Effective Regulation through Permit Trading,* E.F. Joeres & M.H. David, eds., (Wisconsin: University of Wisconsin Press, 1983) at 255.

trading program are estimated to be $15 000 to 30 000 per trade.[37]

If credits are measured retrospectively, government approval of the credit before it is used may not be necessary. Some programs have relied on pre-use approval of credits while others have relied on the threat of audits to the validity of credits after use to ensure their validity.

Those relying on post-credit use audits note that government agencies tasked with approving credits may not have the resources to rigorously review each credit, and once a credit is approved, neither buyers nor users have any incentive to ensure its validity. Thus, if credits can be approved before their use there is a high risk that many unsupported or poorly supported credits will be used, and emission levels will increase.

The US EPA's proposed open market trading rule requires emitters to notify government as to what credits they anticipate using in a particular period, thus providing government with the opportunity to review the validity of such credits prior to use. However, credit users, credit generators and/or third parties are responsible for the validity of credits and their proper use. The emitter is responsible for supplying all the documentation, sample tests, etc., that allow a government auditor to retrospectively review the project and assess whether the credits being used represent *bona fide* emission reductions.

Relying on post-credit use audits decreases the certainty of the value of credits, and, thus, may reduce trading levels. However, parties can use various mechanisms to reduce uncertainty. Credit users can insist that credit generators or brokers indemnify them for any penalties arising from invalid credits. Brokers of credits may also evolve. Brokers may pool risk of uncertain credits and maintain excess emission reductions as an insurance margin against any particular set of credits being found invalid or failing. For instance, a broker may sell a user shares in a credit fund that contains a range of different projects and which includes greater emission reductions than indicated by the shares. A credible enforcement threat combined with auditting of credits after they have been used encourages emitters to "over comply" — to use extra credits as a buffer against the risk of enforcement action.

To be successful this system must be rigorously enforced. First, this requires a significant auditing force. Audits would ensure that credits are retired as used and that they are validly created. Secondly, it requires the use of administrative penalties. The contents of an appropriate enforcement regime for open market trading programs is discussed below.

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37 See Dwyer, above at footnote 3, at 48. This estimate includes SCAQMD approval, engineering studies and locating a seller.

Until the market for credits becomes more sophisticated some pre-use approval of credits may be necessary. Connecticut, for instance, intends to retain pre-use approval in its emissions trading program because credit generators are not yet sophisticated enough to consistently generate valid credits and users cannot trust the validity of unapproved credits.[38] Pre-use approval puts considerable administrative and political pressure on government for expeditious approval and the expectation is that a shift will be made to post-use audits once generators gain experience in generating valid credits and users gain confidence that unapproved credits purchased from reliable brokers are valid.[39] Canadian jurisdictions' initial choice to require credits or not may depend on whether or not market institutions, in response to international demand for credits, have evolved an ability to supply credible credits.

Use of Credits

If credits are used as a compliance option, it is usually assumed that forecast emission reductions will be applied against forecast emission exceedances, and retrospectively measured emission reductions will be applied against measured emission exceedances. In the latter case it is possible to match an actual emission reduction with an actual exceedance. For instance, if a credit user is using credits to comply with a performance standard (x tonnes carbon dioxide per tonne of pulp produced) the actual pulp production and emission levels can be measured. This ensures that there is a balance between the certainty of an emission reduction credit and an emission exceedance.

Conclusion:

Credit trading based on the US EPA's open market trading rule involves retrospective measurement of discrete emission reductions to generate credits, and the auditing of credits after their use to ensure that credits represent a real emission reduction. Measured discrete emission exceedances are offset by measured discrete emission reductions.

Credit trading modeled on the US emission reduction credit trading program involves offsetting of emission exceedances by implementation of an approved emission reduction program. Approval of the emission reduction program occurs prior to the actual emissions.

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38 In one incident a company that was out of compliance claimed credits for bringing its emissions down to a level that was still out of compliance; the company had a poor level of understanding as to which regulations applied to it: personal conversation with Joe Bellanger, Connecticut Department of Environmental Protection, June 6, 1997.

39 *Ibid*.

Basing credits on retrospective measurement of emission reductions potentially leads to much greater certainty that the credit represents a real emission reduction provided that the validity of credits is audited with sufficient frequency and provided there is a credible enforcement threat if audits reveal inadequacies in credits. Certainty that a credit project will offset an emission exceedance may be lower for open market trading if the enforcement threat, auditing, political will, or resources to resist inappropriate approval of credits are insufficient. Open market trading programs also have the advantage that the emissions being offset can be estimated after the fact with greater accuracy than they can be forecast.

On the other hand, a program closer to the US emission reduction credit trading program may be more feasible where there is likely to be a limited demand for credits. Where demand is limited, the market is less likely to become very sophisticated. Brokers who provide expertise and have an ability to guarantee a supply of valid credits are unlikely to exist. Similarly, until a market evolves in which reputable credit generators and brokers exist, government may be reluctant to assume that credit users have the sophistication to use credits without going through a pre-approval stage.

Design Issue 3: Measuring Emission Reductions

Issues:

a) What processes should be used for measuring emission reductions and emission exceedances?

b) Should credit generating projects be limited to projects for which approved measurement protocols exist?

Discussion:

The determination of whether or not credit generating projects actually reduce net global emissions of carbon dioxide is far from simple. Questions such as “What are baseline emissions?”, “How are emissions measured or forecast?”, “Will an emission reduction at the project site lead to an emission increase at some other point?” are all essential. A process needs to be developed which ensures these and other questions are consistently, openly and fairly addressed at a reasonable cost. If these issues are not determined in a transparent process, credit trading programs will have little credibility.

Broad Parameters in Legislation

The first step is developing very broad parameters on acceptable projects and approaches to baseline setting. Legislation can define the range of acceptable projects. Legislation can also determine how some very basic issues such as additionality, leakage and uncertainty are to be dealt with.

Protocol Development

Next, it will be necessary to develop measurement protocols. Protocols define methodology both for evaluating emission reductions from a project and measuring the emission exceedances above a regulatory standard. Protocols are especially important for open market trading programs, as they will provide a measure of certainty as to the value of credits. By ensuring consistent methodology and accounting practices they ensure against double counting of measures and inconsistent quantification protocols. They also avoid the need for credit generators to continuously “re-invent the wheel”.

The first step is to develop guidelines for protocol development specifying issues such as the general approaches to measurement and documentation requirements. The key to developing protocols is to balance the need for quantitative precision with the need for a set of rules which can be applied uniformly and are not too onerous.

Once guidelines for protocols exist, protocols for specific classes of projects can be developed by government and possibly credit generators. Protocols can define measurement methods, adjustment factors, monitoring requirements etc. The development of government approved protocols gives government the opportunity to favour projects which are deemed to be the best from a societal perspective. Even if credit generators are not limited to use of protocols approved by government, they will generally prefer using such protocols as there will be greater certainty as to the validity of the credits.

The key to developing protocols is to balance the need for quantitative precision with the need for rules which can be applied uniformly and are not too onerous.

The beginnings of many protocols are already in place. Tree Canada Foundation has a protocol for forecasting sequestration benefits of tree planting on agricultural land.[40] Standardized protocols for measuring energy savings from demand side management have been developed, and these can be modified to measure greenhouse gas emission reductions in different utility areas.[41]

[40] Bill Freedman and Todd Keith, *Planting Trees for Carbon Credits: A Discussion of the Issues, Feasibility and Environmental Benefits* (Ottawa: Tree Canada Foundation, August 1, 1995).

[41] Ralph Torrie, *Municipal Building Energy Retrofits and Carbon Offsets: Opportunities and Challenges* (Toronto: International Council for Local Environmental Initiatives, December

The US Department of Energy has developed guidelines for voluntarily reporting emission impacts of different projects.[42] The methodologies are easy to use, but sometimes give wrong and in some cases completely contrary signals with respect to the emission impacts of certain measures.[43] They may, however, provide a useful starting point for protocol development. Other starting points include protocols used to generate credits for local pollutant emission reduction projects in jurisdictions which have local pollutant credit trading.

Many protocols that are being developed may establish unimpeachable means of measuring a given parameter, but may be unacceptable because the basic concepts underlying their methodology are inconsistent with a program. For instance, credits currently being offered for conservation of tropical forests in Costa Rica, although well audited, are based on the assumption that a twenty year guarantee to not log a tree that sequesters a tonne of carbon is the equivalent to reducing carbon emissions by a tonne. As discussed in Chapter 12, that assumption is wrong. These and other conceptual underpinnings need to be determined before a protocol is accepted.

Even a basic protocol can provide a valuable template against which project evaluations can be compared. It can define the issues that need to be included. For instance, a comparison of one Canadian credit generator's initial methodology for calculating the impact of spacing young trees (the approach has since been adjusted) and a leading academic model[44] show significant differences:

15, 1996) at 23 and 28 refers to fairly sophisticated models developed for Illinois and Ontario utilities which consider timing (peak/non-peak and winter/summer); life cycle emissions and leakage. The models need to be developed on a utility by utility basis. With retail competition in the electricity market (see Design Issue 22, Chapter 9) it may be necessary to adjust models according to the electricity supplier a customer chooses.

42 US Department of Energy, *Sector Specific Issues and Reporting Methodologies Supporting the General Guidelines for the Voluntary Reporting of Greenhouse Gases under Section 1605(b) of the Energy Policy Act of 1992, vols. 1 and 2*, (Washington: US DOE, 1994) vol. 1, Appendix B and C, vol. 2, Appendix 4.6.

43 For instance, Torrie, above at footnote 41, at 23, notes that the US Department of Energy models do not deal with a number of positive and negative leakages (e.g. the extent to which efficient lighting increases energy needed for heating in winter or decreases energy for cooling in summer). These factors are considered in more sophisticated models.

44 Roderick Dewar, "A model of carbon storage in forests and forest products" (1990), 6 *Tree Physiology* 417; Roderick Dewar "Analytical model of carbon storage in the trees, soils, and wood products of managed forests" (1991), 8 *Tree Physiology* 239. This model was recommended to the author by Canada's leading experts in this area, Michael Apps and Werner Kurz.

- In one model the effects of thinning young trees on carbon stored in soils, branches and roots were an important variable; in the other they were ignored.[45]

- In one model the releases of carbon from wood products (e.g., by eventual burning and rotting of lumber) was ignored; in the other the rate of release was an important variable.[46]

Restricting Projects to Approved Protocols

Restricting companies ability to generate credits from projects where no detailed government approved protocol exists has the advantage of making enforcement easier and much less costly (there will be less judgment inherent in determining the validity of a credit) and allows government to pick preferred credit generating projects. However, it limits the potential for innovative credit generating projects, and thus lowers potential cost savings. Requiring government approval is also likely to put a strain on government resources, and the time and expenses involved in approving all protocols may dampen enthusiasm for unique alternatives. This strain on government resources was a major motivating factor behind the US EPA rejecting detailed protocol pre-approval in the open market trading program.

Adjustment Factors

Protocols can also specify when adjustment factors are to be used to reflect uncertainty regarding a project's estimated benefits. Adjustment factors reflect difficulties in estimating an appropriate baseline, and potential leakage. They are

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45 The credit generator's initial methodology counted the increase of carbon in the boles of merchantable trees, and assumed that carbon content in litter, soil, branches and roots would remain the same. However, studies (on other forest types,) have shown that carbon storage in litter and soil decreases with thinning: See Roderick Dewar and Melvin Cannell, "Carbon sequestration in the trees, products and soils of forest plantations, an analysis using UK examples." (1991), 11 *Tree Physiology* 49. Other modelling supports the assumption of an increase in soil biomass: see David T. Price, *et al*. "Effects of Forest Management, harvesting and wood processing on ecosystem dynamics: a boreal case study," in Michael Apps and David Price, *Forest Ecosystems, Forest Management and the Global Carbon Cycle* (Berlin: Springer-Verlag Publishers, 1996). The company is supporting joint government industry research into this issue.

46 According to representatives of the credit generator, the dependent variable is the increment in wood entering the wood product stream. According to the Dewar model, the operative variable is the increase in the pool of carbon stored in wood products over the long term. This will initially increase as more wood enters the wood product stream, but the increase in carbon stored over time will be less than the increase in the amount entering the wood product stream: David Price *et al.*, "Effects of Forest Management, harvesting and wood processing on ecosystem dynamics: a boreal case study," in Michael Apps and David Price, *Ibid.*

a figure between 0 and 1 which is multiplied with the anticipated benefits of the project. Anything below 1 indicates a discount to account for uncertainty or other factors.

If there are a large number of projects and one assumes there is no general tendency to overestimate emission benefits in cases of uncertainty, adjustment figures may not be necessary (overestimates in one case will be balanced by underestimates in another case). However, there likely will be a tendency to overestimate benefits. The credit generator and user have vested interests in inflating benefits and the government may not have the resources or political will to "counter analyze" defensible estimates. Given this tendency, use of adjustment factors to reflect uncertainty is recommended. Even if there is no general tendency to overestimate benefits, adjustments will be necessary to reflect factors such as leakage, reliability, and additionality. The Oregon Facility Siting Council and Oregon CO_2 Standard rely heavily on adjustment factors in their decision making process.

In some cases the emission benefits of a project may be too difficult to quantify whether done prospectively or retrospectively. For instance, GEMCo is currently working on methods of measuring the carbon sequestration caused by reduced tillage farming. However, the benefits of reduced tillage farming are impossible to estimate with any accuracy at costs that are not prohibitive. In these cases, the recognition of credits will need to await an improved scientific basic for measuring net benefits.[47]

Process for Protocol and Emission Factor Development

It is recommended that government approved protocols and emission factors be developed using an open consensus building process. Expert consultants can be chosen and terms of reference developed in a multistakeholder process aimed at reaching consensus. This will be more effective than competing consultants' reports being used to support polarized positions.

Conclusion:

Government approved protocols should be used to provide guidance on how the emission reductions attributed to a particular initiative can be measured and to ensure that credits generated reflect actual emission reductions. Approved protocols can be used to speed the approval process and ensure consistency. Pre-approving protocols also provides the government an opportunity to focus credit generating activities in certain areas. In the case of open market trading programs,

[47] Personal conversation with Murray Ward, New Zealand Department of Environment and former consultant to GEMCo, April 7, 1996.

development of approved protocols and emission factors will increase credit user's security that credits will be valid if audited.

While there are clear advantages to development of government approved protocols, in an open market trading program the issue remains as to whether protocols need to be approved prior to the use of credits on which they are based. Requiring all credits to be based on approved protocols would reduce the potential cost savings arising from a measure. The issue essentially involves weighing the advantages of not requiring protocol approval (greater potential for innovation) against the disadvantages (the risk of credits based on over-estimates of emission reductions being used to relieve emitters from compliance with regulatory standards). Assessment of the latter risk will depend to a large extent on the level of comfort with enforcement mechanisms.[48]

Design Issue 4: Baseline Setting and Additionality

Issue:

What factors should be considered in setting a baseline? Should a program only provide credits for projects which are additional?

Discussion:

Credits are generated by calculating the difference between a baseline level of emissions and emissions after the implementation of an emission reduction project. Trading will only work if baselines reflect what would actually have occurred in the absence of the project or the absence of the trading program.

How are baselines calculated? Most credit trading programs start with the proposition that the baseline must reflect the lower of actual or legally allowable emission levels before a emission reduction project is implemented. Baselines under emission reduction credit trading program are based on current practices and expected changes in legal requirements. Under the open market trading program the lower of actual legal standards or actual emissions are a baseline. Credits are also based on real emission reductions.

The real and surplus to legal requirements criteria for generating credits will work best where government has been focused on reducing emissions in the past. In

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[48] See Design Issue 9.

jurisdictions where credit trading has been applied governments have worked for years to ensure the adoption of emission reduction measures which are very low cost or worthwhile for other reasons. In this context, credit trading is more likely to ensure additional emission reduction projects. (Additionality is a measure of the extent to which a reduction in emissions or an increase in sequestration occurs because of the credits given in a trading program.)

However, in the case of greenhouse gases, baseline forecasts assume that many emission reduction opportunities will be pursued because they are profitable, but, in aggregate emissions will continue to rise. Thus, a major concern in the context of greenhouse gas emission credit trading is whether or not baselines should reflect whether or not an emission reduction project is additional.

Three Approaches to Additionality

Three approaches can be taken to setting of baselines and additionality:

> **Option A: Baseline Considers Only Current Practices.** The baseline reflects the existing practice at a site and legal requirements. Where a facility with a limited lifetime is replaced by a more efficient facility, the baseline reflects the projected lifetime of the facility that is replaced.
>
> **Option B: Baseline Considers Additionality of Project.** Each project is analyzed to determine whether or not the incentive of credits from emission reduction trading caused the project to go ahead. If not, no credits are generated. This is the approach taken in the Oregon CO_2 Standard, the Oregon Exemption Hearing.
>
> **Option C: Baseline Considers Additionality Relative to Norm.** This approach ignores additionality on a project by project basis. However, normal rates of efficiency improvement, and the norms within a sector are incorporated into baseline setting.

Option A: Baseline Considers Only Current Emission Levels

Simply accepting any changes from existing emission or sequestration levels will reduce and possibly undermine the impact of regulations or voluntary commitments. In the normal course of economic development, thousands of projects proceed which improve energy efficiency and decrease emissions. Yet despite these improvements, overall emissions increase. The projected growth in Canada’s emissions from 1990 to 2000 includes many individual emission reductions. If these individual emission reductions are used to generate credits that can be used as an alternative to compliance with regulations, the effect will be to negate the environmental impact of the regulations.[49]

Option A is essentially what companies use in claiming emission reductions under the Voluntary Challenge and Registry. All the industry representatives interviewed for this project believed that the majority of projects registered under the VCR were non-additional.[50] One US EPA official familiar with the American voluntary program estimated that only about two percent of projects registered under that program are additional.

Experience with proposed local pollutant credit generating projects suggests a similar likelihood of non-additional projects. For instance, two projects proposed by West Coast Energy to offset emissions from its proposed Pine River gas processing plant expansion occurred, or appear likely to occur, without the incentive of investment from West Coast. Counting any reduction from current practices will have the effect of watering down the impact of regulations.

One means of avoiding the problem is to accept the inevitability of non-additional projects but to ensure the supply of such projects is overwhelmed by demand for credits. This will only work where there is a large demand for credits relative to the availability of non-additional emission reduction projects. It will not work for trading programs based on voluntary commitments because the demand will likely be too low. It will be less effective in the context of the clean development mechanism because of the huge supply of non-additional emission reduction projects.[51]

If credit is given for a project which would have occurred in the absence of the credit trading program, the environmental effectiveness of regulations is reduced.

Option B: Baseline Considers Additionality of Project.

While Option A can undermine the impacts of regulations, Option B is difficult to implement. It involves a determination of "project additionality" rather than "emissions additionality".

Additionality for a specific project could theoretically be

49 It is possible, but highly unlikely, that credits would be used to avoid compliance with a regulatory requirement that would have occurred in any event. If the regulatory requirement would have occurred in any event there is no reason why the regulated party would opt to purchase credits instead.

50 See also Chapter 6, under the heading "Voluntary Agreements, Challenges and Covenants;" and Pembina Institute, *Corporate Action on Climate Change 1995: an Independent Review* (Drayton Valley, Alberta: Pembina Institute, July 1996); see also Trexler and Associates, Inc., *Considerations in the Construction of a CO_2 Mitigation Cost Curve for the Next Northwest Power Plan* (Oak Grove, Oregon, Trexler and Associates, Inc., August 14, 1996) [unpublished].

51 This is the reason the United States is insisting on proof of additionality for any clean development projects which are counted toward an Annex 1 country's emission reduction target. See Chapter 11.

determined by reference to what is profitable or appears to be a good investment decision in the absence of incentives offered by credits. During international discussions on generating credits from emission reduction projects in non-Annex 1 Nations it was suggested that the projects for which credits are generated should be limited to projects offering no economic return to private sector investors.

Disallowing projects which eventually pay for themselves means that many worthwhile projects that would not otherwise be implemented will likely be rejected. Whether or not a decision is made to invest in a project will depend on numerous variables: perceived risk, projected rates of return, correspondence to business plan priorities. Many projects which offer a reasonable rate of return are not implemented due to perceived risk and institutional, informational or other barriers to implementation.[52]

If government were capable of accurately second guessing investment decisions this would ensure additionality, but trying to determine what an investment decision would have been in the absence of a credit incentive is far from easy. Credit generators could easily exaggerate the risks and barriers to project implementation, and underestimate financial returns or other advantages.

It is also sometimes suggested that the baselines be based on no-regrets measures.[53] Aside from all the difficulties inherent in determining what is a no-regrets measure (which is more difficult than determining the attractiveness of an investment), this approach would reject an even larger range of measures that are not being implemented for a variety of reasons.[54]

Option B helps ensure that credit trading will not undermine the effectiveness of a regulatory measure, but its practical implementation is very difficult. The FCCC's Subsidiary Body for Scientific and Technical Advice has developed draft criteria for determining additionality but these remain contentious. Final criteria are expected by 1999.[55] While the difficulties of implementing Option B should not be underestimated, efforts are being made to grapple with them.

Option C: Baseline Considers Additionality Relative to Industry

It is possible to judge the additionality of a project by reference to norms within an industry or similar communities. If this approach is accepted it is essentially a

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52 See Chapter 3.

53 Robert J. Anderson, Jr., *Joint Implementation of Climate Change Measures* (Washington, DC: Environment Department, World Bank, March l995).

54 See Onno Kuik, Paul Peters and Nico Schrijver, *Joint Implementation to Curb Climate Change: Legal and Economic Aspects* (London: Kluwer Academic Publishers, 1994).

55 Climate Change Secretariat, "Activities Implemented Jointly: Annual Review of Progress under the Pilot Phase" (4 June 1996).

compromise between Options A and B. Option C does not concern itself with "project additionality" but the method of setting baselines will help eliminate some non-additional projects. It credits projects which are better than standard good practices. It accepts that some non-additional projects will be credited toward regulatory requirements. It also accepts that some projects which are additional but do not represent improvements from standard good practices may be rejected.

If baselines are calculated retrospectively this option becomes relatively easy. However, if credits are being forecast prospectively the factors that would need to be considered in Option B and Option C are similar: the projected rates of technology adoption given different levels of profitability.

Applying the Three Approaches to Additionality

The effects of applying Option A, B or C to the determination of baselines and additionality can be better understood through real and hypothetical examples that compare these options for specific projects. Some examples are outlined here.

Coal Fired Power Plant and Cement Factory.

A coal fired power plant finds it can sell ash to a cement factory to replace lime and avoid the carbon dioxide emissions associated with lime production. The practice is innovative and profitable and resolves a waste disposal problem, but it was not adopted for reasons related to creating credits.

> **Option A:** Credits generated for the life of cement factory.
>
> **Option B:** No credits would be generated.
>
> **Option C:** Credits generated until practice becomes industry norm.

Demand-side Management and Compact Fluorescent Lights

A utility helps finance a demand side management program in Mexico. The program educates households as to the cost savings from using compact fluorescent lights (CFLs) and allows households to spread payments for lights over time through their electric bill. Even in the absence of these incentives the lights would pay for themselves quickly.[56]

> **Option A:** Credits are generated based on penetration of CFLs at time program implemented.

[56] Robert J. Anderson, Jr., above at footnote 53, at 6 to 7.

Option B: Credits only generated if financial assistance necessary to program proceeding.

Option C: Credits are generated. The baseline is based on the anticipated or measured (if credits generated retrospectively) penetration of CFLs in other markets.

Intensive Silviculture and Forest Growth

An eastern Canadian forest company markets credit for a juvenile spacing silviculture program that exceeds industry standards in Ontario and the company's current levels of silviculture.[57] The company is willing to undertake 85% of the cost of spacing because it will increase the allowable cut of the forest company and provide greater security of fibre supply. Juvenile spacing industry wide is expected to increase in the future because government policy changes allow companies to use stumpage fees for approved spacing and other advanced silviculture programs. The company will only sell credits for spacing not paid for from stumpage fees.

Option A: Credits generated so long as sequestration levels increase.

Option B: No credits will be given unless the fifteen percent contribution from credit users is found to be crucial for the project going ahead and stumpage would not be used to pay for spacing in the absence of revenue from credit generation.

Option C: Credits would be generated based on extent to which spacing levels exceed industry norms.

Paper Mill Fuel Switching

A paper mill switches from oil to natural gas. Most mills have already switched fuel. The pay back period for capital costs is comparable to other capital investments in the mill's normal course of business.

Option A: Credits generated for lifetime of paper mill.

Option B: No credits generated.

Option C: No credits generated.

[57] Juvenile spacing involves thinning a young forest so that the remaining trees grow more quickly and have a greater portion of merchantable lumber, less pulpwood and less residue. Because the lumber will not be converted to greenhouse gases as quickly as pulp products or wood residue this can increase the total amount of carbon sequestered in forest and products. Spacing causes an immediate decrease in carbon sequestered in the forest, but this can be more than made up for by faster growth of healthy trees.

Municipal Landfill Methane Recovery

A municipality wants to market credits from its landfill methane recovery project. The project reduces the municipality's exposure to liability for landfill gas explosions, decreases local ozone formation, and generates a modest rate of return. Methane recovery is beginning to be common for comparable landfills.

> **Option A:** Credit generation based on methane captured by recovery system.
>
> **Option B:** Credit generation will depend on a judgment call as to how crucial revenue from credits was to the implementation decision.
>
> **Option C:** Credits generated until recovery becomes the norm for comparable landfills.

Whatever approach to setting baselines is taken, protocols and guidelines for protocol development will need to provide significant guidance on how baselines are projected or calculated. Uncertainty as to baselines can be reflected by adjustment factors. Thus, if Option B is used, most of the uncertainty as to the additionality of a project can be captured by using an adjustment factor.

Retiring Credits and Additionality

As mentioned above, US *Clean Air Act* credit trading programs require a certain percentage of credits generated by a project to be discounted or "retired" — i.e. not used to offset emission exceedances. In the case of the US programs, mandatory retirement of credits is intended to make trading benefit the environment. However, in the case of greenhouse gas credit trading, it can also be justified as necessary to overcome the problem of credit for non-additional projects. Because of the likelihood of such projects, a significant percentage of credits would need to be retired before credit trading had any environmental benefit.

Conclusion:

The use of credits as an alternative to compliance with regulatory standards will diminish the environmental impact of those standards if credits are generated from projects which are not additional. On the other hand, determining additionality of a particular project, or predicting the adoption of a measure within a sector are extremely difficult tasks. Cost effectiveness or profitability are not good measures of additionality because of the existence of various barriers to no-regrets measures, because of the tendency of consumers and industry to under-invest in energy efficiency and because of intangible factors that militate against

Compared to credit trading for local pollutants, ensuring additionality is particularly problematic for greenhouse gas trading, because many projects are profitable or worth doing for other reasons.

profitable projects. Any attempt to reject all non-additional projects will lead to a rejection of no-regrets projects which would not be pursued without the incentive offered by credits.

The problem of ensuring additionality is particularly acute for greenhouse gas credit trading because little regulatory attention has been applied to reducing greenhouse gas emissions, and because many projects are profitable or worth doing for other reasons. These factors mean that the problem of non-additionality is much greater in a greenhouse gas credit trading system than in credit trading for local pollutants. A requirement to retire a significant percentage of credits generated by a project could help offset credit for non-additional projects and make trading benefit the environment.

In an open market trading program a feasible alternative to considering additionality of each individual project is to adjust baselines to reflect changes to regulatory standards, and adoption of particular technologies within a sector. This will not filter out all non-additional projects, and would thus reduce the environmental impact of regulations. For prospectively forecast baselines, forecasting adoption of a particular technology or changes to future regulatory standards is difficult and a much less likely to be accurate. Greenhouse gas credit trading programs based on prospective forecasts have tried to consider the additionality of projects. Whether credits are based on a retrospective assessment of baselines or a prospective forecast, it is appropriate to apply adjustment factors to reflect the uncertainty of baselines.

Design Issue 5: Leakage

Issue:

How should leakage be considered in the calculation of emission reductions?

Discussion:

Leakage refers to the indirect undercutting of emission reductions caused by an emission reduction project. As discussed in Chapter 4, leakage will result from many different emission reduction measures. For instance, major improvements in vehicle fuel efficiency may, in the absence of fuel price increases, lead to increases in kilometers driven. All measures which significantly reduce demand for fossil fuels may decrease fossil fuel prices and thus possibly increase consumption in other jurisdictions. In a credit trading program, it is necessary to consider whether the leakage from a project will be significantly higher than the regulatory or other alternative.

Leakage for some projects can be up to 100%.[58] For instance, an aluminum smelter may purchase “pre-baked anodes” which eliminate perfluorocarbon emissions at the smelter but lead to increased emissions at the point where the equipment is manufactured.[59] Purchase and protection of a tract of tropical forest may simply divert slash and burn farmers onto other tracts of land.

Consideration of leakage is not unique to greenhouse gas credits, but the analysis becomes more complicated in the case of greenhouse gases. For instance, in California, credits for nitrous oxide emission reductions created by replacing gasoline vehicles with electric vehicles reflect reductions in emissions from gasoline marketing and increases in power plant emissions into the local air shed.[60] If greenhouse gas credits were created for the same activity, they would need to consider all upstream emissions from electricity and gasoline production and any differences in the greenhouse gas emissions in the manufacture of electric versus gasoline vehicles. These factors may be considered and dismissed as inconsequential, but need to be given some consideration.

There are a number of measures that can be taken to consider leakage in the generation of credits:

Project Boundary

First, a reasonable attempt must be made to define the project in a way that includes easily measured indirect impacts. The definition of what constitutes the project is referred to as “drawing the project boundary”. If a project is defined as a measure which decreases energy consumption at one point in a production process without considering the need for increased processing at a later point, the project boundary is too narrow. On the other hand, drawing a boundary too widely may overwhelm attempts at calculating emission benefits for a project without adding much accuracy.

There also needs to be rough symmetry between the boundary as applied to indirect negative and positive effects. For instance, if a project involves rebates to encourage purchase of efficient furnaces it is reasonable to assume that some consumers will purchase the new technology, not because they receive a rebate, but because the project has lead to an increased availability of efficient furnaces It would be inconsistent to count this indirect benefit while not counting the negative indirect impacts on where people set their thermostat.

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58 See Trexler, above at footnote 50.

59 In the case of pre-baked anodes the emissions from the anode manufacturer are more easily controlled but are not necessarily controlled.

60 See California Environmental Protection Agency, above at footnote 35, at 56.

Beyond the Project Boundary

Beyond the project boundary, the need to consider leakage involves a balancing of the desirability of accuracy with the ability to determine leakage accurately and at a reasonable cost. To a certain extent, government can reduce transaction costs; ensure acceptable accuracy; and ensure consistency by pre-defining various emission factors, leakage factors and stating types of leakage which can be ignored. In other cases, credit users or generators will be responsible for giving a qualitative analysis of leakage and possibly a quantitative analysis if the potential for leakage appears significant.

Life-cycle Emissions Factors

One step that can be easily taken to ensure that many forms of leakage are quantified at reasonable costs is for government to establish standard emission factors for life-cycle emissions associated with different forms of energy. Much of the work in developing life-cycle emission factors has already been done. Government can add to the accuracy of credits, reduce risk to credit generators and users by defining appropriate life-cycle emission factors. Government intervention is beneficial because the analysis of leakage and life-cycle emissions is complex and fraught with difficulty, and huge variations in life-cycle emissions may result from different assumptions.

Depending on the fuel, life-cycle emissions can vary considerably depending on when and where energy is consumed. Emission factors will need to be defined with varying degrees of geographic and temporal precision. For instance, reasonably accurate estimates of impacts of changed electrical use on emissions will require different emission factors for electricity used in peak and off-peak times, during different seasons, and in different utility areas.[61] On the other hand, factors used for impacts of changed crude oil consumption may be constant across the globe.[62]

To the extent possible emission factors used to calculate changes in emissions resulting from a emission reduction project should reflect marginal sources of a particular form of energy. Marginal sources will need to be adjusted over time.[63]

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[61] See, for example, Torrie, above at footnote 41, Appendix B, at 24.

[62] Crude oil and anthracite coal would require only single emission factors because the market is global. For natural gas, where a single North American market is quickly evolving, a North American emission factor could be used.

[63] World oil sources, for instance, are expected to become more carbon intensive in the next few decades as high quality oil supplies are depleted and the world shifts to oilsands and heavier oils.

If a Canadian or British Columbian trading program recognizes credits from other jurisdictions it will be infeasible to define emission factors for all energy sources in all locales, and generic emission factors may be necessary. Protocols may specify use of different factors for different types of projects.[64] Project proponents can be given the option of justifying different emission factors if the generic factors underestimate benefits.

Protocols

Government approved protocols can also define adjustment factors for leakage. For instance, there is a known, but weak, relationship between improved fuel efficiency and increases in miles driven.[65] Rough but conservative adjustment factors for leakage can be defined in approved protocols, with the onus on the project proponent to show why a less conservative adjustment factor should be used for their project.

Examples of relatively easily applied protocols which effectively incorporate leakage include protocols for quantification of emission reductions from demand side management in Ontario Hydro's service territory, developed by the International Council for Local Environmental Initiatives. The protocols include consideration of "cross-effects", i.e., the impact on inefficient lighting in decreasing heating requirements and increasing air conditioning requirements.[66]

Leakage Where No Protocols Available

Legislation or regulations could also reject certain types of project because of the probability of high leakage rates. A project which simply preserves a tract of land in a tropical rain forest could be rejected unless the proponent incorporates plans that would actually diminish pressures on neighbouring tracts.[67] Guidelines could also specify type of leakage which can be ignored: e.g., increases in oil

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64 Emission factors used to calculate emission reductions from fuel switching will not necessarily be the same as the figures used to measure emission benefits of conservation and efficiency programs. To be conservative, the benefits of fuel switching would need to be measured based on a relatively low life cycle emissions from the fuel being replaced and relatively high life cycle emissions from the new fuel.

65 David L. Greene, "Vehicle Use and Fuel Economy: How Big is the "Rebound" Effect?" (Oak Ridge, Tennessee: Oak Ridge National Laboratory, March 1991) [unpublished].

66 Torrie, see above at footnote 42, at 24.

67 The Canadian federal government has recognized this and insists that any voluntary joint implementation projects involving purchase of forested land also include a management program for sustainable use: see Julia Martinez, *et al*., *Report on the in-depth review of the national communication of Canada* (Geneva: UNFCCC Secretariat, February 1996) at 18. All the forest protection offset projects managed by the World Resources Institute incorporate substantial agroforestry components to minimize leakage.

consumption at other locations because of decreased demand and corresponding price decreases.

For other types of leakage some common sense qualitative assessment of leakage will be necessary. In some cases an initial qualitative assessment may negate the need to consider a certain type of leakage any further. Finally, where no leakage estimates are pre-defined and a qualitative assessment suggests leakage may be significant, proponents could be tasked with developing a defensible leakage estimate. Some guidance should be given as to the level of accuracy expected, as considerable costs can be incurred in elaborate computer modelling of leakage that has no greater accuracy than "back of the envelope" calculations.[68]

Conclusion:

Leakage can best be factored into calculation of credits by government establishing pre-defined life-cycle emission factors and setting leakage adjustment factors in some protocols. Certain types of projects should also be rejected because of the high likelihood of unacceptable levels of leakage. Where no protocol has been approved, protocol development guides will need to establish general guidelines on the setting of project boundaries. Guides can also discuss the types of leakage which can be ignored (i.e., leakage which is no more consequential than leakage under regulation) and those which should be evaluated more extensively.

Design Issue 6: Compatibility with other Goals

Issue:

Should factors other than the impact of a project on greenhouse gases be incorporated into credit approvals and protocol development?

Discussion:

Regulations often reflect a number of competing social and environmental goals. Should the same balancing be incorporated into approval of projects used as an alternative to regulatory compliance? Although few of the credit generating projects pursued to date are problematic, in a system where credits are only

68 See Trexler, above at footnote 42, at 19.

designed with minimizing cost to the generator and maximizing greenhouse gas emission benefits, there is a reasonable likelihood that credits will be claimed for projects which are contrary to other environmental goals. Indeed, Prime Minister Jean Chretien has advocated clean development credits for sales of Candu reactors, and one forest company has tried to market credits from a pesticide spraying program.[69] Credit trading could encourage monoculture afforestation projects which use fast growing species that reduce habitat and biodiversity. There is a risk that credits could be generated by social and environmental travesties like China's Three Gorges dam or nuclear facilities.

On the other hand, many projects will have very significant environmental benefits unrelated to climate change. Soil sequestration projects reduce soil loss and impacts on water quality. Energy efficiency projects reduce the multiple impacts of fossil fuel production, distribution and combustion.

There are several partial solutions to guard against the risk of projects that are environmentally damaging:

- Existing laws can be relied on to ensure that credit generating projects are acceptable. However, even within Canada, environmental laws often fail to provide adequate protection. Moreover, subsidies to the nuclear industry increase the likelihood of credit being claimed for environmentally damaging projects.
- Protocols for credit generation can define sustainability requirements for some types of project. For instance, protocols could require afforestation projects to meet minimum requirements for habitat protection and biodiversity.
- Certain types of project can be rejected as unacceptable. These could include nuclear generation, large scale hydro, and ocean fertilization projects.

Conclusion:

For projects within Canada, use of existing environmental laws, prohibitions on certain types of projects, and conditions in protocols related to protection of non-climate related environmental values could provide protection from environmentally damaging projects.

69 The spray used (Bt) is generally seen as environmentally benign or at least preferable to traditional pesticides; however, this would not necessarily be true.

Design Issue 7: Timing of Emission Reductions

Issue:

Should emissions or emission reductions be discounted according to their timing?

Discussion:

Economists normally discount the value (whether it be positive or negative) of something which occurs far in the future. In the Oregon Exemption proceeding it was argued that emission reductions occurring far in the future should be discounted, i.e., avoidance of a tonne of emissions today should be treated as worth more than avoiding emissions of an equal amount 50 years from today. Discounting of future emission reductions is only an issue in relation to emission reduction credit trading, because in an open market trading program emission reductions have occurred before credits are used. However, the corollary in an open market trading program would be to allow a credit to gain "interest" if it is banked for several years before use. Allowing interest to accumulate on credits would reflect the value of early action.

The idea of discounting future carbon dioxide emission reductions or allowing interest to accumulate on banked credits has been widely rejected.[70] First, because of the long atmospheric lifetime of carbon dioxide (50 to 200 years) there will be considerable overlap between the tonne emitted now and the tonne emitted 50 years from now. Secondly, the relationship between changing concentrations of greenhouse gases and damage at exact points in time is much too uncertain to calculate a defensible discount rate. The appropriate discount rate may be positive or negative. Third, discounting the value of consumer items consumed in the future or money earned in the future may be appropriate, but determining an approriate discount rate for values that transcend market economics is problematic. On an intuitive basis it may seem obvious that causing a species to become extinct is no less wrong if it occurs fifty years from now, yet discounting will often justify decisions that lead to such extinctions. Even very low "social discount" rates have been critiqued as, among other things, being based on the

[70] See Oregon Energy Facility Siting Council, above at footnote 19, and Trexler and Associates, Inc., *Considerations in the Construction of a CO_2 Mitigation Cost Curve for the Next Northwest Power Plan* (Oak Grove, Oregon, Trexler and Associates, Inc., August 14, 1996) [unpublished] at 22.

assumption that future generations will have less pressing needs, an assumption that has been questioned by some economists.[71]

Conclusion:

Emissions or emission reductions occurring in the future should not be discounted except to reflect the lack of reliability — in an emission reduction credit trading program — of an emission reduction project that extends far into the future.

Design Issue 8: Banking and Credit Lifetime

Issue:

In an open market trading program should credits have a limited credit lifetime?

a) Should credit users or generators be permitted to “bank” credits for future use?

b) Should credits have an unlimited lifetime?

Discussion:

In most credit trading programs it is possible for generators or users to bank credits (i.e., hold them for future use). Allowing participants to bank credits provides an incentive to undertake early emission reduction activities and helps to establish a predictable market for credits. This in turn allows firms considering using credits as a compliance option some certainty that they will be able to purchase credits at a predictable price in the future.

However, should credits have an unlimited lifetime? On the one hand, there may be increasing difficulty in auditing a credit after several years, and cancelling credits may mean additional environmental benefits. On the other hand, a large stock of banked credits is to the benefit of the environment in that it represents a

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71 For differences in views on the morality and justification for different discount rates see: William R. Cline *Global Warming: the Economic Stakes* (Washington, DC: Institute for International Economics, 1992); William R. Cline *The Economics of Global Warming* (Washington, DC: Institute for International Economics, 1992) and Herman E. Daly and John B. Cobb, *For the Common Good* 2d ed. (Boston: Beacon Press, 1994). Cline represents mainstream economics and argues for use of a very low social discount rate. Daly argues against use of any discount rate.

stock of carbon not released into the atmosphere. A short credit life encourages the rapid use of credits. Lifetimes of credits in other programs range from one year to infinite, with most programs having lifetimes in the range of five to twenty years.[72]

Conclusion:

The banking of credits is recommended. The appropriate lifetime for credits requires further consideration; however, a credit user should have the onus of overcoming any uncertainty in the validity of a credit caused by the passage of time.

Design Issue 9: Monitoring and Enforcement in an Emission Reduction Credit Trading Program

Issue:

In an emissions reduction credit trading program

a) How can implementation of the project be ensured?

b) Should credits be adjusted for the reliability of a project?

c) What monitoring requirements should be imposed on credit generators/users?

d) If monitoring indicates that a project is not being properly implemented should credits be adjusted or invalidated?

Discussion:

The reliability of a project refers to the likelihood that a project will be implemented as intended. In an open market trading program, the reliability of projects is not an issue, because credits are generated by actual monitoring of the project's impacts. But in an emissions reduction credit trading Program there will

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72 Bovar Environmental, Margaree Consultants Inc. and Constable Associates Consulting Inc. "Requirements for a Pilot Greenhouse Gas Offsets Program in British Columbia" Draft Report prepared for the Cost Benefit/Economic Instruments Steering Committee, January 1997 [unpublished] at 28.

always be some uncertainty regarding whether or not a project will be implemented as intended.

Terms of Operating Licenses

The first step to ensuring the implementation of a project is including appropriate conditions in the legal instruments that require the project. The operating licence for the winner of the Oregon Exemption includes a number of conditions requiring the winning candidate to take a number of specified steps — make available a certain amount of steam for co-generation, place money in escrow for certain purposes, use specified qualified organizations to undertake aspects of the projects, make books available for auditing, ensure that the operator maintains control over emission reduction projects, etc. In most cases the conditions were very specific; in other cases they simply involved making best efforts. Penalties can be imposed on the plant operator if these conditions are not fulfilled.

Under some programs, legal responsibilities may be voluntarily assumed by credit generators. However, credit users must have some responsibility for ensuring the continuation of project implementation. Alternatively it will be necessary to require credit generators to be bonded (i.e., to have bonds or guarantees from financial institutions that they will complete a project) or restrict audit generators to companies with large financial stakes in compliance (e.g., capital assets that cannot be easily transferred). This is necessary so that liability cannot be simply “farmed out” to small shell companies that have no stake in ensuring the continued implementation of an emission reduction project. Unfortunately performance bonds are usually unavailable for projects that will take more than a few years.

Ensuring Third Party Co-operation

Often implementation of projects will depend on third parties who cannot be bound by the terms of operating licenses or contracts. Some steps can be taken to ensure reliability. Proponents of projects which rely on third parties can be required to produce contracts showing the third party’s commitment to a project. For instance, the California Air Resources Board requires proponents with credit generating projects involving purchase of low emission buses to have long term contracts with transit authorities.

Adjustment Factors

Also, adjustment factors can be applied to reflect lack of reliability. For instance, the winning project in the Oregon Exemption proceedings involved replacing steam generated by boilers at a nearby plywood plant with waste steam from the proponent’s electric generation facility. A contract existed for the supply of steam to the plywood plant at a set price. At the set price and under current market conditions the plywood plant would very likely buy all the steam. However, there was no obligation to purchase any steam from the generating unit and the plywood plant had other potential sources. An adjustment factor of 0.5 was applied largely due to this uncertainty.[73]

Factors to be considered in setting adjustment factors include:

- How susceptible is the project to environmental disturbances including climate change itself? This is a particularly acute problem in relation to sequestration projects where changing weather patterns can wipe out the benefits of a project.

- Does the party tasked with ensuring success of the project have control over the variables that will ensure success?

- How experienced is the team implementing the project?

- How susceptible is the project to changes in economic or political conditions? This has been a major issue for credits generated in less politically stable nations; for instance, the reliability of a South Asian fuel switching project was an issue in the Oregon Exemption. However, because clean development credits will be certified by the clean development mechanism (presumably after the emission reduction has occurred and been verified), this will not be an issue in the context of recognizing clean development credits in a domestic trading program.

Monitoring

As well as setting out terms for the implementation of projects, operating licences can set out monitoring requirements for offset projects. The results of monitoring are used to inform future offset approvals, and possibly trigger additional requirements. In California, a credit generator who replaces high emission buses with low emission buses is required to test and report actual emissions from the buses. Regulators are responsible for ensuring that the low emission buses are driven to the same extent as high emission buses.[74] The successful project in the Oregon Exemption proceeding committed to spending up to $50 000 USD per year on monitoring.

[73] Oregon Facility Siting Council, above at footnote 19, at 42 to 44.

[74] See California Air Resources Board, above at footnote 30, at 18.

Contingent Requirements

What happens when monitoring indicates that a project has not been implemented as expected or that the projected emission reductions have not resulted? Under some emission reduction credit trading programs monitoring can be used to invalidate or reduce the value of credits, meaning that credit users will need to take additional steps. The power to invalidate or reduce the value of a credit is especially important if credits are not regularly discounted for certainty and reliability. Monitoring can also be combined with requirements in permits for the establishment of contingency funds that can be drawn on if an emission reduction project is less effective than initially envisaged.

Conclusion:

In a program where credits are approved prospectively it is important to ensure that the program is implemented as intended. This is done primarily by imposing detailed requirements in the operating licenses that fully define responsibility for implementing a project and ensure that implementation will not be stymied by unexpected developments. Where terms of licenses etc., cannot ensure full implementation of a project, adjustment factors should be used to reflect a project's lack of reliability. Monitoring, both by offset generators or users and government agencies is necessary to ensure projects are implemented as intended and to refine future protocols.

Design Issue 10: Regulatory Liability in Open Market Trading Program

Issue:

In an open market trading program who is responsible for deficiencies in the numbers of credits created or invalidly created credits?

Discussion:

This section looks at who will have regulatory liability[75] if an audit uncovers insufficient or invalid credits. In developing its proposed open market trading rule the US EPA considered a number of alternatives for liability:

- **Credit User Liability**. Users are responsible for both the validity of credits and ensuring that credits used equal emission exceedances. Credit users would have an incentive to thoroughly inspect credits and purchase credits from reputable generators, but the uncertainty regarding the validity of credits might make users unwilling to participate in the market.

- **Pre-Approval Requirement**. Government regulators would approve credits prior to use. Credit users' liability would be limitted to having insufficient approved credits. This was rejected for reasons similar to those discussed above under design issue 2.

- **Limited Credit User Liability**. Credit users would only be responsible only for deficiencies in the number of credits held. Generators or third party credit guarantors would be responsible for invalid credits. This would remove any incentive for the user to ensure the validity of credits. Credit generators or third parties who assume liability could include “fly by night” companies who have little financial stake in ensuring the validity of credits. It would be virtually impossible to enforce the validity of credits generated in other jurisdictions.

As a result of the difficulties of each approach, the EPA adopted a rule which relied on making credit users responsible for both deficiencies in the number of credits held and validity of credits (the first option). However, it increased certainty for users by making generators certify as to the accuracy of underlying facts (e.g., monitoring results). The rule also allowed third parties to assume this certification liability where they aggregate many emission reductions from small sources. For instance, in a project to replace inefficient refrigerators with efficient ones, the home owner (the credit generator) might certify that he or she received a particular fridge and assign any credit to the organization carrying out the project. The project sponsor might certify more technical data. To qualify for this role third parties would need to demonstrate financial responsibility to ensure that they

[75] Regulatory liability is distinct from contractual liability. Parties will normally be free to enter into contracts that lessen their exposure to the financial risks of being fined by courts or penalized by administrative agencies for non-compliance. For instance, credit users can insist that credit generators or third parties guarantee credits or compensate them for any legal expenses the user incurs because of credits are invalid.

have a sufficient stake in proving the validity of credits. Users could also increase certainty through contractual agreements.[76]

Conclusion:

For credits that reflect a retrospective measurement of emission reductions, the credit user should be liable for ensuring not only that sufficient credits are held, but that they are valid. Generators, should be required to certify the factual basis for credits. In some cases, especially where a third party aggregates many emission reductions from small sources, financially qualified third parties could be allowed to adopt this liability.

Design Issue 11: Enforcement

Issue:

What enforcement regime is necessary for a credit trading program?

Discussion:

The success of a credit trading program will depend on a credible enforcement threat which ensures both compliance with the regulatory requirements that have been partially waived as a result of securing credits and validity of credits. In a credit trading program regulators must enforce:

- regulatory requirements that have not been waived by the use of credits;
- the veracity of information used to back up credits in an open market trading program or the implementation of measures that are part of a pre-approved package in an emissions reduction credit trading program;
- the credibility of unapproved protocols used in an open market trading program; and,
- whether or not sufficient credits are held by an emitter to offset emission exceedances.

Ensuring the veracity of credits and the implementation of approved emission reduction projects will require regulators to inspect activities that are far outside

[76] See footnote 75 above.

their normal range of inspection activities. Rather than simply checking fuel consumption records or the efficiency of a particular industrial process they may need to review the implementation of employee trip reduction programs, or check the veracity of surveys measuring penetration of a particular technology. They will also need a much higher degree of technical sophistication to assess the credibility of protocols. Because of these difficulties in ensuring compliance, novel approaches to compliance will be necessary.

Compliance Audits

The difficulty of determining compliance in a credit trading regime, especially an open market trading program, suggests the need for submission of compliance audits by those participating in credit trading. The submission of compliance audits would be the first "line of defence" in ensuring compliance. Although, legislation could spell out the minimum requirements of an audit, to be credible, audits would require certification by accredited professionals. Currently, a few professional auditing or credit verification services exist. However, the verification services typically only verify a credit according to a protocol which may or may not adequately consider factors such as leakage or additionality.[77]

Government Enforcement Resources and Powers

Even if credit users are required to submit compliance audits completed by qualified individuals as a condition of trading, a credible enforcement threat from government agencies will be necessary.[78] Although enforcement of environmental laws in Canada has improved in recent years, it is likely not sufficient to ensure compliance in a credit trading program. According to holders of BC *Waste Management Act* permits, 39% of violations reported to the Ministry of Environment, Lands and Parks result in no enforcement action occurring, not even enforcement letters. In 1993-94, of 55 investigations under the *Canadian Environmental Protection Act*, there were only three prosecutions.[79] None of the other enforcement actions available to enforcers imposed a penalty on violators.

77 For instance, SGS Consulting in England offers offset verification services for projects that protect tropical rainforest. Although the protocol used appears to be an accurate measure, it does not deal with crucial issues such as leakage or reliability. Indeed, increased sequestration is only intended to last twenty years. These fundamental problems with conservation projects are discussed in Chapter 12.

78 The current Canadian enforcement regime and the need for administrative penalties is discussed at length in Christopher Rolfe, "Administrative Monetary Penalties: A Tool for Ensuring Compliance" (Paper presented to the Canadian Council of Ministers of Environment Workshop on Economic Instruments, Winnipeg, January 24, 1997) [unpublished].

79 Canada, Environment Canada, "Administrative Monetary Penalties: Their Potential Use in CEPA" [Issue paper 14 of the Reviewing CEPA series, Ottawa, 1994].

Under a credit trading program, this level of enforcement response would be a major incentive for emitters to avoid the cost of securing valid credits, or to profit from sale of bogus credits. A number of improvements to the environmental law enforcement regime will be necessary.

Canadian enforcement officials often lack both the resources and the legal tools to provide a credible enforcement threat.

Canadian enforcement officials do not have the resources to take action in all cases of non-compliance. Enforcement staff in most provinces have been cut back in recent years while the number of regulations being enforced climbs. Spending on enforcement per capita and per source is an order of magnitude less in Greater Vancouver as compared to Los Angeles.[80] According to a recent review of the BC Ministry of Environment, Lands and Parks, most staff feel that they are in "survival mode", only conducting those tasks that are of highest priority.[81] Prosecutions, often the only means of penalizing offenders, are reserved for the most serious cases.

It would be necessary to broaden the inspection powers currently provided by environmental legislation. In particular it will be necessary to maintain a power to inspect credit generators' and guarantors operations and records. Often such parties would not be covered by the inspection powers in federal or provincial environmental legislation.[82]

Enforcement Tools and Administrative Penalties

Canadian environmental enforcement officials also have a much more limited repertoire of enforcement responses than their counterparts in the US. The main enforcement tool is prosecution in the criminal court system, a process which is too cumbersome, time consuming and often inappropriate for minor violations of a credit trading program.[83] Ticketing, where it is available, is much less

80 Personal communication with Hu Wallis July 2, 1996.

81 John Holdstock, *et al*., "Evaluation of the Waste Management Permit System" (Victoria: Project Report KPMG, October 19, 1995) [unpublished] at 52.

82 See for instance, section 21 of the *Waste Management Act;* section 100 of the *Canadian Environmental Protection Act* and section 218 of *CEPA, 1997.*

83 Many procedural safeguards are inappropriate for ensuring compliance with the rules of a credit marketplace. For instance, the defence of due diligence and proof beyond a reasonable doubt are inappropriate for exceedances which both harm the environment and harm other participants in the market. For more discussion regarding the inappropriateness of criminal prosecutions for many environmental offences. See Christopher Rolfe, above at footnote 78; L.S. Fairbairn, "Regulatory and Quasi-Regulatory Offences: Should They be Included in the Criminal Law" [unpublished paper presented to the Conference of the Society for the Reform of Criminal Law, June 28, 1993] and William Drayton, "Economic Law Enforcement" (1980) 4:1 *Harvard Environmental Law Review,* at 1-31.

cumbersome, but the quantum of ticket fines is limited,[84] and fines cannot be varied to recover profits.

Both ticketable offences and other regulatory offences involve extensive criminal procedural safeguards, including a requirement of proof beyond a reasonable doubt and the defence of due diligence.[85] This criminal process is inappropriate for many of the violations that might occur in a credit trading regime. Many of the issues that will determine compliance, especially the adequacy of protocols, involve difficult judgments that are not amenable to proof beyond a reasonable doubt. Proving beyond a reasonable doubt that a firm emitted more of a particular pollutant than allowed can be difficult; proving beyond a reasonable doubt that the firm used an inappropriate adjustment factor, or failed to appropriately consider leakage would likely prove impossible in all but the most egregious cases. The task will be made more difficult by the criminal court's lack of familiarity with such issues.

Administrative penalties provide an efficient deterrent to violations that are too minor for the criminal courts but nonetheless erode the effectiveness of a trading program.

Any credible enforcement threat will require a system of administrative penalties. Administrative penalties are penalties imposed by government tribunals or officials rather than the courts. They are the primary enforcement tool for environmental laws in the United States. They are also a major enforcement mechanism under the *Forest Practices Code of British Columbia Act,* the Alberta *Environmental Protection and Enhancement Act,* the federal *Aeronautics Act,* and the *Income Tax Act*.

Administrative penalties involve neither the risk of jail nor the criminal court system, and are thus not usually subject to the constitutional protections applicable to criminal prosecutions.[86] Proof of a violation is on the "balance of probabilities" rather than "beyond a reasonable doubt", and the onus of proof can be shifted to the alleged violator. Fines under administrative penalty regimes are usually lower than maximum penalties available for offences tried in the criminal courts, but can be very substantial — as high as $100 000 in the case of the *Forest Practices Code.* Fines are also much more structured; for instance, administrative penalties applied under the US *Resource Conservation and Recovery Act* are based on a matrix of different factors which are added to a computer generated calculation of the economic savings attributable to non-compliance. For most administrative penalties, whether or not a firm was diligent in ensuring the validity of credits or the implementation of approved emission reduction programs, will affect the quantum of penalty but not liability for a penalty.

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84 See Fairbairn, *Ibid.*

85 Tickets are simply a convenient means of entering a guilty plea and being subjected to a pre-set fine. Accused can still contest tickets in the criminal courts and use the defence of due diligence etc. See Rolfe, above at footnote 78.

86 *Ibid.*.

Because they can be more easily applied than criminal prosecutions and lead to consistent penalties, administrative penalties offer an efficient deterrent to minor violations in a credit trading program. This is especially important to counter the incentives in a credit trading program to profit from minor violations (by avoiding the expense of buying credits or by selling credits). Administrative penalties could be structured to required purchase and retirement of credits as well as a fine.

Administrative penalties are also especially important to an open market trading program because a tribunal of experts rather than a provincial court judge can be tasked with reviewing the validity of protocols used to generate credits. The tribunal's function would be to assess whether or not protocols overstate the emission reduction credited to a project. Because of the difficulty in proving the invalidity of a credit years after it was generated, and because credit trading is an alternative to compliance with regulatory standards, it is recommended that the onus of proving the validity of a credit should be on the credit user. If a tribunal does find that emission reductions have been overestimated, the credit user will be out of compliance unless it has used extra credits as a compliance margin.

Conclusion:

If credit trading is used as an alternative to compliance with regulatory standards, effective enforcement of trading will be a challenge which will require a number of significant changes to the current environmental enforcement regime. These include reliance on mandatory compliance audits by accredited professionals; increased inspection powers; increased enforcement resources and the use of administrative penalty systems.

If a credit trading program is used, it should impose on all credits created and used a fee that helps pay for enforcement and administrative costs associated with trading. In engaging in trading, companies are placing this cost on government. A fee can internalize that cost.

Design Issue 12: Who Has the Right to Claim Offset Credits?

Issue:

What rules are necessary to ensure that emission reduction projects are not double or triple counted?

Discussion:

In an open market trading program it is essential to establish rules of ownership for credits. This ensures that projects are not double counted. There are many examples of double and triple counting under the Voluntary Challenge and Registry Programs of the US and Canada. For instance, West Coast Energy, the BC Government and forest companies on Vancouver Island have all claimed credit (under the Voluntary Challenge and Registry Program) for reducing emissions by fuel switching from oil to natural gas at Vancouver Island pulpmills. The forest companies switched fuel; West Coast Energy built a pipeline which allowed the switch; the government subsidized the pipeline.

The first approach is simply to require all credits to be signed off by all potential claimants. Thus, if a soil sequestration project involves farmers who own land or lease it from the crown, an agency that provides extension services to encourage no-till techniques, a utility that funds the agency and a provincial government that leases land to some of the farmers, all would need to agree to the utility claiming credit for the project before it could do so. This will likely work, although it may add some administrative burden on credit generators, and could occasionally thwart credits being claimed for a project.

Alternatively, ownership rules could be developed with the original owner being free to trade credits to users or brokers. For instance, if the emission reduction concerned involves process changes and emissions at a particular facility, that facility should have the right to assign credit for the emission reduction. Thus, credit for a cogeneration project would be held by the facility using waste heat to replace fossil fuel powered boilers. Many other rules are obvious. The right to claim and assign credit for an afforestation project should go with ownership the land being used for the project. For projects involving reductions of electric usage at one or two facilities, those facilities should have the right to claim and assign credits.

In other cases, it may not be as intuitively obvious who gets the credit. In a program to retrofit homes with high efficiency hot water heaters should the retrofitter, the heater manufacturer or the purchaser of the heaters get credit? The simplest option is to make the same rules apply as for industrial changes. Part of the retrofit agreement would be an assignment of credit to the retrofitter or hot water tank manufacturer.

Conclusion:

Normally standard contract law can be used to transfer property from one person to another. However, this can only occur where the law defines who has ownership in the first place. Although the common law of ownership is highly developed for most forms of property, there is no body of law defining credit ownership.

Thus a credit trading program must either require all potential claimants to agree on ownership of the credit and/or develop rules of credit ownership. Even if rules are developed, it is likely that areas of uncertain ownership will arise. In these cases, it will still be necessary to negotiate ownership.

Failure to have credits signed off by potential claimants should be a basis for invalidating credits, as double or triple counting poses a major threat to the effectiveness of credit trading.

Evaluation of Credit Trading Programs

Credit trading programs have primarily evolved as a means of reducing the costs of complying with environmental laws and ensuring that environmental laws do not reduce economic growth. Credit trading can also be used to comply with voluntarily commitments.

Credit trading may increase the feasibility of certain types of regulations. Because there are many unrealized opportunities for cost effective emission reductions which can be used to generate credits, credit trading can reduce the cost of compliance with regulation. It thus becomes feasible to outlaw new sources of emissions over specified sizes (unless they are offset). The limits on emissions suggested by the Ontario Collaborative become much more feasible when combined with credit trading or atmospheric user fees dedicated to the purchase of credits. A standard like the Oregon CO_2 Standard, which is intended to consistently exceed best achievable technology currently in use by seventeen percent, becomes more acceptable to industry. Also, the activities that generate credits can smooth the way for improving regulations, as they will identify feasible, cost effective emission reduction opportunities.

Environmental Effectiveness

The purpose of allowing use of credits as an alternative to regulatory compliance is not environmental improvement but reduction of the costs of regulation. The environmental effectiveness of credit trading will depend on whether credit trading is as environmentally effective as strict regulatory compliance or strict compliance with voluntary commitments.

Credit trading will only be as environmentally effective as strict compliance with regulations if the credits represent an emission reduction which would not have occurred in the absence of the incentive offered by the credits. However, accurately determining the additionality of a project is impossible. Trying to reject all projects which are not additional will also lead to the rejection of cost effective additional projects.

Because any credit trading program will give credit for some emission reduction projects that would have occurred anyway, credits will need to be discounted or regulations made more rigorous in a program that allows trading.

Because it is likely that any credit trading program will give credit for some non-additional emission reduction projects, regulations may need to be more rigorous in a program that allows trading than one that does not. Alternatively, a program could require a portion of credits to be "retired." However, credit trading will still reduce the effectiveness of regulations if the retirement requirement does not more than compensate for credit from non-additional projects. On the other hand, if a requirement is imposed to retire a sufficiently large number of credits, trading could benefit the environment.

It is sometimes argued that the issue of credit for non-additional projects is irrelevant in the context of implementing the *Kyoto Protocol* and moving to a national cap on emissions. The issue is still relevant for several reasons. First, prior to 2008, use of credits from non-additional projects to comply with regulatory requirements will slow the rate of overall emission reductions and, if a sufficiently large number of credits from non-additional projects are recognized, impede Canada's ability to comply with the *Kyoto Protocol*. Second, if the use of credits for non-additional projects is concentrated in some sectors, it will have a distributional impact (increasing the emission reduction burden on other sectors) unless compensated for by stricter regulations in the sector using the non-additional credits. In particular, there is a risk that "credit for early action" — i.e. credit for action prior to regulatory requirements being in place — could create a reservoir of credits from non-additional projects.

The problems of trading additional regulatory requirements against non-additional emission reductions will be less significant if baselines accurately reflect the norms of a particular sector. An open market trading program can potentially provide greater certainty that the emission reductions represented by a credit are equivalent to the emission exceedances against which the credit is being applied. Retrospective measurement of emission levels or energy use both at the credit user’s facility and by the credit generators are likely to be more accurate, and estimates of baseline emissions are more likely to be accurate when estimated retrospectively.

However, the environmental effectiveness of an open market trading program will be highly dependent on the level of enforcement as there is no pre-approval of credits prior to their use. The current norms of enforcement are likely inadequate for a credit trading program both because credit trading creates new incentives to non-compliance and because enforcing implementation of emission reduction programs or the validity of credits is significantly more complicated than simple enforcement of regulations. An enforcement regime which would be adequate for a credit trading program would likely include mandatory auditing of compliance, significantly greater resources devoted to enforcement, and provisions for administrative penalties.

Credit trading is likely to be more environmentally effective if it is used as an adjunct to performance standards for both new and existing sources. If offset requirements are only imposed on new or expanded sources, an incentive is created to not develop new or expanded sources even though they may have lower emissions than older sources. There is also a risk that if offset requirements are only imposed on new or expanded sources over a certain size, firms may design new sources or design expansions in a manner that avoids the threshold. Nonetheless, the first step in developing a regulatory program that uses credits as a compliance alternative may be to establish stringent performance standards for new facilities.

The high cost of administering a credit trading program must be weighed against potential cost savings from having an unlimited range of emission reduction opportunities.

In some emission reduction credit trading programs credits are based on the difference between projected emissions and baseline emissions assuming that regulatory requirements are not tightened over the lifetime of the project. If the credits are not cancelled in the event that regulatory requirements are tightened, the effect is that regulators will find it more difficult to pursue significant emission reductions in the future. If the credits are not cancelled, or reassessed to reflect a new baseline, when industry uses a low cost emission reduction option to compensate for not complying with regulatory requirements, government loses the opportunity to mandate that lower cost option as a means of lowering emissions. The benefit of that emission reduction opportunity is instead applied to compensate for an emission that could have been avoided. This is particularly problematic where the credit user is using the credit to compensate for a new high emission facility that cannot be easily retrofitted in the future. In such cases, credit trading may increase the long-term costs of pursuing more stringent emission reductions.

On the other hand, so long as credits are based on regulatory standards actually in place when an emission reduction occurs, credit generation projects may increase the penetration of a new technology to a point where it may be easier for government to impose higher standards. This is because the penetration of the technology caused by credit generation projects will help establish the feasibility and acceptability of higher regulatory standards. Although those profiting from credit generation and use may resist the regulatory change, they will not be in a good position to argue that a technology is unfeasible.

To be environmentally effective, credit trading programs will need to adjust credits for the certainty of emission reductions achieved by an emission reduction project, the potential for the project to cause emission increases at other locations (leakage) and in the case of emission reduction projects in an Emissions Reduction Credit Trading Program, the reliability of projects.

Economic Efficiency

The main attraction to a credit trading program is that firms can seek out the most cost effective emission reduction opportunity regardless of where it occurs. This could potentially include clean development projects, sequestration projects, or a variety of other projects which may be difficult to regulate or would not be within the scope of a cap and emission allowance trading program.

However, the transaction costs of credit trading are significant. The transaction costs of emission reduction credit trades in the South Coast Air Quality Management District are usually in the range of $30 000 to $60 000 per trade for the seller and buyer combined.[87] Transaction costs in the Oregon Exemption Project were several hundred thousand dollars. In open market credit trading, the transaction costs are anticipated to be significant but far lower than in the case of emission reduction credit trading.

In addition to the transaction costs borne by the seller and the buyer, there are costs to government of developing regulations, developing protocols and lifecycle emission factors, and the costs of enforcement. All of these are likely to be significantly higher in credit trading programs than in competing strategic options.

Transaction and administrative costs incurred in relation to projects which are non-additional are wasted. No emission reduction has occurred in addition to what would have occurred in the absence of those costs. Purchasing credits for non-additional credits may be the least cost compliance alternative for a firm but it is not cost effective, unless it is a necessary cost to ensure adoption of additional emission reduction projects.

Offset requirements applied only to new sources or new sources above a designated threshold will create perverse incentives to avoid threshold levels and may encourage the continued operation of inefficient, high-emission facilities.

Equity

The equity of a program that involves regulations and trading as a compliance option will depend largely on the regulations imposed. If only new and expanded sources are required to offset their emissions, the burden of emission reduction is carried solely by these sources even through they may have invested heavily in energy efficiency emission controls and low carbon technology. Inefficient industries may reap the benefit if they become credit generators.

[87] See Dwyer, above at footnote 3.

On the other hand, if emission performance standards are adopted for new and existing facilities, they will tend to penalize less efficient business and reward those companies that have invested in energy efficiency and emission controls. The inequities of emission performance standards will be less where they are combined with credit trading, as firms have the opportunity to pursue lower cost emission reduction opportunities. Moreover, when there is a conflict between pursuing least cost emission reductions and equitable burden sharing, credit trading can reduce the conflict by spreading regulatory burden equitably with the expectation that least cost emission reductions will still be pursued to reduce control costs.

Feasibility

Credit trading is attractive because the regulations that drive the demand for credits can be implemented in a piecemeal manner. On the other hand, credit trading would impose a number of new burdens on government: the development of protocols and lifecycle emission factors, increased enforcement burdens, the need for increased sophistication in determining regulatory compliance, new mechanisms for administrative penalties, and the establishment of accredited professionals who could audit enforcement. Although some administrative challenges, such as the development of the protocols, could be phased in over time, and many of the tools will be developed by international activities and governments in other jurisdictions, Canadian governments would still need to develop a significant regulatory infrastructure prior to trading being used as an alternative to regulatory compliance.

Chapter 9:

Cap and Emission Allowance Trading

Those who will not reason Perish in the act:
Those who will not act Perish for that reason.

— W.H. Auden

The last chapter discussed a number of the inherent problems with emission reduction credit trading: many projects will not represent an improvement from the business as usual baseline; transaction costs are high; trading depends on the development of regulated emission standards and environmental progress depends on a continual ratcheting down of these standards. These problems have led many people to advocate cap and emissions allowance trading programs.

In a cap and emission allowance trading program's simplest form, the government establishes a limit, or cap, on total allowable emissions from participating sources during a time period. It then either auctions or gives away allowances to release that pollutant, with the total emissions allowed by all allowances being equal to the cap set by government. All participating sources must hold sufficient allowances for their emissions. Sources with surplus allowances can sell the surplus to other sources whose emissions would otherwise exceed the amount allowed by their permits.

If all emitters act according to economic theory and there are no transaction costs associated with buying and selling allowances, all emitters with abatement costs below the average abatement cost will reduce emissions and sell their allowances. Those with above average abatement costs, and under most programs new and expanded sources, buy allowances. Over time, either the number of allowances in circulation can be reduced so that the overall cap is reduced.

After a quick review of the elements and main advantages of a cap and emission allowances trading program, this chapter provides an overview of the American experience with cap and emission allowance trading programs used for local or regional pollutants. It then discusses some preliminary issues that determine the viability of a cap and emission allowance trading program. The remainder of the chapter discusses the various issues involved in designing a trading program.

Basic Elements of Cap and Emission Allowance Trading

The basic elements of a cap and emissions allowance trading program are:

- **A defined scope.** What sources are required to participate in the program? Who can opt in?
- **A defined cap.** Total allowable emissions for sources within the scope of the program must be defined.
- **A defined currency.** Will the currency be allowances each representing the right to emit a tonne of carbon dioxide?
- **An allocation mechanism.** How will allowances be distributed to various emitters?
- **A monitoring regime.** Emitters need to know how many allowances they need and how many excess allowances can be sold; regulators need to be able to verify allowances held against actual emissions.
- **A forum to track and publicize available allowances.** At least one trading program has failed because of the difficulty of buyers and sellers identifying one another.[1]
- **An enforcement mechanism.**

Advantages of Cap and Emission Allowance Trading

Additionality, low transaction costs and, once a program is established, momentum toward reduced emissions are the main advantages of cap and emission allowance trading. The trading that occurs within a cap and emission allowance trading program is trading within a closed system. This helps ensure the additionality of emission reductions under the program, because emitters are limited in where they can find emission reductions. Under a credit trading

[1] Robert N. Stavins, "Transaction Costs and Tradeable Permits" (1995) 29 *Journal of Environmental Economics and Management* 133, at 135.

program an emitter could potentially search the world for an emission reduction that would have occurred anyway and purchase it at prices that reflect its non-additionality, and use it to avoid compliance with a regulatory measure. In a cap and emissions allowance trading program, the reduction must occur within the scope of the program. Emission reductions will be additional to the extent that the cap is lower than emissions in the absence of the cap.

Cap and emission allowance trading programs generally have much lower transaction costs than emission reduction credit trading programs. While the purchaser of a credit has to either have the credit approved by government or investigate factors that determine its validity, most emission allowance trading programs allow emitters to accept allowances at face value.

Cap and emissions allowance trading programs offer, but may not always deliver, the promise of an actual cap on emissions. The main problem is that not all emission sources contributing to a problem are within the scope of the program. For instance, a cap and emission allowance trading program for oxides of nitrogen in Southern California only covers about sixteen percent of total emissions. Also, a cap may induce increased emissions not caught by the cap. For instance, Ontario Hydro has increased imports of electricity from dirty sources within the same airshed that are not covered by its voluntary cap on emissions. Although the cap is met, pollution is worse.

Another advantage of cap and emission allowance trading programs is that, once established, they are relatively immune from wavering political will. For credit trading to achieve a cap, especially a declining cap, it is necessary to continually ratchet up regulatory standards. For environmentalists this means continual diligence in ensuring that governments impose more stringent standards. The corollary of this is it may be more difficult to increase the stringency of a cap and emission allowance trading program.

The Experience with Cap and Trade

As with emission reduction credit trading, Americans are the pioneers of cap and emission allowance trading. This section summarizes experience in the US with cap and trade programs for sulphur dioxide under the US *Clean Air Act*, oxides of nitrogen and sulphur in southern California, ozone control in thirteen eastern seaboard states and a New Zealand cap and trade system for fishing quotas. Consideration of a cap and trade system for local pollutants in the Greater Vancouver Regional District is also discussed.

Cap and Trade for Sulphur Dioxide

The premier cap and emission allowance trading program in the US is the sulphur dioxide trading program under Title IV of the US *Clean Air Act, 1990* (the Title IV Acid Rain Program). The Title IV Acid Rain Program is designed to achieve a 7.7 million metric tonne reduction in sulphur dioxide emissions from electric utilities, between 1990 and 2010. In Phase I, 110 utilities are required to hold allowances for 263 high emitting coal fired boilers. Smaller sources can opt into the program and receive an allocation of allowances. Participants were required to reduce their annual emissions by 3.2 million tonnes beginning January 1, 1995. In Phase II, beginning in 2000, about 1800 remaining boilers are required to enter the program. All participants are required to reduce emissions by a further 4.5 million tonnes by 2005.[2]

In order to buy the support of the businesses taking part in RECLAIM, allowable emissions were initially set at sixteen percent to 50% above actual emissions in the baseline year.

Each allowance allows a utility to emit a short ton of sulphur dioxide. The number of allowances allocated to each utility was mainly based on historic production levels, although a number of different allocation rules existed. The number of allowances allocated to a utility decreases over time. Utilities are given full freedom to choose how they achieve the reductions necessitated by the program. Monitoring of emissions is extremely strict, using tamper-proof continuous emission monitors. Operators with emissions that exceed their allowances must pay automatic administrative penalties and must purchase allowances to make up for the exceedance. As a result, both the government costs of administering the program and transaction costs have been very low.[3]

Most of the emission reductions that have occurred to date have occurred by switching to low sulphur coal; this has lead to a plentiful supply of low cost allowances. (During development of the program industry estimated that a one ton allowance would cost $785 or higher during Phase I, in fact the allowance

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2 United States, General Accounting Office, *Air Pollution: Allowance Trading Offers an Opportunity to Reduce Emissions at Less Cost,* (United States General Accounting Office: Washington, 1994) at 16.

3 One percent of staff working on the *Clean Air Act* is devoted to a program which gets 40% of reduction attributable to the *Clean Air Act.* This is based on estimates that the 1990 *Clean Air Act* amendments would yield 28 million tonnes of emission reductions, twelve million of which came from *Title IV* Acid Rain provisions. There are approximately 15,000 federal, state and local employees involved in implementing the *Clean Air Act.* Between 50 and 70 federal staff and between 50 and 80 state/local staff are involved in implementing *Title IV* (state and local staff, primarily certify and audit emissions monitors): Personal communication with Carey Fitzmaurice, US EPA, Office of Policy Analysis and Review, June 30, 1997. Transaction costs are estimated at one percent or less of the cost of an allowance: Carlton Bartels, Cantor-Fitzgerald Environmental Brokerage Services, in "Proceedings of the Controlling Carbon and Sulphur — International Investment and Trading Initiatives" (1997).

price in 1996 dropped to $68[4]). In the first couple of years of the program trading levels were low and most cost savings resulted from flexibility in how a utility meets its emission limits rather than trading.[5] However, there appear to be increased trading volumes which should result in greater savings.[6]

RECLAIM

California's South Coast Air Quality Management District established the Regional Clean Air Incentives Market (RECLAIM) cap and emission allowance trading program for oxides of nitrogen and sulphur oxides. RECLAIM was developed as an alternative to the SCAQMD's 1991 air quality management plan which relied on command and control regulations. RECLAIM applies to all facilities that emitted 3.6 tonnes or more of nitrous oxide or sulphur oxides in 1990 or later. The nitrous oxide trading captures about four hundred facilities representing about 65% of emissions from permitted point sources, or sixteen percent of total nitrous oxide emissions; the sulphur oxides program captures 41 facilities representing 85% of point source emissions. Smaller facilities can elect to join the program, but once in, they cannot opt out.

Emission allowances are issued on the basis of historic production levels and emission factors applicable to the type of facility. Allowances are set out in permits and, if a facility does not trade allowances, allowable emissions decline by 8.3% per year for nitrous oxide and 6.8% for sulphur oxides. New and significantly modified facilities must obtain allowances to offset their emissions and are still subject to "command and control" technology standards. Although most trades do not require approval, there are restrictions in place to ensure against pockets of severe pollution.

Although RECLAIM is expected to eventually achieve emission reductions, many observers believe that greater emission reductions would have occurred through the use of prescriptive regulations.[7] First, the development of RECLAIM took a significant amount of time during which prescriptive standards were not imposed. Second, in order to "buy" the support of the businesses taking part in RECLAIM, firms were given flexibility in determining historic production and emission levels

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4 $785 was the estimated cost of allowances during Phase I developed by a consultant employed by the Ohio Coal Development Office Consultancy. $69 per short ton was the cost of a permit in March 1996: John Palmisano, "How can the Lessons Learned from Joint Implementation Help Construct an International Carbon Offset Regime?" [December 1996] *World Energy Council Journal* 37.

5 US General Accounting Office, above at footnote 2.

6 Carlton Bartels, above at footnote 3.

7 Personal communication with Bill Curtis, Sierra Club Legal Defence Fund, San Francisco, November 15, 1996.

that were the basis for allowance allocation. Because all firms chose high production and emission years, allowable emissions under RECLAIM were sixteen to 50% higher than actual emissions during baseline years.[8] Despite this, there does not appear to be an increase in emissions in the initial years, although data are ambiguous.[9] Government and several environmental groups disagree as to whether or not the end result of RECLAIM is a faster or slower reduction in emissions than would have occurred under the 1991 air quality plan.[10] Groups have also expressed concern regarding the adequacy of enforcement. On the other hand, RECLAIM is projected to save about $58 million compared to costs of prescriptive standards.[11]

Illinois and OTR

Cap and emission allowance trading programs are also being developed in the Northeast's Ozone Transport Region and for the Chicago area in Illinois. The Ozone Transportation Commission has apportioned the cap between each state in the OTR, and each state is responsible for allocating its share among firms within its boundaries. Discussions are ongoing regarding the expansion of the OTR program to all states east of the Mississippi.[12]

An interesting aspect of the Illinois program is the requirement that one percent of each source's allotment of allowances, as well as allowances made available from

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[8] California Environmental Protection Agency, "Public Meeting to Consider Approval to the SCAQMD's Regional Clean Air Incentives Market" (February 8, 1994 background paper) [unpublished] refers to allowed emissions being sixteen percent higher than actual emissions. The Coalition for Clean Air, opponents of RECLAIM, also refer to allowable NOx emissions being sixteen percent over actual emissions prior to RECLAIM: see Matthew Polesetsky, "Will a Market in Air Pollution Clean the Nation's Dirtiest Air? A Study of the South Coast Air Quality Management District's Regional Clean Air Incentives Market" (1995) 22 *Ecology Law Quarterly* 359 at 387. However, the South Coast Air Quality Management District, Office of Stationary Source Compliance "Second Annual RECLAIM Program Audit Report" (February 14, 1997) [unpublished] shows available allowances exceeding reported nitrous oxide emissions by closer to 50% at the beginning of RECLAIM. Oxides of sulphur allowable emissions are much closer to actual. Other unpublished estimates also put the exceedance closer to 50%: personal communication Ben Hennecke, President, Clean Air Action Corporation.

[9] South Coast Air Quality Management District, *ibid.*

[10] According to environmentalists real emission reductions are not expected to begin until at least three to six years after the commencement of RECLAIM: Bill Curtis above, at footnote 7. See also Testimony of American Lung Association before US Congress, as cited in Polesetsky, above at footnote 8, at 389. According to the California Air Resources Board emission reductions will be faster under RECLAIM: California Environmental Protection Agency, above at footnote 8, at 9.

[11] US, Environmental Protection Agency, "Open Market Trading Rule for Ozone Smog Precursors" (proposed policy statement and model rule, October 1995) at 7.

[12] The discussions involve all of the Ozone Transportation Assessment Group (OTAG) states.

shut downs, be put into a special fund for resale in times of high demand. The funds are then spent to pursue further emission reductions.

Consideration of Cap and Trade in GVRD

In 1994, the provincial and federal governments along with the Greater Vancouver Regional District commissioned a report into the use of trading in the GVRD. Based on American experiences with trading, the report concluded that a cap and emission allowance trading program would achieve air quality goals in the Lower Mainland at significantly less cost than prescriptive standards.[13]

Emission allowance trading has not proceeded any further in the GVRD largely because of skepticism regarding the potential cost savings. Skeptics noted that the GVRD is pursuing prescriptive standards which cost much less per tonne of reductions than the standards applicable in American jurisdictions that have adopted cap and emission allowance programs. Second, there was concern that the incremental administrative, monitoring and enforcement costs would be higher in the GVRD where the enforcement and monitoring infrastructure is less developed than in many US jurisdictions.

Transferable Quotas for Fisheries in New Zealand

New Zealand uses a system "Total Allowable Catch" (essentially a cap on the total fish of a particular species that can be caught) and individual transferable quotas (allowances to catch fish) for the management of its commercial fisheries. The Total Allowable Commercial Catch limits are set yearly for different species according to a criteria set in legislation. Fishers' individual transferable quotas for different species are defined as a proportion of the annual Total Allowable Catch for that species. Quotas were allocated on the basis of fishers' historic catches, but fishers are allowed to buy and sell quotas from other fishers. Some restrictions exist to ensure that quotas are not monopolized by a small number of commercial fishing companies and in order to protect small fishers. The fishing quotas are enforced by requiring fish buyers to attest that all the fish they received can be matched with quotas, and an extensive paper record is kept of fish caught and all trades. The paper trail enables government to detect mis-reporting of fish catches long after the offence occurs.

[13] The ARA Consulting Group Inc. and Bovar-Concord Environmental, *Potential Economic Instrument Approaches to Air Quality Management in the GVRD* (Greater Vancouver Regional District, 1995).

Summary

The growing experience with emissions allowance trading programs in the United States will no doubt be valuable in setting the design for any cap and emission allowance trading program for greenhouse gas emissions. Many of the elements of American programs will likely be incorporated into any Canadian cap and emission allowance trading program.

The American experience indicates the potential for very significant and very cost effective emission reductions, and the extent to which emission reduction opportunities are discovered when companies are given an incentive to do so. It also indicates the extent to which a well designed system can have extremely low transaction costs. Finally, it indicates the political difficulty of allocating allowances in a way that is politically viable but does not delay the timing of emission reductions.

Designing a Cap and Emission Allowance Trading Program

In both Canada and the United States, policy analysts have discussed the possibility of cap and emission allowance trading programs for large, point source greenhouse gas emitters. In Canada, the Canadian Energy Research Institute (CERI) examined the potential for point source carbon dioxide trading in Canada and found that a trading program was potentially viable among large point sources. The United States General Accounting Office (GAO) concluded that the *Clean Air Act's* sulphur dioxide trading program could be a model for a trading program to reduce American carbon dioxide emissions. The GAO concluded that trading could be extended from electric utilities to major industrial sources of greenhouse gases such as manufacturers of cement and lime.[14]

Analysis of Canada's industrial and power generation emissions suggests that a cap and emissions allowance trading program could be an important part of a Canadian greenhouse gas reduction strategy.[15] The widest scope for a program would be inclusion of all greenhouse gases from power generation and industrial point sources. A cap and emission allowance trading program for point source emissions could, at its very widest, capture up to one quarter of BC's greenhouse gas emissions but possibly up to almost one half of Canada's emissions.[16] Other

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14 US General Accounting Office, above at footnote 2, at 66.

15 See below under Design Issue 14.

16 The factors that determine what sources could and could not be included within a program are discussed further under Design Issue 14.

measures are essential to reducing greenhouse gas emissions from area and mobile sources. A number of design issues need to be addressed:

A number of issues need to be addressed in designing a cap and emission allowance trading program for greenhouse gases. Key issues are:

- **Design Issue 13:** Data Necessary for Program Design;
- **Design Issue 14:** Scope of the Program;
- **Design Issue 15:** Inclusion of Biomass Emissions;
- **Design Issue 16:** Expanding the Program;
- **Design Issue 17:** Defining the Traded Commodity;
- **Design Issue 18:** Certainty & Property vs. Flexibility;
- **Design Issue 19:** Allocating Allowances;
- **Design Issue 20:** Tax Treatment of Allowances;
- **Design Issue 21:** Monitoring Equipment, Enforcement and Liability of Good Faith Purchasers; and
- **Design Issue 22:** Allowance Trading in a Competitive Electricity Market.

Design Issue 13: Data Necessary for Program Design

Issue:

What information or data is needed for development of a cap and emission allowance trading program?

Discussion:

One major difficulty in designing either a national or provincial cap and emissions allowance trading program is the limited information available in Canada's inventories of emission sources. There is no information indicating:

- the total number of industrial point sources of greenhouses gases;

- the number of point sources which have emissions greater than any defined threshold;[17] or

- the total emissions from point sources with emissions greater than any defined threshold.

CERI's report had recommended that if point source trading were to be pursued, the first step is to develop an inventory of point sources.[18] This information is necessary to:

- Define what sources should be required to participate in a program. Currently it is impossible to calculate what impact various exclusion thresholds would have on the number of sources and quantity of emissions covered.

- Set caps and distribute allowances. In some cases it may be possible to estimate past emissions based on past fuel purchases, but for many emissions there are significant discrepancies in estimates of past and present emissions.[19] This uncertainty can exacerbate the sort of emissions inflation which delayed progress under the RECLAIM program by allowing the initial cap to far exceed actual emissions.

The United States is in a significantly better position to implement point source trading than Canada. Emissions from utilities are currently being accurately monitored and reported.[20] Development of an accurate source specific inventory of greenhouse gas emissions is an important first step towards intelligent policy development. The US EPA is currently considering expanding the ambit of its Toxic Release Inventory (a publicly accessible inventory of pollution emission sources with site specific information) to include greenhouse gases.

Conclusions:

Canada should expand the Canadian equivalent of the Toxic Release Inventory, the National Pollutant Release Inventory, to cover greenhouse gases.

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17 Some industrial associations have voluntarily reported this sort of information. For instance, the Canadian Chemical Producer's Association reports that twelve members had 1995 emissions of carbon dioxide exceeding 100,000 tonnes: Canadian Chemical Producers' Association, *Reducing Emissions: 1995 Emissions Inventory and Five Year Projections*, (Ottawa: CCPA, 1996).

18 Merete Heggelund, *Emissions Permit Trading: A Policy Tool to Reduce the Atmospheric Concentration of Greenhouse Gases* (Calgary: Canadian Energy Research Institute, 1991).

19 For instance, estimates of carbon dioxide stripped and released from natural gas processing plants, emissions from biomass and emissions from fossil fuels consumed by fossil fuel producers are often inconsistent.

20 The *Clean Air Act* requires electric utilities to report either measured or estimated carbon dioxide emissions to the EPA: Section 821 US *Clean Air Act*.

Design Issue 14. Scope of the Program

Issue:

What sources should be included in the scope of a cap and emission allowance trading program?

Discussion:

Generally, the more sources that can be included within the scope of a program at its inception the better. Making the program more comprehensive means there will be larger differentials in emission reduction costs and therefore greater cost savings through trades. A more comprehensive program also means less leakage and greater emission reductions. Industry is unlikely to support a cap and emission allowance trading program with a narrow scope because of the limited opportunities for cost saving trades.

Despite the advantages of a wide initial scope for a program, a number of factors have to be considered in deciding what sources to include within the scope of a cap and emissions trading program:

- Can emissions from a particular source be accurately measured?
- Are the advantages of including smaller sources worth the administrative and monitoring costs involved?
- Will emissions thresholds increase emissions at excluded sources?

Phased entry into a cap and emission trading program may be used to achieve equity among sources. In the US Title IV Acid Rain Program, the dirtiest sources were included in Phase I and required to reduce their emissions before the program expanded to cleaner sources. Although many cost effective emission reductions are occurring and the allowances are being banked to sell to Phase II participants, one US study concluded that some cost saving emission reductions were likely not being realized because of the lack of current demand for allowances.[21] An alternative way of achieving equity between clean and dirty sources may be to use an allocation formula that rewards clean production.

21 This has been a reason behind the lower than expected levels of trading in the US sulphur dioxide program. See: General Accounting Office, above at footnote 2, at 43 and 63.

Measurable Emission Levels

It is important that cap and emission allowance trading programs only extend to sources with emissions that can be accurately monitored at all times and can be verified after the fact. Unlike command and control regulation, it is not sufficient simply to ensure that emissions do not exceed some peak limit or that a source is using the correct emission control technology. Both emitters and regulators need to be able to know whether an emitter's total emissions are balanced by their allowances.

Because of the increased incentives to exceed allowed levels and submit fraudulent monitoring, monitoring must not only be accurate but be designed so that actual emissions can be verified after the fact.[22] Selling of allowances that are not truly surplus is as lucrative as counterfeiting, but in some ways more difficult to control as a counterfeit bill can be identified and removed from the market. An allowance that is sold on the basis of a non-existent reduction is essentially counterfeit, but cannot be identified as such. Firms should not be put in a position where they can wait and see if they are inspected, and if not lie about monitoring results. Accurate tamper-proof monitoring equipment is the gold standard of a cap and emission allowance trading program.

Accurate knowledge of emission levels is important for setting caps and distributing allowances. If sources with uncertain emission levels are included within the scope of a program and trade their allowances to other sources, the result may be an unintended increase in emissions (if emissions from the uncertain source were overestimated). This will be a particular concern if sources are given latitude in how to estimate their emissions, and allowances are allocated free on the basis of historic emission levels. In such a situation, sources will have a large incentive to exaggerate their emission levels so that they receive a larger allocation.

Some reports have suggested a trading system could be extended to many small point sources, area and mobile sources, using crude proxies for emissions.[23] For instance, a proxy for vehicle emissions would be miles driven multiplied by fuel efficiency or emissions per kilometre as measured by an inspection and

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22 Under command and control, a source that exceeds allowed levels may reduce compliance costs. In an allowance trading program the source gets these benefits plus the ability to sell a surplus allowance (or avoid the need to buy an allowance).

23 Task Force on the Comprehensive Approach to Climate Change, *A Comprehensive Approach to Addressing Potential Climate Change* (Washington, D.C.: US Department of Justice, 1991): Richard B. Stewart and Jonathan B. Wiener, "A Comprehensive Approach to Climate Change: Using the Market to Protect the Environment" in [November/December 1990] *The American Enterprise* 75.

maintenance program.[24] A proxy for methane emissions from cattle would be head of cattle multiplied by an emission factor.[25] The factors noted above militate against using proxies which are rough measures of emissions, and only involving sources which can be accurately measured. The use of rough proxies is also problematic because most proxies fail to reflect emission reduction measures (e.g. improved driving habits; changes to cattle feed), thus eliminating the incentive to take such steps.

Accurate information on emissions from individual firms is essential to establishing trading mechanisms, but Canada does not collect information on greenhouse gas emissions under the National Pollutant Release Inventory.

For these reasons programs like the US Title IV Acid Rain Program or RECLAIM have only applied to emitters which can accurately measure emissions using either tamper proof continuous emission monitoring equipment (CEMs), or where it is sufficiently accurate, fuel meters and emission factors.

Luckily, carbon dioxide emissions from combustion of most fossil fuels can be measured with an accuracy equal to CEM by using either tamperproof fuel meters or sales records and emission factors. Thus, in the case of carbon dioxide, the cost of monitoring emissions is a much less significant factor in limiting the scope of a program.

However, for some fuels, such as bituminous coal, coke, hog fuel and spent pulp liquor, carbon content is inconsistent.[26] Carbon dioxide emissions from some industrial processes depend on variable parameters of inputs.[27] For these sources, emitters may need to use CEMs or emission factors which represent the higher carbon content of their fuels. Allowing emitters to use either CEMs or an average emission factor would be inappropriate because emitters will always opt for the measurement method which yields the lowest emission and allows them to sell surplus allowances. On the other hand, use of an emission factor which is relatively high for a particular fuel may provide an incentive for emitters to install accurate emission monitoring equipment. (It should not, however, be used for allocation of allowances on a historic emissions basis, as it could lead to the over allocation of allowances.)

For most other industrial sources of greenhouse gas emissions, such as nitrous oxide from large stationary source fuel consumption, CEMs are likely the only

24 This type of program, using AirCare measured emission rates, was suggested in The ARA Consulting Group Inc. and Bovar-Concord Environmental report, above at footnote 13.

25 Ernst Mohr, "Tradeable Emission Permits for controlling Greenhouse Gases and Complementary Policies" in *Climate Change: Designing a Tradeable Permit System* (Paris: Organization for Economic Co-operation and Development: Paris, 1992) at 244.

26 Emission factors for some type of coal vary by over 50%: A.P. Jaques, *Canada's Greenhouse Gas Emissions: Estimates for 1990* (Ottawa: Environmental Protection Publications, December 1992).

27 For instance, carbon dioxide emissions from cement production are proportional to lime content. Since lime content varies by about fifteen percent, carbon dioxide emission per unit of cement will vary considerably.

means of measuring emissions. Deciding whether to include these sources will require consideration of emission levels and the cost of measurement.

Finally, emissions from some industrial or other large sources may be impossible to accurately measure. For instance, according to Alcan Aluminum, perflourocarbons from their Kitimat smelter, BC's largest source of greenhouse gases, are emitted from a large number of smelting pots and could not be measured using CEMs or accurately estimated using emission factors. Similarly, methane from landfill can be accurately measured when captured, but can only be roughly estimated in the absence of collection systems.

Tables 1 and 2 respectively list Canadian and British Columbian emissions which could be potentially included in a emissions trading program for large industrial sources. Sources at the top of the list — power generation and industrial fossil fuel use — are most amenable to inclusion within a trading program. For those sources at the bottom of Table 1, it is unclear the extent to which emissions can be accurately measured. Current estimates of carbon dioxide from fossil fuel used in non-energy uses and methane from nitric acid production are only accurate to within 30%, and stripped natural gas to within eighteen percent.[28] The feasibility of measuring these emissions more accurately is uncertain and an analysis of the accuracy with which these sources could be measured is beyond the scope of this report. Also, even if technically measurable, it is uncertain how costly measurement would be, and whether it is feasible given the relatively small size of some of the sources listed in Table 1.

[28] SENES Consultants Limited, *Study of Greenhouse Gas Emissions from Non-Fossil Fuel Sources*, (report for Environmental Canada, Conservation and Protection, May 1994) [unpublished] at 6-2.

[Table 1 goes here]

[Table 2 goes here]

Administrative and Monitoring Costs

Administrative and monitoring costs will favour excluding small sources, even if they can be accurately measured. Continuous emissions monitoring, and to a lesser extent tamperproof fuel meters are expensive and used by only about a dozen facilities in BC.[29] Monitoring under RECLAIM was estimated to cost each participant about $US 30 000 more than they would spend on monitoring in a program of "command and control" regulations.[30]

US experience indicates that the administrative burden of including smaller, less sophisticated actors is significant.[31] Also, transaction costs — costs such as finding out about emission control options, and brokerage costs — tend to be more significant for smaller firms making participation in trading less attractive to them.

Thresholds & Leakage

For the above reasons, other programs have established thresholds below which industrial sources would be excluded from a program. Thresholds have been set at a point which allows the program to capture a large portion of emissions but a small portion of emitters. For instance, the RECLAIM program only covers 6% of sulphur dioxide point sources but captures 85% of point source emissions.[32] For both BC and Canada, the impacts of having a threshold are unclear. The Canadian Energy Research Institute estimates that if only "large industrial energy users" are included within a program it would capture about 75% of industrial emissions from energy and about 40% of total Canadian carbon dioxide emissions (32% of total greenhouse gas emissions).[33] However, this estimate is rough and

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29 Personal conversation with Hu Wallis, BC Ministry of Environment, Lands and Parks (MELP). Installation of CEMs or semi continuous emissions monitoring can have an initial cost of between $50 000 and $300000 (personal communication with Robert Marsh, BC MELP; Barry D. Soloman, "Global CO_2 Emissions Trading: Early Lessons form the U.S. Acid Rain Program" (1995) *30 Climatic Change* 75, at 83) or an annual cost of 15,000 to $80,000 dollars: South Coast Air Quality Management District, RECLAIM Development Report and Proposed Rules (Los Angeles: SQAMD, 1993) at IV-4.

30 Monitoring under RECLAIM is expected to cost the 440 participating firms a total of $12.8 million per year more than it would under the prescriptive alternative: Polesetsky, above at footnote 8, at 406.

31 Barry D. Nussbaum, "Phasing Down Lead in Gasoline in the U.S.: Mandates, Incentives, Trading and Banking" in *Climate Change: Designing a Tradeable Permit System* (Paris: Organization for Economic Co-operation and Development, 1992) at 33, 37, and 38.

32 Polesetsky, above at footnote 8, at 380-384.

33 Heggelund, above at footnote 18, at 79. (The term "large industrial users" was not defined by either CERI or the Statistics Canada publication to which they refer).

could be too high.[34] Nonetheless, it appears that a threshold could be set which would significantly reduce the number of persons trading in a program while only reducing coverage slightly.[35]

One concern is that setting a threshold will encourage changes in the design of existing and future sources in order to avoid the threshold. US experience indicates that if trading only applies to emitters above a certain size, there may be a shift in emissions to excluded sources and there may be an incentive for new facilities to be designed below the threshold size.[36] Several measures can minimize this risk:

- Ensure the regulatory standards applicable to the smaller facilities impose costs similar to costs of participation in a trading program;

- Define the types of facilities that are required to participate regardless of emission levels. For instance, apply the program to sources within specific sectors such as pulp and paper, chemicals, iron and steel etc.

Also, a program should apply not only to purchased fuels but also “self-produced fuels” such as natural gas used by natural gas producers or hog fuel and pulp liquor (if the scope of the program includes carbon dioxide from combustion of biomass). Inclusion of self-produced fuels is necessary to ensure a level playing field exists for all emissions within the scope of the program.

The Need for Critical Mass

Trading works best where there is a competitive market with stable prices. This requires a large number of firms. Even with a relatively large number of participants, if only a few firms dominate the market, companies may try to form cartels, reduce allowance prices or exclude competitors by using “strategic

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34 To capture 40% of Canadian carbon dioxide emissions it would be necessary to capture 75% of emissions from all fossil fuel combustion by industry, including all self produced fuels and pipeline compressors. The 75% figure comes from an estimate that 75% of energy (not necessarily carbon dioxide) used by industry is consumed by firms classified as large industrial energy users. However some large industrial users may consume energy at small facilities.

35 BC Environment data show that less than half of permitted sources account for the great majority of criteria pollutant (non-greenhouse gas) emissions: John Holdstock, *et al.*, "Evaluation of the Waste Management Permit System" (Victoria: Project Report KPMG, October 19, 1995) [unpublished] at 25. Depending on the pollutant between two and twenty percent of point sources account for 90% of criteria, non-greenhouse gas emissions from point sources in the GVRD: derived from ARA above at footnote 13, at 2-13, exhibit 2.11. It seems likely that a similar pattern would apply to greenhouse gases.

36 This problem will be less if participation in a cap frees smaller sources from other requirements or gives them a change to profit through sale of surplus allowances.

behaviour."[37] If a program applied to all large industrial users and utilities, it is uncertain if it would have the critical mass of participants to ensure a competitive relatively stable market.

The CERI study assumed that a program applying to large industrial energy users and utilities would apply to 300 firms in Canada. CERI may have over estimated the number of large emitters, possibly counting a large number of firms that rely purely on hydro electric, purchased electricity or biomass.[38] Also, the number of larger industrial sources operating in BC is unknown.

However, there are over 1 000 point sources permitted for emissions of local air pollutants under the BC *Waste Management Act.* These emitters tend to also be greenhouse gas emitters. The largest greenhouse gas emitter accounts for less than two percent of total provincial emissions.[39] Despite the weakness in available data, it is reasonable to conclude that, even if a program applied only to large industrial emitters of carbon dioxide from fossil fuel combustion, there are probably enough firms to establish a competitive market in Canada, and probably BC.

Necessary Cost Differentials

Given this scope, will there be sufficient emission reduction cost differentials to make trading work? The greater the difference in costs of emission reductions at different sources within the scope of a cap, the greater economic savings that can be expected from an emissions trading program. CERI, in its 1990 report, concluded that Canadian industrial and electric generation sectors appear to be diverse enough to provide sufficient variations in cost of emission reductions for trading to be beneficial, but recommended further study.[40] BC also appears to have sufficient diversity of industrial sources to make trading beneficial.[41]

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37 Several emissions trading programs with significant numbers of market participants have been hampered because two or three firms dominate the market. One trading program involved 53 participants but two plants held 75% of the rights traded.

38 How CERI derived these figures is unclear. They state that Statistics Canada classifies over 200 firms as large industrial energy users (Heggelund, above at footnote 18, at 179); however, according to Statistics Canada they have never used this classification, although about 190 larger firms were required to complete a detailed report on energy use from 1982 to 1984. The 190 firms were not disaggregated by province and included firms that only used hydro electric power: Personal communication with Marion Smith, Statistics Canada. The author of the CERI study could not be contacted for comment.

39 Personal communication with Greg Chessman, BC Ministry of Environment, Lands and Parks. The Ministry administers 869 air permits and the Greater Vancouver Regional District administers an additional 277 air permits.

40 Heggelund, above at footnote 18.

41 See for instance, The ARA Consulting Group Inc., H.A. Simons Ltd., and IBI Group Inc., *Evaluation of CO_2 Management Measures* (Victoria: Queen's Printer for British Columbia,

Although these conclusions could be tested by further analysis, one of the central premises of emissions trading is that trading will unleash entrepreneurial efforts to find cost effective emission reduction measures. If one subscribes to this premise, the mere diversity of greenhouse gas emission sources should ensure sufficient diversity in emission reduction costs; government commissioned studies will have a limited ability to verify this premise. Indeed, the experience of far lower than expected emission reduction costs under RECLAIM and the US Title IV Acid Rain Program bears out the limited capacity of government to estimate emission reduction costs.

Conclusion:

A cap and emission allowance trading program would at very most apply to less than half of Canadian greenhouse gas emissions and likely would apply to about one-third of Canadian emissions if exemptions existed for small sources and some relatively difficult to measure sources. If restricted to power generation and carbon dioxide from large industrial sources, including fossil fuel producer consumption, it would only capture about 30% of emissions. More work is need to determine the potential scope of a program. The first step in such work is to expand the National Pollutant Release Inventory to include greenhouse gases.

The broader the scope of the program, the greater the potential savings through trading and the greater the potential for emission reductions. However, expansion to very small sources may not be worthwhile because of monitoring and administrative costs, especially in the case of greenhouse gases other than carbon dioxide and emissions from fuels that have variable carbon contents.

Design Issue 15: Inclusion of Biomass Emissions

Issue:

Should carbon dioxide from industrial burning of biomass be counted in a trading program?

1992), which shows significant cost differentials for different carbon dioxide emission reduction measures.

Discussion:

Some discussions of emissions trading have raised the possibility of applying a cap and emission allowance trading program not only to emission sources, but also carbon sequestration. Under such a program a land developer who clears land would need to purchase allowances for the reduction in levels of sequestration, while a farmer who changes agricultural practices to increase levels of carbon sequestration in soil would be able to sell allowances. Such a program would rely heavily on the use of extremely rough proxies for emissions and thus raises many of the problems discussed above in relation to the use of crude proxies. The program would also likely be administratively untenable. Thus, this report generally assumes that greenhouse gas emissions from biomass sources and increases in sequestration levels would be excluded from an emission allowance trading program.

However, should emissions trading distinguish between carbon dioxide from industrial sources which burn biomass and carbon dioxide from fossil fuel combustion? Proposals for emissions trading are inconsistent in their recommendations, some assuming the inclusion of industrial biomass sources; some assuming their exclusion.[42] Biomass emissions of carbon dioxide are excluded from national inventories of emissions.

This is an important issue. Many pulpmills and sawmills in Canada use waste wood and pulp liquor for energy. Over half of energy use by Canadian pulp and paper mills, representing almost seventeen percent of Canadian industrial energy use, is derived from biomass.[43]

Counting carbon dioxide from biomass would involve significant but not prohibitive monitoring costs. Spent pulp liquor and wood waste have highly variable carbon contents which would likely make continuous emissions monitoring necessary. Such equipment would also be necessary if a trading program applied to industrial sources of methane, as pulp mills and saw mills are the largest industrial sources of methane in BC.[44]

The main reason for not including biomass sources is the assumption that biomass represents a renewable resource. If carbon dioxide from forest fires, silvicultural burns, burned wood waste, and burned and rotting forest and paper products, is balanced by growing trees and the build up of carbon in forest soils, the carbon

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42 Heggelund, above at footnote 18, does not discuss the issue, but refers to inclusion of pulp liquor (a biomass source).

43 Derived from Canadian Industrial Program for Energy Conservation, *CIPEC 1994-1995 Annual Report* (Toronto: CIPEC, 1995) at and 20.

44 B.H. Levelton, B.H. Levelton & Associates Ltd., *An Inventory and Analysis of Control Measures for Methane for British Columbia* (Victoria: Province of British Columbia, April 1992) at 55.

dioxide from biomass does not represent a net atmospheric emission. Whether or not such a balance exists depends on the geographic area being considered.

For Canada in general, the forest carbon balance is uncertain,[45] although best information indicates that forest land has become a net source of emissions in Canada.[46] For BC's boreal and interior forests the effects of logging have been more than balanced by increased forest protection so that these forests are net carbon sinks.[47] On the other hand, for coastal forests replacement of old growth with tree farms leads to a reduction in carbon stored in soil and biomass.[48] It is also possible that BC's interior forests may become net sources in the next few decades, as the growth which followed widespread forest fires in the late 1800s is declining.

Thus, for many areas of BC it would be inappropriate to include carbon dioxide from biomass. However, even for those areas where forest carbon is being "mined" and not replaced by growing trees, a portion of the biomass being burned does represent sustainable yield and arguably, if biomass emissions are to be included, they should be discounted. Determining the appropriate discount would be difficult.

Finally, emissions of carbon dioxide from burning biomass will be counted in counted in determining compliance with the *Kyoto Protocol*. As discussed in Chapter 3, the only emissions counted from the land use change and forestry sector are those from deforestation.

Conclusion:

Exclusion of carbon dioxide from biomass is appropriate in many cases. In some areas partial exclusion would be appropriate but may be administratively infeasible.

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45 Julia Martinez *et al*., *Report on the in-depth review of the national communication of Canada* (Geneva: UNFCCC Secretariat, February 1996) 10.

46 Werner A. Kurz, and Michael J. Apps, "Retrospective assessment of carbon flows in Canadian Boreal Forests" in *Forest Ecosystems, Forest Management and the Global Carbon Cycle* Vol. 18, in the NATO ASI Series I: Global Environmental Change (Heidelberg: Springer-Verlag, 1995).

47 Werner A. Kurz *et al*, *The Carbon Budget of British Columbia's Forests, 1920 - 1989: Preliminary Analysis and Recommendations for Refinements* (Ottawa: Queen's Printer, November 1996) and, M. Wellish, *MB Carbon Budget for the Alberni Region, Final Report May 1990 to June 1992*, (The Research and Development Department of MacMillan Bloedel Limited October 1992).

48 Kurz, *ibid*. at 31.

Design Issue 16: Expanding the Program

Issue:

Can the program be expanded after implementation? Is it worth delaying implementation to allow development of the technical ability to include other sources?

Discussion:

Closely linked to setting the initial scope of a trading program is an assessment of the potential to expand the scope as the technical ability to accurately measure and verify emissions from various sources improves. Some writers have suggested that incremental expansions are politically unlikely, and that efforts should be focussed on improving measuring and monitoring techniques so that a program can begin with the broadest possible scope.

Conceptually, adding new sources to the scope of a cap and emission allowance trading program is simple. A new cap and emission reduction schedule would be developed for the new sources. New allowances would be allocated to the new sources, either according to the formula used for the initial allocation or some other formula. The new allowances could be indistinguishable from existing allowances and fully tradeable with the original sources included within the scope of a program.

However, expansion may change the value of existing allowances, and some observers have warned that there will be a political inertia against expansion because of its impact on allowance values. If it is on average less costly to control new sources than existing sources, the price of allowances will drop; if the average control cost for new sources is relatively high, prices will rise.

This political inertia against expansion of a trading program should not be exaggerated. First, if an allowance program initially applies to all large industrial sources of carbon dioxide, it is likely that the significance of the added sources would be small compared to existing sources. Second, there is likely to be some inertia in exploiting new emission reduction opportunities, limiting the initial impact on allowance prices. Third, although expansion will create winners and losers, it will reduce overall control costs. Fourth, the addition of new sources can be phased in over time, with new sources initially only able to trade with new sources.[49] Doing so would spread the impact of adding new sources over a longer period. Finally, the phasing in of cleaner, smaller units in the Title IV Acid Rain Program was not only politically acceptable, but pursued as a matter of political pragmatism.

A program can also be designed to expand through the voluntary opt-in of new sources. Under the US *Title IV Acid Raid Program* industrial boilers and other sources that are not required to participate in the program can opt-in voluntarily. The opt-in participants only receive allowances for actions taken to reduce their emission rates, not for reducing production or ceasing operation. This is necessary to ensure that facilities do not simply join the program immediately before ceasing operation, receive an allocation of allowances and then sell them after ceasing operations.

Conclusion:

If Canada or BC decides to adopt a cap and emission allowance trading program, they should not delay implementation based on the need to include as many sources as possible and the perceived difficulty in adding new sources once a program is established. If a program is designed to allow voluntary opting-in of sources, rules need to be in place to ensure that facilities can only sell allowances that are surplus because of actions taken to reduce their emission rates, not for reducing production or ceasing operation.

Design Issue 17: Defining the Traded Commodity

Issue:

Does an allowance represent a permit to a flow of emissions or a right to emit a tonne of carbon dioxide?

Discussion:

A cap and emission allowance trading program can involve trading of permits to a flow of emissions (e.g. one one-thousandth of the total emission cap for every

[49] This is discussed in greater detail in Michael Grubb and James K. Sebenius, "Participation, Allocation and Adaptability in International Tradable Emission Permit Systems for Greenhouse Gas Control" in *Climate Change: Designing a Tradeable Permit System* (Paris: Organization for Economic Co-operation and Development, 1992) at 215.

year for the indefinite future). New Zealand's tradeable fishing quota system is based on a right to catch a defined share of the cap. Alternatively, allowances to emit a single unit of pollution, as in the US Title IV Acid Rain Program, can be traded. To some extent the distinction is semantic; a source with a right to emit a tonne a year can rent that right to another source for a year, the result being the equivalent to trading a single tonne allowance. Similarly, a twenty year permit to emit one hundred tonnes per year is little different from an allocation of one hundred allowances for each of twenty successive years (the issue of whether allowances would be tied to emissions in a particular year is discussed below).

Nonetheless, allowances have a number of definite advantages:

- They can be issued annually (even if according to a predefined formula). This makes a program more adaptable to changes in emission reduction schedule necessitated by increased recognition of the threat of climate change.

- Transaction and administrative costs may be lower. Although brokerages are likely to reduce the transaction costs of renting, it is simpler to sell one tonne allowances than to rent fractions of a permit for differing periods. It is simpler for government to simply ensure that emitters deliver required allowances to cover their emissions; and it is simpler to use surplus allowances from one year in a following year.[50]

- The use of allowances appears to be the favoured approach of the United States and thus may be more conducive to international trading.

Conclusion:

A program should use allowances rather than permits.

Design Issue 18: Certainty and Property vs. Flexibility

Issues:

a) Should allowances represent a licence to emit in a particular year (possibly with an option for later use) or should emitters be given a budget of allowances for use over a longer time period with no restrictions on when they are used in that time period?

[50] Mohr, above at footnote 25, at 231.

b) Should allowances that represent rights to emit in a single time period be distributed at the beginning of the program or at the beginning of each time period?

c) Should allowances represent property rights or revocable licences?

d) Should emitters be given temporal flexibility in when they use allowances by allowing them to "bank" unused allowances from one time period for use in later time period, or "borrow" allowances designated as being for a later time period for use in an earlier time period?

Discussion:

A tension arises in the design of a cap and emission allowance trading program between:

a) providing emitters with certainty as to the value of allowances, certainty as to their future supply of allowances, and flexibility as to when they emit greenhouse gases; and,

b) ensuring the system is flexible enough to respond to increased understanding of the dangers posed by climate change.

At one extreme, a cap could be set each year for the next year and allowances distributed annually. This system will be able to respond flexibly to changing science and environmental values. But it would also produce uncertainty as to the supply (and thus value) of future allowances. Businesses may be unwilling to invest in emission reductions if they think the cap will not be reduced and will be reluctant to invest in high emission facilities if they think allowances will only be available in the future at prohibitively high costs.

At the other extreme, government could set a cap on total emissions over the next twenty years, issue allowances that represent property rights, and issue the allowances for the entire twenty years at the beginning of the program with no restrictions on when they can be used. This would provide greater certainty and flexibility for allowance holders, but involves an unacceptable limitation on the flexibility of the program and its ability to change the cap.

Annual Allocations

The simplest method of balancing flexibility and certainty is to announce government's intent as to what the cap and allocation formulas will be over a relatively long time horizon and issue allowances annually. If government decides a more rapid phase out is necessary, the cap can be changed and all annual allocations reduced proportionately (presumably with some notice). Emitters wanting a certain supply of future allowances can do so in the same manner as any business wanting a certain supply of a particular commodity at a particular price: they purchase futures (futures are a contractual right to buy a particular commodity at a particular price at a particular date). Additional flexibility can be provided by allowing the banking of allowances (see next section).

Budgets

Under the *Kyoto Protocol* nations are given multi-year budgets of allowable emissions. This gives nations flexibility in when they reduce emissions as long as the multi-year budget is not exceeded.

One person interviewed for this report assumed a parallel approach would be adopted within a domestic trading program. This would provide greater certainty as to the supply of allowances (at least for the short term) and greater flexibility as to when emitters reduce their emissions. Although the only difference from annual allocations is that a time period of longer than a year is used, use of longer time frames causes some problems:

- Varying the cap within the specified time period would require cancellation or devaluing of allowances.
- Budgets covering a period longer than a year are incompatible with allocations based on production in the year of the emissions or recent emissions.
- A general tendency to overspend budgets may lead to politically irresistible pressures to back off from emission reduction targets.
- Incentives to immediate action may be weakened, with firms overspending their budgets and delaying the development of energy efficient and renewable technologies.[51]
- There will be a delay in when the market begins to provide accurate signals as to the value of an allowance.

In sum, budgets are not recommended for a domestic trading program. The advantages of budgets can be provided by other mechanisms such as banking.

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[51] Under a long term budget there is likely to be less certainty as to the immediate profits to be made from emission reductions, and there may be a delay in when price signals manifest themselves, thus reducing investments in such technologies.

Allowances for Specified Years Distributed at the Beginning of the Program

If allocations are made on the basis of historic emission levels or historic production levels, great certainty would be provided by issuing allowances for use in a specific year or later, and distributing them at the beginning of a program for a relatively long time period. Under the Title IV Acid Rain Program, allowances are dated for a specific year and most were distributed at the beginning of the program covering emission levels to 2010.

This provides a great deal of certainty for emitters as to their future emission rights (at least for the first ten years of the program), but makes changes to the program difficult. In the case of the Title IV Program the scientific understanding of acid deposition was well advanced, so the chance of revisions to the cap was low relative to the likelihood of a cap revision in greenhouse gas trading. Allocations at the beginning of a program for an extended period are also incompatible with some allocation formulas (e.g. allocation on the basis of annual production levels or recent emission levels).

One method of allowing emitters to purchase allowances for twenty or more years into the future without compromising the ability to reduce emission targets is to distribute allowances every five or so years for a declining share of the next twenty or more years.[52] Sources would receive dated allowances for many years in the future, but would only be allocated a decreasing fraction of the cap for future years. For instance, at the inception of program, for the first five years the source might receive its full share of the cap (x tonnes for 2000, x-y tonnes for 2001 ... x-5y tonnes for 2005). For the next five years it might only receive three quarters of its expected share of the cap (e.g. $^3/_4$.(x - 6y in year 2006); ... $^3/_4$.(x - 10y in year 2010). For the next five year period the source would receive only half its expected share, etc.

If the annual cap continues to be reduced according to schedule, in year 2005 the source would receive allowances for the next twenty years, representing the quarter of its share of the cap not allocated in the year 2000. However, if a decision is made to speed up emission reductions, less than the originally anticipated quantity of allowances could be distributed. This system allows sources wanting more secure emission rights to purchase them. This system provides some additional certainty, but may add an unnecessary layer of complexity to a program. It is also incompatible with some allocation systems such as allocation based on annual production or a rolling average of emissions during recent years.

52 This is based on a proposal in Grubb, above at footnote 49.

Property Rights

Closely related to the need for flexibility versus certainty is the question of whether allowances should represent property rights or revocable licenses. Defining allowances as property rights is often advocated as means of giving market participants greater certainty that allowances will continue to have value. If allowances are property rights their cancellation or devaluation could give rise to a claim for compensation for expropriation.[53]

Canceling or devaluing allowances is unlikely to be necessary for purposes of accelerating reductions in emissions if allowances are distributed annually or for fairly short time frames, or if the staggered distribution system is used. However, there may still be instances where government decides to cancel allowances. For instance, if government initially distributes large numbers of emissions to a firm based on an overestimate of its historic emissions, cancellation may be necessary, and if allowances represent property rights, the cancellation may give rise to a claim for compensation. Also, although a staggered distribution system provides flexibility for tightening caps it would be difficult for a future government to cancel a cap and emission allowance trading program.

Defining allowances as property rights may increase certainty in the market, but it severely compromises government's ability to correct problems without public expenditures.

If allowances are designated as revocable licenses, they will have value and be "property" in everything but the legal sense. A number of revocable licences — Canadian commercial fishing licences and marketing boards' production quotas — are commonly traded as very valuable assets.[54] They maintain their value because purchasers anticipate that regulations and legislation will not be drastically changed.

For programs where allowances are allocated for more than a single year, designation of allowances as revocable licences has been crucial to gaining environmental support. As a senior EPA analyst speaking about the Title IV Acid Rain Program stated:

> The suggestion that Congress should assign the status of unrestricted property rights to certain polluters ... and, in the absence of perfect information or prescience, compromise its ability to correct new pollution problems without public expenditures, is foolish and irresponsible, suggesting that economists are so involved in the establishment and manipulation of property rights, that they are blind

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53 Providing that the Canadian constitution is not amended to protect property rights, expropriation without compensation can occur in Canada, but only if specifically sanctioned by the legislature.

54 See *Sanders v. Milk Board* (1991), 53 B.C.L.R. (2d) 167 and C*ream Silver Mines Ltd. v. British Columbia* (1993), 75 B.C.L.R. (2d) 324. For greater discussion also see Christopher Rolfe and Linda Nowlan, *Economic Instruments and the Environment, Selected Legal Issues* (Vancouver: West Coast Environmental Law Research Foundation, 1993) at 109 to 111.

> to the existence of other, higher rights — such as the right to a clean and healthy environment — which society has always protected against the market.[55]

Temporal Flexibility: Banking and Borrowing

With the exception of multi-year budgets of emissions none of the above possibilities offer temporal flexibility, i.e. flexibility as to when emissions occur. Because, emissions tend to fluctuate several percentage points from year to year as result of changes in economic activity and the weather,[56] a system will need to accommodate these changes either by building in an extra margin to allow compliance or by allowing temporal flexibility. For other pollutants, giving emitters flexibility as to when they emit is a concern for environmentalists because of the potential for pollution being concentrated in a single year. However, because climate change is caused by the accumulation of relatively long lived greenhouse gases in the atmosphere, it makes little difference if emissions are high in one year so long as this is balanced by a reduction in the next year.

A trading program could be made more flexible by allowing allowances which are not used in the time period for which they are issued to be banked and used in a latter period. Banking surplus allowances is generally seen as an integral part of emission allowance trading for greenhouse gas emissions. Sources can strategically over control in the early years of a cap and create a reserve which they can use to avoid non-compliance in years of unavoidably higher emissions. This ability to create a safety margin to avoid inadvertent non-compliance may be essential to support for more aggressive emission reduction caps.

Banking also rewards early action, spurs earlier development of emission reducing technologies,[57] and contributes to creation of a stable market. Finally, banking can create a vested interest in favour of greater environmental protection. Holders of banked allowances will favour effective enforcement and further emission reductions, because they will increase the value of banked allowances.

However, if the initial cap does not closely reflect actual emissions, banking must be limited to ensure that an initial oversupply is not carried forward to later years, further delaying the timing of real emission reductions. Banking can be limited by devaluing allowances over time or having allowances expire after a certain number of years.

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55 Nancy Kete, "The U.S. Acid Rain Control Allowance Trading System," *Climate Change: Designing a Tradeable Permit System* (Paris: Organization for Economic Co-operation and Development, 1992) at 86 - 87.

56 For instance, an unusually cold year can change American emissions by as much as two percent: US Dept. of State. In both Canada and the US the carbon content of fossil fuel consumed in any one year can vary by around three percent above long term trends.

57 See ARA, above at footnote 13, at A-34.

Some analysts have suggested that banked allowances gain interest based on the value of early emission reductions over future emission reductions.[58] At present this is inappropriate given the poor understanding of the relationship between timing of emission reductions and damage. Given the long atmospheric life of greenhouse gases, delaying emissions by ten or twenty years makes little difference to the impact on climate change. Also, in much the same way as deficit spending ties the hands of future governments, interest on banked allowances may tie the hands of future regulators attempting to adopt more aggressive emission reductions.

It is also theoretically possible that emitters could borrow emissions from future time periods, with some sort of penalty or interest payment (e.g. ten 2005 one tonne allowances could be used in 2000 but would only purchase eight tonnes of emissions). For instance, the New Zealand system of transferable quotas for commercial fisheries initially allowed fishers to borrow from their next year's quota. While borrowing has been proposed for international regimes, it is unacceptable for a domestic trading program:

All systems for allocation allowances will be politically contentious; and most will have perverse economic effects.

- Incentives to immediate action are negated, with firms relying on overspending and borrowing, delaying the development of energy efficient and renewable technologies.
- Enforcement can become impossible, with companies borrowing to cover excess emissions, potentially borrowing against a time when they will no longer exist.
- Borrowing is only compatible with initial allocations that extend over long time frames. It is incompatible with allocations based on annual production or recent emissions.
- A general tendency to borrow heavily may lead to politically irresistible pressures to back off from emission reduction targets.

Because of the administrative complexity of borrowing and the enforcement problems it created, the New Zealand tradeable fishing quota system no longer allows borrowing.

For these reasons, banking should be the primary means of providing temporal flexibility. Borrowing if allowed at all should be strictly limited to allowing a company to "true-up" its emissions allowance balance by applying a limited portion of allowances from one year to cover a shortage of allowances in the previous year.

58 Daniel J. Dudeck and Tom Tietenberg, "Monitoring and Enforcing Greenhouse Gas Trading" *Climate Change: Designing a Tradeable Permit System* (Paris: Organization for Economic Co-operation and Development, 1992) at 256.

At the beginning of a program, before companies have had an opportunity to bank allowances it may be necessary to provide an "escape valve" that allows emissions to temporally exceed the cap in the event of unusual circumstances such as a very cold year. Because greenhouse gas emissions are currently closely associated with important services such as producing electricity for home and water heating, it may be necessary to provide an escape valve to allow greater emissions in the event that cold weather or other unusual circumstances produces a particularly high demand for electricity. This is particularly important in the early years of a program when emitters will not have had an opportunity to strategically over control and accumulate a buffer of banked allowances. An escape valve could be created by allowing the purchase of excess allowances (allowances which represent an exceedance of the cap) at a price significantly above the anticipated market price for allowances. This would ensure that a cap and emission allowance trading program does not lead to shortfalls in energy needs in the event of a particularly cold year or other unexpected event. The price paid for the excess allowances could be used in future years to buy back allowances.

Conclusions:

Denominating allowances as a right to emit in a particular year, issuing allowances annually, and announcing government's intent as to cap sizes over an extended time horizon would likely provide sufficient certainty as to the value and supply of future allowances, while maintaining government flexibility to reduce overall caps. Temporal flexibility can be provided by allowing banking of allowances and "truing up" of allowance shortfalls in one year with limited borrowing of allowances from the following year. An escape valve can also be built into the system to reduce the risk that a tight cap might cause hardship during the initial stage of a program, before emitters have had an opportunity to accumulate a buffer of banked allowances. Defining allowances as revocable licences is especially important where allowances are allocated for time periods of more than a year.

Design Issue 19: Allocating Allowances

> *No sort of scientific teaching, no kind of common interest will ever teach men to share property and privileges with equal consideration for all. Everyone will think his share too small and they will always be envying, complaining and attacking one another.*
>
> *— Fydor Dostoyevsky, in Brothers Karamazov*
>
> *Negotiations over emissions allocations ... have a "zero sum" character, in the sense that an allocation given to one party implies another does not receive it. By their very nature such negotiations tend to be difficult, acrimonious, and damaging to relationships. They often involve harsh tactics and brinkmanship.*
>
> *— James Sebenius, Kennedy School of Government.*

Issue:

What formula or other mechanism should determine the distribution of allowances?

Discussion:

Where the ability to emit greenhouse gases — i.e., the ability to burn fossil fuels, manufacture cement etc. — is limited, rights to emit will have a significant value. An issue at the crux of the design of an emissions allowance trading program will be how to allocate those valuable rights.

The allocation of allowances will determine how the costs of emission reduction are shared. Any allocation system will be politically contentious; all systems will create some perverse economic incentives; those that are likely to be the most equitable will undermine other potential advantages of a cap and emission allowance trading program. At least one key Canadian observer has concluded that the current political attractiveness of an emission allowance trading program over a carbon tax may be the result of politicians not having faced the political difficulties of allocation.

Where cap and allowance trading programs have been developed to date, the issues surrounding allocation have been much simpler than in the case of a program for greenhouse gas emission allowance trading. In the case of the Title

IV Acid Rain Program, only a single industry was involved. Under the RECLAIM Program, allowance allocations could be based on current and projected future emissions under the fully developed Air Quality Management Plan which RECLAIM replaced. No such detailed program of prescriptive measures exists for carbon dioxide.

Allocations to equalize marginal costs

Likely, the most equitable allocation would be one in which emission factors reflect costs of emission reduction. All firms' marginal costs of emission reductions would be equal.[59] Thus, firms which could reduce emissions at a very low cost would receive a lower allocation than firms with higher reduction costs.

However, allocating allowances on the basis of estimated emission reduction costs would defeat one of the attractive features of cap and emission allowance trading: government would be back in the business of estimating who can reduce emissions at what costs. Businesses would have an incentive to exaggerate their costs rather than finding less expensive alternatives. Government's task would be daunting. Emission factors would have to be developed for a huge number of products using a wide variety of processes. Its is also likely that government's assumptions regarding available technologies and marginal costs would be wrong. A review of estimated distributive impacts of the US phase out of CFCs shows that pre-phase out estimates of marginal costs were far from actual costs.[60]

The only cap and emission allowance trading program which in any way reflects an attempt to allocate allowances so that all firms have equal marginal costs of emission reduction is the RECLAIM Program. The allocation of allowances in RECLAIM was based on multiplying a firm's production in a baseline year by emission factors for hundreds of processes that are listed in the RECLAIM regulations.[61] For the first year of RECLAIM, the emission factors are based on emissions that would occur under the South Coast Air Management District (SCAQMD) Regulations in force when RECLAIM started. Those legal requirements are, in turn, based on an attempt by the SCAQMD to ensure that all facilities face similar marginal costs of emission reduction. Allocations under RECLAIM from 1994 to 2000 also implicitly reflect estimates of marginal costs of emission reduction at different sources. Some industries' allocations decrease by 95% between 1994 and 2000, while others are not reduced.[62] Allocations for

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59 In fact, if such distribution actually occurred, there would be no trading.

60 Timothy Quinn, "Distributive Consequences and Political Concerns: On the Design of Feasible Market Mechanisms for Environmental Control" in *Buying a Better Environment: Cost Effective Regulation through Permit Trading* (Madison, Wisconsin: University of Wisconsin Press, 1983).

61 RECLAIM rule 2002(c)(D).

62 RECLAIM rule 2002, Table 1.

the year 2000 are based on emissions projected if the SCAQMD implemented its command and control standards, and these standards reflect anticipated costs of emission reduction at different sources.

In the case of RECLAIM, it was possible to roughly base allocations on anticipated marginal costs of emission reduction largely because a comprehensive command and control regulatory system already existed for the year in which RECLAIM began. Allocations for future years were possible because the SCAQMD had already developed a program of prescriptive standards. Allocations simply reflected emission reductions that would have occurred under the program of prescriptive standards.

For greenhouse gases, it is unlikely government would try to estimate marginal emission reduction costs and attempt to allocate allowances on that basis. Instead a number of different allocation programs could potentially be used.

Historic Emission Levels

One of the simplest methods of allocation would be to distribute allowances for the first year of a program on the basis of emissions in some baseline year. Allowances for subsequent years would decrease at an equal rate for all sources.

Advantages

- Information requirements are minimized. Any cap and allowance trading program will require information on emission levels from each source within the program. Only one or two year's additional historic emissions data are necessary if allocations are based on emissions in the year before allocation. However, if an earlier baseline year is chosen there may be some difficulty in estimating past emissions.

- Allocation of allowances on the basis of current emissions also has the advantage of being transparent and simple.

Disadvantages

- Allocation of allowances on the basis of emissions in a baseline year imposes high costs on those who have invested in energy efficiency and renewable technologies prior to the baseline year and rewards those who have invested in carbon intensive technology. Thus, for instance, BC Hydro would pay for its investment in hydro, while Alberta utilities would be able to shift from coal to less carbon intensive sources and profitably sell excess allowances. This can be eased by quickly establishing an accurate source specific inventory of emissions and committing to using an early year (most likely 1990) for the baseline in the event a cap and emission trading allowance trading program is implemented.

- If there is a perception that the baseline year will be set for a year following discussions over the establishment of a cap and emission trading program, emitters will be encouraged to delay emission reductions. This can be overcome by quickly establishing an accurate source specific inventory of emissions and committing to using an early year for the baseline.

- If the baseline year was a year of low production for an individual emitter, that emitter will face higher costs when it increases production. This has been solved in other programs by giving sources a choice of baseline years.[63] So long as the cap is initially set to reflect actual emissions in the year a program begins, and baseline year emissions are used only to prorate allocations, this will not delay emission reductions. However, in the case of RECLAIM, total allocations rose as a result of giving emitters a choice of baseline years, thus delaying the impact of a cap on emissions.

- It rewards companies for shutting down production and punishes companies for expanding production. For instance, a factory may receive its allocation of allowances and then close, selling the allowances for profit. If production is simply shifted to another location which is not subject to a cap, global emissions may remain unaffected. This is a larger problem in the context of greenhouse gases because there is no environmental benefit to a source simply moving to another locale. The Illinois trading program confiscates twenty percent of allowances made available when companies shut down production. The significance of this impact will depend on the value of allowances.

- Sources which are established after the program begins, bear relatively higher compliance costs (because they must purchase all their allowances) than their older competitors. This problem could be reduced by annually taking back some allowances from emitters and allocating them to new sources on the basis of production levels. However, the amount taken back would need to vary with changes in the number of the new sources.

Rolling Average of Emissions

The inequitable treatment of new and expanding sources and low emitting facilities can be reduced, but not eliminated by basing allocations on a rolling average of emissions over a specified period such as the last five years. However, if too short a period is used a rolling average may reduce the incentives of

[63] Also in some programs sources have been allowed to use non-tradeable credits that help ease the transition to allocations based on the baseline year. See: RECLAIM rule 2002(h)(1) gives sources a choice of three baseline years, plus allows sources to use non-tradeable credits if the baseline years were lower than surrounding years. The non-tradeable credits are phased out in the first few years.

companies to invest in emission reduction actions and create uncertainty regarding future allocations.[64]

Allocation by Historic Throughput and Emission Factors

Some trading programs allocate allowances according to firms' throughput in a baseline year multiplied by an emission factor. Throughput can be represent input (e.g. joules of energy; tonnes of fuel[65]) or output (e.g. tonnes of pulp produced).

Emission factors can be established for a fairly generic measure of throughput (x allowances per tonne of pulp). Alternatively, emission factors can also be much more specific, specifying emission factors for very specific product types produced through specific processes (y allowances per tonne of bleached pulp produced at pulp mills built before 1990, using natural gas power and chemical/thermal process).

The advantages and disadvantages of using emission factors and throughput levels will depend on the details of design. However, the following observations can be made:

- The system can be designed to reward certain past behaviors. For instance, the US Title IV Acid Rain Program distributed allowances based on energy inputs, thus rewarding facilities who had invested in scrubbers, but did not reward companies for energy efficiency. A program which had different emission factors for different fuels would reward past investments in efficiency but not fuel switching.

- If the baseline year was a year of low production for an individual emitter, that emitter will face higher costs when it increases production.

- Allocation on the basis of production in a historic baseline year rewards companies for shutting down production. The significance of this effect will depend on the value of allowances. For RECLAIM allocation reflecting production in baseline years does not appear to be a significant contribution to job loses, but this may change as the value of allowances increase.[66]

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64 A five year rolling average would likely provide sufficient certainty and provide sufficient incentives to emission reductions: Erik Haites, *et al.*, "Analysis of the Potential for a Greenhouse Gas Trading System for North America: Phase 1: Institutional Analysis and Design Considerations" (Draft Final Report submitted to Ivan Rios, Climate Change Program Manager, North American Commission on Environmental Cooperation Secretariat, 14 December 1996) [unpublished].

65 This will represent actual emissions for carbon dioxide but not for other greenhouse gases.

66 South Coast Air Quality Management District, see above at footnote 8.

- The more generic emission factors are (and thus the less administrative costly a program is to develop) the greater the initial impacts on the profits of different companies and the more a program will likely be percieved as inequitable.

- The transfers of wealth implicit in an allocation occur very early in the program. Sources who receive fewer allowances than their emissions must purchase allowances prior to the tradeable allowance holdings becoming mandatory. This may increase political resistance, because the economic implications are immediate. This resistance can be reduced by the same approach as used in RECLAIM (i.e. initially allocating emissions on the basis of historic emissions with a shift to allocation based on throughput and emission factors).

- Initial emission factors can reflect industry averages. This avoids the need for detailed plant by plant cost information, and can reward plants that have invested heavily in efficiency. Much of this information is already being developed by Simon Fraser University's Canadian Industry Use Data and Analysis Centre.

- Use of industry average emission factors may involve a windfall for owners of plants that are not necessarily environmentally superior and could increase the costs of compliance for high emitting facilities above what they would be under command and control regulation. For instance, a distribution of allowances to power generators on the basis of *x* tonnes per kilowatt hour will reward BC Hydro and Quebec Hydro because they rely heavily on major hydro projects. Nova Scotia Power may face higher costs if it has to both reduce emissions at its coal burning facilities, and buy allowances. Even if different emission factors are set for coal burning facilities, natural gas burning facilities etc., regions which have not grown substantially and are using older, less efficient plants will be penalized, albeit to a much lesser extent.

- The complexity of a program can be reduced by applying it only to industrial sectors that are the largest greenhouse gas contributors and produce about 30% of both total greenhouse gas emissions and carbon dioxide emissions.[67] Restriction of a program to these sectors may be simpler because it involves sectors that produce relatively generic products. However, even industries that are perceived as homogenous can use very different processes with very different energy requirements.

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[67] These include power generation; cement and lime production; chemical production; petroleum refining; pulp, paper and sawmills; and iron and steel.

Allocation by Annual Throughput and Emission Factors.

Another method of allocation is using annual throughput rather than throughput in some baseline year. Prior to the beginning of each year (or other emissions period) firms would be required to estimate their production levels in the next year. Emission factors would be applied to the estimated production levels to determine the firm's allocation for that year. If the combination of emission factors and estimated production levels result in emissions higher than the cap, all emission factors would be reduced by an equal percentage in order to maintain the cap. At the end of the year a "truing" of estimated and actual production levels would be necessary (so that firms would have no incentive to overestimate or underestimate production levels). The annual allocation process would use rules set out at the establishment of the program so that annual allocations would be an administrative issue, and avoid the difficult political horse trading inherent in initial design of the allocation system.

Advantages

With the following exceptions, this system will generally have the same advantages and disadvantages of allocation based on throughput in a baseline year. Its distinct advantages include:

- Firms are rewarded for increasing rather than decreasing or closing down production.
- There are no disproportionate barriers to new facilities starting production.
- Because emission factors will be reduced most in boom years and least in recessionary years, the program includes a Keynesian self correcting aspect; i.e., it lowers cost of production in recessions and increases them in boom years.
- Since allowances are allocated annually, there is greater potential for midcourse adjustments in emission factors to correct for inequities in the initial design.

Disadvantages

The use of annual throughput to allocate allowances has several disadvantages:

- If allowances are distributed on the basis of units of production that are common across a wide range of firms (for instance, at the extreme, *x* allowances per dollar of value added) the greater the windfall to firms that are less carbon intensive, and the greater likelihood that carbon intensive industries will be made uncompetitive, increasing the likelihood of leakage.

Even within a sector such as steel or paper there can be significant differences in carbon intensities of different plants due to product specialization.

- To avoid the above problem, allowances could be distributed annually on the basis of output of more specifically defined products, with the number of allowances per unit of output differentiated according to the nature of the product or the nature of the process or fuels. For instance, x allowances could be allocated per tonne of recycled writing paper manufactured with renewables as an energy source and y allowances per tonne of pulp using kraft process (an energy intensive process) and bunker oil (a carbon intensive fuel). However, to the extent a lower emission factor is given for a low carbon intensity or process that can be substituted for a high carbon intensity product or process, the incentive to switch to less carbon intensive products is reduced and the overall cost of emission reductions increased. For instance, if higher emission factors are given for high quality paper from virgin stock than medium quality paper from recycled stock, a firm reducing emissions by switching to recycled paper is punished by a lower allocation of allowances in the next year. This effect could be reduced by basing allocations on past production over a longer period than one year.

- More ongoing administration is required, especially to the extent that allocations vary according to narrowly defined classes of product, the production of which must be monitored. (If allocation is on the basis of value-added ongoing administration becomes much simpler).

- If new products (not included in various measures of throughput) are developed by firms within the scope of the program, there would be a need to develop new emission factors for those products.

- Greater uncertainty is created regarding future allocations.

Thus, although allocations on the basis of emission factors common to generic units of production across a sector (e.g. x allowances per tonne of steel) will produce some windfalls to less carbon intensive producers, separate more narrowly defined units of production will reduce the efficiency of market signals. However, the equity issues that favour more narrowly defined allowances may not be as significant when considering the equity between large integrated corporations, as compared to equity between separate plants.

Revenue Generation Auction

There are a number of means by which tradeable allowances could be auctioned. The simplest of these is a single price auction in which everyone wanting to purchase allowances could submit a list of how many allowances they would purchase at given prices. These “demand schedules” can then be aggregated and the selling price would be the price where total demand is equal to the cap. If the demand for allowances is likely to be dominated by a small number of market participants, auctions can be designed to discourage the “major players” from using their dominant market position to force other participants out of the market or to artificially depress the market price.[68]

The impacts of auctioning permits will flow through the economy to an even greater extent than free allocations, leading to higher prices or lower profit margins for products with high embodied energy content, and increasing demand for less carbon energy intensive products. Consumers will be compensated for the impacts on prices by the recycling of revenue into the economy through lower taxes. These lower taxes are likely to be eventually reflected in lower prices for less carbon intensive goods and services.[69]

Under an auction program not only are emitters required to pay for the cost of reducing aggregate emissions, they are also required to pay for the right to emit on their remaining emissions. The total cost of emission reductions may be greater for polluters under a revenue generating auction system than under prescriptive standards.[70] Because of this cap and trade systems based on auctioning of permits are generally unpopular with industry. It is also likely the reason that no auctioned cap and trade program has ever relied completely on auctioned permits.[71]

Advantages

The advantages of auctions can be summarized as follows:

- Simplicity.
- In a small market, auctioning some or all allowances may help kick start the market by establishing a clear predictable allowance price. This will in turn increase trading and reduce aggregate costs of emissions reduction.[72]

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68 "Groves Mechanisms" attempt to ensure that it is always in a individual dischargers best interest to truthfully reveal the value they place on emission allowances. Rights are allocated to the highest bidders, but the price paid depends on the price offered by others for an equal number of permits: See Randolph M. Lyon, "Auctions and Alternative Procedures of Allocating Pollution Rights" (February 1982) 58:1 *Land Economics* 16.

69 See Chapter 6, under the heading "Fine Tuning Taxes and Green Taxes" subheading "Ecological Tax Reform," for a discussion of the double dividend of replacing taxes on jobs and value added with revenue from taxes or auctions.

70 Simulations of costs under revenue generating auctions (without recycling of revenue to polluting industries) as compared to equal percentage reductions from all sources have found the former to be more costly to emitters of local pollutants. Lyon, above at footnote 68.

71 However, the German Ministry of Economics has proposed auctioning of carbon dioxide permits: See Mohr, above at footnote 25, at 232.

72 Robert N. Stavins, "Transaction Costs and Tradeable Permits" (1995) 29 *Journal of Environmental Economics and Management* 133.

- Revenue can be recycled into the economy, making less carbon intensive industries more competitive.

- Allocation by auctioning is consistent with the polluter pays principle: those that have invested in energy efficiency benefit.

- Auctioning discourages sources from trying to justify a larger allocation (and thus a larger cap) than actual emission levels.

Disadvantages

However, there are a number of disadvantages:

- Costs for carbon intensive industries may be significantly higher than under command and control regulations. If Canada's trading partners did not either auction permits or adopt carbon taxes, the competitiveness of some sectors could be adversely impacted.

- The auctioning of emission permits faces significant political resistance. Its distributional effects would be similar to a carbon tax on industrial sectors. However, it would have the advantage of being clearly tied to an environmental goal.

Revenue Neutral Auctions

In a revenue generation auction, revenue from allowances can be recycled into the economy through lower taxes. However, there are also a number of different formulas by which allowances could be auctioned and revenues returned directly to auction participants.

Typically the equity of different means of recycling auction revenues raises the same concerns as different methods of allocating allowances. For instance, if revenues are returned on the basis of production levels, the issues raised will be similar to the issues raised by allocation on the basis of production. For example, the more revenue returned on the basis of production measured in common terms (e.g., dollars of value added), the greater the windfall to firms that are less carbon intensive, and the greater likelihood that carbon intensive industries will be made uncompetitive.

Also, auctions can be designed so that if participants reveal their true costs of emission reduction, revenues can be returned on a basis that is considered equitable. For instance, one formula has been developed to return revenue according to the price auction participants are willing to pay for allowances.[73]

[73] At its simplest the "Knaster Allocation Procedure" involves each auction participant bidding for an allowance. The participant with the highest bid receives the allowance. If

Auction participants with higher emission reduction costs do not face disproportionate costs because they will receive a greater portion of the revenue (reflecting the higher price they are willing to pay for allowances). Those with lower emission reduction costs receive a smaller portion of revenue because their bids for allowances will be lower.

There is a significant body of economic literature that considers different auction formulas, yet discussion of these design choices has been relegated to the sidelines of most policy discussions. This appears partly to be a result of the business community equating revenue neutral auctions with revenue recycling through the tax system, a process which that community does not favour. It is also likely due to the esoteric nature of the allocation formulas. Although consideration of various revenue neutral allocation formulas is beyond the scope of this report, it is recommended that future policy discussions give greater consideration to revenue neutral auctions. Although conceptually these allocation methods may be complex in that they require use of complicated formulas, in practice they may be among the simplest and equitable of allocation formulas to apply.

Combined Allocation Method

The ideal allowance allocation method may in fact use a mix of different methods. For instance, the allocation of allowances in the first year of a program could be based purely on emission factors for different products and processes. A portion of allowances in every year may be distributed free of charge on the basis of throughput or historic emissions while another portion of allowances may be auctioned. For instance, under the US Title IV Acid Rain Program, a small portion of emission allowances were withheld from distribution and auctioned (with revenues returned to emitters) to ensure that a market for allowances developed. Similarly, some of the states in the Ozone Transportation Region are considering auctioning a portion of their allowances as a disincentive to the gross exaggeration of the historic emissions that plagued the RECLAIM program.[74]

An allocation method used in the beginning of a program may be phased out over time and replaced with another allocation method. For instance, initial annual allocations could be based on historic emissions or a rolling average of emissions during the last five years. Over time, a larger and larger proportion of the allocation could be made through auctions or based on annual production levels

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there are *n* participants, revenue is returned to participants on the basis of 1/*n*th of their bid plus (the "fair share") 1/*n*th of the surplus between all parties fair shares and the winning bid. The formula is in fact more complicated because the value of allowances depends on the number held: See Randolph M. Lyon, "Equilibrium Properties of Auctions and Alternative Procedures for Allocating Transferable Permits" (1986) 13 *Journal of Environmental Economics and Management* 129, at 139.

74 Personal communication with Carey Fitzmaurice, Senior Policy Analyst, US EPA, December 9, 1996.

using relatively generic measures of production (e.g. value-added). This method would overcome the initial adjustment shocks of auctioning allowances or issuing them on the basis of annual production levels, giving firms time to adapt and shift to less carbon intensive forms of production. At the same time, it will avoid the inequity between present and future producers of providing allowances on the basis of historic emissions alone. However, in the long term, allocations would use a method which does not create any unnecessary economic distortions, does not reward companies for going out of production and is administratively relatively simple.

Conclusion:

The choice of allocation method is likely to be divisive. Among existing emitters, it will be particularly contentious if allocations are on the basis of historic emission or production factors because of the relative certainty as to what a formula will mean for a particular firm. In comparison, an allocation formula based on rolling average emissions or annual production levels will be less contentious because of the uncertainty regarding future production levels. Nonetheless, existing emitters will generally favour allocations based on historic factors because doing so favours them relative to future participants in the market.

All allocations will create equity concerns, and efforts to redress equity issues can introduce other problems such as a reduction in incentives or a higher degree of administrative complexity. For instance, allocation on the basis of historic emissions or historic production levels places a particularly high burden on expanding and new sources and rewards firms for reducing production. This is particularly significant given that most of the participants in a cap and emission allowance trading program will be replaced by new sources during the long life of a trading program.

But the alternatives create new problems. For instance, annual allocations on the basis of average emissions in the preceding five years mutes the incentive to invest in emission reduction measures. If production is defined in relatively specific units and allocations are made on the basis of annual production levels, a firm's incentive to switch to less carbon intensive products or processes will be reduced if doing so leads to a reduction in its allocation. Basing allocations on production of different products also adds to the complexity of a program.

Despite these problems, allocation on the basis of emission levels in recent years or annual production levels defined by generically defined units of production are attractive alternatives in that they balance a number of competing factors. Revenue neutral auctions are also worthy of further consideration.

An appropriate allocation formula may shift over time. In particular, an initial reliance on historic emissions or rolling average of recent emissions could eventually be replaced by allocation on the basis of production or allocation by auction.

The adoption of any formula needs to carefully consider the extent to which it creates distortions, and possibly creates unnecessary leakage, given policies being developed in other countries. For instance, allocation on a historic emissions basis or historic production basis will encourage a shift in new production to jurisdictions that reward expanding production. Revenue generating auctions and allocations based on production as measured by value added — although attractive due to their simplicity and their power to provide clear incentives — will raise costs for carbon intensive industries the most and may lead to unnecessarily high levels of leakage to nations not subject to an emission reduction target.

Choosing an appropriate allocation formula is a highly political decision, and should be made as transparently as possible. Ideally, if Canada adopts emissions trading, Canada, the United States and other trade competitors considering cap and emission allowance trading, should work together in developing an allocation formula. Competing considerations such as impacts on production patterns, administrative ease, long term economic efficiency, and different concepts of equity should be identified, weighed and analyzed to determine the different impacts of various allocation formulas.

Design Issue 20: Tax Treatment of Allowances

Issue:

How should allowances be treated for tax purposes?

Discussion:

If a trading program is established nationally, the federal government will need to consider how allowances are treated for tax purposes. If allowances are taxed when sold between firms, but not when used there may be a disincentive to cost effective trading. In the absence of changes to the tax law this may occur if the allowances are distributed gratis. For instance, under the US sulphur dioxide trading program the price received by an emitter who sells an allowance is treated as a capital gain, possibly reducing the incentive to reduce emissions and sell allowances.[75] On the other hand, treating the price as a capital gain or income implies that the purchaser can write off part or all of the allowance as a capital or other expense. This provides a balance to the vendor's disincentive to trading, and may reduce the inequities of a distribution. A complete analysis of the tax implications of different allowance allocations systems is beyond the scope of this report; however, it is recommended that tax implications receive some attention during the development of a program.[76]

Conclusion:

Further consideration should be given as to whether specific tax rules are needed to ensure full trading.

Design Issue 21: Monitoring Equipment, Enforcement and Liability of Good Faith Purchasers

Issues:

a) What monitoring requirements should be imposed on emitters?

b) What levels of enforcement are necessary?

c) What liability should purchasers of allowances have if the allowances were not truly surplus to the vendors needs?

Discussion:

The importance of being able to accurately monitor emissions was discussed above in regard to setting an appropriate scope for a cap and emission allowance trading program. Monitoring requirements will affect the environmental effectiveness of a program, enforcement and administrative efforts and whether or

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75 US General Accounting Office, above at footnote 2, at 58.

76 Allowances could be treated as inventory, depreciable capital property, or eligible capital property depending on variables such as whether or not allowances are allocated free of charge or auctioned, and how long a period they cover. Each categorization will have different implications, usually advantages to the vendor being balanced by disadvantages to the buyer. For instance, the tax disadvantages to the vendor of treating allowances as depreciable capital assets will be balanced by the purchaser being willing to pay a higher price.

not purchasers of allowances are responsible for ensuring that the allowances are surplus.

Continuous Monitoring and Enforcement Costs

Under the Title IV Acid Rain Program utilities are required to install tamper-proof continuous emission monitoring systems or fixed monitors where the sulphur content of fuel is consistent. If these systems, indicate that the utility has emitted more sulphur dioxide than it is allowed to, it must pay a fine of US $2 000 (in 1990) for every short ton or fraction of a ton by which it exceeds its allowable limit. The fine is imposed whether or not the utility was negligent in allowing the exceedance to occur. Monitoring is determinative. Without government having taken any enforcement action, a utility will be subject to a further fine if it does not pay within a required time. Violators must also remediate their exceedance by reducing future emissions to a level which is equal to their allowed emissions level, less their past exceedance.

Continuous emissions monitoring and automatic penalties create a gold standard for allowance trading. With them a system can be extremely efficient and effective.

Since the current price for an allowance to emit one ton of sulphur dioxide is approximately $110 and since 100% of exceedances are fined, the combination of an automatic $2000 per ton bill, plus the requirement for a future emission reduction, provides a very effective enforcement threat. Criminal prosecutions and discretionary administrative penalties are also available to punish non-compliance. This system has been estimated to yield 40% of *Clean Air Act* emission reductions utilizing one percent of EPA air emissions staff.[77]

Continuous emissions monitoring systems were unpopular with utilities because of their high costs, but their tamper proof nature, and their accuracy to within a few percentage points is the *sine qua non* of environmental support for the Title IV Program as well as a key to low enforcement costs.[78] As discussed above, comparable accuracy can be achieved at less cost for most greenhouse gas emissions.

The RECLAIM program relies on either continuous emissions monitoring for major sources[79] (representing the vast majority of emissions) or fuel usage and regularly tested emission rates for smaller sources. Monitoring requirements are considerably more stringent than under command and control.[80]

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77 See US General Accounting Office, above at footnote 2.

78 According to most published estimates CEMs are accurate to within a percent point or two, although there was anecdotal of CEMs sometimes being consistently biased by as much as twenty percent in either direction: personal communication with Mark Brownstein, Public Service Electric and Gas Company; Kete, above at footnote 55, at 95; and Solomon, above at footnote 29.

79 Over ten short tons emissions in any baseline year.

80 California Air Resources Board, "Public Meeting to Consider Approval of the SCAQMD's Regional Clean Air Incentives Market" (February 8, 1994) [unpublished] at 10.

Whatever monitoring requirements are imposed, changes will also need to be made to the Canadian or British Columbia enforcement regime. A key to effectiveness of the Title IV Acid Rain Program is that penalties for exceeding allowed levels are automatic. It is recommended that any Canadian cap and emission allowance trading program use automatic administrative penalties.

It should be noted that some cap and trade systems have not used automatic monitoring systems or administrative penalties. For instance, in the New Zealand system of transferable quotas for commercial fisheries, monitoring of the paper trail of fish purchases and sales enables the government to detect misreporting even long after an offence occurs, and fisheries cases are tried before a judge in the criminal courts. The threat of forfeiture of vessels in the event of violation as well as the forfeiture of quota has allowed the system to maintain integrity.

Nonetheless, if automatic administrative penalties and tamper proof, continuous monitoring systems are not used it would be necessary to devote considerably greater expenses to enforcement and make changes to the way environmental laws are enforced. As discussed in the last chapter, the current level of enforcement threat in Canada is not sufficiently credible for a trading system.[81] More resources devoted to enforcement as well as improvements to the enforcement alternatives available, in particular, establishment of administrative penalty provisions, would be required for a credible trading system.

Conclusion:

A combination of tamperproof monitoring systems and automatic administrative penalties is necessary for effective enforcement of a cap and emission allowance trading program. In the absence of these elements, there would need to be a large increase in enforcement staff as well as provision of additional enforcement tools such as discretionary administrative penalties, but, even with these measure, the program's environmental effectiveness would be less certain.

81 The current Canadian enforcement regime and the need for administrative penalties is discussed at length in Christopher Rolfe, "Administrative Monetary Penalties: A Tool for Ensuring Compliance" (Paper presented to the Canadian Council of Ministers of Environment Workshop on Economic Instruments, Winnipeg, January 24, 1997) [unpublished].

Design Issue 22: Trading in a Competitive Electricity Market

Issue:

If deregulation in the electricity market proceeds, what mechanisms can be put in place to ensure that cost effective demand side management measures are adopted among electrical users?

Discussion:

Trends in the regulation of electricity generation and supply in North America may conflict with the cost effective reduction of greenhouse gases through emissions trading. Traditionally in North America, electricity has been provided by utilities that have a monopoly over electricity supply in their service area. To protect electricity consumers from monopolies, governments have exerted control either through ownership of utilities or utility commissions, or in some cases both. Because consumers tend to under-invest in energy efficiency and have major information hurdles in determining the best means of reducing their energy bills, one of the best means of protecting the consumer and the broader public interest has been for utility commissions to require utilities to undertake demand side management programs.

This model of utility monopolies being required to implement demand side management is increasingly coming into conflict with restructuring in the electricity market. In the United States, the Federal Energy Regulatory Commission has ordered owners of transmission lines to deliver power from generators to other utilities and electricity wholesalers at reasonable, non-discriminatory rates.

In addition, a number of states have implemented varying degrees of competition in the retail electricity sales market. Consumers, potentially including residential consumers, may be able to purchase electricity from their choice of suppliers, regardless of who owns the transmission and distribution facilities. In Ontario, the MacDonald Committee on Competition in Ontario's Electricity System has recommended restructuring, and a breakup of Ontario Hydro's monopoly is widely expected. In British Columbia a number of electricity market reforms have been implemented, and the BC Task Force on Electricity Market Reform is developing recommendations on retail competition.

In a competitive retail market it is difficult for utility commissions or government owners to mandate implementation of demand side management, and customers are unlikely to support demand side management activities. Even though energy conservation activities may reduce customers overall energy bill, the tendency is to purchase electricity at the lowest costs per unit, and demand side management will increase those costs. Also, a company investing in demand side management may loose the benefit of those investments if its customer moves to another supplier.[82]

This raises problems in the context of emission allowance trading. Generation facilities may not be able to adopt the most cost effective means of reducing emissions. Demand side management will often be cost effective, but generators may only be able to encourage demand side management by passing on the costs of allowances or the cost of clean energy sources. At least two means of dealing with this problem have been proposed:

- delegating compliance requirements to distribution utilities and industrial purchasers; or,
- funding demand side management through electrical line charges, charged on all distribution.

Delegating Compliance

If retail competition is limited, i.e., if only large consumers can purchase electricity directly from generators, the responsibility for holding allowances can be devolved to the local distribution utility or large industrial purchasers. Laws would need to be in place to ensure that generators accurately report their emissions.

In the case of allowance trading, the distribution utility would be responsible for holding enough allowances to cover emissions from electricity it has purchased. It can choose to implement demand side management, buy from generators with cleaner emissions profiles or purchase more allowances.

Funding Demand Side Management Through Line Charges

The other alternative is simply to retain responsibility among actual emitters for meeting requirements for emission allowances, but use other mechanisms to

82 For a lengthier discussion on the difficulty of implementing demand side management in a deregulated market see Timothy Brennan *et al.*, *A Shock to the System: Restructuring America's Electricity Industry* (Washington, DC: Resources for the Future, 1996) or Carol Reardon and Dermot Foley, "The Future of Energy Conservation in a Competitive Electricity Market" (Discussion paper for the Association for the Advancement of Sustainable Energy Policy, Vancouver, BC, August 1997) [unpublished].

ensure cost effective demand side management. The possibility of charging a surcharge on all electricity to fund demand side management was already referred to in Chapter 6.[83] California has adopted this model to ensure continued investment in demand side management in a deregulated electricity market. A similar model has been proposed for British Columbia and enjoys substantial support from a range of stakeholders.[84]

Conclusion:

If electrical market deregulation proceeds, there is a risk that cost effective demand side management will not occur even though it may be the most effective means of reducing emissions. Cost effective emission reductions can be ensured either by passing responsibility for holding sufficient emission allowances to retail utilities or using a separate instrument such as a surcharge on electricity devoted to emission reductions.

Passing responsibility for compliance to retail utilities and large industrial consumers has the advantage that the holder of allowances has control over the various means to reduce emissions. However, it is only compatible with limited de-regulation. If residential and small commercial customers are able to choose their suppliers, distribution utilities will not be in a position to implement demand side management even if that is the most cost effective emission reduction strategy. While a charge dedicated to funding demand side management means emitters do not have control over all the tools that determine their emissions, it is feasible in the context of retail competition at the commercial and residential level.

Evaluating Cap and Emission Allowance Trading Programs

Environmental Effectiveness

The key determinants of whether a cap and emission allowance trading program is environmentally effective are whether or not the cap is set at a level higher than actual emissions at the beginning of the program, and whether or not the program

83 See under the heading "Fine Tuning Taxes and Green Taxes," subheading "Dedicated Taxes and Atmospheric User Fees".

84 See Reardon, above at footnote 82. Personal conversation with Richard Gathercole, BC Public Interest Advocacy Centre.

includes an effective monitoring and enforcement component. Although the theory of cap and emission allowance trading consistently assumes that the initial cap will be set at a level no higher than current emissions, political expediency — in particular the desire to buy support for a particular allocation system — may lead to a higher cap being set.

The main hurdles to an effective monitoring and enforcement system are resistance to the cost of tamper-proof continuous monitoring systems and lack of familiarity in Canada with automatic administrative penalties. With appropriate monitoring systems, and with automatic administrative penalty systems, effective compliance can be assured. Without these two ingredients, the effectiveness of a cap and emission allowance trading program could be severely undercut because the current state of environmental law enforcement in Canada does not create a sufficient enforcement threat.

To the extent an emission cap represents lower emissions than would occur under business as usual, a cap and emissions allowance trading program can achieve significant additional changes. The level of leakage from a cap will depend on a number of factors including how participation thresholds are set, whether or not sources below thresholds are subject to equally stringent standards, and how allowances are allocated. Leakage may also be significant if other jurisdictions do not impose similarly stringent standards on their industrial and power generation sources.

Although cap and emission allowance trading programs are not designed to focus on emission reduction opportunities which have multiple environmental benefits, they are likely to do so because most of the emissions under a cap and emission allowance trading program are likely to be from combustion of fossil fuels. This will likely have a substantial impact on a range of air pollutants that are associated with fossil fuel combustion.

A final advantage to cap and emission allowance trading programs is the extent to which they create a forward momentum in reducing emissions. By setting a schedule of planned emission reductions, allowances are banked and investments are made in reducing emissions in order to sell credits. Once the caps are set and the process of banking and investing in emission reductions is underway, it appears difficult to derail this process. Political will is mainly required at the program development stage. In comparison, environmental improvements through use of regulatory standards require constant political will to continually increase the stringency of standards.

Cost Effectiveness

It is generally assumed that cap and emission allowance trading programs are highly cost effective because within the scope of a program, emission reductions can occur at sources that have the lowest emission reduction costs. Because the transaction costs of trading in a cap and emission allowance trading program are very low (as compared to emission reduction credit trading), it is more likely that trading will occur so that sources can take advantage of differentials in emission reduction costs between different sources. Cap and emission allowance trading programs also fare well on a number of other cost effectiveness criteria. The proposed monitoring and enforcement regime not only ensures environmental effectiveness, it drastically lowers government administrative costs and enforcement.

On the other hand, if cap and emission allowance trading programs are not combined with the potential to use credits, they will exclude some very low cost emission reductions which are outside the scope of the program. A domestic program would likely be limited to about one-third of Canadian emissions and thus two-thirds of total emission reduction opportunities are unavailable to participants. Because the level of investment in energy efficiency is relatively greater in industrial sectors (the sectors covered by an emission allowance trading program) industry is unable to avail itself of some very cost effective emission reductions. These can, however, be secured by other programs in the overall portfolio of measures.

Cap and allowance trading can create a momentum toward environmental improvement which is absent in systems relying on regulatory standards to drive improvement in environmental quality.

However, the cost effectiveness of a cap and emission allowance trading program will depend on the extent to which price signals work to ensure lowest cost emission reductions. For instance, a cap and emission allowance trading program may limit emissions from electric utilities. The most cost effective way to reduce these emissions may involve increased efficiency in homes and businesses, but experience indicates that these energy users do not always respond to higher electrical prices by taking the most cost effective emission reduction measures. Reducing emissions at lowest cost will continue to depend on programs such as energy efficiency standards, demand side management programs and energy auditing. A program must be designed to ensure these efforts continue. A program will be more efficient if combined with efforts to remove split incentives and internalize costs of local air pollution.

Several allocation formulas can introduce distortions that reduce efficiency. For instance, allocation on the basis of annual production levels of different products may reduce the cost effectiveness of a program if the classes of products to which different emission factors are applied, are too narrowly defined.

A cap and emission allowance trading program can involve high administrative costs in determining the appropriate allowance allocations. If an attempt is made to distribute allowances at no cost on the basis of which sources face the lowest emission reduction costs (i.e., so that those sources facing the lowest emission reduction costs receive lower allocations), a very high level of administrative effort will be needed to assess the emission reduction costs faced by different sources.

Finally, the proposed monitoring requirements will involve higher monitoring costs than under a regulatory program. However, they are likely much lower than monitoring costs in a credit trading program and lower than monitoring costs in most emission allowance trading programs for local pollutants.

Equity

The equity of a program will depend completely on the allocation method. Any allocation method will likely involve trade-offs between different concepts of equity (e.g., the importance of rewarding sources that pursued energy efficiency prior to a baseline year versus those that have sunk capital investments into carbon intensive technologies).

Feasibility

The main hurdle to achieving broad political support for cap and emission allowance trading programs is likely to be the contentious nature of designing an allowance allocation method. Allowance allocations represent a zero sum game in which there will be winners and losers. Because of the high diversity of sources involved in a greenhouse gas cap and emission allowance trading program, allocation is likely the most significant difficulty in designing and achieving political support for a program.

On the other hand, businesses tend to favour allowance trading in principle, although as discussed in Chapter 7, this support may be soft. Environmentalist support for a cap and emission allowance trading program is also uncertain although it is likely to be greater than for a credit trading program because of the difficulties in ensuring the additionality of emission reductions under the latter.

Although Canadian government officials are generally unfamiliar with the details of cap and emission allowance trading programs, it is likely that there is sufficient expertise to develop and implement a program. A cap and emission allowance trading program can be feasibly implemented into Canadian legislation although, as discussed further in Chapter 14, new legislation will be necessary.

Chapter 10:

Cap and Carbon Coupon Trading

When I see an adult on a bicycle I have hope for the human race.

— H.G. Wells

Trading systems are usually thought of as involving trades of emission rights between point sources. However, government could establish a cap and trade program in which participants trade in rights to distribute, or rights to produce and import, fossil carbon. This system would allow a trading system to capture emissions from millions of small emitters such as motor vehicle owners which would be difficult to regulate using emissions allowance trading. While a cap and emissions allowance trading program can cap less than half and likely less than a third of Canadian emissions, a cap and carbon coupon trading program which applied to all fossil fuel carbon used in combustion would capture over 74% of Canada's greenhouse gas emissions and 78% of BC emissions.[1]

A cap and carbon coupon trading program could be combined with a cap and emission allowance trading program for all large point sources. Large point sources would receive allowances, while fossil fuel distributors supplying fuel to sources other than large point sources would receive carbon coupons. Coupons and allowances would be fully transferable. Alternatively, the cap and carbon coupon trading program would be combined with allowance trading only for non fossil fuel sources that can be adequately monitored. These combinations are discussed further in the Chapter 15.

National Economic Research Associates — in a 1990 discussion paper prepared for Alberta Energy, Alberta Environment and the Canadian Petroleum Association as part of the background materials for the development of the Clean Air Strategy for Alberta (the NERA Report) — recommended a cap and carbon coupon trading

1 Derived from A.P. Jaques, "Trends in Canada's Greenhouse Gas Emissions" (Ottawa, Environment Canada, 1996) [unpublished].

program.[2] Environment Canada's 1992 discussion paper, *Economic Instruments for Environmental Protection*, also discussed a cap and carbon coupon trading program as being one method by which Canada could reduce greenhouse gas emissions.

How Cap and Carbon Coupon Trading Works

Although a cap and carbon coupon trading program is a trading program, its effect is much closer to that of a carbon tax. The difference is that the level of the tax is set by the market rather than the government. The limited supply of carbon coupons would allow producers/importers or distributors to charge a premium to their customers so that demand does not exceed the limited supply. The premium will be higher for more carbon intensive fuels. For instance, if the cost of an allowance allowing the sale of one tonne of carbon were $25, natural gas consumers would pay an additional $338 for every terajoule (about $13 per thousand m^3), while consumers of sub-bituminous coal would have to pay $638 per terajoule, or about $12 per tonne of coal.[3]

A cap and carbon coupon trading program is significantly different from a carbon tax in that it is not known what the effect of the program will be on prices, whereas with a carbon tax the effect on prices will be known, but the impact on demand for fossil fuels will be unknown. Under a cap and carbon coupon trading program, the increase in prices paid by the consumer would depend on:

- The aggressiveness of the cap. If a trading program were to simply set a ceiling on carbon dioxide emissions higher than what emissions would otherwise be, there would be no impact on the consumer. If a trading program were used to rapidly phase out fossil fuels, the price per tonne would be higher.

- The demand curve for fossil fuels will determine the price of allowances per given cap. The demand curve represents the quantity of fossil fuels consumers will buy at different prices. This will depend on a number of factors. Consumers do not demand fossil fuels; they demand services — heat, transportation etc., — that are currently provided by burning fossil fuels. If

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2 National Economic Research Associates Inc., *Market Based Approaches to Managing Air Emissions in Alberta* (Alberta: Alberta Energy, Alberta Environment and Canadian Petroleum Association, 1991) at 169 and 198.

3 This assumes perfect elasticity of supply. The share of the allowance cost passed on to the consumer may be lower if there is any inelasticity of supply. This is discussed further below. See NERA, *Ibid*., at 172.

regulations, demand side management or technology developments allow these services to be provided with less need for fossil fuels, the demand curve will be more elastic and the carbon premium lower. For instance, the demand for gasoline will not only depend on how far people will drive at a certain price per litre, but also investments in transit, the cost of producing ethanol as a substitute for gasoline and fuel efficiency standards for cars.

- The supply curve for fossil fuels fuel will determine the extent to which fossil fuel producers absorb the cost of allowances and to what extent prices will be passed on to consumers. The supply curve is the amount of a fossil fuel suppliers will supply at different prices. For oil, in the absence of export controls, the price suppliers must receive is fixed by world markets. Canadian firms will sell abroad if the Canadian price is below the world level. As a result, the supply curve for oil is highly elastic meaning that all of the cost of coupons will be passed on to consumers of oil. At the other extreme, some types of coal have only a local market and thus a relatively inelastic supply curve. Producers of these coal types will likely absorb a large portion of the cost of carbon coupons. The elasticity of natural gas would be high if trading were imposed in BC or Canada alone, but less elastic if a trading program applied to all North America.

The premium paid by consumers will be paid to the owners of carbon coupons, fossil fuel importers, producers or distributors. A cap and carbon coupon trading program essentially involves privatizing the right to charge a carbon tax. To be socially acceptable, most or all of the windfall revenue from the premium must be captured by government. This can occur by auctioning allowances or taxing allowance holders. That revenue can in turn be used to reduce income or other taxes.

Trade Law Considerations

Although a cap and carbon coupon trading program places restrictions on imports, it should not run afoul of Canada’s international trade obligations under the North American Free Trade Agreement, the General Agreement on Tariffs and Trade or other World Trade Organization rules. Prohibitions against quotas or import licenses are likely inapplicable, because the quotas in question are aimed equally at imports and production. Similarly, so long as the allocation method is impartial to importers and domestic producers, it does not violate national treatment rules because producers and importers are treated alike. In any event, the prohibition would likely come within exceptions provided for environmental measures.[4]

Other Cap And Trade Programs for Substances

Cap and trade programs have been used to restrict the import, production and use of substances other than fossil fuels. In particular, the *Montreal Protocol on Ozone Depleting Substances* caps production of ozone depleting substances (ODSs), and allows nations to transfer their production quotas for ODSs. A number of jurisdictions, including Canada, the US and the EU have established domestic cap and trade programs for the production, import and consumption of ozone depleting substances (ODSs). Under these programs, production quotas can be purchased by domestic producers from producers in other countries. Allocations have been made on the basis of production, import or consumption levels during a baseline year. In Canada, import quotas for methyl bromide were allocated to users rather than importers because of the fear that the few importers might collude and take advantage of their monopoly on import rights.

Although these programs indicate the effectiveness of a cap and trade program for substances, they are fundamentally different from a carbon coupon program in one very important respect. Canadian society was not as reliant on ODSs as it has historically been on fossil fuels. Because of this, in the case of ODSs it was socially acceptable to create cartels on import or production without taxing back the resulting monopoly profits. The same would not be the case for fossil fuels.

4 For instance, Article XX(g) of the General Agreement states that "Subject to the requirement that such measures are not applied in a manner which would constitute a means of arbitrary of unjustifiable discrimination between countries ... nothing in this Agreement shall be construed to prevent the adoption or enforcement by any contracting party of measures ... relating to the conservation of exhaustible natural resources if such measures are made effective in conjunction with restrictions on domestic production or consumption." Although, the national treatment rule has been interpreted expansively and Article XX(g) interpreted narrowly (see for instance, *Canada — Measures Affecting Exports of Unprocessed Herring and Salmon,* Report of the Panel 22 March 1988; *United States — Restrictions on Imports of Tuna,* Panel Report, June 1994; *United States — Restrictions on Imports of Tuna,* Panel Report, 3 September 1991; *United States — Standards for Reformulated and Conventional Gasoline,* Panel Report, 17 January 1996) none of these decisions suggest that a cap and carbon coupon system would be contrary to trade law.

Designing a Cap and Carbon Coupon Trading Program

Various issues must be addressed in designing a cap and carbon coupon trading system. Some key design issues are discussed in this section:

- **Design Issue 23:** Scope of Carbon Trading;
- **Design Issue 24:** Defining the Commodity;
- **Design Issue 25:** Certainty and Property vs. Flexibility;
- **Design Issue 26:** Allocating Carbon Coupons;
- **Design Issue 27:** Excluding Fossil Fuel Feed Stocks;
- **Design Issue 28:** Exemption of Fuel Exports;
- **Design Issue 29:** Monitoring and Enforcement Regime;
- **Design Issue 30:** Recycling Revenue.

Design Issue 23: Scope of Carbon Trading

Issues:

a) Should a carbon coupon trading program apply to the importers and producers of fuel, distributors of fossil fuel, or transporters of fuel?

b) Should a carbon coupon trading program exclude any fossil fuel producers?

c) Should a carbon coupon trading program include biomass fuel producers?

Discussion:

Who Trades?

A carbon coupon trading programs could apply to importers and producers of fuels, distributors (i.e., gas utilities and refineries) or transmitters (e.g., pipeline operators). Several factors favour applying the system to importers and producers:

- Fuel consumed in production, refining and transmission is caught by the system. This is very significant as carbon dioxide from fossil fuel producer consumption amounts to 9.5% of carbon dioxide from fossil fuel combustion. Pipeline compressors contribute another 2.5%.

- The numbers of importers, exporter and producers — three to five hundred in Canada[5] — is manageable yet sufficiently large to create a competitive market.[6]

- Production levels of individual companies fluctuate more than they do for transmitters and distributors. This will help spur supply and demand and thus a vigorous market.

The remainder of this chapter assumes a program would be applied to producers, importers and exporters. References to producers or production should be read as producers and importers or production and import.

Exclusions and Thresholds for Fossil Fuel Producers

Chapter 9 discussed the need to weigh the advantages of including certain sources versus the difficulty in measuring those sources and the difficulty in administering small sources. Because a cap and carbon coupon trading program works by putting a premium on fuels, it is absolutely essential that fossil fuel sources not be excluded from a trading program. To do so would create a major incentive to purchase fuels from the excluded fossil fuel source.

Luckily, the reasons for excluding sources are much less compelling in a cap and carbon coupon trading program. Because the number of producers is limited, government administrative costs are not significantly increased by applying a program to all producers. Moreover, for most fossil fuels the carbon produced is relatively easily measured on the basis of a carbon factor and volumes produced or imported.

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5 Personal communication with Erik Haites, January 17, 1997.

6 The number of fossil fuel transportation companies is on the other hand dominated by a few pipeline companies. Personal communication with Michael Toman, Resources for the Future, Washington DC; See also NERA, above at footnote 2.

Exclusions for Biomass Fuel Producers

Chapter 9 discussed the pros and cons of applying a cap and emissions allowance trading program to sources that use biomass for fuel. The issues are identical for a cap and carbon trading program.

Conclusion:

The program should apply to producers and importers of fossil carbon. It should not exclude any fossil fuel producers, but should exclude biomass fuel producers.

Design Issue 24: Defining the Commodity

Issue:

Do the rights traded under a carbon coupon trading program represent rights to produce or import a tonne of fossil carbon or rights to import and produce fossil carbon at a set rate?

Discussion:

As discussed in Chapter 9, cap and trade programs can define tradeable rights in different ways. In the case of carbon coupon trading, coupons can represent either rights to import or produce a discrete amount in a defined time period or a right to import and produce a defined share of the total cap (or at a defined rate) in perpetuity. The former has several significant advantages. In particular it creates a program which is more flexible and has lower transaction costs.

Conclusion:

It is recommended that the carbon coupons represent a single tonne of carbon rather than a rights to produce a certain tonnage per year.

Design Issue 25: Certainty and Property vs. Flexibility

Issues:

a) Should carbon coupons represent a licence to produce or import fossil fuels in a particular year (possibly with an option for later use) or should emitters be given a budget of coupons for use over a longer time period with no restrictions on when they are used in that time period?

b) Should allowances that represent rights to emit in a single time period be distributed at the beginning of the program or at the beginning of each time period?

c) Should allowances represent property rights or revocable licences?

d) Should emitters be given temporal flexibility in when they use allowances by allowing them to "bank" unused coupons from one time period for use in later time period, or "borrow" coupons designated as being for a later time period for use in an earlier time period?

Discussion:

The issues in relation to providing:

- flexibility for government to alter a carbon cap;
- certainty regarding the supply of carbon coupons and greater predictability as to fossil fuel prices; and
- temporal flexibility as to when fossil fuel consumption is reduced;

are very similar to the issues discussed in the previous chapter, under Design Issue 18 and are closely linked.

As was the case with emission allowances, the simplest means of balancing certainty and flexibility is for government to announce its intent as to what the cap will be over a relatively long time horizon, but only issue carbon coupons annually. If government decides a more rapid phase out is necessary, the cap can be changed and annual allocations reduced accordingly (presumably with some notice). Emitters wanting greater certainty as to production rights can purchase futures for carbon coupons.

Multi-year budgets of coupons or allocating coupons covering many years in the future is problematic for the reasons discussed in the last chapter. It is also likely incompatible with auctioned carbon coupons.[7]

As is the case with emission allowance trading, the need for government flexibility to accelerate emission reductions militates against defining carbon coupons as property, especially where the coupons are allocated for more than a year in the future. Also, the government should be reluctant to create a virtual monopoly on the supply of fossil fuels which it cannot dismantle without paying compensation to the holders of monopoly rights.

Fossil fuel consumed will vary from year to year because of fluctuations in the weather and economy. As discussed in Chapter 9, allowing producers to bank coupons provides them with some flexibility. In particular it allows them to accumulate a reserve of banked coupons which can be used in a particularly cold year or a year of particularly high economic activity. Some more flexibility can be provided by allowing producers to true-up any shortfalls in their balance of coupons and production in the year following the shortfall.

In the initial years of a program it may be necessary to provide an additional escape valve whereby producers or importers can meet increased demand due to a cold year or series of cold years even though they have not had the opportunity to develop a reserve of banked coupons. This is even more important in the case of a carbon coupon trading program because of our current dependence on fossil fuels for the delivery of essential services such as heat. It may also be necessary to have additional coupons which can be purchased at a price significantly above the expected market price for allowances. These could be used if several cool years or other circumstances produce an unexpected demand for fossil fuels.

The great virtue of a cap and carbon coupon trading program is the ease with which a single, simple instrument encourages a wide range of emission reduction activities.

Conclusion:

Denominating carbon coupons as a right to produce fossil fuels in a particular year, issuing coupons annually, allowing banking and announcing government's intent as to future annual coupon budgets would likely provide sufficient certainty as to the value and supply of future coupons, while at the same time maintaining government flexibility to reduce overall caps. Defining coupons as revocable

[7] Since the demand curves for fossil fuels are not well known, it would be impossible for government or producers to assess the premium which producers will be able to charge. Because of this uncertainty, auction prices are unlikely to reflect the true value of coupons, and government risks politically and socially unacceptable transfers of wealth to those buying coupons. (Similarly, producers risk large transfers of wealth to government if they overestimate the premium they will be able to charge.) The amount raised by auction would depend on the costs of reducing emissions and, initially, expectations of the costs of reducing emissions.

licences is essential in any Canadian cap and trade program, especially where allowances are allocated for time periods of more than a few years. Some additional temporal flexibility could be offered by allowing producers to make up for short falls in coupons in one year the next year. In the initial years of the program it may be necessary to allow the purchase of coupons that fall outside the cap to ensure that the cap does not cause major dislocation in the event unusual circumstances increase the need for fossil fuels in a particular year.

Design Issue 26: Allocating Carbon Coupons

Issue:

What formula or other mechanism should determine the distribution of allowances?

Discussion:

There are far fewer means by which carbon coupon allowances can be distributed than is the case with emission allowances:

- auctions;
- distribution based on historic production levels;
- distribution based on recent production levels; and,
- distribution on a per capita basis.

Annual Auctions

As discussed above,[8] auctioning of coupons is only compatible with annual allocations because revenue officials will, from year to year, be able to predict revenue generation from allowances in the future year. A slow phase-in allows a government and market participants to discover the shape of the demand curve for fossil carbon gradually so that the premium charged by coupon holders and auction revenue can be predicted more accurately. The exact distributional impacts of an annual auction will depend on how revenues are recycled.

[8] See footnote 7.

Grandfathering based on Historic Production Levels

Carbon coupons for a long time period could be awarded to companies based on historic production levels, with a tax charged to capture the premiums the producer charges. If there is a slow phase in combined with a tax on coupon holders it should be possible to effectively capture the premium and adjust other taxes accordingly. Sales records, excise tax records, transmission charges paid to pipeline companies, records of fuel used by transmission companies and various other corporate and government records can be used to accurately establish and verify aggregate and individual company carbon production and imports. A difficulty with this approach is that it adversely impacts companies with expanding market shares.

Annual Distribution Based on Recent Production Levels

To reduce the negative impacts that a free distribution based on historic production levels would have on companies with expanding market share, coupons could be distributed based on production levels in the preceding years. Companies would still have to purchase coupons from other producers to expand their market share, but free coupon allocations in the following years would reflect the larger market share.

Per Capita Distribution

Carbon coupons could be allocated annually to the public on a per capita basis. Individuals would sell their coupons to producers, most likely using intermediaries such as banks who could efficiently purchase coupons from millions of citizens and sell them to producers. The transactional costs, including distributing coupons to the public and educating the public as to their ability to sell the coupons, would be very high.

Theoretically, such a system is moderately progressive. Poorer households spend less than average on energy (though more as a percentage of their income) and would gain by sale of their per capita distribution. Rich households would lose, although very slightly compared to their incomes. However, there is a significant chance that the poorest people in society would receive discounted prices because they would not understand the system or would be willing to sell quickly for the sake of quick cash.

Also, the ability to use the tax system to determine income redistribution impacts (for instance, by offering credits to northern and rural residents, increasing the progressiveness of the tax system or recycling revenue to industries most impacted) would be lost. Per capita distribution also removes the possibility of recycling revenues to replace distortionary taxes. As discussed below, replacing such taxes has a “double dividend” and may promote positive economic activity.

Conclusion:

Distribution of carbon coupons is likely to be less contentious than emission allowances because their value will be taxed back. However, choice of an appropriate allocation method will depend on various competing factors. No allocation method in inherently the ‘correct’ method.

Design Issue 27: Excluding Fossil Fuel Feed Stocks

Issue:

Should fossil fuels used as a feed stock for long lived products be exempted from a carbon coupon trading program?

Discussion:

Oil and natural gas are used not only as fuel but also to produce other products such as polyester, plastics, paints and synthetic rubber tires. Even where some of these products are incinerated for energy recovery, carbon is fixed in the products for a relatively long time and much may never be released. It is recommended that fossil fuels used in these long lived products be exempted from the carbon coupon program. This could be done by giving coupons to producers of long-lived products that use fossil fuels as a feed stock. They can then sell the coupons at market prices, which should roughly equal the premium charged by the fossil fuel producer. Capturing the carbon from incineration of waste products could be done by combining the carbon coupon trading program with emissions trading from sources that burn waste products.[9] This exemption should only apply to the carbon converted into products where carbon will remain sequestered in the product.

[9] These sources tend to be significant emitters, such as cement plants and municipal incinerators, which are well suited to emissions trading.

Conclusion:

Fossil fuels used as feed stock for long lived products should be exempted from a carbon coupon program by issuing coupons equal to the carbon content of the feed stock.

Design Issue 28: Exemption of Fuel Exports

Issue:

Should fossil fuel exports be exempted from a carbon coupon trading program?

Discussion:

If countries consuming fossil fuels produced in Canada (mainly the United States) are committed to emission reduction goals equivalent to Canada's, it is clear that Canadian fossil fuel exports should be exempted from a carbon coupon trading program. If such an exemption were not made, Canadian fossil fuels would be disadvantaged in international competition, possibly inhibiting fuel switching to low carbon fuels such as natural gas, but international greenhouse gas emissions would not be reduced.

If Canada exports fossil fuels for consumption in countries which are not subject to an emission reduction goal, it is possible to argue that these exports should not be exempt because their consumption will have a negative impact on Canada. On the other hand, if exports are not exempt from a carbon coupon program, Canadian exports will be reduced, but it is likely that other producers will simply fill the void, having little effect on actual emissions. Canadian coal and oil exports would be reduced with some domestic coal and oil displacing imports. Western natural gas exports might also be reduced; but it is not clear whether American consumers (the fastest growing source of demand being utilities) would reduce consumption of fossil fuels or simply switch to other, possibly more carbon intensive, fossil fuel sources. The result is that not exempting exports from a tradeable coupon system may harm Canadian industry while having minimal or no impact on global emissions.

Excluding exports is also consistent with commitments under the *FCCC* as each country is only responsible for its consumption.

Conclusion:

Carbon coupon exports should be excluded from a carbon coupon trading program by issuing coupons equal to the carbon content of the fuel exported.

Design Issue 29: Monitoring and Enforcement Regime

Issue:

What monitoring and enforcement regimes would need to be implemented to enforce a cap and carbon coupon trading program?

Discussion:

A very significant advantage of cap and carbon coupon trading programs over emission allowance trading programs is the ease with which carbon coupon programs can be monitored and enforced. As with cap and allowance trading programs a credible enforcement threat is essential. A credible enforcement threat will generally be easier to provide because of the relatively limited numbers of importers, producers and exporters.

For most fossil fuels a combination of monitoring equipment at pipelines, manifesting systems for fossil fuel exports by train, truck and ship, and production/sales records are likely to provide an effective means of production import and export for most fossil fuels. Information on imports, exports and production is in most cases already being gathered for purposes of imposing excise taxes and royalties, regulating energy exports and imports, and collecting tolls for pipelines.[10] New Zealand's experience with enforcing tradeable fishing quotas through paper records suggests such an monitoring mechanism should work in most cases.[11]

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10 The *National Energy Board Act*, R.S.C. 1985 c. N-7 regulates interprovincial and international trade in oil and gas. Provincial legislation regulates intraprovincial pipelines (e.g. see *Pipeline Act*, R.S.B.C. 1996, c. 364) and applies royalties to production (e.g. see Petroleum and Natural Gas Act, R.S.B.C. 1996, c. 361).

11 See Chapter 9, under the heading "The Experience with Cap and Trade Programs" subheading "New Zealand Tradeable Fishing Quotas".

The above monitoring methods do not, however, capture upstream emissions from fossil fuel producers' consumption of fossil fuels.[12] Use of emission factors applied to final production would not provide incentives to reduce upstream emission reductions, so additional monitoring may be necessary. Because of variability in the carbon content of fuels consumed by producers continuous emissions monitoring equipment may be necessary in some cases.

For some fuels, such as bituminous coal, coke and unprocessed natural gas, carbon content is less consistent, and mechanisms would need to be developed for monitoring carbon content in a manner which can be verified after the fact. This would likely involve frequent sampling, with an opportunity for government inspectors to verify testing.[13] This enforcement cost is not too great given the limited number of importers or producers of these fuels.

As in the case of cap and emission allowance trading programs administrative penalties, especially automatic penalties, would be necessary to enable more effective enforcement against companies in minor breach.[14]

Conclusion:

Although monitoring and enforcement of a carbon cap trading program may require additional manifesting procedures and some monitoring equipment, it is relatively simple compared to an emissions allowance program. Nonetheless, some additional enforcement tools would be likely necessary, in particular, provisions for automatic and discretionary administrative penalties.

Design Issue 30: Recycling Revenue

Issue:

How should revenue raised from a cap and carbon coupon trading program be recycled into the economy?

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12 For instance, royalties on natural gas and oil production often only apply to sales or amounts delivered for processing.

13 For these fuels, carbon factors could also be used, but importers/producers would have the option of establishing sampling programs for carbon content that meet minimum standards and show that actual carbon content is lower. Because importers and producers would always opt for the measurement method which gives the lowest carbon content result, the carbon factors used should not be based on average carbon content, but instead on the highest possible carbon content for the fuel.

14 See Chapter 9, under the heading "Design Issue 21: Monitoring Equipment, Enforcement and Liability of Good Faith Purchasers."

Discussion:

With the exception of allocating carbon coupons on a per capita basis, all of the allocation or allocation and claw back methods discussed above raise substantial government revenues. How should these revenues be used by government?

It is often assumed that revenue from carbon taxes and carbon coupon trading programs will either go to general revenue and be used to increase spending on social and other programs, reduce income and other taxes, or pay down the debt. Similarly, it is assumed that carbon taxes and coupons will be expensive for carbon intensive industries. On the other hand, it is often assumed that cap and emission allowance trading programs will involve a free allocation of emission rights, thus imposing far lower costs on existing carbon intensive industries.

These assumptions are not necessarily true. Chapter 6 noted that carbon taxes can be dedicated to emission reduction programs or returned to energy intensive industries, and Chapter 9 noted that emission allowances can be allocated by auction or on the basis of production levels. Similarly, the revenue from a cap and carbon coupon trading program can be recycled into the economy in a manner that mimics the effects of any carbon tax and almost any emission allowance allocation method. Portions of revenue could be:

- **Dedicated to reduction of general taxes.** Revenue could be especially targetted to reducing distortionary taxes that reduce economic vitality. This will make low carbon intensity sectors more competitive. However, adding the cost of carbon coupons onto the cost of emission reductions will increase the costs of carbon intensive industries and potentially impact on their competitiveness. As discussed in Chapter 6, fossil fuels only account for a small portion of the costs of many exports, but are very significant for other sectors.[15]

- **Dedicated to demand side management programs and other initiatives that cure market failures**. If these programs are successful in curing market failures, they will reduce the demand for fossil fuels. In turn this will minimize both fossil fuel price increases and the impact of carbon coupon trading on carbon intensive businesses and individuals.[16]

- **Rebates or subsidies to energy intensive sectors.** Rebates could reduce impacts on competitiveness or inequitable impacts on individuals. Rebates could be in the form of border tax adjustments (as discussed in chapter 6);

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15 See discussion in Chapter 6, under the heading "Fine Tuning Taxes and Green Taxes" subheading "Ecological Tax Reform".

16 See discussion in Chapter 6, under the heading "Fine Tuning Taxes and Green Taxes" subheading "Dedicated Taxes and Atmospheric User Fees".

income tax credits for northern or rural residents with higher dependency on fossil fuels; or rebates that mimic the impacts of different emission allowance allocations. For instance, rebates to historic energy users would mimic the impact of allocating emissions on a historic emissions basis. Rebates on the basis of a company's production of energy intensive products would mimic the impacts of emission allowance allocation based on annual production levels. As noted in chapter 6 and chapter 9,[17] these adjustments can reduce the efficiency of a program, create barriers to new firms, and be extremely administratively difficult. Attempts to reduce redistributive impacts will tend to add to complexity of a program. Finally, revenue could be used to subsidize the transition of carbon intensive sectors to less carbon intensive products and processes

The extent to which revenue should be used to lower general taxes, dedicated to removing barriers to cost effective emission reductions, or rebated to energy intensive industries, will ultimately depend on analysis of three issues: the extent to which government can cost effectively cure market failures; the extent to which the Canadian society can be improved by placing taxes on pollution and reducing regressive taxes or taxes on jobs, value added and income; and the extent to which higher costs for fossil carbon will reduce the competitiveness of energy intensive businesses, causing unnecessary adjustment costs. The latter issue will depend in part on policies undertaken by Canada's trade competitors in energy intensive goods.

Chapter 9 discussed the possibility of shifting from one allocation method to another over time. For instance, it suggested that a program could begin with allocations based on historic emissions and gradually shift to allocations based on production. Similarly, the mix of spending in a cap and carbon coupon trading program could shift over time. Potentially, rebates could initially be offered to communities dependent on carbon intensive industries to aid in their transition. However, once established subsidies tend to be difficult to remove.

Conclusion:

How revenue is recycled under a carbon coupon trading program is vital to its overall effectiveness. Revenue generated from a carbon coupon trading programs can be recycled into the economy in ways that would reflect the impacts of any carbon tax and almost any emission allowance allocation method both on how the burden of emission reductions is shared, and on the competitiveness of different sectors. Further analysis and discussion among stakeholders is necessary to determine how revenues should be recycled.

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[17] See discussion in Chapter 6 under the heading "Dedicated Taxes and Atmospheric User Fees" and Chapter 9, under Design Issue 19.

Evaluating Cap and Carbon coupon Trading

A cap and carbon coupon trading program is attractive because of its simplicity and its ability to capture 74% of Canadian greenhouse gas emissions. Alternatively, cap and carbon coupon trading could also be used as a backstop for other measures. For instance, it could be laid over a program of demand side management, energy planning and regulation. If such a program is effective in reaching targeted levels, the cap and coupon trading program will have no effect on energy prices.

Compared to a carbon tax, a cap and carbon coupon trading program has the advantage that it avoids the need for repeated, often politically difficult, tax adjustments.

Any discussion on cap and carbon coupon trading begs the question: why not simply phase in a direct carbon tax, rather than privatizing the right to charge a carbon premium? Usually, the selling point for carbon coupon trading is the certainty it provides in reaching an agreed emission level. Because of uncertain demand and supply curves for fossil fuels, it is difficult to predict the emission reductions that would flow from different levels of carbon taxes. It is for instance, impossible to predict the taxation level which will reduce emissions by twenty percent in 2010. While this is true, it is unnecessary to predict the impact of a particular tax rate in 2010. Carbon taxes can be phased in with adjustments made from year to year so that policy makers achieve a desired goal (e.g., twenty percent reduction by 2010).

The essential difference between carbon coupon trading and carbon tax is that to reach a certain emissions level through a carbon tax requires relatively frequent budget adjustments (carbon tax increases) that may be unpalatable at the time. Politicians may prefer to make optimistic assumptions regarding the impacts of other measures or previously imposed taxes. On the other hand, carbon coupon trading involves a legislated schedule of cap reductions, avoiding the need for repeated, difficult political decisions. Carbon coupon trading may be politically easier because the political consequences (resistance to impending fossil fuel price hikes) are likely to be lower when the prices occur further in the future. Once a market in coupons is established and companies bank coupons hoping to sell them at higher prices in the future, or invest in coupon futures, there will be considerable resistance to increasing available coupons above the legislated schedule.

With the exception of the above differences, the pros and cons of carbon coupon trading mirror those of ecological tax reform discussed at length in Chapter 6. The primary pros and cons are as follows:

Environmental Effectiveness

A cap and carbon coupon trading program will be very environmentally effective. If the carbon cap represents lower carbon dioxide emissions than would occur under business as usual, a cap and carbon coupon trading program will achieve significant additional changes.

An argument that is likely to be made against carbon coupon trading is that it will cause leakage by encouraging energy intensive businesses to shift their production to non-Annex 1 Nations or other jurisdictions with less costly emission reduction programs. However, the extent to which cap and carbon coupon trading places higher costs on energy intensive industry than allowance trading depends on how revenues are recycled. The distributive impacts are not necessarily any different from credit trading or cap and emission allowance trading. The impact of a program on fossil fuel prices, and therefore leakage, can also be reduced by dedicating revenue, or a portion of revenue, to the reduction of barriers to cost effective emission reduction measures, e.g. funding demand side management.

By focussing on reducing emissions from fossil fuel combustion, a carbon cap and emission trading program is likely to have substantial impacts on a range of air pollutants that are associated with fossil fuel combustion. However, if governments allow large scale hydroelectric developments or other environmentally damaging projects to make up for fossil fuel combustion, negative side effects will arise.

Cost Effectiveness

Classic economic theory suggests that a carbon coupon trading program, by increasing fossil fuel prices and providing an indication of future increase in prices, will lead to adoption of lowest cost emission reduction measures. It will lead to increased investments in energy efficiency, fuel switching and decreased use of products with high embodied fossil energy content. Cap and carbon trading provides a great deal of flexibility as to how emissions are reduced. It could be combined with some point source emission allowance trading to capture non-fossil fuel sources and emission reduction credit trading to allow sequestration or joint implementation projects. Although carbon coupon trading does not force any particular technology it provides an economy wide incentive to technological innovation. Its administrative costs are likely the lowest of any program assessed.

Nonetheless, as discussed in Chapter 4 and 6, there are some areas where government intervention is clearly appropriate in order to correct market failures and remove the various barriers to no regrets measures and other cost effective measures. It is clear, for instance, that price signals are not effective in ensuring optimal levels of investment in energy efficiency in the residential sector and passenger transportation sector. Government intervention in areas such as urban planning and setting energy efficiency standards will be essential to ensuring that a carbon coupon trading program realizes emission reductions in the most cost effective manner.

Cost effectiveness will ultimately depend on finding the right balance in how revenues are recycled. Recycling to reduce distortionary taxes may ultimately make the economy stronger, but could increase the adjustment costs faced by carbon intensive industries and communities dependent on them. Recycling a portion of revenues to carbon intensive industries, either through rebates to carbon intensive exports or rebates to carbon intensive industries would reduce adjustment costs, but would make the system less efficient because it subsidizes energy intensive industry. Adjustment costs can be reduced, and efficiency can be improved, if revenues are recycled to demand side management programs, but only if those programs prove to be cost effective.

Equity

A cap and carbon coupon trading program is highly equitable in that costs will reflect emissions of carbon dioxide from fossil fuel combustion. It may be inequitable, however, if combustion sources are required to pay for their carbon dioxide emissions, while significantly less costly regulatory regimes apply to other sources. This problem would be partly resolved by combining carbon coupon trading with emission allowances for non fossil fuel combustion sources of greenhouse gases.

Social equity is dependent on how revenues from auctions or the taxes on fossil fuel producers are recycled back into the economy. Ignoring the effects of revenue recycling, a carbon coupon program will tend to have disproportionate impacts on low income individuals. Low income earners spend a higher portion of their income on energy, do not have money to invest in energy efficiency, and are often dependent on automobiles or fossil fuel heat. However, these inequities can be removed or reversed by using revenue from the program to reduce regressive taxes or by making income tax more progressive. Inequities can also be reduced by using revenues to fund demand side management programs specifically aimed at low income households.

How revenue is recycled will also affect the impacts of carbon coupon trading on communities that are dependent on energy intensive industry. These impacts will also depend on how real the threat of industry relocation actually is, and whether or not border tax adjustments can be made to reduce impacts on competitiveness. As discussed in Chapter 6, Canadian energy costs are a small portion of value added and export prices, but can be very high for a few industries. Finally these impacts will depend on policies applied by the United States and other major competitors in energy intensive goods.

Feasibility

A carbon coupon trading program is highly feasible in terms of the technical challenges involved in implementing it, and its administration and enforcement. Although some investment is necessary in monitoring of producer consumption, imports, exports, production and sales are already monitored.

As noted above a carbon coupon system has some distinct political advantages as compared to a carbon tax. It likely reduces the number of difficult decisions that will be faced by politicians, and although likely to be perceived as a tax, carbon coupon trading has the political advantage of being clearly linked to an environmental goal.

Although carbon coupon trading is likely to be portrayed by the opposition as leading to uncertain but extreme price increases, as with carbon taxes discussed in Chapter 6, the potential for public support increases if there is greater understanding of the idea that revenue will be recycled to reduce other taxes.

Its uncertain how carbon allowance trading would be perceived by the fossil fuel industry. Although a cap on production may strike them as anathema, acquiescence may occur if they feel they can keep a portion of the carbon premium. Interestingly, the 1990 proposal for a carbon allowance program was contained in a study sponsored by Alberta Energy and the Canadian Petroleum Association (at the time, Canada’s trade association for major oil companies).

Chapter 11:

The Clean Development Mechanism and International Emissions Trading

We are performing a global experiment on our natural ecosystems for which we have little information to guide us.... The rate of projected change is enough to threaten seriously the survival of many species.... While plant and animal communities may be able to eventually adapt to a stable climate system that is warmer than the existing one, many species may not be able to survive a transition to that new climate.

— *Ecologists' Statement on the Consequences of Rapid Climate Change, signed by 2,400 scientists, delivered to US President Bill Clinton, May 1997.*

Cap and emission allowance trading programs could potentially extend across national boundaries and credits in a credit trading program could be generated by projects outside the nation in which they are used. This chapter examines issues related to trading between jurisdictions and how such trading could be tied to a domestic trading program.

Processes for International Credit and Allowance Trading

A number of different processes related to interjurisdictional emissions trading have been established under the *United Nations Framework Convention on Climate Change* (the *FCCC*) and the *Kyoto Protocol to the United Nations*

Framework Convention on Climate Change (the *Kyoto Protocol*). To avoid misunderstanding, this section describes these processes, and how terms have been used and how this report will use them.

International Trading

Under article 6 of the *Kyoto Protocol*, for the purposes of meeting their emission reduction commitments, Annex 1 Nations can transfer and acquire from one another "emission reduction units resulting from projects" if the projects provide "a reduction in emissions or enhancement of sinks that is additional to what would otherwise occur." When emission reduction units are purchased by a nation they are added to that nation's assigned amount of allowable emissions and subtracted from the assigned amount of the nation transferring them. Essentially, article 6 creates an amalgam between credit trading and allowance trading. Article 6 allows nations to authorize firms to generate, transfer and acquire emission reduction units.

In addition to article 6, article 16 bis [sic] states that the Conference of Parties to the *FCCC* will define the "principles, modalities, rules and guidelines" for emissions trading. It then states that the nations with binding emission reduction commitments can participate in emissions trading for the purposes of fulfilling those commitments, and article 3 states that nations' assigned amounts will be adjusted up and down to reflect trades in international emission allowances. Although article 16 bis appears to contemplate trading beginning after rules are established, some nations believe they can begin trading prior to rules being set.[1]

In this report, international emission trading refers to any mechanism for trading international emission allowances. Thus, it includes any transactions under either article 6 or article 16 bis.

Clean Development Mechanism

The *Kyoto Protocol* allows Canada and other Annex 1 Nations to fulfill their emission reduction commitments through a clean development mechanism defined by the *Kyoto Protocol.* Essentially the clean development mechanism establishes a process for generating credits in non-Annex 1 Nations for use by Annex 1 Nations. Emission reductions accruing from projects in non-Annex 1 Nations can be used if they are certified under the clean development mechanism. The *Protocol* states that reductions will be certified on the basis of:

[1] The conclusion that rules are to be set first is based on the fact that the article refers to setting rules before it refers to nations being allowed to trade.

- Voluntary participation of each Party [to the *Protocol*] involved;
- real, measurable, and have long-term benefits related to mitigation of climate change; and
- emission reductions that are additional to any that would occur in the absence of the project.

Clean development projects are also to be approved by both the Annex 1 Nation using them and the host nation, and are supposed to benefit the host nation. The entities responsible for certification of emission reductions and the process for certification are to be determined by future conferences of the Parties to the *FCCC*. The *Kyoto Protocol* allows nations to meet their emission reduction commitments for the period 2008 to 2012 by using certified clean development emission reductions generated between 2000 and 2007.

Joint Implementation

The term "joint implementation" has been used to refer to a variety of different concepts. During the negotiations leading up to the *Kyoto Protocol* it was widely used, especially within Canada and the US, to refer to a process for generating credits in non-Annex 1 Nations, essentially the same as the clean development mechanism. It was also used to refer to a process similar to the international trading provisions in article 6 of the *Kyoto Protocol.* To avoid confusion this report avoids use of the term.

Activities Implemented Jointly

Activities Implemented Jointly (AIJ) is used to refer to projects approved under a pilot program established at the First Conference of the Parties to the *FCCC*. Parties to AIJ can be located in Annex 1 Nations or non-Annex 1 Nations. This pilot phase is expected to end in 2000. Reductions achieved by such projects cannot be credited to meeting investor nations' international commitments. Because reductions from projects can not be used to meet international commitments, no real trading occurs. The purpose of the program is to experiment with the idea of generating credits from projects in other nations, test methodologies, develop reporting requirements, etc.

Over fifteen countries, including Canada and the United States, have developed pilot AIJ initiatives. Over 39 projects have been undertaken or approved as part of the pilot AIJ program. Although many of the early AIJ projects focused on forest sequestration, there has been greater emphasis on energy efficiency and renewables in recent projects. Most projects have occurred either in Latin America or the former Soviet bloc. Costa Rica is the only non-Annex 1 Nation to have an official pilot program for AIJ. Some nations have focused on projects that will help develop measurement techniques and have imposed relatively significant evaluation requirements.[2] Nonetheless, extensive information is only available on a few projects.[3]

Unofficial Joint Implementation

Unofficial joint implementation refers to projects in other nations used to generate credits where the project has not been sanctioned by national governments and credits cannot be used to meet commitments of the credit user's national government.

Rationale for Interjurisdictional Trading

Interjurisdictional trading is particularly applicable to climate change because concentrating greenhouse gas emissions in certain jurisdictions will not lead to hot spots of local pollution. The rationale for allowing emission reduction projects outside the jurisdiction implementing a program include:

- **Reducing the costs of emission reduction.** This is the primary rationale for extending the range of a program beyond the implementing jurisdiction's borders. Because less developed countries typically are relatively inefficient energy users, the costs of avoiding a tonne of carbon dioxide emissions in less developed nations has been estimated as up to a quarter or even a twentieth of the cost of developed nations.[4] Wide emission control cost differentials may also exist among Annex I Nations; in particular, the profits from reducing emissions in the nations of Eastern Europe are substantial.[5] There is,

[2] Japan's project selection criteria include regular review and modification of predictions regarding emission impacts. The US program also imposes relatively rigorous evaluation requirements.

[3] Roland Sapsford, *Final Report to the Ministry for the Environment on Joint Initiatives and Actions: Issues and Opportunities for New Zealand*, Vol. 1 (Wellington, New Zealand: Ministry for the Environment, December 1996) [unpublished] at 26.

[4] James M. Poterba, "Global Warming Policy: A Public Finance Perspective" (1993) 7:4 *Journal of Economic Perspectives* 47, estimates a differential of 1:4. John Palmisano, "How can the Lessons Learned from Joint Implementation Help Construct an International Carbon Offset Regime?" (December 1996) *World Energy Council Journal* 37, estimates a differential of up to 20:1.

[5] Fiona Mullins and Richard Baron, *International GHG Emission Trading*, Policies and Measures for Common Action, Working Paper 9 (Paris: Annex I Expert Group on the UN FCCC, March 1997) at 49.

however, little empirical evidence to support widely varying conclusions on the extent to which the clean development mechanism and emissions trading might reduce costs of achieving emission reductions. Many business people and environmentalists suggest that the cost savings may be limited.[6]

On the other hand, several leading economists[7] have suggested that, at least in the next decade, emission reductions in third world countries would be better achieved, not by focusing on individual projects, but by developing institutional capabilities and decision making processes which will have a broader impact than single projects. Emission reductions from such projects are too intangible to be the basis for credit generation. Such investments in institutional capacity would avoid the need for costly policies and institutions to verify implementation and measure impacts of specific projects.

- **Demonstrating compatibility of emission reductions and economic development.** Advocates of mechanisms such as the clean development mechanism argue that, even in the face of trade sanctions, sovereign nations like China or India are unlikely to agree to international commitments unless they see those commitments as compatible with their economic development. It is argued that clean development projects will demonstrate renewable and efficient technologies in developing nations so that these nations are willing to eventually accede to international agreements and change the current pattern of investment in familiar, proven highly carbon-intensive technologies.

- **Avoiding investments in developing countries which will trap countries into patterns of high emission rates.** Closely linked to the last rationale is the need to avoid the so-called “China Trap.” Current investment patterns in rapidly industrializing third world nations will have impacts on the emission patterns over a longer term than most investments being made in developed countries. A high portion of developing world investment is in projects such as coal burning electricity production and freeways that tend to lock in high emission patterns and which cannot be easily reversed without very high costs.[8] Although per capita emissions are low, the rate of emission increases is extremely high.[9] Avoiding inappropriate investments now — e.g. redirecting investment to renewables and transit and avoiding rapid increases in emission levels — will make it easier for developing countries to adopt significant emission reductions in the future.

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6 Sapsford, (above at footnote 3), for instance, argues that the most important, cost-effective measures relate to avoiding emission increases, but these are also the least easily quantified.

7 See for instance, Robert N. Stavins, "Transaction Costs and Tradeable Permits" (1995) 29 *Journal of Environmental Economics and Management* 133.

8 Sapsford, above at footnote 3, at 7; also see Thomas C. Heller, "Environmental Realpolitik: Joint Implementation and Climate Change" (1996) 3 *Indiana Journal of Global Legal Studies* 117.

9 Sapsford, above at footnote 3.

Critics of the clean development mechanism have noted that there are alternatives to achieving shifts in investment patterns. In particular official development assistance could be redirected from carbon intensive projects such as coal based power generation to less carbon intensive investments such as renewable based generation and demand side management.[10]

- **Drawing less developed nations into international commitments.** Advocates of credit for projects in developing nations also argue that such credit will foster recognition that agreeing to an emission cap could be profitable.[11] If it assumed that emission trading will not limit trades to emission reductions that have resulted from a particular project, agreeing to a national cap could allow developing countries to profit to a greater extent than under the clean development mechanism. Developing nations would still be able to make low cost emission reductions, thus providing surplus allowances for sale, but trading would not have the transaction costs and restrictions inherent in limiting trading to measurable emission reductions resulting from a project.

  On the other hand, it is also argued that a country which can access foreign investment without acceding to an emission limit will not agree to participation in a trading program. Which incentive proves dominant may depend on the rigour with which measurability and baseline requirements are applied to clean development projects.

Incorporating Interjurisdictional Trading Into a Domestic Trading Program

There are two main issues in relation to integrating interjurisdictional trading into domestic trading:

- **Design Issue 31:** Recognizing Clean Development Credits; and

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10 A 1997 report by the Australian group, AID/WATCH, ("Aiding Global Warming: Can Coal be Clean?") found that the World Bank spent 33 three times more money on coal than on renewables and DSM over the last two years and will be lending around $US 1.5 billion more on coal in the next two to three years. Similar biases existed within other national and international aid programs.

11 Michael Grubb and James K. Sebenius, "Participation, Allocation and Adaptability in International Tradeable Emission Permit Systems for Greenhouse Gas Control" in *Climate Change: Designing a Tradeable Permit System* (Paris: Organization for Economic Co-operation and Development, 1992) at 220.

- **Design Issue 32:** Recognizing and Generating International Emission Allowances.

A provincial or Canadian program could potentially give credit for unofficial joint implementation or AIJ (for instance, the Oregon Exemption used credits generated by unofficial joint implementation projects in Sri Lanka and India). However, it is assumed that, with the establishment of the clean development mechanism, Canada will only recognize credits from certified clean development projects or allowances traded pursuant to international agreements.

Design Issue 31: Recognizing Clean Development Credits

Issues:

a) If a domestic trading program is established, should Canada recognize emission reductions certified by the clean development mechanism as valid credits or allow them to be used as alternatives to allowances?

b) If certified emission reductions are recognized, what restrictions should be placed on their use?

Discussion:

None of the representatives of environmental, government and industrial organizations interviewed for this report believed that credits generated in non-Annex 1 Nations should or would become a *major* part of Canada's greenhouse gas emission reduction strategy. Nonetheless, many industry representatives and government representatives believe that such credits should be recognized by any Canadian program. On the other hand, most environmentalists and some industry and government representatives were opposed to any credit being given for projects in the developing world, or thought that credits should be discounted or their use restricted. Within the Climate Change Group of the Economic Instruments Collaborative gaining credit from joint implementation was one of the most difficult issues.[12]

[12] Economic Instruments Collaborative, "Limiting Greenhouse Gas Emissions" in *Achieving Atmospheric Quality Objectives through the Use of Economic Instruments: A Final Report of the Economic Instruments Collaborative* (Ottawa: The National Round Table on the Environment and the Economy, October 1993).

Less Chance of Additionality

A primary problem with the clean development mechanism is that credit may be given for projects which would have occurred in the absence of the mechanism. The *Kyoto Protocol* requires "reductions in emissions that are additional to any that would occur in the absence of the certified project activity." This is a requirement for "emissions additionality." It does not require the project to be something that would not have occurred in the absence of the clean development mechanism, i.e., it does not require "project additionality." Therefore, credit could potentially flow from a project that reduces emissions but would have occurred anyway. If credit is given for such a project, and is used to avoid making an emission reduction in Canada, the net effect is to undermine the significance of Canada's emission reduction commitments.

As discussed in Chapter 8, the problem of credit being given for projects which are not additional is inherent in greenhouse gas credit trading. Additionality is a crucial problem for clean development projects because many projects which reduce emissions are profitable, and thus there is a steady supply of non-additional projects. In the case of domestic credit trading programs, stringent regulations can "dry up" the supply of non-additional projects. However, it will become much more difficult to dry up the supply of non-additional projects where credit generating projects can occur in countries not subject to binding emission limits.

Moreover, in a domestic credit trading program, generation of credits from a non-additional project will only mean that regulations will need to be made more stringent in order to meet national commitments. Assuming that national commitments are met, the atmosphere does not suffer. However, this is not the case in relation to clean development projects. If credit is given for non-additional clean development projects, more greenhouse gases will enter the atmosphere. National caps do not provide a safeguard to ensure the realization of true reductions in emissions from business as usual.

Additionality is also a larger problem in the context of clean development projects because there are fewer constraints on what a reasonable baseline is. In a domestic trading program, the emission performance standards that drive the demand for credits will also help provide a basis for reasonable baselines. In a nation where there are no regulations, no national baseline predictions, no commitments to stabilization, and a lack of reliable baseline data, it is possible to argue that any project short of the worst-case scenario is an improvement from baseline emissions.

Finally, the problem of credit being given for projects that would have occurred anyway is exacerbated by the ability of nations to bank clean development credits for emission reductions that occur between 2000 and 2007. Although this will help spur some early action, it will also create a stockpile of banked credits from non-additional projects that can be used to avoid emission reductions in the first compliance period. The total effect of non-additionality and the ability to bank credits is uncertain but is likely to be very substantial.

Clean Development Credits and the Availability of No-Regrets Measures

Canadian recognition of credits generated in developing nations has been criticized on the basis that Canada's emissions could be substantially reduced through no-regrets measures. During interviews for this report, a number of environmentalists, government and industry representatives believed that credits generated in developing nations should not be recognized until no-regrets measures are exhausted in Canada. Several representatives linked this concern to worries regarding the impact of an outflow of capital investment to other nations.

Indeed, this concept has been discussed internationally. At the Ministerial Conference on Atmospheric Pollution and Climatic Change held November 1989, in the Netherlands, a report based on interviews with senior government officials in seventeen countries proposed a two phase approach to climate change.[13] During the first phase countries would take whatever domestic actions were most effective in their circumstances. The key thrust was in ensuring effectiveness. As costs of mitigation and societal resistance rose the second phase would involve focusing on the least cost measures in other states.

Many environmentalists have endorsed this approach, arguing that Canada should not claim credit for measures in other countries until our emissions are below 1990 levels. While realizing secondary benefits in Canada is a valid concern, many joint implementation projects will have equally significant secondary impacts in developing countries.

The Clean Development Mechanism and Equity

Prior to negotiation of the *Kyoto Protocol*, the concept of credit from projects in developing countries — especially profitable projects — was harshly criticized by developing countries as inequitable. It was often argued that allowing credit from projects in developing countries would allow developed countries to "cream" profitable emission reduction opportunities at unfair prices. Applying the benefit of low cost emission reduction opportunities to meeting the commitments of industrialized nations will, in some cases, be an opportunity cost for developing countries. The developing country will not be able to use that opportunity to meet any emission reduction requirements that are eventually imposed on it. It was

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13 McKinsey and Co., "Protecting the Global Environment: Funding Mechanisms" cited in Onno Kuik, Paul Peters and Nico Schrijver, *Joint Implementation to Curb Climate Change: Legal and Economic Aspects* (London: Kluwer Academic Publishers, 1994) at 5.

feared that, because of developing nations' pressing needs for immediate investment, and in some cases because of short sighted or corrupt governments, developing countries may not receive a fair price for credits.

However, this argument is only relevant to the extent emission reduction opportunities are static. In practice, opportunities for emission reduction are created and lost continuously. Many, if not most, opportunities for low cost emission reduction that exist in 2000 are unlikely to exist twenty or more years later when developing nations are likely to become subject to binding emission reduction commitments. Moreover, the argument that credit from emission reduction projects in developing nations is exploitive has lost much of its force due to the support of developing nations for the clean development mechanism.

It has also been argued that the clean development mechanism and emission trading may allow developed countries to avoid curbing the energy intensive lifestyles that have caused climate change, and that Canada and other energy intensive nations have a moral responsibility to reduce emissions at home rather than "buying out" of their responsibilities. Although many of the lifestyle changes — such as increased urban density and decreased reliance on the motor vehicle — are no-regrets measures, their adoption by developed countries is a symbolic indication that the industrialized world is serious about emission reductions. So long as profligate energy use characterizes western lifestyles, western calls for developing nations to curb energy use will have little credibility. This concern could be significantly reduced if limits are imposed on the extent to which the clean development mechanism is used to meet national commitments.

Conclusions:

There are many emission reduction opportunities in developing countries that are not being pursued but which have very significant economic, social or environmental benefits beyond their impact on greenhouse gases. Long term global reductions in greenhouse gas emissions necessitates pursuit of emission reductions in developing countries and eventually the accession of developing countries to binding emission caps. Western private sector financing of energy efficiency and renewable energy projects in developing countries may help demonstrate the compatibility of emission limitations and economic development, but changes in official development aid are also needed.

Nonetheless, recognizing credits generated by clean development projects as alternatives to compliance with Canadian regulations raises several cogent issues. First, rather than Canadian private capital being used to reduce emissions in other nations, we may want to encourage investment in no-regrets measures domestically. From the perspective of Canadian society, investments in developing nations' institutional capacities might be a more cost effective means of securing emission reductions in the developing world even if it would not necessarily reduce the costs of compliance to individual Canadian emitters.

Second and more important, because some clean development projects will be non-additional, recognizing clean development credits in a domestic program may reduce the effectiveness of Canadian commitments. As discussed in Chapter 8, the problem of credit being given for non-additional projects can be limited by setting stringent criteria for the baselines against which emission reductions are measured. In order to ensure that Canadian use of clean development credits does not undermine the effectiveness of the *Kyoto Protocol*, Canada could work towards strong international rules for baseline setting. Baselines used in measuring emission reductions from clean development projects could reflect:

- standard good practices, with credit given only for emission reductions that go beyond standard practices;
- the probability that a technology against which emission reductions are measured would have been improved;
- any legal requirements, with credit being given only for reductions that go beyond legal requirements; and,
- the estimated lifetime of an emission source in the absence of the project.

A stringent approach to baseline setting will not cure the problem of credit given for projects that are not additional, but it can make this problem less acute.

Recognition of clean development credits could begin as early as 2000. However, as noted above, banking of clean development credits exacerbates the problem of credit being given for non-additional projects and reduces the effectiveness of emission limits established by the *Kyoto Protocol.*

Because of these problems, consideration should be given to both delaying when clean development credits are recognized in a Canadian domestic program, and limiting the extent to which a Canadian emitter can use clean development credits. Such limitations can be justified because they will reduce the extent to which non-additional emission reductions undermine international emission limitations, because Canada may be better off investing in domestic no-regrets measures, and because of the need to demonstrate Canada’s willingness to undertake real emission reductions.

Design Issue 32: Recognizing and Generating International Emission Allowances

Issues:

a) Should Canadian emitters be able to purchase international emission allowances to meet domestic requirements?

b) Should Canadian emitters be allowed to convert domestic allowances to international emission allowances, or generate international emission allowances from domestic emission reduction projects?

Discussion:

Like the clean development mechanism, international trading can theoretically reduce the cost of emission reductions without sacrificing environmental quality. However, there is a risk that the emission trading regime allowed by the *Kyoto Protocol* will allow global emissions to increase far above levels that would exist in the absence of trading. To maintain the integrity of the international and domestic systems, Canada could restrict use of international allowances in a Canadian domestic program. In any event, Canada will likely need to place conditions on use of international allowances to ensure they do not threaten a Canadian trading scheme.

Hot Air

From an environmental perspective, the biggest problem with international trading is the possibility that Annex 1 Nations may be able to purchase international emission allowances from nations that have received allocations of international emission allowances far excess of their needs. A number of nations have emission allowances for the 2008 to 2012 commitment period that exceed their likely emissions under a business as usual scenario. For instance, Russia and the Ukraine are allowed to emit at 1990 levels in the compliance period. However, due to the collapse of their economies emissions are currently far lower than 1990 levels. Russian carbon dioxide emissions are currently only 74% of 1990 emissions. This is only projected to increase to between about 80% and 90% of 1990 levels by 2010.[14]

If Annex 1 Nations are able to purchase the windfall of excess emission rights allocated to Russia, they will be able to claim a four percent emission reduction without any real emission reductions occurring.

Under trading rules supported by most non-EU developed nations, Eastern European nations would be able to sell their surplus international emission allowances. The existence of surplus international emission allowances (or "hot air" as they are colloquially referred to) will allow nations that buy allowances to increase their emissions while the nations that sell allowances do nothing to reduce emissions. Russian hot air alone will allow other Annex 1 Nations to increase their collective emissions by roughly two to four percent above commitments.[15] By some estimates, Russian and Ukrainian hot air could allow the United States to achieve 50% of necessary emission reductions.[16]

The problem of hot air may become more acute if non-Annex I Nations are eventually allowed to accede to binding but growing emission limitations. There are powerful incentives for countries to negotiate emission limits higher than their business as usual emissions. The country with such emission limits can reap windfall profits by selling international emission allowances which they could not otherwise use. Other countries may be happy to agree to high binding emissions targets that will ensure a supply of cheap allowances. Given the outcome of the *Kyoto Protocol* it is not clear that an effective counter balance will be created by countries hoping to take strong domestic measures and sell their surplus.

14 Yu Izrael *et al.,* "Mitigation Analysis for Energy System and Forestry Sector of the Russian Federation" in *Global Climate Change Mitigation Assessment: Results for 14 Transitioning and Developing Countries* (Washington, DC: US Country Studies Program, August 1997) at 139, project emissions to be 81.2% in 2010, or 87.9% under an optimistic scenario for economic growth. The in-depth review of Russia's national communication projects these emissions to increase to between 80 and 90% of 1990 levels by 2010: UNFCCC Secretariat, *Summary of the Report of the In-Depth Review of the National Communication of the Russian Federation* (Geneva: FCCC Secretariat, 1997). Note the emissions referred to are for CO_2 from energy use only. Total emission projections are unavailable. However carbon dioxide from energy represents 72% of Russian greenhouse gas emissions in 1990 and is closely tied to methane emissions from energy production and transport (which were twenty percent of total Russian emissions in 1990).

15 As noted in footnote 14, data is not available on projected emissions of total greenhouse gases for Russia. However, Russian emissions of carbon dioxide from fuel combustion in 1990 were roughly 2,330 kilotonnes of CO_2: Framework Convention on Climate Change Secretariat, "Anthropogenic CO_2 emissions from fuel combustion, 1990" (Geneva: UNFCCC Secretariat, 1996). This is approximately 19.8% of total Annex 1 CO_2 emissions from fuel combustion: Jane Ellis and Karen Treanton, International Energy Agency "Recent trends in energy-related CO_2 emissions" (1997) manuscript accepted for publication in *Energy Policy* vol. 26. Since ten to twenty percent of that amount will likely be surplus that could be sold to other Annex 1 Nations, this would allow emissions in other Annex 1 Nations to increase by 1.98 to 3.96 percent above committed levels.

16 Lelani Arris, "A brief analysis of the *Kyoto Protocol*" (December 24, 1997) IX: 24 *Global Environmental Change Report* 1.

The problem of hot air trading could be significantly reduced if article 6 of the *Kyoto Protocol* is used as the basis for international trading.[17] In that situation, emission trading would be supplemented by requirements similar to the clean development mechanism. Trades of international emission allowances would need to be linked to emission reductions from specific projects. This would still provide flexibility through the undertaking of profitable emission reduction projects in nations like Russia and it would thus assist Russia in its economic recovery. Under article 6, stringent criteria could be developed for measuring the emission reductions from projects, and these criteria would reduce the extent to which hot air is traded.

Buyer Beware and Seller Beware

Another concern with trading is that the trading mechanisms that have evolved or are evolving — both those under article 6 and article 16 bis — are "seller beware" systems.[18] Under a seller beware trading system, a country purchasing international emission allowances need not be concerned whether or not the nation selling its allowances is likely to be in compliance with its emission limitations. A nation could potentially continue emitting at well over 1990 levels but sell all of its quota of international emission allowances. A nation buying the allowances would then be able to increase emissions and maintain compliance. The net effect is to allow the environmental effects of one nation's breach of international law to multiply and undermine the whole system.

Seller beware works well in domestic trading programs where there are mechanisms that guarantee that non-compliance will be expensive, but it is problematic in an international agreement without any enforcement mechanisms other than international reputation. Unfortunately, international law is often honoured more in the breach than in compliance. It is not unusual for only one-

17 See above under the heading "Processes for International Credit and Allowance Trading" subheading "International Trading."

18 Article 6.4 provides that the buyer is only at risk if questions are raised under article 8 regarding compliance with "requirements referred to in this paragraph". Presumably "this paragraph" refers to all of article 6 since there are no requirements in article 6.4. Therefore, it is irrelevant whether or not the seller is in compliance with its emission reduction commitments. Article 16 bis appears to be a seller beware system because article 3 refers to transfers of allowable emissions from one nation to another without anything suggesting that transfers would be invalidated if the seller is out of compliance. It is possible future rules for trading developed under article 16 bis could specify a buyer beware system, but nations supporting trading have consistently supported a seller beware system. (The only exception to this is that trading proposals place risk on the buyer if a question is raised regarding the seller's compliance with reporting provisions.)

third of signatories to major environmental agreements to comply with simple enforcement requirements such as submitting reports.[19]

Although compliance may be greater among the Annex 1 Nations that are committed to emission reductions, the *Kyoto Protocol* does not establish mechanisms to address non-compliance. This is deferred to later negotiations. There is a risk that countries may ignore their legally binding commitments. Because of that risk, there is a possibility that the trading rules eventually established under article 16 bis may include buyer beware provisions. As is discussed below, adoption of buyer beware provisions would significantly affect how Canada integrates international trading with a domestic trading program.

The Availability of No-Regrets Measures

As discussed in relation to the clean development mechanism, the availability of low cost emission allowances from other nations may mean that Canadian businesses do not invest in no-regrets measures in Canada. Although a Canadian emitter may find it less costly to meet requirements by purchasing hot air, Canadian society may be better off if the emitter instead invests in domestic no-regrets measures.

Allowing Emitters to Convert Domestic Emission Rights into International Emission Allowances

So far, this section has only considered the effects of Canadian purchasing of international emission allowances. The opposite issue is whether or not Canadian emitters should be allowed to convert their emission rights to international emission allowances, and sell such allowances.

In the case of a cap and emission allowance trading program, conversion of domestic allowances to international emission allowances is relatively simple. However, if Canada does not establish emission caps, or if a cap and emission allowance trading program is combined with credit trading, any efforts to generate international emission allowances from domestic emission reduction projects would need to be tightly scrutinized. As soon as a company receives international allowances for emission reductions resulting from a project, the allowances can be sold and will represent a reduction in Canada's assigned amount of allowable emissions. Thus, Canada will want to ensure that the project caused emission reductions that would not have occurred otherwise. Unlike the situation in open

[19] United Nations Conference on Environment and Development, *The Effectiveness of International Environmental Agreements* (Cambridge, UK: Grotius Publications Limited, 1992).

market trading, there will be no incentive for buyers of the international allowances to scrutinize the validity of the project.

The problems associated with converting Canadian domestic emission reduction projects or domestic allowances into international emission allowance may simply not arise. Studies indicate that if an allowance trading system were established requiring all OECD nations to reduce emissions by twenty percent, Canada would be a net seller of allowances because of our low emission reduction costs.[20] However, hot air trading combined with very profitable emission reduction opportunities in Russia would likely make Canadian allowances uncompetitive and eliminate Canadian opportunities to sell international allowances.[21] Thus, establishing a process that would allow the sale of Canadian international emission allowances to other nations may be premature.

Supplemental

Under the *Kyoto Protocol* trading is to be "supplemental to domestic actions for the purpose of meeting quantified emission limitation and reduction commitments." Although supplemental is not defined, international rules may limit the extent to which trading can be used to meet national commitments. Such a limitation might need to be reflected in limits on the extent to which Canadian emitters use international emission allowances.

Conclusions:

Allowing Canadian emitters to purchase international emission allowances and use these to meet domestic requirements could reduce emitter's compliance costs. However, from a societal perspective, this may not be cost effective if the alternative to purchasing international allowances is investing in no-regrets measures in Canada. There is also a large risk that international trading rules will reduce the environmental effectiveness of Canada's international commitments.

If domestic programs do allow emitters to comply through use of international allowances, Canadian regulators will need to set some simple rules. For instance:

- Canadian implementing legislation can require the invalidation of international emission allowances purchased from countries that are out of compliance with their emission limitations. This is essential if the international community adopts a buyer beware system, but it could also be a

[20] The effect is marginal. The study projects that Canadian emissions would drop by 21%: Fiona Mullins, above at footnote 5, at 48.

[21] Even if the absence of hot air trading, this may be true because Russian and the Ukraine have many highly profitable opportunities to reduce emissions: see Mullins, *Ibid.*

Canadian domestic requirement even if the international system is a seller beware system. It would not, however, be as effective in the latter case because allowances from nations that are out of compliance could be traded — or "laundered" — through other nations.

- In the case of a buyer beware system, emitters using international emission allowances would, in some circumstances, need to provide a guarantee from a third party that the allowances are valid. Guarantees would be required for any international emission allowances purchased prior to the seller nation meeting its commitments and having its Reports to the FCCC Secretariat accepted as accurate. The guarantees would oblige the third party to purchase other allowances or pay for emission reductions if it is found that the international emission allowances were needed by the seller nation to remain in compliance. The third party would need to be a financial or other institution that will clearly have the continuing financial ability to stand by its guarantee. (Actual emitters may not have the financial wherewithal if a company sells its assets or bankruptcy occurs between the time that an international allowance is used and the time it is found to be invalid.)

- Third party guarantees would also be necessary in the case of a seller beware system. For instance, some of the seller beware rules include provision for limited buyer beware where a question has been raised regarding the accuracy of a seller nation's reports to the FCCC Secretariat.

- Where allowances are sold internationally from firm to firm, it is essential that Canadian requirements ensure that the vendor is in compliance with all aspects of the other nation's program during all years between when the allowance was issued and is used. Exporting countries must have approved the sale, either through the terms of their law or individually.

Evaluation of the Clean Development Mechanism and International Trading

Environmental Effectiveness

Because their energy systems are generally inefficient and emissions are growing rapidly, there are many very cost effective emission reductions that can be achieved in developing nations and eastern European nations. Allowing Canadian companies to exploit these low cost emission reduction opportunities by purchasing allowances from other countries, or allowing Canadian companies to use credits generated from emission reduction activities in other countries could reduce Canadian companies' compliance costs. Also, to the extent the clean development mechanism brings new investment in low carbon intensive technologies to developing countries, the clean development mechanism may help demonstrate that binding emission caps are consistent with developing nations' economic aspirations.

Unfortunately, neither the purchase of clean development credits nor the purchase of international emission allowances guarantees that emissions in other nations will be reduced below levels that would occur in any event. In the case of the clean development mechanism, the extent of this problem will depend on the stringency of criteria for setting baselines. In the absence of very strict and tightly enforced criteria for setting baselines, recognizing credits from clean development projects could significantly reduce the effectiveness of a Canadian program. In the case of international trading, environmental effectiveness will depend on whether hot air trading is eliminated and whether a buyer beware system is eventually adopted.

Cost Effectiveness

The clean development mechanism and international trading are likely to reduce the cost of compliance for individual emitters, but, from a broader social perspective, they may not be as cost effective as typically thought. First, Canadians as a whole may be better having Canadian emitters invest in no-regrets measures here in Canada. Second, the money spent on quantifying emission reductions from clean development projects may be better spent developing the institutional capacities of Third World countries.

Equity

The most significant equity issue arising from joint implementation and emissions trading relates to the potential for nations to "buy their way out". Many countries object vehemently to the possibility that the US or Canada might not reduce their emissions, but might instead buy inexpensive allowances from Russia and inexpensive clean development credits from developing countries. Whether this is right or wrong is a value judgment. However, what is a very real concern regardless of values is the risk that if rich developed nations like Canada do not actually curtail profligate energy use, developing countries may be less willing to take on commitments.

Feasibility

Although the exact rules of trading or the clean development mechanism have not yet been settled, it appears to be feasible to integrate a Canadian domestic trading program with both mechanisms. Firm to firm international trading will be most feasible with nations that have the administrative capacity to establish allowance trading programs, but there are few obstacles to firms making purchases of allowances or clean development credits from other nations.

Chapter 12:

Including Forest and Agricultural Soil Reservoirs in a Trading Program

> *Further uncertainties arise because changes in climate and atmospheric CO_2 over the next decades to a century are likely to produce changes in the structure of natural and managed ecosystems. ... With rapid change, direct impacts on the growth and survival of particular types of plants could cause die back and carbon loss before better adapted type become established. ... The magnitude of this feedback is highly uncertain...*
>
> — *J.M. Melillo et al.*[1]

Carbon dioxide and other greenhouse gases are naturally released into the atmosphere from a variety of processes such as forest fires, respiration and the decay of organic matter. After being released into the atmosphere greenhouse gases remain in the atmosphere for periods ranging from decades to hundreds of years before they are naturally removed from the atmosphere and stored in reservoirs. Increasing the rate at which greenhouse gases are removed from the atmosphere and stored or sequestered in reservoirs is a means of mitigating climate change.

This chapter reviews different types of sequestration projects, reviews how carbon reservoirs are treated under the *Kyoto Protocol* and then examines the questions: "Should a program treat destruction of carbon reservoirs as being equivalent to other increases in emissions of carbon dioxide?" and "Should a program treat

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1 J.M. Melillo *et al.*, "Terrestrial Biotic Responses to Environmental Change and Feedback to Climate" in J.T. Houghton *et al.*, eds, *Climate Change 1995: The Science of Climate Change: Contribution of Working Group I to the Second Assessment Report of the Intergovernmental Panel on Climate Change* (Melbourne, Australia: University of Cambridge, 1996) at 449.

protection or enhancement of carbon reservoirs as equivalent to the reduction of emissions of carbon dioxide?”

Carbon Sequestration

Carbon can be sequestered in oceans and ocean sediments, vegetation and soils. Ultimately oceans are the major long term sink for carbon dioxide, but there is no practical[2] or environmentally safe[3] means by which to speed this process. On the other hand, there is a large potential to increase the amount of carbon stored in plants. Since 1850, deforestation has reduced the carbon stored in the world’s vegetation by about 38%. This is equivalent to about one third of emissions from burning fossil fuels. Depletion continues, especially in tropical countries but also in some areas of Canada such as BC’s coastal rain forest.[4] Policies which help re-establish forest cover, protect existing forests and maximize carbon stored in working forests are important measures to minimize climate change.

IPCC scientists have suggested that initially carbon sequestration strategies, especially in the tropics, could play a major role in mitigating climate change, but in the longer term, sequestration has limited potential.[5] The IPCC divides carbon sequestration projects into two general categories: conservation management projects and storage management projects.[6]

Conservation Management

Deforestation currently accounts for twenty percent of global carbon dioxide emissions, and the rate of tropical deforestation is escalating.[7] Most deforestation is caused by the clearing of forests for farming and grazing and to meet either subsistence demands for wood, (e.g. fuel wood), or to meet demands of the

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2 C.J. Jepma *et al.*, "A Generic Assessment of Response Options" in James P. Bruce *et al.*, eds, *Change 1995: Economic and Social Dimensions of Climate Change: Contribution of Working Group III to the Second Assessment Report of the IPCC* (Cambridge, UK: Cambridge University Press, 1996) at 245.

3 *Ibid*.

4 Werner A. Kurz *et al.*, *The Carbon Budget of British Columbia's Forests, 1920 - 1989: Preliminary Analysis and Recommendations for Refinements* (Ottawa: Queen's Printer, November 1996).

5 Jepma, above at footnote 2, at 254.

6 Roderick C. Dewar, "Analytical model of carbon storage in the trees, soils, and wood products of managed forests" (1991) 8 *Tree Physiology* 239 at 254.

7 World Commission on Forests and Sustainable Development, *Annual Progress Report, 1 June 1995 to 30 May 1996* (Geneva: WCFSD Secretariat, 1996), Annex 3.

international commodities market.[8] Deforestation trends are often a response to underlying pressures of population growth, economic displacement and political strife.

Conservation management projects are intended to slow or stop the rate of deforestation and conserve existing carbon reservoirs. These projects usually involve a mix of establishing protected areas and efforts to reduce the pressure on forested areas. For instance, they may involve reforestation to provide fuel wood, promotion of agroforestry, and even micro-hydro projects to provide an alternative to using fuel wood for energy.[9] Projects with the highest probability of success are those with large components of local benefit and involvement; however, these projects tend to be much more expensive per tonne of carbon sequestered.[10] Without efforts to reduce the social and economic pressures that cause deforestation, most conservation management projects will have unacceptably high levels of leakage, as development or agriculture shifts to other locations.[11] Conservation management projects may also involve changes to forest practices aimed at reducing damage to forest and forest soils during logging.

In practice, conservation management projects have been largely restricted to developing countries, but one of the emission reduction credit projects required under the Oregon Exemption was purchase of conservation covenants from private forest owners who were deemed likely to log their lands.

Storage Management

Storage management projects are projects intended to increase the amount of carbon stored in vegetation, soil and durable wood products. The goal is to increase the "equilibrium" of carbon stored. While it is growing, a forest is removing carbon dioxide from the atmosphere and "fixing" it. In an old growth forest the carbon being fixed is generally balanced by the carbon being released by forest decay.[12] The old growth forest is no longer a net remover of carbon from the atmosphere, but compared to a managed forest may contain as much as twice

8 Sandra Brown *et al.*, "Management of Forests for Mitigation of Greenhouse Gas Emissions" in Robert T. Watson, ed, *Climate Change 1995: Impacts, Adaptations and Mitigation of Climate Change: Scientific-Technical Analyses, Contributions of Working Group II to the Second Assessment Report of the IPCC* (Cambridge, UK: Cambridge University Press, 1996) at 780.

9 Paul Faeth *et al., Evaluating the Carbon Sequestration Benefits of Forestry Projects in Developing Countries* (Washington, DC: World Resources Institute, February 1994) at 4-5.

10 *Ibid.* at 66.

11 *Ibid.*

12 Dewar, above at footnote 6.

the average amount of carbon in trees and one and a half times the carbon in soils as a managed forest.[13]

However, when logging occurs some of a forest's carbon is stored in paper and wood products as well as forest detritus and soil. Both the detritus and the products release carbon over time. Some of the forest's carbon is immediately turned into carbon dioxide when saw mill waste is burned or when sites are burned prior to replanting. Eventually, a theoretical equilibrium is reached between the carbon being fixed by the growing managed forest and the carbon being released from the detritus of past logging and from forest products. Basic approaches to increasing the storage of carbon include afforestation and reforestation projects, forest management projects, projects to increase the portion of wood used in long-lived products and soil sequestration projects.

Afforestation and Reforestation.

In relation to carbon sequestration, afforestation and reforestation are used to mean planting trees on areas that have not been recently covered by forests. In Canada, reforestation is often used to refer to replanting and natural regeneration after logging, and afforestation is often used to refer to planting trees on areas that were historically forests. However, the IPCC defines afforestation as "planting of new forests on lands which, historically, have not contained forests" and reforestation as "planting of forests on lands which have, historically, previously contained forests but which have been converted to some other use."[14] In practice, afforestation is usually used to refer to lands that have not been covered by forests for over 50 years, while reforestation refers to land cleared in the last 50 years.[15] This report uses reforestation and afforestation in the same way as the IPCC.

In either case, land can either be converted to "carbon cemeteries," where the land will be reserved from logging, supposedly in perpetuity, or "carbon plantations" where trees will be harvested and the area replanted. Afforestation and reforestation projects often require significant follow up to ensure the survival of trees. Many projects in developing countries and US urban tree planting projects have fallen far short of expectations because of poor survival rates.[16]

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13 Roderick C. Dewar, "A model of carbon storage in forests and forest products" (1990) 6 *Tree Physiology* 417.

14 Intergovernmental Panel on Climate Change, Working Group I, *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reporting Instructions Glossary* (Geneva: IPCC, 1996).

15 Jepma, above at footnote 2, at 258.

16 *Ibid.*, at 247.

The potential for afforestation and reforestation is significant although it is at best a small part of the overall solution. Worldwide, an estimated two billion hectares of non-industrial, deforested and degraded agricultural lands may be available for afforestation and Canada may have 8.3 million hectares available.[17] The potential in BC is limited by the area of marginal agricultural land and this land's location in areas of slow forest growth.[18]

Afforestation and reforestation are often favoured because they are low cost means of reducing net emissions. However, costs for carbon cemeteries are likely to climb as suitable land runs out. Carbon plantations may in some cases be less costly because the land can still be used to produce timber. However, afforestation and reforestation in Canada are still estimated to be less cost effective than other initiatives such as shifting to more fuel efficient vehicles.[19]

Forest Management.

Logging and replanting is likely to lead to an increase in carbon sequestration over natural levels only in the case of fast-growing, short rotation forest harvested for long-lived products such as building material.[20] Silvicultural practices, such as better replanting, fertilization and thinning may increase the growth of logged areas, but some practices aimed at increasing a forest's yield of timber or pulp do not necessarily increase the total carbon sequestered in the forest. Also there can be significant leakage; for instance, nitrous oxide and carbon dioxide emissions associated with fertilizer use may offset some of the gains from fertilization.

The potential for altering silviculture and logging practices is generally seen as limited for British Columbia. Logging BC's coastal old growth forests will lead to a reduction in total carbon sequestration unless trees are converted to lumber used in buildings with twice their current life spans.[21] Prompt replanting and silviculture are already required under the BC *Forest Practices Code*. Rotation periods on managed forest land could be extended, but this would substantially

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17 Bill Freedman and Todd Keith, *Planting Trees for Carbon Credits: A Discussion of the Issues, Feasibility and Environmental Benefits* (Ottawa: Tree Canada Foundation, August 1, 1995) at 14.

18 The ARA Consulting Group Inc., H.A. Simons Ltd., and IBI Group Inc., *Evaluation of CO_2 Management Measures* (Victoria: Queen's Printer for British Columbia, 1992) at A-7, and British Columbia, Legislative Assembly, Select Standing Committee on Agriculture, *Inventory of Agricultural Land Reserves in British Columbia* (Victoria: Queen's Printer, 1978). ARA estimated that the equivalent of 750 to 2,290 kt of carbon dioxide could be sequestered annually. This amounts to between 1.5% and 4.5% of BC annual emissions.

19 Clark S. Binkley and G. Cornelis Van Kooten, "Integrating Climatic Change and Forests: Economic and Ecological Assessments" (1994) 28 *Climatic Change* 91 at 134-135.

20 Dewar, above at footnote 6, at 255.

21 *Ibid.*, at 240.

reduce fibre supply.[22] Because of the political contentiousness of issues surrounding timber supply and because of the likely value of carbon sequestration credits versus timber,[23] in the short term, there is little chance that carbon credits will motivate significant changes in rotation periods in BC. It seems more likely that changes to logging practices will be motivated by concerns for maintaining biodiversity, water quality and wilderness values.

Products Management.

Carbon sequestered in wood products can be increased by extending the lifetime of wood products. For instance, paper recycling not only reduces emissions associated with paper manufacturing but increases the amount of carbon stored in paper. Forest management techniques can also increase the amount of lumber produced from a given area of forest. For instance, thinning of young forests may not increase the carbon sequestered in the forest, but it increases the amount that can be used in long lived products and reduces the amount that is burned as waste or used in short lived products like paper. A difficulty with estimating impacts of projects such as this, as well as planting trees for carbon plantations, is modelling the leakage.[24] Changes to the supply of lumber and pulpwood will impact on markets and indirectly impact harvest and sequestration levels.

Agricultural Soil Sequestration.

Worldwide, a quarter of the carbon stored in cultivated soils has been lost through erosion.[25] Depletion continues especially in tropical countries but also on Canadian farms and other temperate agricultural land.[26] Seven to nine megatonnes of carbon are lost from soils in the Canadian prairies every year.[27] Much of this loss can be curbed and past losses reversed by changing agricultural practices such as reducing or eliminating tillage and maintaining summer fallow.

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22 D.L. Spittlehouse, *British Columbia's Forests and the Carbon Cycle* (Victoria: BC Ministry of Forests, Research Branch, 28 September, 1995) [unpublished]; Personal communications with Werner Kurz, Michael Apps.

23 Binkley, above at footnote 19, at 104.

24 Brown, above at footnote 8, at 788.

25 Vernon Cole *et al.*, "Agricultural Options for Mitigation of Greenhouse Gas Emissions" in J.T. Houghton *et al.*, eds, *Climate Change 1995: Impacts, Adaptation and Mitigation of Climate Change: Scientific-Technical Analyses* (New York, NY: Cambridge University Press, 1996) at 751.

26 *Ibid.*, at 751; Smith, W.N. *et al.*, *Agroecosystem Greenhouse Gas Balance Indicator: Carbon Dioxide Component* (Ottawa: Agriculture and AgriFood Canada: Agricultural Environmental Indicators Project Progress Report, December 1995).

27 Smith, *Ibid*. at 22.

For Canada it is estimated that improving carbon sequestration on farm land could offset about 3.4% of annual fossil fuel related emissions.[28]

Substitution Management

The IPCC identifies substitution management along with conservation management and storage management as a third category of forest management that can be employed to curb climate change. Substitution management is distinct in that it is not aimed at conserving or enhancing the reservoirs of carbon in forests, soils and products, but instead it is aimed at using forest biomass to replace fossil fuel based energy and products. For instance, ethanol from woodwaste can be used to replace gasoline. Lumber can be used to replace steel and concrete. Forests with high growth rates and low initial biomass are best suited to substitution management.

Unlike conservation management and storage management, substitution management has a huge potential in the long term. It does not raise the same issues of reliability, reversibility, and permanency. Because of this distinction, most of the concerns raised in this chapter with regard to sequestration projects do not apply to substitution management projects.[29]

Carbon Reservoirs and the *Kyoto Protocol*

Under the *Kyoto Protocol* net emissions from a limited number of land use change and forestry categories are considered when determining if a nation is in compliance with its international emission limits. Article 3.3 of the *Kyoto Protocol* states that:

> The net changes in greenhouse gas emissions from sources and removals by sinks resulting from direct human-induced land use change and forestry activities, limited to afforestation, reforestation, and deforestation since 1990, measured as verifiable changes in stocks in each commitment period shall be used to meet the commitments in this Article [i.e. emission limits for the first commitment period] of each Party included in Annex 1.

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28 Cole, above at footnote 25, at 753.

29 It should be noted that environmental concerns do exist with regard to widespread plantations of fast growing species displacing natural biodiversity.

Article 3.4 then goes on to establish a process for potentially including emissions and removals from other land and forest categories:

> The Conference of the Parties ... shall ... decide upon modalities, rules and guidelines as to how and which additional human-induced activities related to greenhouse gas emissions and removals in the agricultural soil and land use change and forestry categories shall be [included in determining whether a party is in compliance with emission limitations].... Such a decision shall apply in the second and subsequent commitment periods. A Party may choose to apply such a decision on these additional human-induced activities for its first commitment period, provided that these activities have taken place since 1990.

Although the language of the *Kyoto Protocol* is unclear, the most likely interpretation is that, until there is agreement to include more categories, a nation's emission during the first commitment period will be determined by:

- gross emissions (i.e. all emissions not related to carbon reservoirs);

minus

- removals during the period 2008 to 2012 if these removals result from reforestation or afforestation since 1990;

plus

- emissions during the period 2008 to 2012 if these emissions result from deforestation since 1990.

The author believes the above is correct based on context and observations of the meetings in which the above phraseology was decided.[30] As noted above, the IPCC defines reforestation and afforestation as meaning planting trees on areas that have never been forested or have been taken out of forest use. Deforestation is not defined, but it is likely to include the category of emission the IPCC calls

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[30] The first problem with the interpretation given is that it is not clear whether "since 1990" qualifies deforestation only, or afforestation, reforestation and deforestation. The comma after the word "reforestation" suggests that "since 1990" qualifies deforestation only. However, the reference at the end of article 3.4 to "provided these activities have taken place since 1990" very strongly suggests that "since 1990" qualifies all three activities. The interpretation given also fails to make sense of the phrase "changes in" at the beginning of article 3.3. "Changes in" suggests that net emissions from the listed forest activities in the commitment period will be compared against net emissions from these activities in the baseline year. However, the reference to "measured as verifiable changes in stock in each commitment period" suggests that change in stock, not the rate of change in stock, is measured.

forest conversion. It will likely exclude harvesting followed by replanting or natural regeneration of forests.[31]

They *Kyoto Protocol* is ambiguous in relation to whether the clean development mechanism will certify emission reductions from sink protection or enhancement in developing nations. The clean development mechanism provisions refers to “emission reductions”, suggesting that projects that conserve forests could be included but afforestation and reforestation, which increase removals rather than reducing emissions, may be excluded.

Also, under article 3.1 emissions from “agricultural soils” are included in calculations of gross emissions. Canada takes the position that this allows it to claim credit for reductions of carbon dioxide as well as nitrous oxide emissions from agricultural soil; however, that position will likely be challenged.[32]

The partial and ambiguous inclusion of forest related sources in the *Kyoto Protocol* suggests that it is premature to guess exactly what land use change and forestry emissions will be counted in determining whether a nation is in compliance with its emission limits for the first or subsequent commitment periods. There is a chance that future Conferences of the Parties to the *FCCC* will amend the existing provisions or allow further inclusions. This report considers the possibility of integrating activities other than reforestation, deforestation and afforestation into a domestic trading program.

Design Issues for Including Carbon Reservoirs in a Trading Program

There are essentially two issues relevant to integrating carbon reservoirs in a trading program:

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31 It is unlikely that the IPCC would include harvesting in the definition of deforestation because this would result in a huge, unfair penalty to nations with forestry operations and relatively long rotation periods between harvests. Even if managed forests were in a steady state, with no net removals or emissions of carbon dioxide, nations with forests would count all emissions from harvesting in the compliance period, but could only offset this with removals of carbon dioxide on areas reforested since 1990. If rotation periods exceed twenty years, the result would likely be a penalty to a country practicing sustainable forestry.

32 Although Canada's interpretation is supported by the wording of article 3.1 in isolation, it is contrary to article 3.4 which refers to development of methodologies to count both emissions and removals in the agricultural soil category.

- **Design Issue 33:** Including Reservoir Degradation in the Scope of a Trading Program.
- **Design Issue 34:** Sequestration Projects.

Design Issue 33: Including Reservoir Degradation in the Scope of a Trading Program

Issue:

Should a trading program be designed so that those responsible for degradation of carbon reservoirs are required to offset resulting emissions?

Discussion:

Theoretically, a trading system could reflect the importance of carbon reservoirs by treating destruction of carbon reservoirs in the same manner as emissions from fossil fuels and industrial uses. Those causing emissions could be required to hold sufficient credits or allowances to cover their emissions. Counting these sorts of human caused changes to sequestration has been suggested in a number of articles,[33] but has generally been rejected as unworkable given the scarcity or poor quality of information on impacts of different developments on carbon reservoirs.[34] Data on national emissions from sources such as land clearing, deforestation, forest degradation etc. are very rough. For instance, impacts from prescribed burns are only accurate to within 50%.[35] Estimates become even less accurate when applied at a project level.

Moreover, under the terms of the *Kyoto Protocol* the only source that would included would be deforestation. As noted above, deforestation will likely be interpreted as meaning only conversion of forests into agricultural land, residential areas and other non-forest uses. In Canada, there has been no significant

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33 Rob Swart, "Greenhouse Gas Emissions Trading: Defining the Commodity" in *Climate Change: Designing a Tradeable Permit System* (Paris: Organization for Economic Co-operation and Development, 1992) at 157; and Binkley, above at footnote 19.

34 United States, General Accounting Office, *Air Pollution: Allowance Trading Offers an Opportunity to Reduce Emissions at Less Cost* (United States General Accounting Office: Washington, 1994) at 66; and Swart, above at footnote 33, at 162.

35 *Ibid.*

conversion of forests into agricultural land since 1931.[36] Information is not available on emissions from other types of deforestation, but total emissions from this category are likely very low.

Conclusion:

Including degradation of carbon reservoirs within the scope of a trading program is unfeasible at this time. Moreover, it is likely unnecessary given the limits on forest related sources that are included under the *Kyoto Protocol.* Eventually, as international rules and methodologies for estimating emissions from these sources are developed, it may be possible to include them in the scope of a trading program.

Design Issue 34: Sequestration Credits

Issues:

a) Should credits be generated by sequestering carbon?

b) If so what, if any, restrictions should apply to the credits?

Discussion:

There is wide agreement among scientists, environmentalists, business people and policy makers that preserving and enhancing carbon reservoirs is essential to combating climate change. Including sequestration projects within the range of a trading program will broaden the range of cost effective abatement opportunities. Indeed, reducing costs of credits is the central rationale for allowing sequestration projects. Yet European Union and other nations were strongly opposed to inclusion of counting carbon removals from land use change and forestry in the *Kyoto Protocol*, and many environmentalists interviewed for this report objected to generation of credits from sequestration projects. This skepticism about the value of sequestration projects was also shared by several government and a few business representatives. The reasons are discussed in the following sections. Based on the possibility that international agreements may eventually permit

[36] Senes Consultants Limited, "Study of Greenhouse Gas Emissions from Non-Fossil Fuel Sources" (Report prepared for Environment Canada, May 1994) [unpublished] at 2-20.

Canada to count carbon removals from a wider range of sources than is currently the case, all types of sequestration project are discussed.

Reliability and Reversibility

Sequestration projects raise a unique reliability issue that is not a concern for projects which reduce energy use or reduce carbon intensity of energy. A project which reduces use of a tonne of coal has effectively made a permanent emission reduction of carbon dioxide. The equivalent of that coal will remain in the ground until such time as the world's fossil fuel supply is exhausted.

However, when a tonne of carbon is sequestered in a new forest, or in agricultural soil, there is no guarantee that the carbon will remain sequestered. Future changes in forest management or land use and the effects of climate and other environmental conditions pose a significant risk of reversing the sequestration process. Indeed, many forest sequestration projects are only intended to impact atmospheric concentrations for periods as short as twenty years.[37]

A sequestration project which does not successfully sequester carbon forever mitigates climate change in the short term, but it may also shift the burden of our emissions onto a future generation.

To completely offset the climate impacts of a new emission source, a sequestration project must sequester carbon equivalent to that emitted by the source for perpetuity.[38] Forest management projects will only lower concentrations of carbon dioxide in the atmosphere over the long run if changes to silviculture practices remain in effect.

A sequestration project which does not successfully sequester carbon forever is simply buying time. Temporarily increasing sequestration levels has a value. It mitigates climate change in the short term, giving time for less carbon intensive technologies to develop and replace carbon intensive technologies during natural capital turnover.[39] But it may also shift the burden of our emissions onto a future

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[37] For instance, SGS Forestry Services in England audits Costa Rican conservation projects, but the projects are only monitored for twenty years. A company attempting to sell credits from forest management projects in Ontario similarly only promise to change management practices for a single rotation period (which will only affect atmospheric concentrations for that rotation period).

[38] Personal communication with Ken Reid, BC Ministry of Environment, Surrey. Within 30 years after an emission of carbon dioxide occurs, 40 to 60% of that emission's impact on the atmosphere is removed. Most of the impact would be gone after a century but a portion would remain in the atmosphere for thousands of years. However, if the carbon sequestered to avoid that pulse is released later, the pulse is simply delayed. Intergovernmental Panel on Climate Change, Working Group I "Technical Summary of the Science of Climate Change, Contribution of the Working Group I to the Second Assessment Report of the Intergovernmental Panel on Climate Change" in J.T. Houghton *et al.*, eds, above at footnote 1.

[39] See Chapter 4, under the heading "The Timing of Emission Reductions."

generation. Temporary increases to carbon reservoirs are good, but not as good as lowering emissions.

The reliability of any emission reduction project that runs thirty or forty years into the future is difficult to predict. Over a one hundred year plus time frame, the likelihood of pressure to clear particular tracts of forest, the likelihood of fires devastating a plantation or the possibility of a farmer plowing a field is high and the value of corporate commitments made a hundred years earlier questionable.

Reliability of sequestration is also thrown into doubt by the possible impacts of climate change itself and other environmental stresses. According to the IPCC,

> ... [c]limate-induced vegetation changes could release CO_2 into the atmosphere, counteracting the biosphere's capacity to take up CO_2. The magnitude of this feedback is highly uncertain; it could be near zero, or with low probability, as much as 200 GtC [36 times average annual emissions from fossil fuels] over the next one to two centuries. The more rapid climate change, the greater probability of a large transient carbon release.[40]

There are some indications that, for Canadian forests, climate is already reducing net levels of sequestration. Best estimates indicate that from 1970 to 1990, Canada's forests shifted from removing over 200 million tonnes of carbon dioxide per year, to emitting about 60 million tonnes of carbon dioxide per year.[41] Warming leading to more forest fires and pest outbreaks is believed to be one of several factors causing this change.[42] Analyses suggest that forest fires could double by 2050 in the McKenzie Basin because of climate change.[43]

Most of the emissions are occurring in unmanaged boreal forests. Nonetheless, there is a risk that sequestration levels in managed forests including afforestated and reforested areas will also be reversed. The forecast impacts of climate change on forests of the Pacific Northwest have been described as "highly disruptive in the short and mid term" with forest destruction occurring more rapidly than forest re-establishment, and with managed forests being less resilient to changed

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40 Melillo, above at footnote 1, at 449.

41 Julia Martinez *et al.*, *Report on the in-depth review of the national communication of Canada* (Geneva: UNFCCC Secretariat, February 1996) at 10.

42 Kurz, above at footnote 4.

43 Climate models forecast that a doubling in the forest fire index will occur. This will mean a doubling in forest fires given current management practices: Personal communication with Stewart Cohen, UBC, Sustainable Development Research Institute.

climate.[44] If sequestration projects burn or die due to disease the resulting emissions may be counted against Canada's emission commitments.

Some of the unreliability of conservation and storage management projects can be reduced through use of conservation covenants. A condition of any project could be registration of a permanent conservation covenant in favour of organizations that are likely to exist and be supportive of carbon sink protection over a long term. The covenants would require landowners to maintain carbon pools and replant and engage in intensive silviculture if a tree plantation fails or is logged.[45] Unfortunately, covenants or easements in favour of environmental organizations or the Crown which bind future landowners to take positive acts to protect carbon reservoirs are not available in many jurisdictions and are only available for private land.[46] Even where conservation covenants require the replanting of burnt or logged lands, it will take time to re-establish carbon reservoirs and enforcement of covenants may be difficult, especially where the costs of complying with the covenant are significant compared to the value of the land.

Additionality

Even if one can be assured that a soil sequestration, afforestation or forest management project will be maintained in perpetuity, each tonne of carbon sequestered will only be equivalent to an additional tonne of fossil carbon emission reduced if the sequestration project is additional in perpetuity. If an energy efficiency project is only additional for ten years, it will still have succeeded in reducing carbon emissions to the atmosphere for ten years, and this will have a permanent impact on global carbon dioxide concentrations. In the case of a sequestration project, if it is only additional for ten years it will only move sequestration levels forward ten years. After those levels have plateaued, it will have no impact on atmospheric concentrations.

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44 Jerry F. Franklin *et al.*, "Effects of Global Climatic Change of Forests in Northwestern North America" in Robert L. Peters & Thomas E. Lovejoy, eds, *Global Warming and Biological Diversity*, (New Haven: Yale University Press, 1992) at 253.

45 In BC and several other provinces, covenants in favour of government and certain conservation organizations can commit the owner of land to maintaining, enhancing or restoring environmental values on land in perpetuity: Section 219(4) of the *Land Title Act*, R.S.B.C. 1996, c. 250.

46 Under common law, covenants cannot bind future land owners to take a positive step (e.g. replanting a forest after a fire) and can only be made in favour of the owner of a neighbouring lot which benefits from the covenant. These rules have been changed in section 219 of the BC *Land Title Act*, R.S.B.C. 1996, c.250 and partially changed in some other provinces and states land law. See David Loukidelis, *Using Conservation Covenants to Preserve Private Land in British Columbia*, (Vancouver, West Coast Environmental Law Research Foundation, 1992).

Time Value

Thus, a tonne of carbon sequestered only fully offsets a tonne of carbon emitted if it remains sequestered in perpetuity and remains additional to the level of sequestration that would occur in the absence of credit being given. To reflect this difference between the atmospheric effect of a sequestration project and an emission reduction project, credits from sequestration projects could be given limited time values. Sequestration credits would only defer the need for obtaining credits generated by actual emission reductions.

For instance, if a utility exceeds regulated emission levels it could purchase sequestration credits generated from a soil sequestration project. The number of sequestration credits initially generated would be based on the difference in levels of soil sequestration at the farms who are generating credits for the utility and other farms. However, as levels of sequestration at other farms increase and approached levels at the farms that have generated credits, the utility would need to replace sequestration credits with credits generated by emission reduction. Similarly, if for five years a utility relies on credits generated by a farmer practicing no-till agriculture and on the sixth year the farmer plows his or her field reducing sequestration levels to average levels, the utility would need to replace all the credits used over the last five years with credits generated by emission reductions.

Although this approach would be consistent with the atmospheric effect of a sequestration project, it has several difficulties. First of all, the user of a sequestration credit may no longer be in existence at the time the sequestration credit has to be replaced with an emission reduction credit. Thus, enforcing the replacement of credits may be impossible. Although government could require major financial institutions to guarantee the replacement of the credits, there would still be a risk of default given the time scales involved.

Second, limiting the value of a sequestration credit to the time for which it represents an increase in sequestration over baseline levels would add considerably to the transaction costs of using sequestration credits. Every credit used would need to be constantly monitored to evaluate whether or not it still reflects an increase in sequestration over baseline levels. These transaction costs would likely be very significant.

Masking Emission Increases with Uncertain Reservoir Improvements

A number of environmentalists and forest industry representatives interviewed for this project were concerned that counting credits from afforestation and reforestation while not counting degradation of carbon reservoirs would be misleading. They feared that doing so would give the mistaken impression that Canada's net emissions have been successfully capped or reduced. We do not know whether our managed forests are net sinks or net sources, and thus, even though Canadian forests might be a net sink, we may get credit for afforestation and reforestation.[47]

Transparency in Impacts

Some environmentalists believed sequestration credits would be acceptable if both the credit generator and credit user counted all the impacts on carbon reservoirs caused by their activities. Thus, if a natural gas producer wanted to generate or use credits from afforestation on marginal agricultural land, it should only be permitted to do so if it counted the impacts of its activities, for instance, counting deforestation along pipeline right of ways. This basic rule would ensure some accuracy and honesty in the carbon reporting of individual companies. It was recognized that these rules would mean potentially rejecting projects which are additional and have net emission benefits.

Although the above concerns were raised in relation to credit for sequestration under a regulatory program, it would seem that the concerns raised are more applicable to a voluntary challenge program than a regulatory program. It seems unlikely that companies would be restricted from generating credits from an emission reduction simply because emissions from another, unrelated source were increasing or are not regulated.

Balance between What is Counted and What is Not Counted

A number of academics, environmentalists and industry representatives believed no credit should be given for certain types of project, if emissions from similar activities are ignored in other cases. For instance, if one forest company is able to claim credits for intensive silviculture practices, other companies should be required to offset net emissions from logging old growth temperate rain forests. Under the *Kyoto Protocol* there is in fact a balance between limited sequestration related emissions counted and removals counted. (This is only true if emissions from harvesting are included in the second commitment period.)[48] However, as noted above, at a domestic level it is probably unfeasible to require deforesters to hold carbon allowances or offset their emissions.

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47 Canada has estimated carbon emissions from its forests, but has been unable to report human induced changes.

48 Until harvesting is included, nations may be able to avoid counting the release caused by harvesting during a second commitment period of carbon sequestered in the first commitment period even if the sequestration was counted toward national commitments.

Awarding Credit Where Credit Is Not Due

A number of representatives interviewed for this project questioned whether credits should be given for sequestration projects where the level of sequestration is less than or equal to what would occur in the absence human activity. Essentially this is a baseline issue: should baselines reflect natural sequestration levels, business as usual, or the lower of the two?

For reforestation projects, under the *Kyoto Protocol* all growth during the commitment period is counted, regardless of the fact that many projects will simply re-establish carbon stores that existed prior to the land being cleared. Several people interviewed for this report suggested that credit was inappropriate in such cases. Similarly, they rejected the idea of giving credit for conservation management projects that simply maintain carbon stocks.

The issue in both cases relates to the equity of getting credit for maintaining or restoring something that already existed (although conservation management also has severe problems in terms of leakage and setting accurate baselines). However, the same could be said of getting credit for reducing emissions: one is getting credit for not adding something to the environment that was not there originally.

It is suggested that, if credit is given for afforestation and reforestation, standard rules relating to baseline setting should apply. Credit should only be given for afforestation and reforestation projects that appear to go beyond business as usual trends. This means rejection of credit for projects occurring prior to 1998 unless they were clearly motivated by climate change concerns. If additional sequestration activities can eventually be counted toward international commitments, credits would not normally be awarded to replanting or regeneration in the normal course of logging. Similarly, suggestions that credits could be generated by restocking not-sufficiently restocked (NSR) lands[49] could be rejected because programs such as Forest Renewal BC are already aimed at restocking the backlog of NSR lands.

Forest and Soil Projects Do Not Encourage Technological Development

Several environmentalists opposed generation of credits through conservation management and storage management projects because these projects will not encourage the social and technological changes that provide long term solutions to climate change. While there is a great potential for improving carbon reservoirs,

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[49] One consultant and several academics have suggested this approach: See ARA above at footnote 18; and Binkley, above at footnote 19, at 131. It is also problematic because NSR lands are often forested with less commercially attractive species such as alder.

these projects are interim measures, only increasing the carbon stored in soils, forests and wood products up to some maximum achievable equilibrium.[50] By comparison, not all energy efficiency projects will spawn technological development.

Sequestration Projects Ignore Other Negative Effects of Fossil Fuels

Several environmentalists interviewed for this project were opposed to the use of sequestration projects on the basis that sequestration projects do not have the same positive secondary environmental benefits as projects to reduce fossil fuel use. A focus on reducing fossil fuel dependence rather than increasing sequestration was preferred because of the many environmental issues associated with fossil fuel use:

> [Fossil fuel] extraction damages terrestrial and offshore ecosystems. .... Transport and the accompanying leaks and spills have enormous impacts on coastal ecosystems. The benzene by-products of refining and impacts on surrounding communities are not healthy. Finally, combustion has multiple hazards .... Ending our civilization's addiction to fossil fuels is a healthy "no-regrets" policy.[51]

The Rational Energy Plan, which is primarily focused on reducing fossil fuel consumption, is projected to reduce energy related emissions of sulphur dioxide 24%, volatile organics thirteen percent and oxides of nitrogen sixteen percent by 2010. Also, afforestation, reforestation and forest management projects can involve monocultures of fast growing non-native species that reduce biodiversity.[52]

However, sequestration projects may have positive environmental side effects, and renewable projects or fuel switching may have negative environmental impacts. For instance, afforestation and soil sequestration will curb the soil erosion that causes stream sedimentation, water pollution and loss of fish habitat.[53] Some projects may restore native species and biodiversity. Also, some renewable projects — large scale hydro is an obvious example — are hardly benign.

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[50] Brown, above at footnote 8, at 781.

[51] Paul Epstein, Harvard Centre for Health and the Global Environment, quoted in *Current Effects of Climate Change* (Washington: Ozone Action, 1996).

[52] Brown, above at footnote 8, at 781.

[53] See Robert D. Sopuck, *Canada's Agricultural and Trade Policies: Implications for Rural Renewal and Biodiversity* (Ottawa: National Round Table on the Environment and the Economy, July 1993) at 12.

Quantification

Finally, a number of people interviewed for this project thought that forest or soil sequestration projects were inappropriate sources of credits because quantification would be particularly difficult. In some cases, scientists are unsure whether or not a particular activity has negative or positive impacts on carbon sequestration or whether certain types of reservoir are net sinks or sources.[54]

Lack of certainty was the main reason behind the European Union's opposition to inclusion of net land use change and forestry emissions in the *Kyoto Protocol*. For afforestation and reforestation — the two types of sink enhancement in developed countries that can be counted under the terms of the *Kyoto Protocol* — carbon sequestration can be estimated with reasonable accuracy and cost by taking above ground measurements. However, for certain forest types uncertainty is very high. For instance, afforestation in peat bogs will lead to an increase in carbon sequestered above ground, but this may largelly come from an decrease in below ground carbon. Environmentalists fear that methodologies will not account for this negative impact.

Uncertainty is very high for soil sequestration projects. Because of unpredictable variability and the cost of measuring carbon in soil, and the resulting difficulty in deriving statistically significant samples, it is currently impossible, at costs that are not prohibitive, to develop soil sequestration projects with quantifiable benefits.[55] Also, it is unknown the extent to which carbon benefits will be undercut by greater nitrous oxide emissions from soils.[56]

Uncertainty, is high in the case of forest management projects. Although models for determining total carbon sequestration are well developed, measurements of carbon benefits from forest management projects are often dependent on knowledge regarding the lifecyles of products and modelling the market impacts of changing forest products. Uncertainty levels for these parameters are very high.[57] Also, nations are inconsistent in how they count emissions from disease and fire on managed forest land. It is unlikely that nations will be able to take

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54 Personal communication with Kevin Gurney, School of Environmental Science and Management, University of California, Santa Barbara.

55 Personal communications with Werner Kurz, Aldeyn Donnelly and Murray Ward. See also Cole, above at footnote 25, and Jepma, above at footnote 2, at 245.

56 Smith, above at footnote 26.

57 See Maria Wellish, MWA Environment Committee, *MB Carbon Budget for the Alberni Region, Appendix III Primary Manufacturing Activities* (The Research and Development Department of MacMillan Bloedel Limited, October 1992) and *MB Carbon Budget for the Alberni Region, Final Report May 1990 to June 1992,* (The Research and Development Department of MacMillan Bloedel Limited October 1992) at 57.

credit for forest management projects until these methodological issues are worked out.

Uncertainty is also high for conservation management projects in developing countries. Project sites are often remote and largely neglected by government agencies, and information requirements are outside the normal experience of project managers and government agencies.[58]

Conclusion:

Based on the terms of the *Kyoto Protocol* only a few categories of forest or soil related emissions and removals will be counted in determining if a nation reaches its emission reduction commitments. Assuming that Canada will only credit activities which assist Canada in reaching its international commitment, it appears that a domestic trading program would, at most, only credit afforestation, reforestation and avoided deforestation. Canada may also attempt to get credit from soil sequestration projects.

For afforestation and reforestation projects, credit can be measured as verifiable changes in stock, but care will be needed in developing protocols that accurately reflect changes to carbon sequestered above and below ground. As compared to emission reduction projects, these afforestation and reforestation projects only have a limited time value. Accurately reflecting this appears to be unfeasible. Instead, afforestation and reforestation credits could be significantly discounted, and generators of sequestration credits could be required to commit to the long term maintenance of plantations and carbon cemeteries through instruments such as conservation covenants.

Given the lack of data on emissions from deforestation in Canada, it is likely premature to consider giving credit for conservation management projects in Canada. Uncertainty is very high in relation to calculating the emissions avoided by such action. There are also major problems of leakage, as efforts to preserve one area of forest may simply divert development pressures onto another tract.

It is not clear what if any forest and soil sequestration projects will be certified under the clean development process. Due to problems with leakage, additionality, uncertainty and reliability, Canada may wish to work towards international rules which will restrict the certification of emission reductions from sequestration projects by the clean development mechanism. Even if emission reductions from sequestration projects are certified under the clean development mechanism, Canada may wish to restrict their use in Canada, or discount them, to reflect these issues.

58 Faeth, above at footnote 9, at 64 to 65.

If international agreements eventually allow Canada to consider a broader range of forest and soil related activities, many of the above issues will need to be carefully considered. For instance, if international rules are interpreted in a manner that allows Canada to count sequestration in agricultural soils, domestic policy makers will need to determine how to set baselines, decide what occurs if sequestration is reversed by drought or a farmer plowing his field, and consider negative impacts on nitrous oxide emissions.

Evaluation of Integrating Forest and Soil Sinks into a Trading Program

The potential for increasing sequestration in British Columbia and Canada through afforestation and reforestation appears limited. Prairie soil sequestration may have a greater potential nationally, and Canadian carbon reservoirs could also be enhanced by increasing rotation periods and protecting coastal old growth forests. These strategies are important for maintaining biodiversity, wilderness values, water quality and fish habitat. However, the latter strategies would not count toward meeting international commitments.

Environmental Effectiveness

Globally, protecting and enhancing carbon reservoirs is an important aspect of any greenhouse gas emission reduction strategy. However, there are compelling reasons for restricting integration of sequestration projects into a domestic trading program. In particular, a tonne of carbon sequestered in an afforestation or reforestation project only fully offsets a tonne of carbon emitted if it remains sequestered in perpetuity and remains additional to the level of sequestration that would occur in the absence of credit being given. For some types of project uncertainty as to actual reductions in net emissions and the possibility of leakage also limit the environmental benefit of integrating sequestration projects into a domestic program.

Some problems associated with reforestation and afforestation projects — their lack of potential for generating new technologies or secondary benefits, difficulty in setting baselines, and associated environmental impacts — are not unique to sequestration projects. In some cases these problems can likely be dealt with through mechanisms developed for credit trading in general. For instance, minimum requirements for protection of biodiversity can reduce the risk that credits will lead to massive monocultures.

Cost Effectiveness

Including sequestration projects in a domestic program could possibly reduce compliance costs although this is uncertain. Obviously, projects will only reduce costs of compliance with international agreements if they can be counted toward international commitments. Currently only afforestation, reforestation and avoiding deforestation would be counted. For afforestation and reforestation, the cost of land may become prohibitive. If international rules eventually allow counting of credits from agricultural soil sequestration, the cost of quantifying sequestration may be prohibitive.

Feasibility

Credits from afforestation and reforestation projects appear to be feasible, although reflecting their limited time value accurately is unfeasible. Instead, it will be necessary to discount such credits. At this time it appears unfeasible to require those responsible for sink degradation to hold allowances for their impacts. Emissions from activities such as forestry, farming and land clearing are simply too uncertain.

Chapter 13:

Trading Between Gases

While focusing a trading program on carbon dioxide or fossil fuel combustion alone clearly has great potential to reduce greenhouse gas emissions, it is equally true that widening the focus to include other gases covered by the *Kyoto Protocol* could potentially permit more cost effective emission reductions. This chapter considers the issues surrounding inter-gas trading.

Design Considerations for Inter Gas Trading

The design considerations for inter-gas trading are relatively simple: should it be allowed, and if so how should the environmental impact of gases be compared?

Design Issue 35: Inter-gas Trading

Issue:

If a trading program is established, should it permit inter-gas trading and how would inter-gas trading work?

Discussion:

The main reason for allowing inter-gas trading is simply reduction of costs. The more sources included in a cap and emission allowance trading program or a credit trading program the more likely that those programs will yield low cost emission reductions.

Moreover, if trading between gases is not permitted, it would be difficult or impossible to develop a workable credit trading or cap and emission allowance trading system for methane or nitrous oxide because of the limited number of major emission sources. Allowing inter-gas trading may be the only feasible way of introducing market measures to cover these gases.

Global Warming Potential

For inter-gas trading to work it is essential to have an index with which to compare the impact of different greenhouse gases. The Intergovernmental Panel on Climate Change (IPCC) has developed an index known as the Global Warming Potential (GWP) which allows policy makers to compare the impacts of different gases on climate change and which could be used to establish equivalencies between greenhouse gases.

The GWP of a gas depends on the fate of that gas in the atmosphere and the radiative forcing of that gas. Radiative forcing is a measure of how much a gas at a given point in time changes the balance between incoming solar radiation and outgoing solar and heat radiation, thus contributing to warming of the atmosphere. The GWP of a gas represents the total or cumulative radiative forcing of a kilogram of that gas emitted now, over a defined time period. It usually expressed in carbon dioxide equivalence, i.e. relative to the impact of a kilogram of carbon dioxide over the same period.

Because different greenhouse gases have different life times in the atmosphere, the relative GWPs of different gases will vary over time. Methane has a twenty year GWP of 56 (i.e., 56 times as powerful as carbon dioxide over twenty years) but a five hundred year GWP of only 6.5; sulphur hexaflouride is 16,300 times as powerful as carbon dioxide over twenty years and 34,900 times as powerful over 500 years.[1] The IPCC specifies twenty, 100 and 500 year GWPs for different greenhouse gases.

As noted in Chapter 3, the *Kyoto Protocol* applies to six gases (or to be precise 4 gases and two families of gases). Rather than establishing separate emission reduction targets for each gas, they are pooled together with compliance determined by comparing the carbon dioxide equivalence of all gases emitted in 1990 and all gases emitted during the commitment periods. In 1996, the third Conference to the Parties of the *FCCC* adopted IPCC recommendations as to the 20, 100 and 500 year GWPs for all the gases covered by the *Kyoto Protocol.*

The *Kyoto Protocol* thus establishes a basic framework for allowing inter-gas trading, that could be relatively easily adopted into a domestic trading program. Nonetheless, there have been objections to trading between gases.

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1 D. Schimel, "Radiative Forcing of Climate Change" in J.T. Houghton *et al*., eds, *Climate Change 1995: the Science of Climate Change* (London: Cambridge University Press, 1995) at 121.

Accuracy of GWPs and Effectiveness of Program

Although considerable effort has gone into improving GWP estimates, significant uncertainty remains and is likely to remain for a few decades.[2] Because the fates of different greenhouse gases in the atmosphere are not well understood there are substantial margins of error for GWPs: ± 25% for methane; 200% for some hydrofluorocarbons.[3] Also, the contribution of any greenhouse gas to climate change will depend on its concentration in the atmosphere; thus, the accuracy of GWPs depend on future atmospheric concentrations that will vary depending on emission reduction strategies.

There is a risk that the GWPs used for trading are inaccurate and could lead to greater levels of emission reduction for gases that are less potent than reflected in GWPs. For instance, if a high GWP is set for methane it will tend to make methane reductions a popular source of credits to offset carbon dioxide emissions. If methane is later discovered to be a less potent greenhouse gas, the result may be that money spent on greenhouse gas emission reductions was spent inefficiently, concentrating too much on methane and yielding fewer climate benefits than would have occurred if equal emission reductions were required for each gas.

However, over 80% of Canadian emissions are carbon dioxide, and carbon dioxide accounts for an even higher portion of emissions that could be included within a cap and emission allowance trading program.[4] Thus it is unlikely that the inaccuracy of GWP's would have a large effect on the overall effectiveness of a trading program. Moreover, the risk of inaccurate GWPs reducing the effectiveness of a trading program have to be weighed against the possibility that they may increase effectiveness.

Certainty of Emission Measurements

The key issue for deciding whether or not greenhouse gases other than carbon dioxide should be included in a trading program is likely to be the accuracy with which non-carbon dioxide sources can be measured. This is particularly true in the context of a cap and emission allowance trading program where the ability to accurately monitor emissions is essential. The need for accuracy in measurement is less essential in the case of creating credits where credits can be discounted to reflect uncertainty.

As discussed in previous chapters, carbon dioxide is typically much easier to measure than other greenhouse gases. While Canada's anthropogenic emissions

2 L.D. Danny Harvey, "A guide to global warming potentials (GWPs)" [January 1993] *Energy Policy* 24 at 27.

3 Schimel, above at footnote 1.

4 See Chapter 9, Tables 1 and 2.

of carbon dioxide are considered accurate to within ±4% nineteen times out of twenty, anthropogenic emissions of methane are only accurate within ± 30% seventeen times out of twenty and emissions of nitrous oxide are only accurate within ± 40% seventeen times out of twenty.[5]

There are few estimates as to the accuracy with which emissions from a specific site can be measured, but the accuracy of site specific emission estimates will often be lower than national estimates. For most major sources of non-carbon dioxide greenhouse gases in BC and Canada, estimates are very crude.[6]

In some cases, emissions can, however, be accurately measured. For instance, continuous emissions monitoring equipment could be used to measure nitrous oxide from industrial fossil fuel combustion. With investments in monitoring, these sources could be potentially included in a cap and emissions allowance trading program. In other cases, uncertainty may be too great for a cap and emission allowance trading program, but once control mechanisms are implemented, it may be possible to measure emission reductions. For instance, landfill emissions of methane are likely too uncertain for inclusion in a cap and allowance trading program, but once methane capture systems are installed, reductions could be accurately measured and used to generate credits. Finally, in some cases, emissions or reductions are likely too uncertain for either allowance trading or credit generation.

Appropriate GWP

As noted above, the *Kyoto Protocol* uses a 100 year time GWP. Choosing an appropriate time horizon for a trading program inherently involves an arbitrary weighing of the value of protecting our generation versus the value of protecting future generations. A twenty year time frame would be appropriate if the main policy concern is reducing the risk of potential surprise events and slowing the rate of climate change. Although it will partially shift focus to short lived greenhouse gases this is a valuable stop gap measure while carbon intensive technologies are being substituted with low carbon technologies during normal capital turnover. A longer time horizon is appropriate if the focus is guarding against long term climate change. Given the *Kyoto Protocol's* use of a 100 year GWP and the balance it represents between competing policy objectives, a 100 year GWP is the obvious choice for a Canadian program.

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5 T.J. McCann and Associates, "Uncertainties in Greenhouse Gas Emission Estimates" (Report to Environment Canada, February 1994) [unpublished].

6 SENES Consultants Limited, *Study of Greenhouse Gas Emissions from Non-Fossil Fuel Sources*, prepared for Environmental Canada, Conservation and Protection (Richmond Hill: SENES Consultants Limited, May 1994) [unpublished].

Radid Phase Out for Extremely Long Lived Gases

A number of environmental groups have advocated setting separate phase out schedules for hydrofuorocarbons, perfluorocarbons and sulphur hexafluoride. There are several concerns.[7] First, the perfluorocrbons and sulphur hexafluoride have atmospheric lifetimes that are extremely long, and both these gases and hydrofluorocarbons are extremely potent. For instance, perfluoromethane has an atmospheric lifetime of 50 000 years, and HFC-134a is 3 400 times as powerful as carbon dioxide over a twenty year time frame. Several environmentalists argued that interference with the atmosphere over such a long time frame was unconscionable. There was also concern that hydrofluorocarbons may decompose in the troposphere to form toxic acids. Even though inclusion of these gases in a trading program would create an incentive for phase out, a more rapid phase out may be justified because of the powerful short and long term impact of these gases.

Incorporating Changes to GWPs

Under the *Kyoto Protocol* the 100 year GWPs adopted by the Third Conference of Parties to the *FCCC* will be used to determine compliance for the first commitment period. If the IPCC recommends changes to GWPs based on improved scientific understanding, those changes will only be used to determine compliance for commitment periods that were negotiated after adoption of the new GWPs.

A domestic credit trading system could denominate credits in units of the actual greenhouse gas for which reductions have been made. The credit's carbon dioxide equivalence could then float with the GWP in use internationally at the time the credit is used. This would give investors in greenhouse gas emission reduction projects some certainty that the value of the projects would not suddenly drop with changes to the GWP of the gases reduced by a project. At the same, if investors know that the GWPs are about to shift, they would have an incentive to invest in projects that reduce those greenhouse gases which are believed to be most powerful, banking the credits for use in the future.

A cap and emission allowance trading program could adjust the allocation of allowances, denominated in carbon dioxide equivalence, in each allocation period according to the allocation formula applied to the GWPs used in that allocation

[7] Greenpeace International, "Headed for Catastrophe: HFCs" (Greenpeace position paper prepared for 3rd meeting of the parties to the Climate Convention, December 1997, Kyoto, Japan)[unpublished]

period.[8] Once allocated, the allowances' carbon dioxide equivalence would be frozen.

Conclusion:

For carbon dioxide, nitrous oxide and methane, difficulty in accurately measuring emissions of a particular greenhouse gas is likely to be the crucial factor in deciding whether to include a source of greenhouse gases in a trading program. In some cases it is feasible to include sources of greenhouse gases other than carbon dioxide in a trading program. Only a few sources could be feasibly included within the scope of a cap and allowance trading program while more could be included as potential sources of credits.

Given the international consensus surrounding the use of a one hundred year GWP and the balance that offers between short and long term protection, it is likely the most appropriate time horizon.

Summary

It would be both feasible and effective to restrict a trading program to carbon dioxide emissions. Such a program would capture 84% of BC emissions and 81% of Canadian emissions and will also reduce emissions of methane and nitrous oxide associated with fossil fuel production and combustion. However, a trading program could be extended to some other greenhouse gases. Global warming potentials could be used to allow program participants to trade off emissions in one gas with emissions of another gas. Although there is some uncertainty as to the accuracy of GWPs this is unlikely to undermine the effectiveness of a BC program.

There are only a few non-carbon dioxide emission sources that can be accurately enough measured to be included within the scope of a cap and emission allowance trading program. Most sources are too difficult to quantify with sufficient accuracy. However, there appears to be no reason for excluding non-carbon dioxide emission reduction projects from the range of acceptable credit generating projects.

[8] This assumes that allocations would not extend beyond commitment periods for which emission reduction targets have been set.

Chapter 14:

Putting Strategies into Law: The Constitutional and Legislative Basis for Action

> *The all important duty of Parliament and the provincial legislatures to make full use of the legislative powers respectively assigned to them in protecting the environment has inevitably placed upon the courts the burden of progressively defining the extent to which these powers may be used to that end. In performing this task, it is incumbent on the courts to secure the basic balance between the two levels of government envisioned by the Constitution. However, in doing so, they must be mindful that the Constitution must be interpreted in a manner that is fully responsive to emerging realities and to the nature of the subject matter sought to be regulated.*
>
> — *Mr. Justice Gerald La Forest, Supreme Court of Canada*, in R. v. Hydro Quebec, *September 18, 1997.*

An effective greenhouse gas emission strategy will contain numerous disparate elements. Possible elements include changes to tax laws, emission trading programs, energy efficiency standards, programs or regulations to increase carbon sequestered in soils and forests, restrictions on nitrogen content in fertilizer, urban growth management legislation, requirements for methane recovery at landfills, etc. So far this report has examined the different potential elements of a greenhouse gas emission reduction program with little examination of how a particular program should be put into law.

This chapter addresses how greenhouse gas emission strategies should be implemented in legislation. The focus of the chapter is on establishment of emission trading or carbon coupon trading programs. It looks at the provinces' and the federal government's constitutional powers to implement greenhouse gas emission reduction programs and other factors that underlie how greenhouse gas emission reduction programs should be implemented in legislation. It also examines the extent to which existing legislation could support different elements of an emission reduction program.

Designing a program to reduce Canada's greenhouse gases is complicated by the limited powers of both federal and provincial governments. Any program, unless it is purely voluntary, will require some legal basis, most likely a mix of statutes and regulations, and these must be within the constitutional powers of the government passing them.

Regulations are laws passed by bodies to whom provincial legislatures or the federal parliament have delegated regulation making authority. Most regulations are passed by either Lieutenant Governors in Council or the Governor in Council (that is, provincial or federal cabinets with the approval of Lieutenant Governors or Governors General). Regulation making authority can be also be given to independent authorities (such as, the Canadian Radio and Telecommunications Commission) or to local and regional governments. Like statutes, regulations must be within the constitutional powers of whichever level of government passed them. They must also be authorized by statute.

The courts are responsible for determining whether or not government has the constitutional authority to pass a particular regulation or statute and whether a statute gives it the authority to enact a particular regulation or gives administrators the power to act in a particular way.

This chapter begins with a review of the constitutional division of responsibilities between the federal and provincial government as they relate to greenhouse gas emissions as well as a review of the factors that determine what statutory basis is needed for regulations aimed at reducing greenhouse gases. It then answers the two crucial issues that flow from the preceding analysis: how should responsibilities for reducing greenhouse gas emissions be divided between the federal and provincial governments? And, what steps are necessary to ensure a proper statutory basis for legislation aimed at reducing greenhouse gas emissions?

Greenhouse Gases and the Division of Responsibilities

Both the federal and the provincial governments have wide powers to pass laws for the purposes of reducing greenhouse gases, but neither level of government has an unlimited power to enact any instrument for any purpose. The division of powers between the federal and provincial governments is based on the

Constitution Act, 1867[1] as interpreted by the courts. Both levels of government have powers to regulate for the purpose of reducing greenhouse gas emissions based on the subject areas over which they have authority under the *Constitution Act, 1867*. Jurisdiction of either level of government to pass laws relating to greenhouse gas emissions will depend both on how climate change is characterized by the courts and on the form and scope of any law aimed at it.

In reading the leading constitutional law cases dealing with environmental matters, one cannot avoid being struck by the courts', and especially the Supreme Court of Canada's, profound desire not to stymie effective environmental legislation, combined with the courts' deep respect for a balanced Canadian Confederation. This theme pervades both majority and minority decisions in a series of cases decided in the late 1980s and 1990s. For environmental threats that extend across provincial and national boundaries there appears to be a willingness to avoid technical approaches to the Constitution which could confound effective policy, so long as legislative drafters respect the importance of a balanced Confederation.

Courts have strived to avoid technical approaches to the Constitution which could confound effective environmental policy.

The federal power to pass regulations impacting on greenhouse gas emissions is based mainly on federal powers related to peace, order and good government; criminal law; taxation and trade and commerce.[2] The provinces' powers over the environment are based mainly on their authority over property and civil rights, local matters, intra-provincial undertakings and forest resources.[3] The provinces also have an authority to levy direct taxes.[4] Municipalities, regional and territorial governments have no constitutional powers, but instead have whatever powers are delegated to them by the federal or provincial governments.

Often provincial and federal powers overlap. For instance, the federal government might establish national energy efficiency standards based on its criminal law power while the provinces establish higher standards based on their powers over property and civil rights.

1 *Constitution Act*, *1867* (U.K.), 30 & 31 Vict. c. 3.
2 *Ibid*., s. 91.
3 *Ibid*., s. 92.
4 *Ibid*., s. 92(2).

Provincial Powers over Property and Civil Rights

The "property and civil rights" head of power is the constitutional basis for most provincial environmental initiatives.[5] Provincial regulations restricting the production and use of ozone depleting substances, provincial permits to introduce air contaminants into the environment, and permits requiring certain monitoring devices and imposing reporting requirements are all based on the property and civil rights head of power. Among other things, the property and civil rights power allows provinces to regulate emissions, building codes, land use, efficiency standards, and product stewardship and recycling requirements — all measures which affect greenhouse gas emissions directly or indirectly. Subject to some limits discussed below, provincial laws extend to federal lands, such as ports and Indian Reserves, and federal undertakings such as inter-provincial natural gas pipelines.[6]

Although provinces cannot regulate imports *per se*, they may be able to do so in combination with regulation of fossil fuels produced in a province.[7] Thus, provinces could potentially establish cap and carbon coupon trading programs. Subject to the possibility that the courts might find climate change to be a matter of national concern over which the federal government has exclusive authority,[8] provinces should also have clear authority to establish regulatory standards for

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5 *R.* v. *Lake Ontario Cement Ltd.* (1973), 11 C.C.C. (2d) 1 (Ont. H.C.).

6 A number of cases reject the idea that federal lands are enclaves from provincial law: *Montcalm Construction Inc.* v. *Minimum Wage Comm'n* (1978), 93 D.L.R. (3d) 641 (S.C.C.) at 660, and *Cardinal* v. *A.G. Alta.* (1973), 40 D.L.R.(3d) 553 (S.C.C.) at 560. Cases upholding application of environmental laws to federal lands include: *Canadian National Railway Co.* v. *Ontario (Director appointed under the Environmental Protection Act)* (1992), 8 C.E.L.R. (N.S.) 1 (Ont. C.A.), in which a provincial order requiring the preparation of a report on contamination of federal land was held valid because it did not purport to regulate the use or ownership of the federal land; and *R.* v. *Harrt and Stewart* (1979), 94 D.L.R. (3d) 461 (N.B.S.C., App. Div.) in which provincial game laws werre held to apply to federal land.

7 Case law is divided on this point with some cases supporting provincial marketing restrictions that apply to products imported into a province, (*Carnation Co.* v. *Quebec Agricultural Marketing Board*, [1968] S.C.R. 238; followed in *Can. Indemnity Co.* v. *A.G.B.C.*, [1976] 5 W.W.R. 748 (S.C.C.); *Shannon* v. *Lower Mainland Dairy Products Board*, [1938] A.C. 708 (P.C.); and *Home Oil Distributors* v. *A.G.B.C.*, [1940] S.C.R. 444) and other cases rejecting provincial laws that apply to nationally marketed goods. Provincial schemes must not, for instance, be aimed at restricting intra-provincial trade disadvantaging out of province producers: see *A.G. Manitoba* v. *Manitoba Egg & Poultry Association*, [1971] S.C.R. 689 and Peter Hogg, *Constitutional Law of Canada*, loose-leaf edition (Toronto: Carswell, 1992) at 21-19. See also *British Columbia (Milk Marketing Board)* v. *Bari Cheese Ltd*., [1996] B.C.J. No. 1789 (B.C.C.A.).

8 See below under the heading "Overlapping Powers and the National Concerns Tort."

greenhouse gases, credit trading programs and cap and emission allowance trading programs.

Federal Power over Matters of National Concern

The Constitution gives the federal government an overarching power to pass laws for the "Peace, Order and Good Government" of Canada. This power has been interpreted as allowing regulation of "matters of national concern."[9] There is a strong likelihood that the courts would uphold direct federal regulation of greenhouse gases as a matter of national concern, but the exact limits of this federal power are uncertain.

The leading case addressing which environmental issues constitute matters of national concern is *The Queen v. Crown Zellerbach Canada Limited.*[10] In a five to four split decision the Supreme Court of Canada upheld the federal *Ocean Dumping Act.*[11] That Act regulated dumping of waste into marine waters both within and outside of provinces.

Crown Zellerbach: Majority Supports Core Jurisdiction

In the majority judgment, the Court stated that legislation upheld under the national concerns test must be in relation to a subject matter which either did not exist at Confederation (for example, aviation) or which, although a local or provincial matter at Confederation in 1867, has grown to be a matter of national concern.[12] The subject matter must also have "a singleness, distinctiveness and indivisibility that clearly distinguishes it from matters of provincial concern and a scale of impact on provincial jurisdiction that is reconcilable with the fundamental distribution of legislative power...."[13] In determining whether a matter has the required degree of "singleness, distinctiveness and indivisibility," the Court said

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9 The *Constitution Act, 1867* actually gives the federal government a general power to "make laws for the peace, order and good government [POGG] of Canada, in relation to all matters not coming within" subject matters specifically assigned to the provinces. The *Constitution Act, 1867* then lists a number of "federal heads of power" as examples. The Courts have generally interpreted POGG narrowly, limiting federal POGG powers to "matters of national concern," emergencies, and matters not dealt with in the *Constitution Act, 1867*.

10 [1988] 1 S.C.R. 401*;* 3 C.E.L.R. (N.S.) 1.

11 *Ocean Dumping Act*, S.C. 1974-75-76, c. 55.

12 *R.* v. *Crown Zellerbach Canada*, above at footnote 10; *Labatt Breweries of Canada Limited* v. *Canada (A.G.),* [1980] 1 S.C.R. 914 at 944 to 945.

13 *R.* v. *Crown Zellerbach Canada*, above at footnote 10, at C.E.L.R. 32.

that it is particularly relevant to consider the effect of a provincial failure to deal effectively with the issue on extra-provincial interests.

According to the majority, ocean dumping had the requisite singleness, distinctiveness and indivisibility because the federal legislation was limited to dumping in marine waters. The majority noted various international protocols dealing with ocean dumping and noted that it would be difficult for the federal government to distinguish between disposal of waste in marine waters internal to a province and those external to a province.

The application of the national concern test to environmental matters was revisited by a minority of the Supreme Court of Canada in *R. v. Hydro Quebec.*[14] The primary issue in the *Hydro Quebec* case was whether federal regulation of toxic substances under Part II of the *Canadian Environmental Protection Act*[15] (*CEPA*) was constitutional. The majority of the Court upheld Part II of *CEPA* on the basis of the federal criminal law power and thus did not deal with the constitutionality of Part II under the national concerns test.

The minority was of the opinion that Part II did not meet the national concerns test because, in their view, it did not have the necessary singleness, distinctiveness and indivisibility. The minority focused on the fact that *CEPA*, even though it only applied to a handful of highly toxic substances in practice, could potentially apply to any substance harmful to the environment regardless of factors such as degree of toxicity, persistence or potential for extra-provincial effects. The minority in *R. v. Hydro Quebec*, while rejecting application of the national concerns test to any substances that cause harm to the environment, strongly suggests that federal legislation would be upheld if it were clearly limited to diffuse, persistent toxic substances.

These cases suggest that the regulation of greenhouse gases likely has the singleness, distinctiveness and indivisibility required for a matter of national concern. Although their sources are myriad, greenhouse gases are treated as a distinct topic within environmental protection distinct from local air pollution, toxic pollution or regional air pollution. It is thus distinct from the wide range of topics that according to the minority in *R. v. Hydro Quebec* could be covered by *CEPA* Part II. Also, as in the case of ocean dumping an international legal agreement deals specifically with climate change. Most importantly, greenhouse gases will persist in the environment and have effects outside the province regulating them.[16] Federal jurisdiction is also supported by the pronouncements

[14] September 18, 1997, doc. no. 24652, Supreme Court of Canada.

[15] R.S.C. 1985, c. 16 (4th Supp.).

[16] Subsequent judgments have highlighted the importance of considering whether a province's failure of to deal effectively with the intra-provincial aspects of the matter could have an adverse effect outside the province. See *Re: RJR MacDonald Inc. v. Canada (Attorney*

of provincial politicians vowing to resist regulatory measures.[17] These statements support the argument that, not only is there a potential for provincial inaction having extra-provincial consequences, but there is a real likelihood of it.[18]

On the other hand, federal regulation must have a scale of impact on provincial jurisdiction that is reconcilable with the fundamental distribution of legislative power. It must have “ascertainable and reasonable limits, in so far as its impact on provincial jurisdiction is concerned”.[19] In *Crown Zellerbach* the court decided that this condition was met because the federal legislation being attacked was limited to marine waters and did not apply to other activities such as air emissions and dumping into rivers, which might affect ocean pollution but would mean a greater intrusion on provincial jurisdiction. Essentially, the majority appeared willing to accept somewhat artificial boundaries on what was truly a broader topic.

So long as legislation is clearly linked to reducing international pollution, the federal government may not be constrained by artificial boundaries.

Applying this test to greenhouse gases, it is unclear where federal jurisdiction would begin or end. Where would a court draw the boundary around federal jurisdiction? Any boundary is likely to be arbitrary. One possibility is that courts will simply look at the level of intrusion on areas traditionally regulated by the province. The courts are likely to uphold energy efficiency standards that apply to all goods sold in Canada, as well as direct regulation of greenhouse gas emissions, because regulation in these areas would have little impact on the overall balance of powers between the federal and provincial governments.[20] On the other hand, the courts are unlikely to uphold federal legislation which involves a major

General) (1993), 102 D.L.R.(4th) 289 (Que. C.A.) and *Labatt Breweries,* above at footnote 12. Similarly, federal regulation of nuclear power has been held valid because the failure of one province to adequately regulate nuclear safety could expose other provinces' residents to extreme risk: *Ontario v. Ontario Hydro,* [1993] 3 S.C.R. 327.

17 See, for instance, Sheldon Alberts, "Greenhouse gases treaty under gun. Alberta will fight mandatory cutbacks." 22 October 1997 *Edmonton Journal* page A1, in which Alberta Environment Minister Ty Lund is quoted as saying "We are going to resist binding, regulatory measures ... The province has made it very clear that if we do not agree, then the feds will be responsible to implement them."

18 It should also be noted that federal authority to regulate greenhouse gases is not limited only by the possibility that provinces might solve the problem through cooperative provincial action. In *R. v. Crown Zellerbach* the majority refers to and rejects an academic article discussing this issue. The article postulates that, if provinces can deal fully with a problem through cooperative action, the national concerns test only justifies federal legislation aimed at the risk of non-cooperation. The majority rejects that approach, stating that where a matter is upheld under the national concerns test, Parliament has an exclusive, plenary jurisdiction to regulate, including regulation of intra-provincial aspects. See *Crown Zellerbach,* above at footnote 10, at 33. The academic article referred to is Gibson "Measuring 'National Dimensions'" (1976), 7 *Man L. J.* 15.

19 *R.* v. *Crown Zellerbach,* above at footnote 10.

20 Current federal regulation of energy efficiency is based on the federal power over inter-provincial or international trade, and only applies to goods crossing provincial boundaries. As is discussed in Chapter 6, this causes some problems.

intrusion on traditional provincial jurisdiction: e.g., regulating urban growth, improving transit, or regulating forests on provincial crown land. Unfortunately, the end result could be that the federal government has a limited ability to deal with a problem that is a global concern.

Crown Zellerbach: Minority Supports Comprehensive Jurisdiction

In order to avoid that outcome, a court might turn to the minority judgment in *Crown Zellerbach*. Although a minority opinion, nothing in the majority opinion or either of the opinions in the *Hydro Quebec* case contradicts the minority in *Crown Zellerbach.* The dissenting judges recognized the artificiality of the distinction between dumping in coastal marine waters and territorial waters and the problems that would arise from trying to draw similar distinctions in other environmental cases. The attempt to define "ocean pollution" as a distinct legislative category could only create "a truncated federal pollution control power only partially effective to meet its supposed necessary purpose".

According to the minority in *Crown Zellerbach,* so long as federal legislation is clearly linked to the matter of national concern, the federal government is not constrained by artificial boundaries that give the subject matter the required distinctness. The federal government would have jurisdiction over dumping into rivers, air pollution or groundwater pollution, so long as there was evidence that federal regulation was linked to protection of oceans:

> In legislating under its general power for the control of pollution in areas ... falling outside provincial jurisdiction, the federal Parliament is not confined to regulating activities taking place within those areas. ... Regulation to control pollution... could arguably include... not only emission standards but the control of substances used in manufacture, as well as the techniques of production generally, insofar as these may have an impact on pollution.[21]

The minority recognized the huge implications of its reasoning on the balance of federal-provincial powers. Courts, the minority said, would need to develop "judicial strategies" to confine the ambit of federal legislation and avoid encroaching on provincial powers while still allowing the federal government to protect the broader national and international interests. One judicial strategy supported by the minority was to require evidence of a link between the federal regulation and the matter of national concern. For instance, if there was clear evidence that pollution of a river (a matter of provincial concern) was linked to ocean pollution (a matter of national concern) the federal government would have power to regulate river pollution. If the federal government regulates direct

[21] *R.* v. *Crown Zellerbach,* above at footnote 10, at 3 C.E.L.R. 44.

greenhouse gas emissions in a flexible manner, the clear link to an international problem would likely be sufficient to support federal jurisdiction.

Another judicial strategy may be to allow federal intervention only if legislation provides the provinces with an opportunity to regulate instead of the federal government. For instance, the *Canadian Environmental Protection Act* provides that federal regulations will not apply to a province if the province has equivalent legislation. However, this approach gives provinces no flexibility in how they approach a matter, and the minority opinion in *Hydro Quebec* suggests that equivalency provisions undermine the national concerns test by showing that a subject matter is divisible.[22]

An approach which offers greater flexibility to the provinces is for the federal government to provide the provinces with an opportunity to reduce their emissions before the federal government intervenes. Under the draft *Canadian Environmental Protection Act, 1997,* before regulating provincial sources, the federal Minister of Environment must consult with provincial governments. If the provincial governments are unable to prevent pollution under their laws, or are unwilling to do so, the federal government can regulate the problem.[23] The difficulty with this approach is that the majority opinion in *Hydro Quebec,* as well as earlier cases, stresses that matters upheld under the national concerns test are matters of exclusive federal jurisdiction. This suggests that, if based on the national concerns test, federal legislation on greenhouse gases must exclude the potential for provincial legislation directly aimed at greenhouse gas emissions.

Federal calls for provincial implementation plans may give the provinces the greatest flexibility without stymieing effective federal power.

There is a third approach which, although novel, may be most consistent with case law. Federal legislation could establish its own program directly aimed at reducing greenhouse gas emissions, but also give provinces the opportunity to take additional necessary actions that indirectly affect emissions. For instance, the federal government might specify its intention to establish an emission trading program, directly regulate some sources and set efficiency standards for some products and processes. It could then request provinces to develop a provincial implementation plan that includes matters which are

[22] In the opinion of the writer this reasoning is unsound. "Indivisibility" should be interpreted as meaning that there is a need for coordination for regulation to be effective. Essentially the minority in *Hydro Quebec* suggests that the possibility that a provincial enactment, dealing with one aspect of a larger subject area, might be equivalent to one of many federal regulations is evidence of divisibility. If followed, this would mean that, to qualify as a matter of national concern, subject matters must be very narrowly defined. For instance, the government might only be able to pass legislation enabling regulations on PCBs from incinerators only, ocean dumping from oil platforms only, airplane radio requirements only, rather than the broader areas in relation to which courts have upheld federal legislation, e.g. persistent diffuse toxic substances, ocean dumping or aeronautics.

[23] Sections 166(2)(3) and 167.

essential but are closely tied to areas of clear provincial jurisdiction and lie outside the scope of the federal program. The provincial implementation plans might, for instance, deal with forest carbon sinks, transportation demand management, or demand side management. If provincial governments fail to develop plans, or fail to develop plans that meet criteria established by federal legislation, the federal government could regulate in those areas.

Requirements for provincial action plans that supplement federal action are unprecedented in Canada. It is, however, a component of other federal systems and analogous to the approach used in the US *Clean Air Act*. Although potentially controversial, it may be the best means of minimizing federal intrusion into areas of traditional provincial jurisdiction while at the same time ensuring that matters of national concern are dealt with effectively.

The federal government could buttress the incentives for provinces to take necessary steps by making federal funding available to provinces for programs such as demand side management and making such funding contingent on the existence of acceptable provincial action plans. Using funding to ensure provincial adherence to national standards has been the usual, albeit sometimes contentious, means of promoting national standards in areas such as welfare and health care.

Federal Treaty Power

It may also be possible to uphold federal regulation of greenhouse gases on the basis of a federal power to implement treaties. Although the federal government has the power to implement British Empire treaties, neither the *Constitution Act, 1867,* nor the subsequent constitutional amendments that gave Canada the power to enter into treaties on its own behalf, explicitly gave the federal government the power to implement its own treaties. A 1937 decision of the Judicial Committee of the Privy Council (formerly Canada's highest court) decided the Canadian federal government did not have the power to implement treaties in areas of provincial jurisdiction.[24] This decision was made despite earlier cases to the contrary, despite the anomaly of being able to implement empire treaties but not other treaties and despite other federal governments having powers to implement treaties.

Several Supreme Court of Canada cases have expressed a willingness to reconsider the issue, so long as the federal legislation that is being attacked clearly states federal jurisdiction is based on implementation of treaties.[25] A number of

24 *A.G. Canada v. A.G. Ontario (Re: Labour Conventions)*, [1937] 1 D.L.R. 673 (J.C.).

25 *MacDonald v. Vapour Canada Ltd.*, [1977] 2 S.C.R. 134; *Francis v. The Queen*, [1956] S.C.R. 618, at 621.

constitutional scholars have criticized the 1937 decision, suggesting that implementation of treaties should be considered a matter of national concern.[26] Thus, if Canada ratifies the *Kyoto Protocol* there is a chance that federal jurisdiction to implement it would be upheld.

However, once again it is likely that the courts will want to minimize the intrusion of federal laws into areas of provincial jurisdiction. The above strategies to address this concern could also be applied to implementation of Canadian commitments under the *Kyoto Protocol.*

Federal Criminal Law Power

The federal Parliament has exclusive legislative authority in relation to "The Criminal Law". Along with the national concerns test, this power provides the primary constitutional support for federal regulation of greenhouse gases. A court may be pre-disposed to upholding federal greenhouse gas legislation on the basis of the criminal law power simply because, unlike the national concerns test, upholding federal regulation of environmental matters under the criminal law power does not preempt provincial regulation of the same subject matter. On the other hand, using the criminal law power to support a complex system of regulation through systems such as emission trading would involve an unprecedented extension of what is considered to be criminal law.

In *R. v. Hydro Quebec*,[27] the Supreme Court of Canada upheld Part II of the *Canadian Environmental Protection Act* as a valid exercise of the criminal law power. Part II establishes a system of notification and approval for new substances being brought into Canada; it includes provisions for the mandatory provision of information on potentially toxic substances; it includes a system for assessing existing substances; and it gives the Governor in Council broad regulation making powers in relation to the use, release, processing, packaging, sampling etc. of substances that may cause harm in the environment.

The decision of the majority, written by Mr. Justice La Forest, indicates that environmental regulation is largely an area of concurrent jurisdiction. The reasons shows a willingness of the Court to accept a major federal role on environmental matters, so long as this does not preempt more stringent provincial action. Mr. Justice La Forest quotes from the World Commission on Environment and Development (the Brundtland Commission) in its report *Our Common Future:*

> It is becoming increasingly clear that the sources and causes of pollution are far more diffuse, complex , and interrelated — and the

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[26] For example, see Hogg, above at footnote 7.

[27] Above at footnote 14.

> effects of pollution more widespread, cumulative, and chronic — than hitherto believed. ....
>
> ...[N]ational governments should establish clear environmental goals and enforce environmental laws, regulations, incentives, and standards on industrial enterprises. ....
>
> *The regulations and standards* should govern such matters as air and water pollution, ... energy and resource efficiency of products and processes, and the manufacture, marketing, use, transport, and disposal of toxic substances. This *should normally be done at the national level, with local governments being empowered to exceed, but not to lower national norms."* [emphasis added by Mr. Justice La Forest][28]

Mr. Justice La Forest also refers to his statement for the minority in *Crown Zellerbach,* to the effect that allocating environmental pollution exclusively to the federal Parliament would involve "sacrificing the principles of federalism enshrined in the Constitution."[29] He then goes on to say that he:

> would be equally concerned with an interpretation of the Constitution that effectively allocated to the provinces, under general powers such as property and civil rights, control over the environment in a manner that prevented Parliament from exercising the leadership role expected of it by the international community and its role in protecting the basic values of Canadians regarding the environment through the instrumentality of the criminal law power.[30]

While these excerpts and others show strong support for the policy of broad concurrent federal and provincial environmental powers, federal legislation upheld on the criminal law power will need to meet some of the previously established tests for valid use of the criminal power. The courts will generally uphold a law as criminal if two conditions are met. First, the purpose of the law must be to suppress some "evil, or injurious or undesirable effect upon the public. The effect may be in relation to social, economic or political interests...." Second, the law must be characterized as a prohibition and penalty. Both tests are relevant in considering whether a federal statute regulating greenhouse gas emissions would be upheld using the criminal law power.

In *R. v. Hydro Quebec* both the majority and the minority agreed that protection of the environment was a legitimate aim of the criminal law. The majority stated that "Parliament may validly enact prohibitions under its criminal law power against specific acts for the purpose of preventing pollution or, to put it in other terms, causing the entry into the environment of certain toxic substances."

28 Above at footnote 14, at 61.

29 *Crown Zellerbach,* above at footnote 10, at 51.

30 *R. v. Hydro Quebec,* above at footnote 14, at 72.

Parliament clearly has a wide ambit to protect the environment by means of prohibitions and penalties.

It is also clear that the federal Parliament has considerable latitude in what enactments will be characterized as prohibitions and penalties. For instance, the majority in *Hydro Quebec* upheld the regulation of toxic substances under Part II of the *Canadian Environmental Protection Act* as valid under the criminal law power. They were unconcerned that *CEPA* itself (as opposed to the regulations under it) did not contain any actual prohibitions. Nor were they concerned that many of *CEPA's* regulation making powers were expressed in terms of setting emission limits, requiring reporting, putting conditions on use of substances, rather than simple prohibitions. Moreover, in other cases the courts have been willing to uphold prohibitions on activities that are only an indirect cause of the harm at which the law is directed.[31] This suggests that bans on activities or products indirectly increasing greenhouse gas emissions might be upheld.

However, it is not clear that courts will uphold all federal environmental laws simply because they use prohibitions and penalties for the purposes of regulation. The majority in *Hydro Quebec* raises the possibility that a particular prohibition could be so wide as to be no longer in relation to the environment. Mr. Justice La Forest states "a particular prohibition could be so broad or all encompassing as to be found to be, in pith or substance, really aimed at regulating an area falling within the provincial domain and not exclusively at protecting the environment."[32] He was also careful to point out that *CEPA*, Part II, worked in such a way that it only applied to a narrow range of very harmful substances.

It is not clear if economic instruments for reducing greenhouse gases would constitute criminal prohibitions and penalties.

Would a system prohibiting excess greenhouse gas emissions be too "all encompassing" as to fall outside the proper purposes of criminal law? Such a system would apply to a much broader field of activity than the legislation considered in cases where the criminal law power has been upheld.[33] However, the *Hydro Quebec* majority's reference to federal laws being too all-encompassing to be upheld under the criminal law appears to be a

[31] For instance, a prohibition of tobacco advertising was valid under the criminal law power even though it was only indirectly aimed at the underlying public purpose of reducing smoking: *RJR MacDonald v. Canada*, above at footnote 16.

[32] *R. v. Hydro Quebec*, above at footnote 14, at 63.

[33] Prohibitions upheld as valid criminal law include anti-combines prohibitions, price fixing, sale of dangerous or adulterated food products: *Proprietary Articles Trade Association v. A.G. Canada*, [1931] A.C. 368; *A.G. B.C. v. A.G. Canada*, [1937] A.C. 368; *R. v. Wetmore*, [1983] 2 S.C.R. 284.

response to the fear that the federal government might try to regulate all aspects of the environment using *CEPA*, Part II.[34] Greenhouse gases are a discrete environmental problem and are not all encompassing in this way. Indeed, Mr. Justice La Forest's refers to environmental pollution as 'a by-product of everything we do' and refers to the need for effective federal regulation. This suggests a very broad ambit for federal regulation.

It is unclear from *Hydro Quebec* whether a system of greenhouse gas regulation might at some point become so complex that it could no longer be viewed as a prohibition and penalty. The minority in *Hydro Quebec* quoted a statement by one of Canada's leading constitutional law experts that "the more elaborate a regulatory scheme, the more likely it is that the court will classify the dispensation or exemption as being regulatory rather than criminal".[35] More importantly, the majority was careful to characterize *CEPA*, Part II as primarily legislation aimed at creating prohibitions.

Would the courts accept that an emissions trading program is primarily a system of prohibitions? This would require an even more liberal approach to what constitutes a system of prohibitions and penalties than was necessary to characterize *CEPA*, Part II and the regulations under it as prohibitions and penalties. However, it would seem nonsensical for the courts to uphold the regulation of greenhouse gas emissions where a system of strict emission limits is used, but hold that the federal government has no power where they use a more flexible approach. The policy directions espoused by the majority in *Hydro Quebec* support an interpretation of the law that gives the federal government latitude in how they regulate greenhouse gases, but, outside of the *Hydro Quebec* case, there are few guides to how the court will define what regulatory systems can be upheld under the criminal law power.

Thus, the criminal law power as in interpreted in *Hydro Quebec* provides the federal government with strong authority to regulate some of the areas that affect greenhouse gas emissions. It provides strong support for national standards that relate to greenhouse gas emissions, for instance, energy efficiency of equipment, houses and buildings, landfill methane recovery. This is significant, because federal regulation of energy efficiency standards is currently based on the federal trade and commerce power and only applies to goods crossing provincial or

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34 The reference can be interpreted as an acknowledgment by the majority that if they interpreted Part II in the same way as the minority — as "the wholesale regulation by federal agents of any and all substances which may harm any aspect of the environment or which may present a danger to human life or health" — they might find it to be unconstitutional. See *R. v. Hydro Quebec*, above at footnote 14, at 26.

35 Above at footnote 14, at 30.

national borders.[36] Given the decision in *Hydro Quebec*, the federal government should feel confident that it can set national standards without the unnecessary complexity of only regulating goods in inter-provincial or international trade. The criminal law as interpreted in *Hydro Quebec* may also provide support for a national program of emissions trading. However, there is some uncertainty in this regard because a trading program is relatively complex and not obviously characterized as primarily a prohibition and penalty provision.

Federal Trade and Commerce Power

Another area of federal jurisdiction that may be important in any national greenhouse gas emission reduction strategy is the Canadian government's power to regulate "trade and commerce". As noted above, the federal government has a clear power to set labelling standards, energy or fuel efficiency standards, or emission standards for any good traded across provincial boundaries.[37] The Canadian federal government could also arguably use the "trade and commerce" power to justify regulating the production and import of fossil fuels but such a basis for regulation is very uncertain.[38]

Federal and Provincial Taxation Powers

Under the *Constitution Act, 1867*, the federal government has the power to raise revenue through both direct and indirect taxation. This gives the federal

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36 The federal government has used a ban on international or inter-provincial trade of goods that do not meet federal standards to create national standards for motor vehicle safety and emissions (*Motor Vehicle Safety Act);* pesticide labeling (*Pest Control Products Act*, section 5(2)); appliance energy efficiency (*Energy Efficiency Act*); motor vehicle fuel efficiency (*Motor Vehicle Fuel Consumption Standards Act* section 6(1) (not in force); and fuels (*Manganese Based Fuel Additive Act).*

37 *Dominion Stores v. The Queen*, [1980] 1 S.C.R. 844.

38 It has usually been assumed that simply because markets for fossil fuels are national in scope the federal government likely cannot impose a national cap on production of fossil fuels on the basis of its trade and commerce power. Cases have upheld federal legislation regulating the trade, including the intra-provincial trade, of products like oil and wheat that are routinely traded across provincial boundaries, but these cases involved protecting international marketing schemes for wheat or protecting western oil producers from foreign competition. However, in these cases, the regulation of intra-provincial trade was clearly tied to international trade issues, not protection of the environment. When federal regulation of a national market has been used for other purposes, such as consumer protection, it has been found unconstitutional: *Labatt Breweries Ltd. vs. Canada (Attorney General)*, [1980] 1 S.C.R. 844 (1979).

government a clear power to impose an energy tax or a carbon tax applied either on the retail sale or production and import of fossil fuels. Taxes are routinely used to discourage undesirable activities such as smoking, drinking or fossil fuel combustion.[39] As well, most of the tax subsidies to fossil fuel industry in Canada are federal, and the federal government also has the ability to alter the tax structure to remove federal tax subsidies to mining and oil and gas production.

Provinces can also alter their tax systems to remove or reverse subsidies in favour of carbon intensive energy use and establish new taxes that encourage sustainable energy use. In regard to ending existing subsidies, provinces can end the exemption of gasoline from provincial sales tax.[40]

In regard to new taxes, a province can impose direct taxes, but not indirect taxes.[41] A tax will be indirect if it relates to units of a particular commodity and is charged to a person other than the consumer.[42] A charge on greenhouse gas emissions (for instance, the addition of greenhouse gas emissions to the BC *Waste Management Permit Fee Regulation)* would be legal as a direct tax, as it is not charged on units of production or import and can be avoided or reduced by more energy efficient production.[43] On the other hand, a fuel tax, applied per unit of fuel, will be an indirect tax if applied to producers or distributors of fuel, but will

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39 The main limit on federal taxation powers is that they cannot be used as a means of forcing compliance with a regulatory scheme: see G.V. La Forest, "The Allocation of Taxing Power Under the Canadian Constitution" Toronto: 1981. The Canadian approach to the limits of the taxing power is much more restrictive than in the United States, where a tax is valid even if aimed purely at regulation with negligible revenue generating potential: see for instance *United States* v. *Sanchez* (1950), 340 U.S. 42. Nonetheless, extremely high taxes for foreign publishers of Canadian magazine editions aimed at protecting Canadian publishers have been upheld by the courts. *Reader's Digest Association (Canada) Ltd.* v. *Attorney General of Canada* (1967), 59 D.L.R. (2d) 54.

40 In British Columbia and other provinces, exemptions from the provincial sales tax exist for motor fuels, but separate motor fuel taxes are imposed. Since motor fuel taxes are generally dedicated to providing services to motorists, i.e., road construction and maintenance, the exemption from sales taxes constitutes a subsidy: See Chapter 6.

41 *Constitution Act*, *1867*, s. 91(3) and 92(2). An exception exists for natural resources produced in the province.

42 See *Simpsons-Sears Ltd.* v. *Provincial Secretary of New Brunswick* (1976), 71 D.L.R. (3d) 717 at 724, rev'd (1978), 82 D.L.R.(3d) 321 (S.C.C.). Although the Supreme Court of Canada was equally divided on this point, the decision of the New Brunswick Court of Appeal was supported by G.V. La Forest prior to his appointment to the Supreme Court of Canada: G.V. La Forest, *The Allocation of Taxing Power Under the Canadian Constitution,* 2d ed. (Toronto: Canadian Tax Foundation, 1981) at 83. See also *Canadian Industrial Oil & Gas Ltd.* v. *Government of Saskatchewan* (1977), 80 D.L.R.(3d) 449 (S.C.C.) for a discussion of how courts distinguish between direct and indirect taxes.

43 Discharges resulting from the manufacture of a good are analogous to products purchased and incorporated into another product which is sold. Courts have held that taxes on such products are direct: *Cairns Construction Ltd.* v. *Saskatchewan*, [1960] S.C.R. 619, 24 D.L.R.(2d) 1.

be a direct tax if applied at the consumer level.[44] Similarly, a charge on electricity distribution paid for by distribution utilities would be an indirect tax.[45]

Thus, provincial carbon taxes or electricity line charges would clearly be legal if paid by industrial, commercial or residential and mobile consumers. Second, if paid for by energy producers or distributors, they would be valid if ancillary to a regulatory scheme. For instance, they may be valid if earmarked for a greenhouse gas emission reduction fund, or a demand side management fund.[46] Applying the charge under the same statute as other discharge fees would help support a finding that a tax is ancillary to a regulatory scheme. However the province cannot adopt a carbon tax applied to importers, producers or distributors if the tax has a major revenue raising function.[47]

Federal and Provincial Powers in Relation to Forests

Most forests in Canada are on provincial crown land. As owner, the provinces have the ability to control the resource, restricting logging or establishing silviculture requirements that protect carbon sinks. The provinces also have control over forests on private land through their power over property and civil rights, and their power over forest resources. The federal parliament controls forests on federal land and in the territories (although much of the latter power has been delegated to the territorial governments).

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[44] *British Columbia (Attorney General) v. Canadian Pacific Railway,* [1927] 4 D.L.R. 113 (P.C.) outlawed a BC tax that applied to wholesale fuel sales but allowed the tax when applied to the consumer: *British Columbia (Attorney General) v. Kingcome Navigation,* [1934] A.C. 45 (P.C.).

[45] Even if a carbon tax had exemptions for renewable content so that there was not a perfect correlation between the tax and the increased cost of fuels, it would likely be treated as an indirect tax. The relevant question is whether a tax clings to the vast majority of units which enter the market: *Allard Contractors Ltd. v. Coquitlam (District)* (1993), 109 D.L.R. (4th) 46 (S.C.C.) at 64.

[46] In *Allard, ibid.,* a municipal tax charged per unit of gravel produced was upheld because the revenues were intended to cover damage to roads caused by gravel trucks.

[47] It would be possible to impose a carbon tax under the province's power to impose indirect taxes on "non-renewable...resources in the province and the primary production therefrom:" section 92A *Constitution Act 1867,* as amended by *Constitution Act 1982.* This was intended to allow provinces to capture a greater portion of the profits from oil and gas production on their territory. However, it does not allow placement of a carbon tax on fossil fuels imported into a province and is unlikely to be an effective way of affecting final retail price and consumption levels.

Provincial and Federal Powers over Transportation.

Using their powers over local matters, municipal institutions, property and civil rights, management and sale of provincial crown land, and intra-provincial works and undertakings, the provinces have control over roads in the province, intra-provincial railway systems and intra-provincial trucking companies. These powers could be used to achieve emission reductions in a number of areas, for instance, by adjusting speed limits, achieving shifts in patterns of road development, and requiring emission reduction plans from intra-provincial trucking or railway companies, etc.

The federal government, on the other hand, has the power to regulate railway, trucking, pipeline and shipping operations which extend beyond provincial boundaries. It also has power over aeronautics and ship standards. These powers will be relevant to fuel efficiency standards for ships and planes as well as regulations specifically aimed at inter-provincial and international transportation undertakings.

Overlapping Powers and the National Concerns Test

The fact that the federal government has the power to regulate pollution of international or inter-provincial airsheds does not mean that the provinces do not have powers to impose higher standards in their environmental regulation of these airsheds.[48] Merely because the federal government has the power to regulate a particular subject does not mean that the provinces do not have this power and vice versa. For instance, if the federal government strategy to reduce greenhouse gases uses the federal criminal law power and the federal tax and spending powers, the provinces also would be able to regulate greenhouse gases using their power over "property and civil rights".

Courts will allow otherwise constitutional federal and provincial laws to operate concurrently unless there is a direct clash of purposes or an operational conflict (in the sense that one law says a person must do something which another law

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[48] In *R.* v. *Nitrochem Inc.*, (1993), 14 C.E.L.R. (N.S.) 151 (Ont. Ct. J. Prov. Div.) the court held that provincial statutes which supplemented *CEPA* provisions for discharges into inter-provincial waters were valid. See also *TNT Canada Inc.* v. *Ontario* (1986), 1 C.E.L.R. (N.S.) 109 (Ont. C.A.).

forbids).[49] If both levels of government regulate the same issue, citizens must obey the highest standard. If there is a conflict, however, the federal law prevails.

There are some limits to the extent of permissible overlap. For instance, provincial regulations that affect federal undertakings (such as interprovincial pipelines, rail companies or trucking companies) must not significantly impair those undertakings or be overly specific as to how they are managed.[50]

Most importantly, provincial environmental laws will not be upheld if their dominant aspect is characterized as being in relation to a matter of federal jurisdiction. For instance, provincial regulation of land use will not apply to federally owned land, because regulation of federally owned public land is an area of exclusive federal jurisdiction.[51] The possibility of provincial legislation being unconstitutional because it is characterized as relating to an area over which the federal government has exclusive jurisdiction is greater if federal programs are upheld on the basis of the national concerns test. In *R. v. Hydro Quebec* the Court is clear in stating that the national concerns doctrine operates by assigning full power to regulate an area to the federal Parliament, and warns against the danger of invoking too readily a doctrine that places matters beyond the

If the federal government establishes a trading program based on its power over matters of national concern, the federal action may reduce the range for provincial programs.

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49 *Multiple Access Ltd.* v. *McCucheon*, [1982] 2 S.C.R. 161 at 163; *Bank of Montreal* v. *Hall*, [1990] 1 S.C.R. 121.

50 In *Ontario.* v. *Canadian Pacific Ltd.* (1993), 10 C.E.L.R. (N.S.) 169 (Ont. C.A.), aff'd *R. v. Canadian Pacific Ltd.* (1995), 125 D.L.R. (4th) 385 (S.C.C.) the Ontario Court of Appeal upheld provincial environmental protection laws which prohibited the cheapest method of vegetation clearing along a railway right of way because the provincial regulations did not "bear essentially upon the management" of the federal undertaking. At the Supreme Court of Canada written reasons were not given, but in oral reasons the Court referred to a decision that allowed provincial regulations so long as they do not "sterilize" the federal undertaking. See also *R.* v. *Norris* (1992), 17 W.C.B. (2d) 160 (Ont. Ct. J. Prov. Div.). The trend of recent cases suggests that provincial environmental regulation of greenhouse gases from federal undertakings would likely be valid so long as it does not target federal undertakings, does not have significant adverse impacts on a federal undertaking and is not overly specific as to how federal undertakings are managed. See Hogg, above at footnote 7, at 15-30 to 15-31. *Irwin Toy* v. *Quebec*, [1989] 1 S.C.R. 9 stated that provincial laws can affect a vital part, as long as the effect is indirect. See also *R.* v. *Nitrochem Inc.*, above at footnote 48, which upheld application of provincial spills legislation to a federal undertaking. On the other hand, courts have invalidated provincial regulation of labour relations at federal undertakings because they do bear essentially upon "a vital part of the management and operation of federal undertakings": *Commission de Salaire Minimum* v. *Bell Telephone Co.*, [1966] S.C.R. 767; *Alberta Government Telephones*, [1989] 2 S.C.R. 225.

51 Cases where provincial or municipal regulation has been struck down include *Canadian Occidental Petroleum* v. *North Vancouver* (1986), 13 B.C.L.R. (2d) 34 (B.C.C.A.); *Delta* v. *Aztec Aviation Group* (1985), 28 M.P.L.R. 215 (B.C.S.C.); *International Aviation Terminal Inc.* v. *Richmond (Township)* (March 16, 1992) Van. Reg. CA 01384, (B.C.C.A.); *Surrey v. Peace Arch Enterprises Ltd.*(1970), 74 W.W.R. 380 (B.C.C.A.); all of these involved provincial or municipal attempts to regulate use of federal land through zoning and building bylaws.

scope of provincial jurisdiction. The approach of the court appears to be as follows: use of the national concerns test should be avoided unless it is the only head of power available to uphold federal legislation; however, once invoked it may make provincial legislation that is essentially aimed at the matter of national concern unconstitutional.

If courts can construe laws on bases other than the national concerns test, they can avoid taking powers away from the provinces. It may be possible to construe a federal law as essentially being a prohibition and penalty, or as a law in relation to trade and commerce, or as a tax. However, in the case of some legislative programs, in particular emissions trading, it is not clear whether the court has an alternative to using the national concerns test. Thus, the effect of a federal emissions trading program may be to reduce the potential range of provincial action. This could mean that provincial legislation aimed solely at greenhouse gases might be unconstitutional. Nonetheless, provinces would continue to have powers to affect greenhouse gas emissions through their powers over land use, forestry, road transport, etc.

Summary of Federal and Provincial Powers

Case law strongly supports the federal government having jurisdiction to unilaterally implement major economic instruments to reduce greenhouse gas emissions. Except in relation to direct carbon taxes or energy taxes, provincial authority to implement major economic instruments is less certain. This is especially true if the federal government has acted first on the basis that greenhouse gases are a matter of national concern. Moreover, implementation of a national program by the provinces may be difficult and inefficient.

Both the federal and provincial governments have authority to establish energy efficiency standards and emission standards for greenhouse gases. Federal authority is not limited to establishment of standards for goods crossing national and provincial borders. Provincial standards can exceed federal standards.

Many essential aspects of a program are best implemented by provincial governments because they relate to matters traditionally within the provincial realm, e.g. forestry, urban growth management, regulation of utilities. However, the federal government may have some authority over these subject areas if federal intervention is necessary for an effective greenhouse gas emission reduction program. Federal intervention in these areas should, however, be designed to avoid unnecessary intrusion in areas of provincial jurisdiction.

Table 1 sets out conclusions regarding the powers of the federal and provincial governments to impose some of the potential elements of a greenhouse gas emission reduction program. The references under the second and third columns specify the degree of certainty with which one can conclude that the federal or provincial governments respectively have the requisite authority. These conclusions are tentative, with the actual constitutional basis for programs depending to some extent on the details of regulations and statutes.

Table 1: Federal and Provincial Powers to Legislate in Relation to Greenhouse Gases

Program Element	Federal Power	Provincial Power
1. Carbon tax	• clear authority	• clear authority if direct tax
2. Establishment of climate fund to fund emission reduction project	• clear authority	• clear authority
3. Energy efficiency standards, technology standards and labelling standards.	• clear authority for goods crossing provincial or international boundaries • very strong authority, under national concerns or criminal law power, for all goods	• clear authority
4. Cap and emission allowance trading for greenhouse gases	• very strong authority, under national concerns test; • medium authority under criminal law power	• very strong authority, but may be excluded if court finds climate change is matter of national concern
5. Emission limits and credit trading or atmospheric user fees	• very strong authority, under national concerns test • good authority under criminal law power	• very strong authority, but may be excluded if court finds climate change is matter of national concern
6. Cap and carbon coupon trading.	• very strong authority	• medium authority
7. Urban growth management/road transportation planning	• no authority (except see 11)	• clear authority
8. Forest management for sequestration	• no authority for private South of 60 or provincial Crown land (except see 11)	• clear authority
9. Mandatory energy audits	• clear authority for federal government and federal undertakings; some authority for other facilities	• clear authority for facilities other than federal undertakings or the federal government
10. Limits on emissions from federal undertakings (e.g. inter-provincial pipelines and facilities)	• clear authority	• no authority unless part of general program; no authority if limits impair operation of understanding
11. Ability to regulate forest sinks, urban growth etc. if provinces fail to implement measures in their areas of jurisdiction	• very uncertain authority	• not applicable

Statutory Basis for Reducing Greenhouse Gases

As discussed in the introduction to this Chapter, any program to reduce greenhouse gas emissions must have both a constitutional basis and a legislative basis. The statutory basis for a program will depend on several factors. Statutes must authorize all the regulatory or administrative requirements imposed by a program. Valid regulations must be authorized by statute, and valid permits and orders issued by government officials ("administrative requirements") must be authorized by either regulation or statute. Although some components of an emission reduction program could, as a matter of law, be included in either regulation or statute, there may be policy reasons for putting them in one or the other. This section reviews the various factors affecting this decision. It then considers whether or not new statutes need to be passed or existing statutes amended.

Statutory Interpretation

The courts are responsible for interpreting statutes to determine if they allow governments to regulate in the manner they have chosen. In deciding whether a particular administrative or regulatory requirement is authorized, courts will apply rules of statutory interpretation and administrative law.

Courts use these rules to ensure that regulations and administrative requirements are applied fairly and reflect the intention of Parliament or legislature. While courts in Canada have been liberal in broadly interpreting statutory mandates to pass regulations, in some circumstances courts may require very specific statutory mandates in order to uphold certain types of regulations.[52] For instance, the BC *Waste Management Act* states that the "Lieutenant Governor in Council may make regulations." While courts may interpret this as allowing regulations requiring traditional end of pipe waste treatment, they are less likely to interpret it as permitting a relatively novel approach to environmental protection.[53] The result is that more specific regulation making power may be necessary. Often it will be

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52 See *CKOY Ltd.* v. *The Queen*, [1979] 1 S.C.R. 2 and John Keyes, *Executive Legislation: Delegated Law Making by the Executive Branch* (Toronto: Butterworths, 1992) at 181-187.

53 The fact that legislation such as the BC *Waste Management Act* enumerates very specific regulation making powers worsens the problem. Judges may infer that if the legislature specifically empowered a regulation to do A, but did not specifically allow a regulation to do B, they had no intention to allow regulation of B.

impossible to provide all necessary regulation making powers until the basic elements of a program are known.

In addition, there are regulatory actions against which "presumptions of statutory interpretation" exist. For these actions very specific statutory authority will be necessary to overcome the presumption that they are not authorized. There are a number of instances where presumptions of statutory interpretation will necessitate very specific statutory provisions:

- **Limiting Access to Judicial Review.** Specific statutory authority would be needed to limit the public's ability to have administrative decisions reviewed by the courts.[54] In many programs it may, in the interest of expediency and certainty, be necessary to limit the ability of affected parties to have the courts review administrative decisions. For instance, in a cap and emissions allowance trading program, if administrative officials determine how many allowances each emitter receives, it would be important to ensure that implementation of the program could not be impeded by emitters seeking judicial review of their allocations.

- **Imposition of Criminal or Administrative Penalties.** Regulations cannot impose liability, either criminal liability for an offence or liability to pay an emission fee, tax or an administrative penalty, unless there is clear statutory authority to do so.[55]

- **Absolute Liability Offences.** Specific statutory authority may be required to pass regulations which create absolute liability offences.

- **Sub-Delegation of Regulation-Making Power.** When Parliament delegates a regulation making power to a regulator, the regulator will not be allowed to delegate standard setting powers to a third party without the specific statutory authority to do so.[56] For instance, if the Lieutenant Governor in Council wants to incorporate a specific monitoring standard into regulations, including future amendments to that standard, it must have specific authority.

- **Transformation of Regulation Making Powers.** Courts will generally presume that where the legislature delegates a power to make regulations, the delegate must exercise that power through regulation making rather than *ad hoc* administrative decisions. For instance, if an agency were given the power

[54] See *Re Kendrick and Ontario* (Milk Control Board), [1935] O.R. 308 (C.A.).

[55] See Elmer Driedger, *Construction of Statutes*, 2d ed. (Toronto: Butterworths, 1983) at 318 and Keyes, above at footnote 52 at 166.

[56] The more the authority delegated involves discretion, the more likely it cannot be delegated without statutory authority: see *Steve Dart Co*. (1974), 46 D.L.R. (3d) 745 (F.C.T.D.); *Dene Nation* v. *The Queen*, [1984] 2 F.C. 942 (T.D.), and Keyes, above at footnote 52.

to pass regulations establishing energy efficiency standards, the agency could not pass regulations which allowed it to set standards on a case by case basis through permits.[57]

- **Defining Appeal Procedures.** Unless statutes state otherwise, courts will assume that any administrative powers given to government officials are to be exercised according to the “rules of procedural fairness and natural justice.” The exact content of these rules will depend on the situation, ranging from a right to be notified of a decision and discuss it to more extensive rights such as the right to cross examination. Usually where significant administrative powers such as allocation of emission allowances or permitting of emissions are delegated to officials, legislation defines an appeal process. This helps to establish the otherwise vague standards of procedural fairness.

Policy Issues

Even where the rules of statutory interpretation allow government to implement a program based on cursory regulation making powers, there are a number of policy reasons for establishing a program in statute. These include:

- **Democratic Process and Accountability.** New regulatory programs that represent major changes in the way an environmental problem is handled or affect large segments of the economy are usually based on relatively detailed legislation, not cursory regulation making powers. This allows for fuller parliamentary debate. Detailed legislation is also often less open to political attacks based on unfounded fears.

- **Commitment.** Enshrining a principle or policy in statute rather than leaving it to regulation or administrative action shows a government’s commitment to that principle or policy. For instance, the *Canadian Environmental Protection Act* included a requirement for a parliamentary review of *CEPA* five years after its passage into force. Emissions trading legislation might make a similar commitment to review.

- **Focusing Stakeholder Discussions.** Legislation can focus discussions among stakeholders, by resolving key issues that would otherwise block progress.

- **Certainty.** Establishing a program, or the basic elements of a program, in legislation rather than regulation will provide greater security that the program or elements of it will not be changed. For instance, legislation establishing a

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57 See *Brant Dairy Company* v. *Milk Commission of Ontario*, [1973] S.C.R. 720 for an analogous situation of allotment of marketing board quotas for milk.

tradeable allowance program would give parties contemplating investments in emission reductions greater confidence.

- **Control.** Legislatures or Parliament may want to enact detailed legislation in order to exercise control over the bodies empowered to pass regulations. This is especially true where a body independent of government is given regulation making authority. For instance, if the federal parliament established an independent climate fund to invest in greenhouse gas emission reduction opportunities, detailed legislation would be necessary to guide the agency.

- **Political Mileage.** New legislation may be chosen as it provides politicians with an "announceable" for which they receive political credit.

The Adequacy of Existing Legislation

Given the policy and legal reasons that determine when issues should be dealt with by statute, how can existing Canadian and British Columbian legislation be used to reduce greenhouse gas emissions? This section reviews how existing legislation could be used to pursue greenhouse gas emission reduction goals.

Federal Statutes

Canadian Environmental Protection Act

Canada's premier environmental protection legislation for air pollution is the *Canadian Environmental Protection Act* (*CEPA*) passed in 1988. In December 1996, the government introduced a bill into Parliament that, if it had passed, would have repealed *CEPA* and replaced it with the *Canadian Environmental Protection Act, 1997* (*CEPA, 1997*). *CEPA, 1997* was not passed when Parliament dissolved for the 1997 election, but may be re-introduced into Parliament.

Both *CEPA* and *CEPA, 1997* contain International Air Pollution divisions. Although both laws are apparently intended to give the Governor in Council wide regulation making authority to deal with international atmospheric problems in the event provinces do not reduce emissions, there are some problematic ambiguities:

- It is possible to make a technical argument that *CEPA, 1997* and to a lesser extent *CEPA* do not apply to greenhouse gases.[58]

58 *CEPA, 1997, s*ection 166 lays out the conditions that must be met before government regulates under Division VI. The Ministers of Environment and Health must "have reason

- If some provinces take sufficient action to reduce greenhouse gases, but others do not, it is not clear whether or not the federal government can regulate provincial sources (which account for the vast majority of greenhouse gases) in the provinces that have taken sufficient action.[59] Thus it is not clear whether the federal government could intervene to establish a national program.

- It is not clear how much time the federal government must give provinces to reduce their greenhouse gas emissions before facing federal regulation. The uncertainty could delay federal action.

Thus, the international air pollution provisions in both *CEPA* and *CEPA, 1997* provide a shaky basis for federal regulation of greenhouse gas emissions. While application of both acts to greenhouse gases would likely be upheld in court, the slight uncertainty could create some difficulty, especially in relation to trading programs, where the American experience shows the need for a clear statutory basis.[60]

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to believe that a substance released from a source in Canada creates (a) air pollution in a country other than Canada; or (b) air pollution that violates, or is likely to violate, an international agreement binding on Canada." "Air pollution" is defined as the condition of the air caused by the release of substances into it, not the substances *per se*. Because of this, it is possible to argue that Canada did not create the condition of the air but only contributed to it. Although Canadians are among the world's biggest greenhouse gas emitters on a *per capita* basis, we only contribute two percent to global emissions. This argument is buttressed by the changes in the wording from the earlier Act. In particular, s. 61 of *CEPA* refers to air contaminants released from Canadian sources resulting in violation of an international agreement, and refers to air contaminants, "either alone or in combination with other air contaminants" creating air pollution. However, since, most international air pollution is caused by sources in more than one country, interpreting "creation of air pollution" as not including "contribution to a global air pollution problem" would be overly narrow, and contrary to the general rule that legislation be interpreted liberally. A less significant ambiguity exists for both *CEPA* and *CEPA, 1997*. The international air pollution divisions in both Acts apply only to substances which cause air pollution. Air pollution is defined broadly, as "a condition of the air" which causes various problems. Nothing in the definitions makes it absolutely clear that atmospheric pollution is covered, and because air pollution is often used in a way which refers to local and regional air pollution only, one can argue that neither Act applies to greenhouse gases.

59 The term "provincial sources" is used here to mean sources (provincial or federal) which are not "federal sources" under *CEPA, 1997* or "federal works and undertakings" in the case of *CEPA*. *CEPA, 1997* defines federal sources as the federal government, federal crown agencies and federal crown corporations and federal works undertakings (e.g. inter-provincial railways, airlines etc.). Section 166(2)(3) and 167 of *CEPA, 1997* and s. 61 of *CEPA* state that before regulating provincial sources the Minister of Environment must consult with provincial governments. If the provincial governments can prevent or control the pollution under their laws, and are willing to do so, the Minister does not have the authority to act.

60 James T.B. Tripp and Daniel J. Dudek, "Institutional Guidelines for Designing Successful Transferable Rights Programs" (1989) 6 *Yale Journal on Regulation* 369.

Nor do the *CEPA* and *CEPA, 1997* divisions for the regulation of "toxic substances" give an ideal basis for regulation of greenhouse gases. Toxic substances under *CEPA* and *CEPA, 1997* are defined broadly to include substances entering the environment in quantities that have or may have a long-term harmful effect on the environment. Based on a strict interpretation either Act would likely support the regulation of greenhouse gases; however, the Supreme Court of Canada decision suggests a narrower interpretation of *CEPA*, implying such an interpretation may be necessary for it to be constitutional.[61] Thus, relying on either act's toxic provisions may invite a constitutional challenge even if there is a clear constitutional power to regulate greenhouse gases.

Neither CEPA nor CEPA, 1997 provide a strong basis for regulating greenhouse gases through use of emission trading.

If the federal government attempted to regulate on the basis of the international air pollution provisions of either *CEPA* or *CEPA, 1997*, the specific regulation making powers are sometimes deficient.

- The general regulation making powers (powers other than those related to trading) associated with the international air pollution provisions of *CEPA* and *CEPA, 1997* are limited to prescribing the minimum average or maximum quantity or concentration of substances.[62] This very narrow regulation-making power provides little basis for most of the sorts of regulations that have been suggested for reducing greenhouse gas emissions. It may not, for instance, be an adequate basis for requiring mandatory landfill gas recovery, quotas for the carbon content in imported electricity, minimum ethanol requirements for gasoline or requirements for fugitive methane controls.

- There is no express power to implement any form of trading program under either the international air pollution or the toxic substances divisions of *CEPA*. Although existing regulatory provisions have formed the statutory basis for trading programs for ozone depleting substances, they are an insufficient basis for developing a more extensive program of emission trading. Again, American experience indicates the need for certain legislative authority.

- Both the international air pollution divisions of *CEPA, 1997* provide the legislative basis for the central elements of credit trading, cap and allowance trading and cap and carbon coupon trading programs. It does not provide a clear basis for imposing requirements related to the implementation of offsite

61 Even though there are ample grounds for concluding that the federal government has the power to regulate greenhouse gases, an interpretation of *CEPA*, Part II that supported a regulation aimed at greenhouse gases would have to be so broad that *CEPA*, Part II would be unconstitutional even if the regulation was, by itself, constitutional: See *R. v. Hydro Quebec*, above at footnote 14. All naturally occurring substances, including carbon dioxide, are deemed to be on the Domestic Substances List: *Supplement to the Canada Gazette*, January 26, 1991, iv.

62 Section 87 of *CEPA*, and s. 330 of *CEPA, 1997*.

emission reduction projects through permits (required for the enforcement of an emission reduction credit trading program).

- *CEPA, 1997* does not provide a clear power to auction allowances.[63]

- Neither Act provides inspection powers necessary to inspect the implementation of off-site emission reduction projects or records of credit generators.

- Neither *CEPA*, nor *CEPA, 1997*, provide the legislative basis for establishing a system of administrative penalties, a system which is essential to the smooth running of any allowance or emission reduction credit trading program.

- Under both *CEPA*, and *CEPA, 1997* there is a risk that a court would find that regulations could not define allowances as revocable licences.[64]

- There is no clear power to impose auditing requirements or licence environmental compliance auditors, essential or at least likely elements of an open market trading program.

- *CEPA, 1997*, only allows a stand-alone trading program, not allowing a trading program which is integrated with provincial programs or programs of other jurisdictions.

- Neither *CEPA* nor *CEPA, 1997* provide any basis on which the federal government could establish criteria to be met by provincial action plans for

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63 Section 326 of *CEPA, 1997* only refers to making regulations providing for "the conditions related to distribution of a tradeable unit". Courts require relatively clear statutory powers to impose liabilities and charge fees. They are likely to require similar clear statutory authority in relation to selling a right that was previously free. Section 328(1) allows the Minister to make regulations prescribing fees or the manner of determining fees for services, use of facilities, rights, privileges, processes or approvals. The amounts chargeable for services, use of facilities, processes and approvals are all limited to cost recovery. The amounts chargeable for rights and privileges are not limited. Because section 328 involves regulations by the Minister, rather than Governor in Council, and because it generally empowers cost recovery fees rather than auctions, it is likely to be narrowly interpreted. The failure to make references to auctions for rights or tradeable units likely means the Minister does not have the power to unilaterally establish auctions. Finally, because the fees are likely to be major revenue raisers they may be treated as taxes which can only be imposed by Parliament directly.

64 The author is of the opinion that any form of property created by regulation is inherently a revocable licence which can be canceled through amendments to the regulation. This opinion is backed up by several leading Ontario and British Columbia court cases, but conflicts with one New Brunswick case: see Chris Rolfe and Linda Nowlan, *Economic Instruments and the Environment: Selected Legal Issues* (Vancouver: West Coast Environmental Law Research Foundation, 1993) at 109 to 111. Moreover, litigation in the US has challenged the ability to revoke banked allowances.

greenhouse gas emission reduction, or under which the federal government could intervene on issues that affect greenhouse gas emissions indirectly.

Although it would be possible to make a series of minor amendments to *CEPA* and *CEPA*, *1997* to correct the above problems, it is recommended that any major federal initiatives on greenhouse gases, especially any initiative involving emission limits and potential trading of allowances, coupons or emission reduction credits, should be based on legislation specifically designed for such a program. Basing such a program on specific legislation would allow for increased public and Parliamentary debate, and could specify the basic framework of a program, helping to focus debate over the details that would be included in regulation.

Energy Efficiency Act *and* Motor Vehicle Fuel Consumption Standards Act

The federal government regulates energy efficiency of energy using products through the *Energy Efficiency Act*,[65] and has also passed but not proclaimed the *Motor Vehicle Fuel Consumption Standards Act (MVFCSA).*[66] Both Acts are based on the federal power to regulate trade and commerce and only apply to standards of products crossing provincial or international boundaries.

The imposition of energy efficiency legislation through regulation of goods crossing provincial borders causes several problems. First of all, average efficiency standards such as CAFE and CAFC are normally based on numbers of vehicles sold in a jurisdiction, rather than vehicles crossing provincial boundaries. The *MVFCSA* tries to solve this problem by requiring all vehicles that cross provincial boundaries to carry a national fuel consumption mark. The CAFC standard is based on the average fuel efficiency of vehicles carrying the national fuel consumption mark. Unfortunately, there is a slight chance that this provision, which indirectly regulates fuel efficiency and labelling of vehicles manufactured and sold within a province, could be ruled unconstitutional.[67]

Only applying energy efficiency standards to goods entering the country or crossing provincial boundaries could also lead to potential challenges to these

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[65] R.S.C., c. E-6.4.

[66] R.S.C., c. M-9.

[67] Similar provisions, which required foods to carry the federal agricultural product grade name to meet federal standards, were ruled unconstitutional in *Dominion Stores* v. *The Queen*, above, at footnote 37. *Dominion Stores* was decided by a narrow majority and has been criticized by Canada's leading Constitutional scholar, Peter Hogg: Hogg, above at footnote 7, at 20-9.

measures on the basis that they are contrary to international trade law.[68] Although such challenges are unlikely to succeed, they could be avoided through basing energy efficiency standards on the national concerns test.[69]

Given the strong support in the *Hydro Quebec* case for national standards for energy efficiency, the federal government should feel comfortable in establishing national energy and fuel efficiency standards that apply to all goods manufactured, or sold in Canada regardless of whether or not they cross provincial boundaries. This would also avoid the need to duplicate regulatory development in all provinces.

Canadian Environmental Assessment Act

The *Canadian Environmental Assessment Act*,[70] is not designed to allow the consistent application of on-site greenhouse gas emission reduction requirements or requirements for off-site emission reduction projects. First, it generally only applies to projects requiring transfer of federal lands, federal undertakings, and federally funded or regulated projects.[71] It also allows the Minister of Environment and Secretary of State for External Affairs to require assessments of projects which in their opinion would lead to significant environmental effects outside of Canada.[72] This limited scope of powers would not provide for consistent application of greenhouse gas emission requirements although it could be used where a project will have a major impact on Canada's emissions.[73] Second, the federal government may have difficulty enforcing the implementation of emission reduction projects or other mitigation measures under federal

68 Imposing national standards through inter-provincial trade in products which do not meet a standard, has been challenged as a protectionist measure contrary to international trade law. The only manufacturer of the fuel additive banned by the *Manganese Based Fuel Additive Act* has claimed that the legislation is trade illegal: see Barrie McKenna, "Trade row looms over MMT" Globe and Mail, Tuesday, September 10, 1996, p. B-1.

69 The argument that standards only applying to international or inter-provincial trade is trade illegal ignores Canadian constitutional realities and ignores the practical impact of such standards in effectively imposing national standards rather than protecting domestic production. See letter to Lloyd Axworthy from Chris Rolfe, June 3, 1996, available at West Coast Environmental Law Association's website: http://vcn.bc.ca/wcel.

70 S.C. 1992, c. 37.

71 Section 5.

72 Section 47.

73 For instance, the New Zealand government used their environmental assessment legislation in an *ad hoc* manner to require the offsetting of emissions from a project which had the potential to add substantially to New Zealand's global emissions.

environmental assessment.[74] Third, the responsibility for ensuring compliance with terms would be scattered among a number of federal departments.[75]

British Columbia Legislation

Waste Management Act

The *Waste Management Act*, the centerpiece of BC's antipollution laws, provides limited authority to regulate greenhouse gases. Waste is defined as including "a substance that is emitted into the air and that is capable of damaging… air, land, water or other external conditions under which man, animals and plants live." Although historically waste management officials have not considered greenhouse gases as a waste, the definition in the *Waste Management Act*, appears sufficiently broad to include them. However, like federal legislation, the application of the *Waste Management Act* could be made clearer.[76]

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74 Sections 20(2) and 37(2) make the federal authorities responsible for ensuring the implementation of mitigation measures, but do not specifically give the authorities a power to ensure such implementation. It is usually assumed that the federal government powers to impose mitigation measures include powers associated with the regulatory approval which triggers an environmental assessment. (For instance, if an application for a permit under a particular act triggers an assessment, the federal government can impose conditions in that permit that are provided for under the particular act). In *Curragh Resources Inc. v. Canada (Minister of Justice)* (1993), 11 C.E.L.R.(N.S.) 173 (Fed. C.A.) the Federal Court of Appeal found that a federal government power to impose conditions (payment of security) was implied by environmental assessment legislation. However, *Curragh* was decided in the context of the territories (where different constitutional factors come into play), and was decided under the *Environmental Assessment Review Process Guidelines Order* (the predecessor to CEAA). *Curragh* also involved a condition which could be fulfilled prior to giving an approval. (If the federal government did not receive the required security payment, it could withhold approval.) Enforcement of offsets may be difficult in other situations (unless the government imposes requirements for bonds to pay for offsets in the event of default).

75 Depending on who is the responsible authority under the Act: s. 37(2).

76 It has been argued that the *Waste Management Act* does not cover greenhouse gases because the damage and injuries caused by greenhouse gases are indirect as compared to other pollutants. However, many pollutants which only indirectly cause environmental damage are regulated. For instance, volatile organics are regulated because of their tendency to react with other substances and form ground level ozone. Secondly, it is sometimes argued that interpreting waste as including greenhouse gases leads to the absurd result that all breathing humans require waste management permits. However, this absurd result is not unique to greenhouse gases. Read literally the *Waste Management Act* requires all painters and offices with photocopiers to hold permits because they are emitting volatile organics. This simply does not happen because common sense is used in application of the *Waste Management Act*. It is only applied to significant sources.

The *Waste Management Act* is already used to regulate greenhouse gas emissions such as landfill methane, and could be used to set emission/fuel efficiency standards for new vehicles,[77] set energy efficiency standards for large facilities that rely on fossil fuels for energy, and charge large facilities a greenhouse gas emission charge dedicated to administration and projects to offset greenhouse gas emissions from industrial sources. On the other hand the *Waste Management Act* has a number of weaknesses:

- It does not permit atmospheric user fees on emissions that exceed permitted amounts.
- It contains no specific powers to pass regulations which establish trading programs, and, given the very specific regulation making powers used elsewhere in the Act, courts are unlikely to imply the power to establish trading programs.[78]
- The inspection powers would not allow inspection of off-site emission reduction projects or records of credit generators.
- The permitting powers do not include powers necessary to impose ad hoc off-site emission reduction requirements on either the parties required to offset their requirements or credit generators.
- It does not provide the legislative basis for establishing a system of administrative penalties.
- It does not include a power to mandate energy audits (although the Province can encourage facilities to audit energy use as part of the permitting process).
- There is no means of encouraging energy efficiency at facilities that are not direct emitters (i.e. electricity users).
- A court could find that legislation, not regulation, is necessary to define allowances as revocable licences.[79]

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77 Section 24.3 enables government to set average emission standards and could be used to create average emission standards for carbon dioxide (essentially the same as Corporate Average Fuel Efficiency Standards). Similar to the way the BC *Motor Vehicle Emission Reduction Regulation* adopts US emission standards, average greenhouse gas emission standards could adopt the certification process for fuel efficiency used by the American CAFE process.

78 The only trading program established by BC regulation is a very limited program for trading among vehicle manufacturers to meet vehicle emission standards. This appears to be based on the specific reference to establish "schemes requiring vehicle manufacturers to sell a mix of vehicles determined by formula."

79 See above at footnote 64.

- There is no power to make a "rolling reference" to international standards or other jurisdictions' regulations, an ability which could become very important if the Province takes part in a coordinated national or international trading program.[80]

Energy Efficiency Act

The BC *Energy Efficiency Act*[81] could be used to impose minimum energy efficiency performance standards and energy efficiency technology standards for products manufactured or sold in British Columbia. The *Energy Efficiency Act* does not permit average energy efficiency performance standards. Enforcement of the *Energy Efficiency Act* could be enhanced through the use of administrative penalties, but this would require amendments.

The Municipal Act

Under the *Municipal Act*,[82] the Minister of Municipal Affairs can adopt energy efficiency standards under the Building Code of BC[83] and municipal councils can adopt more stringent standards.[84] Several changes would enhance cost effective enforcement of energy code provisions. For instance municipalities could be given a power to require certification by a professional engineer that a building complies with approved plans, or that building plans comply with higher energy efficiency standards imposed by a municipality.[85] Energy planning, currently a voluntary process, could also be made a necessary element of community planning.

Utilities Commission Act

The *Utilities Commission Act*,[86] could be used to impose requirements to offset emissions through off-site projects. Such requirements could be imposed on an

80 A "rolling reference" is a reference to a standard or regulation "as it is amended from time to time" and is often necessary to ensure a program is harmonized with other jurisdictions. Regulations which incorporate other jurisdictions regulations or standards are based on specific provisions of the *Waste Management Act:* see for instance, section 35 of the *Waste Management Act.*

81 S.B.C. 1990, c. 40.

82 R.S.B.C. 1979, c. 290.

83 Section 740.

84 Section 734.

85 Municipalities can only require certification of *plans* by engineers to ensure compliance with *provincial* energy standards: section 734.2.

86 S.B.C. 1980, c. 60.

ad hoc basis by Cabinet for significant new or significantly expanded thermal generating stations. The conditions that can be attached to Orders in Council granting an energy project certificate or energy operation certificate are relatively unlimited.

BC Environmental Assessment Act

The BC *Environmental Assessment Act*[87] allows a project approval certificate to include measures to minimize greenhouse gas emissions. Although, the *Act* does not include a specific power to require project proponents to undertake off-site greenhouse gas emission reduction projects, tribunals in other jurisdictions have ruled that a power to impose mitigation measures includes a power to require carbon dioxide offsets.[88] However, requirements relating to monitoring appear to be limited to monitoring the impacts of the project assessed, not the off-site emission reduction project.[89]

The Social Service Tax Act

The *Social Service Tax Act*[90] could be used to charge environmental levies on the sale of electricity or fossil fuels.[91]

87 S.B.C. 1994, c. 35.

88 The power to require mitigation under the New Zealand *Resource Management Act, 1991* has been interpreted by the New Zealand Minister of Environment and a Board of Inquiry established under the Act to include the power to require mitigation. Although offsets are a form of mitigation that falls outside the sort of mitigation measures typically included in project approvals, its unlikely a judge would find that *Environmental Assessment Act* mitigation powers do not include the power to require offsets.

89 See section 38.

90 R.S.B.C., c. 388.

91 Section 2.4 permits the Lieutenant Governor in Council to set environmental levies for "hazardous products". Hazardous products do not need to be actually hazardous, but can include any product prescribed as a hazardous product. The Lieutenant Governor in Council has used this provision to charge environmental levies on products no more hazardous than tires. The *Social Service Tax Act* exemption for fossil fuels in section 4 does not apply to environmental levies.

Designing Legal Tools for Achieving Reductions in Greenhouse Gas Emissions.

Given the needs for legislation which is constitutionally valid, regulations which are firmly based in statute, clear policy directions and democratic discourse, how can we begin to develop the legal tools that would implement emissions trading and other aspects of a national program to reduce greenhouse gas emissions? The key design issues are:

- dividing the responsibilities for reducing greenhouse gas emissions between the provinces and the federal government;

- ensuring that a proper statutory basis exists for the different elements of an emission reduction strategy.

Design Issue 36: Dividing Responsibilities Between the Provinces and Federal Government.

Issue:

Which level of government should be responsible for implementing different elements of a greenhouse gas emission reduction strategy?

Discussion:

Which level of government should be responsible for implementing particular aspects of a greenhouse gas emission reduction strategies depends on the constitutional abilities of federal and provincial governments, the efficiency and effectiveness of national or provincial programs and the political ramifications of a particular level of government regulating in a particular field. Essentially there are two main options for how a program could be structured. A national program could either place the greatest responsibility for reducing greenhouse gases on the provinces, or the federal government could assume the greatest responsibility.

Provincially Dominated Program

In a provincially dominated program, the federal government could keep to its limited areas of traditional jurisdiction, assisting provinces with development of their own standards, adjusting taxes and establishing efficiency standards for goods in inter-provincial trade, and establishing funding programs for emission reduction initiatives. The provinces could take primary responsibility for emission reductions.

If emissions trading is part of an emission reduction strategy, a provincially dominated trading program should rely on parallel, interlocking legislation. Provincial legislation could establish emission limits for provincially regulated sources; federal legislation could establish limits for federally regulated sources such as federal undertakings. Both federal and provincial legislation could establish the concept of emission reduction credit trading in legislation. Provincial legislation might then delegate to the federal government the power to pass regulations which define the criteria for credits used in inter-provincial trade, and the power to determine if credits that have been used meet these criteria. Federal legislation could regulate the standards that must be met by emission reduction credits traded across provincial borders.

Politically, a provincially dominated program has the advantage that it avoids an extension of federal regulation into new areas. Given the resistance of provinces like Quebec, Alberta and British Columbia to extensions of federal control, this may avoid discontent among some provincial politicians. On the other hand, when the time comes for actual implementation, even these provinces may be loathe to taking primary responsibility for reducing greenhouse gas emissions within their boundaries.

Negotiating separate provincial emission caps may place strains on national unity as each province has different perceived challenges to reducing emissions.

While there is potential for a provincially dominated program made up of interlocking provincial and federal programs, establishing such programs adds a significant layer of complexity and leads to duplication of bureaucracies in different provinces. Negotiating separate provincial emission caps or negotiating a formula that determines provincial emission caps may place strains on national unity as each province has different perceived challenges posed by population growth, current levels of carbon intensity or reliance on renewable energy. Moreover, even if a national program of interlocked provincial emission trading programs can be initially negotiated, changes to the program necessary to meet national commitments may prove impossible to negotiate.

Finally, because matters of national concern exclude provincial jurisdiction, a greenhouse gas trading program relying on provincial legislation is more susceptible to legal challenges than purely federal programs. The federal government has stronger constitutional authority to establish a greenhouse gas emission trading program.

Federally Dominated Program

In a federally dominated program, the federal government could establish broad based measures such as emission trading mechanisms and national climate funds, set efficiency standards for a wide range of products, and adjust taxes. The provinces could supplement federal actions and take action in areas such as reforming forest practices, transportation, land use planning etc.

Ideally, provinces and federal government could negotiate the actions that would be taken by the provinces to reduce greenhouse gases. This could either take the form of emission reduction targets that different provinces would meet through their own emission reduction plans or it could be in the form of policy measures that all provinces would agree to implement. These provincial responsibilities would, however, be more limited than responsibilities under a provincially dominated program. The federal government would, for instance, be primarily responsible for implementing any emissions trading programs or developing standards for consumer products and industrial processes.

As discussed above, the federal government may be able to use its peace, order and good government power to require provinces to develop implementation programs, and, if provinces fail to develop and implement programs that have a reasonable likelihood of success, the federal government may have powers to develop regulations in areas of traditional provincial jurisdiction. Unfortunately, the existence of such far reaching federal powers is uncertain.

Uncertainty could stymie development of a coherent, effective national greenhouse gas emission reduction program. To help dispel the uncertainty, the federal government should ask the Supreme Court of Canada for advise on the constitutionality of different strategies for reducing greenhouse gas emissions. Although considerable work would be necessary to define the questions being put to the Court, the federal government has the power to submit such "reference questions" to the Supreme Court.[92]

Conclusions:

The federal government should assert primary responsibility for reducing greenhouse gases. If an emissions trading program is part of a national program, it should be established by the federal government, after consultation with stakeholders including the provinces. The federal government can also take a more proactive approach in setting national standards for energy efficiency and emission performance, setting standards that are binding whether or not the regulated product crosses provincial boundaries. Other aspects of a federal action

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[92] *Supreme Court Act*, R.S.C. 1985, c. S-26, s. 53.

should include spending programs such as climate action fund aimed at realizing no regrets emission reductions, reform of federal taxes and application of federal environmental assessment to all projects that have major greenhouse gas implications.

While the above measures will all be important in reducing greenhouse gas emissions, additional actions will be necessary in areas traditionally regulated by the provinces. Ideally the federal government and provinces should negotiate actions to be implemented by the provinces. However, if one or more provinces are unwilling to cooperate in taking their share emission reduction measures, the federal government should consider passing legislation requiring provinces to develop implementation plans, and, if such plans are not developed and implemented, allowing the federal government to take steps in areas of provincial jurisdiction that directly affect greenhouse gas emissions. Prior to passing any such legislation the government should submit it to the Supreme Court of Canada for a reference regarding its validity.

Design Issue 37: Ensuring a Proper Statutory Basis

Issue:

What statutes need to be in place to support elements of a greenhouse gas emission reduction strategy?

Discussion:

As discussed above, there are a number of legal and policy reasons that determine what legislation will be necessary to reduce greenhouse gases. Current legislation allows for many actions to reduce greenhouse gases, but does not provide a statutory basis for major emission trading regimes.

New Legislation for Emission Trading

Although there is only limited room on the parliamentary agenda for major pieces of legislation, new, legislation specifically relating to greenhouse gases is likely necessary for any major greenhouse gas emission trading program. Such legislation could either be in the form of a new statute or a new part to existing legislation.

Legislation specifically relating to greenhouse gas emissions has the advantage that it can be designed to support the constitutionality of a federal greenhouse gas emission strategy. Legislation which is more broadly aimed — for instance, at international air pollution – must by necessity be worded in a manner that is broad and applicable to numerous circumstances. Because the legislation has to support regulation in a variety of circumstances, the subject matter of the legislation is less separate, distinct and indivisible, and thus less likely to be constitutional under the national concerns test.

Legislation specifically intended for greenhouse gas emission trading is also advisable for many of the legal reasons discussed above. In many cases, the necessary elements of a trading program will need specific legislative support, but the details of needed legislation will not be apparent until basic policy choices are made. For instance, the administrative penalty system appropriate for an allowance trading program will be different from the system appropriate for credit trading (under allowance trading, the administrative penalties may be automatic; while in credit trading, there is a need for expert judgment and there may need to be expert tribunals to estimate the validity of credits). Similarly, if allocations of allowances turn on administrative decisions (as would be necessary in any annual allocation of allowances based on a formula) it may be necessary to restrict the ability to have allocation decisions reviewed by the court.

Finally, there are a number of policy reasons for creating legislation specifically aimed at greenhouse gas emission trading. Because of the national importance of a trading regime it is worthwhile debating its basic framework in parliament. Framework legislation could also set basic principles. For instance, it could specify that any cap on emissions should be no higher than the estimated actual emissions in the year prior to the cap being set. It could direct the use of discount factors for leakage and certainty in a credit trading program. Once basis policy decisions are made it could be used to focus discussions among stakeholders.

Any legislative initiative related to emissions trading should include a commitment to review of emissions trading after several years of experience. As note in Chapter 7, environmentalists have one fundamental concern in relation to trading versus regulation. Trading removes decisions on how and where emissions will be reduced from the public sphere, thus removing the public's ability to influence adoption of measures that have multiple social and environmental benefits. A commitment to review may partially alleviate this concern as it creates a new venue for public involvement in decision making. This was a factor in the decision to include a commitment to public review after two years of experience in RECLAIM's implementing regulations. Similarly, a commitment to review by a parliamentary committee was included in the *Canadian Environmental Protection Act* when it was passed in 1988.

Amendments to Existing Legislation

While new legislation is appropriate for establishing an emissions trading program, in many other cases policies could be implemented without making major amendments or additions to federal and provincial legislation. For instance, statutes such as the federal *Energy Efficiency Act* or the *Motor Vehicle Fuel Consumption Standards Act* could be easily amended by making them apply to all goods offered for sale in Canada or imported into Canada. A statute such as the *Canadian Environmental Assessment Act* could be amended to allow regulations specifying that projects will be assessed if their impacts on greenhouse gas emissions exceed a defined threshold.

Conclusion:

Although various steps to reduce greenhouse gas emissions through regulatory measures can be taken under existing federal and provincial legislation, legislative changes are necessary. In particular, new legislation, either in the form of a new statute or a new part to existing legislation, and specifically aimed at greenhouse gases, is advisable for any major greenhouse gas emissions trading program. Legislation will likely be necessary to give regulation makers sufficient legislative authority for all aspects of a trading program. Any legislative initiative related to emissions trading should be used to enshrine basic principles necessary for environmental effectiveness of a program and should include a commitment to review of emissions trading after several years of experience. For many other measures, amendments ranging from minor to major are necessary.

Summary

How a greenhouse gas emission strategy is put into effect will depend on the constitutional powers of the governments implementing the strategy. In determining the constitutionality of environmental laws, courts have endeavored to ensure that governments' ability to effectively deal with environmental problems not be constrained, while at the same time working to maintain a balanced Confederation. These competing judicial policies are particularly important in relation to greenhouse gases due to the ubiquitous sources of greenhouse gases and the international nature of the problem.

Courts have tried to resolve the tension between effective environmental law and a balanced Confederation through several strategies. They have interpreted the federal criminal law power in such a way that the federal government can establish national standards and provincial governments can establish higher levels of protection. They have also recognized a federal power to regulate emissions that have impacts in other provinces or nations, but have tried to devise means to limit the intrusion on provincial jurisdiction this could imply.

Although there is uncertainty in how courts would apply the Constitution in relation to laws aimed at reducing greenhouse gases, the federal government appears to have authority to unilaterally implement major economic instruments for greenhouse gases. Provincial authority to implement major economic instruments is less certain, especially if the federal statutes occupy the field of greenhouse gas emission regulation. Federal jurisdiction in this area may be advantageous as implementation of a national program by the provinces could prove both difficult and inefficient. Nonetheless, the provinces have a clear power to reduce greenhouse gases through an number of initiatives, including establishment of some economic instruments. For instance, provinces can impose direct carbon taxes, possibly directing the revenue to funding projects that reduce greenhouse gases and are worth pursuing for other reasons.

Both the federal and provincial governments have authority to establish energy efficiency standards and emission standards for greenhouse gases. Federal authority is not limited to establishment of standards for goods crossing national and provincial borders. Provincial standards can exceed federal standards.

One of the most difficult issues to predict is how the courts will respond to federal legislation that deals with topics that are closely linked to areas of provincial jurisdiction but directly impact greenhouse gases, e.g. sequestration of carbon in forests on provincial land, utilities, land use planning and community energy planning. Although these aspects of a greenhouse gas emission reduction strategy are probably best implemented by the provincial governments because they are traditionally within the provincial realm, they may also be essential components of an effective national emission reduction strategy. Failure of a province to cooperate could have adverse affects outside the province. Because of this, the federal government may have some authority over these subject matters if federal intervention is necessary. Federal action in this areas would, however, need to be designed to avoid unnecessary intrusion in areas of provincial jurisdiction.

Legal instruments to reduce greenhouse gases require both a constitutional basis and a statutory basis. Although many existing laws such as the federal *Canadian Environmental Assessment Act, Canadian Environmental Protection Act* and the provincial *Waste Management Act, Utility Act* or *Environmental Assessment Act* could be used to support some greenhouse emission reduction requirements, none of them is well suited to implementation of emissions trading. In many cases, once new initiatives to reduce greenhouse gas emissions are designed, new legislation will be necessary to support the initiative.

Chapter 15:

Conclusions

Where is the Wisdom we have lost in Knowledge? Where is the knowledge we have lost in information?

— T.S. Eliot

Climate change represents an unprecedented challenge to humanity. Our intelligence as a species, our ability to harness the energy of fossil fuels, created the problem. It will require wisdom to solve the problem.

The challenge

The characteristics of climate change create a unique challenge for human political and economic institutions. There is a likelihood of devastating ecological change and human misery if major emission reductions do not occur. Uncertainty is inherent in complex atmospheric processes, and this uncertainty includes the possibility of catastrophic outcomes. There is uncertainty regarding the economic and social impacts of reducing emissions. Climate change's causes are ubiquitous, and there is a historic link between fossil fuel combustion and economic activity. There is a need for huge emission reductions to simply mitigate the impact of climate change, and there is a delay between when emissions occur and when their full ecological impact will be felt. There is a need for global emission reductions, but there is a gross inequity and impracticality of requiring less developed countries to reduce their emissions.

All of these factors make the choice of appropriate strategies difficult. Yet several truthes stand out. Despite the difficulty in ascribing cause and effect in a system as complex as the atmosphere, the balance of evidence shows that humans are changing the climate. As we continue to release greenhouse gases, we are engaging in an uncontrolled experiment with the climate — one of the greatest forces of nature — which could have devastating and unforeseeable consequences. The more we emit today, the faster the rate of climate change will be in the near term. The more we emit today, the less opportunity future generations will have to choose greater levels of protection. The more we delay making these reductions, the deeper and more precipitous future reductions will need to be to achieve a given concentration.

And last, despite a large body of evidence showing that we can reduce emissions at no cost to society, we — Canada, the United States and most other developed nations — have so far done little to reverse or even slow our rapidly increasing emissions of greenhouse gases. Cities built for cars rather than humans, local air pollution, a distorted tax system, wasted energy, wasted money, oil spills: all of these are part of the problem. Changing these patterns is worth doing for reasons unrelated to climate change. Yet, little is being done.

The challenge posed by climate change will not be addressed in a single step. The most aggressive emission reduction schedules being proposed within the international community are, by themselves, expected to do little more than slightly mitigate the rate of temperature increase over the next few decades.

The chances of the nations of the world subscribing to necessary emission reductions will be increased by demonstrations of the desirability of, or at least the low costs of, emission reductions. We live in a political climate where politicians' fear of short term job losses and public reaction to interference with lifestyles will weigh heavily against damages that are felt mainly in the longer term. The more the policies adopted in the next decade show that reducing emissions can be inexpensive or worth doing for other reasons, the greater the chances that future governments will agree to emission levels that can curb climate change more significantly than current proposals.

What strategies will demonstrate the ability to reduce greenhouse gas emissions in a way that is acceptable, even attractive, for society?

Narrowly Focused Measures

Clearly, part of any strategy must be aimed at ensuring the adoption of no-regret measures, that is, measures that slow climate change but are also worth doing for other reasons. Experience and sound economic analyses show that government intervention can not only succeed in reducing emissions but can also save consumers money, make cities more livable, and make businesses more competitive.

These policy options include regulations that are good for individual regulated businesses, because such regulations push those businesses closer to their market potential. There are many examples where well crafted regulations have created pressures that motivate innovation, overcome organizational inertia and improve long term competitiveness. In many cases the regulations that have been most successful in spurring innovation have been fiercely opposed by the companies affected by them.

One approach to reducing greenhouse gas emissions is to rely on a broad array of instruments that can be used to achieve specific changes in behavior or cure specific market failures. Government can implement a wide array of regulations, educational initiatives, and narrowly focused instruments such as rebates on energy efficient appliances and road tolls. Instruments can be chosen because they achieve multiple goals and are thus expected to be best from a societal perspective.

For instance, strategies in the passenger transportation sector could be developed not only to reduce greenhouse gas emissions, but to facilitate commerce, reduce vehicle accidents and increase community livability. Individual instruments used might include road tolls dedicated to improving transit and maintaining roads, stricter speed limits, smart growth legislation to encourage transit-friendly development patterns, programs to assist ride sharing, fuel efficiency standards for cars, restrictions on parking, minimum renewable content requirements for gasoline and increased investment in transit infrastructure.

While there is a large potential for narrowly focused measures, given the magnitude of greenhouse gas emission reductions that are necessary, these measures may not achieve sufficient reductions.

It must be recognized that even if measures are the lowest cost measures from a societal perspective, they may not always be the lowest cost measure for a particular firm. There are numerous market failures which will inhibit companies from investing in measures that are best for society as a whole. Polluters do not pay the cost of hospitalizing asthmatics suffering from air pollution caused by dirty production processes. Poor households do not have the money necessary to invest in energy efficiency. Home builders do not pay house heating bills and home buyers or renters seldom have perfect information on the value of investments in the energy efficiency. Thus, pursuit of no-regrets measures is not effortless on the part of government, and solely relying on market instruments will not always yield the most cost effective emission reductions.

The distinction between minimizing costs of compliance to an individual firm and minimizing Canada's cost of complying with the *Kyoto Protocol* can be illustrated with an example from the transportation sector. Assume that investments in transit and trip reduction services have the highest benefits per investment of any greenhouse gas emission reduction measure because of the social and other environmental benefits of decreased automobile dependence. Nonetheless, an emitter looking for the lowest cost source of credits to comply with a regulation may not invest in these measures because the emitter does not benefit from the social and environmental spin-offs that make these measures attractive. Similarly, even if a shift from cars to transit has the highest net benefits of any emission reduction measure, a carbon tax alone may not shift individuals from their cars to buses because the carbon tax only reflects one element of the externalized costs of the motor vehicle.

The full potential of narrowly targeted instruments has not been realized. For instance, energy efficiency standards have not been made as stringent as would be best from consumers' perspective, let alone a broader societal perspective. While efficiency standards could reflect the environmental costs of energy they have not done so. Vehicle fuel efficiency standards have not been improved for over a decade, despite analyses showing that doing so would be highly cost effective. Adoption of the National Energy Code by provinces is foundering even though it will save consumers money. Where efficiency standards have been implemented, they have generally only been used to pursue incremental improvements in energy efficiency rather than forcing more significant technological improvements.

There are a number of reasons why prescriptive standards and other narrowly focused instruments have not been used to their full potential. And there are a number of difficulties inherent in relying solely on narrowly focused instruments for reducing climate change. Often the barriers to no-regrets measures are purely political. The costs of a measure like stringent fuel efficiency standards or removal of tax subsidies will be concentrated among a few politically powerful actors while the benefits are spread among many people. Measures like road tolls carry a political risk because they involve a change in how costs are borne by society. In other cases measures are not adopted because of resistance to new pressures on the public purse. For instance, one of the reasons energy codes for buildings have not been adopted is because municipalities do not want to be saddled with the corresponding enforcement costs.

Even if plans to reduce emissions through narrowly targetted measures are cost effective and worthwhile from a societal perspective, they may not lead to the least cost emission reductions.

Often innovative approaches to regulation or public policy can reduce some of these hurdles. For instance, rebates for efficient appliances can smooth the way for tighter efficiency standards. Use of certified auditors can reduce municipal energy code enforcement costs. But these solutions may also face their own hurdles. Demand side management programs that are not operated on a cost-recovery basis (for instance, rebates for energy efficient equipment) are not being implemented either because of fiscal restraint in the public sector or deregulation in energy markets.

A difficulty with relying purely on a range of targeted instruments is simply the difficulty of aggregating enough measures. While there is a large potential for narrowly focused measures, given the magnitude of greenhouse gas emission reductions that are necessary, these measures may not achieve necessary reductions. The sources of greenhouse gas emissions are ubiquitous and an effective strategy needs to deal with a huge range of sources. Although the environmental effectiveness of the Rational Energy Plan was likely underestimated, its wide array of regulatory, voluntary and narrowly based economic measures, as well as a carbon tax, were only able to reduce emissions by 6.5% below 1990 levels.

Even if a program of narrowly based measures is adopted by government, there is no guarantee it will be fully implemented. Despite their potential, many plans to protect the environment through a wide variety of prescriptive standards and narrowly targeted incentives have faltered when difficulties in implementation arise or political support waivers.

Finally, due to the unpredictable nature of technological development and exaggeration of costs by businesses intent on deflecting regulatory requirements, governments have difficulty in determining where least cost emission reductions lie. Even if plans to reduce emissions are cost effective and worthwhile from a societal perspective, they may not necessarily lead to the least cost emission reductions. Studies comparing the cost of emission reductions for local air pollutants under prescriptive standards versus the least cost method show that the former may be anywhere between six and 600 percent higher. Studies showing that well crafted regulations can improve competitiveness have highlighted the need for flexibility in how emitters achieve a given environmental goal.

Even where least cost emission reduction measures can be identified by government, the measures may not be pursued because of governments' concern for an equitable distribution of costs. Some companies with very high marginal costs of emission reduction may escape regulation while others, with low marginal costs pay a disproportionate amount.

Market Instruments

Broad-based market instruments such as carbon taxes and emissions trading have been proposed as means of overcoming at least some of the above limitations. A single market instrument potentially affects a broad range of decisions that prescriptive regulations do not reach. Taxes and trading create incentives to hasten the turnover of carbon intensive capital stock — whether it be cars, appliances, buildings, factories, transportation infrastructure or the form of cities — to less carbon intensive capital stock. They also encourage investments in less carbon intensive capital stock and change how we use capital stock.

Both carbon taxes and emissions trading create an economy wide impetus to innovate in ways that reduce greenhouse gases. While they may fail to force the development of a particular technology, they may lead to innovations that had not been thought of by government regulators. This is particularly important in the context of greenhouse gases, where there is a need for technological innovations across the economy.

Carbon taxes and emissions trading shift the onus of finding most cost effective emission reduction measures from government to the private sector. Strategies to reduce emissions through prescriptive standards encourage businesses to exaggerate the cost of emission reductions so as to reduce the risk of regulations requiring unwanted expenditures. In contrast, once in place, economic instruments encourage businesses to examine their processes for new ways of reducing emissions.

Depending on the extent to which the economy reflects a perfectly competitive market — a market in which there are no market failures, no transaction costs, and in which adherence to rules of the market is absolute — market instruments should reduce emissions at lowest possible costs. While such a perfect market has never existed and never will exist, the market may often be more effective in locating least cost emission reductions.

Depending on their design, market instruments can couple equity with cost effectiveness. The cost of emission reductions can be spread across many sectors even if reductions are concentrated in a few areas where the most cost effective solutions lie.

Because emissions trading and carbon taxes will not cure most of the market failures that block adoption of cost effective solutions, there will be a continuing need for non-market interventions.

Because market instruments will not remove externalized environmental costs, split incentives, and the host of financial, institutional and information barriers to the adoption of cost effective solutions, there will be a continuing need for non-market interventions to cure market place failures. Any intelligent strategy for reducing greenhouse gases will continue to use a number of prescriptive standards, narrowly focused market incentives, and other instruments to that end. Whether or not carbon taxes or trading is adopted, specific measures will be necessary to ensure transit friendly growth patterns. Energy auditing and information programs will be needed to reduce information and institutional barriers to energy efficiency. Energy efficiency standards will be necessary to overcome the split incentives between product manufacturers and users. And programs aimed at reducing local pollutants will be required to internalize environmental costs other than those related to climate change, and to protect the public and the environment.

Whether carbon taxes, carbon coupon trading or emission trading is used, policy makers will need to grapple with similar core issues. Although carbon taxes and emission trading are often seen as being very different in their impacts on competitiveness and on who pays for emission reductions, this is not neccessarily the case. In designing any of these instruments it is essential to consider a number of competing factors:

- the need to avoid subsidies to carbon intensity which will limit cost effective shifts in industry to less carbon intensive sectors;
- the desire to minimize unnecessary dislocation in communities dependent on carbon intensive industry during the transition to a less carbon intensive future; and
- the need to develop regulations, allowance allocations or revenue recycling programs which do not create barriers to efficient and expanding businesses.

Whether it happens through the recycling of revenue from a carbon tax, allocation formulas for emission allowances, or regulatory standards in a credit trading program, broad-based economic instruments can be designed to place the costs of paying taxes or buying credits or allowances on emitters in proportion to their contribution to the problem. Low carbon intensity industries would be rewarded with lower tax levels or the ability to sell credits or allowances, thus encouraging a shift to less carbon intensive industries, products and processes. Alternatively, these market instruments can be designed to reduce impacts on carbon intensive industries and communities, but doing so may reduce incentives to shift to less carbon intensive industries, products and processes, or it may create barriers to new efficient industries.

The first alternative — making the polluter pay — could possibly lead to shifts in production to other jurisdictions and economic adjustments that would not occur under equally effective programs. Ideally this problem would be solved by coordinating a Canadian program with those of major trade competitors, but this may prove impossible. Competitiveness impacts could also be dealt with through border adjustments to highly energy intensive goods. However, doing so may run contrary to Canada's trade obligations, and border adjustments would reduce the overall efficiency of the market instrument. Similarly, exemptions for energy intensive sectors means exempting the sectors where firms are most likely to react efficiently to changed price signals and where emissions are growing most rapidly.

In many of Canada's most energy intensive, export oriented sectors such as aluminum and pulp, most energy comes from renewable sources, and the potential impacts on competitiveness are far less than suggested by energy intensity alone.

In the absence of border adjustments or exemptions for energy intense sectors, there are a number of factors that determine the effects on competitiveness and the potential for unnecessary adjustment costs. In many cases, industries have fixed investments in Canada and cannot easily pull up their stakes and move, but they may do so over the longer term. The potential for unnecessary adjustment costs caused by carbon intensive industry shifting to other locations depends on the portion of energy costs in energy intense industries which are accounted for by fossil fuels. In many of Canada's most energy intensive, export oriented sectors such as aluminum and pulp, most energy comes from renewable sources like biomass and hydro electricity. The potential for unnecessary adjustment costs also depends on the costs of reducing energy use or switching to renewable energy sources, costs that are widely debated. And finally, it depends on what emission reduction programs are adopted by Canada's competitors in energy intense sectors. Unfortunately, there is a dearth of reliable information on these crucial issues.

While impacts on carbon intensive sectors can not be ignored, they need to be weighed against the positive effects of measures that do not allocate free emission rights to carbon intensive industry, but instead help reduce the costs to low carbon industry. For instance, some macroeconomic analyses show that carbon taxes have moderately positive impacts on GDP because revenue is used to reduce distortionary taxes. Canada can shift its product mix towards greater value added, less energy intensive industries. Indeed, the majority of Canadian industrial GDP is from non-energy intensive sectors, and, if revenue from a carbon tax reduces these sectors' tax bills, or if these sectors are allocated allowances which they can sell to carbon intensive industries, these sectors will become more competitive.

Carbon Taxes and Carbon Coupons

Charging taxes on the sources of climate change, especially carbon in fossil fuels, is a promising means of reducing greenhouse gas emissions. Provided there are no exemptions, carbon taxes provide price signals across the economy in favour of emission reductions. Similarly, a cap and carbon coupon trading program creates broad economy wide price signals to reduce emissions. The central difference between these two mechanisms is that one uses the market to set the taxation level. The other uses the government.

The great virtue of both instruments is the ease with which a single instrument encourages a wide range of emission reduction activities. An incentive is created to reduce all carbon dioxide emissions from energy use. This will in turn reduce methane and nitrous oxide emissions associated with fossil fuel production, distribution and use. Despite the wide impacts of a tax or carbon coupons, the administration and transaction costs are likely the lowest of any instruments discussed in this report.

The great virtue of carbon taxes and carbon coupon trading is the ease with which a single instrument encourages a wide range of emission reduction activities.

Carbon taxes and carbon coupon trading are often seen as politically inviable because of the unpopularity of tax increases. While this is a hurdle, it may be overcome by increasing familiarity with the idea of ecological tax reform. Given a choice between paying GST or payroll taxes and polluters paying tax, the general public in the US, Europe and likely Canada tend to prefer the latter. An added advantage to carbon coupon trading is the fact that the market sets the taxation level, making continuing emission reductions less subject to ongoing political will. On the other hand, carbon coupon trading essentially establishes a tax which will be of unknown proportions.

While macroeconomic analyses often assume that carbon taxes are among the most efficient means of reducing greenhouse gas emissions, as discussed above, they clearly need to be accompanied by other programs. Although price signals are a strong tool, in the absence of efforts to cure market failures, they will not lead to the most cost effective or equitable outcome. For this reason, many economists and environmentalists have advocated dedicating a portion of the revenue from carbon taxes to reducing greenhouse gas emissions through direct government interventions. The choice as to how much of a carbon tax should be dedicated to reducing distortionary taxes and how much should be dedicated to projects to reduce emissions depends in large part on an assessment of government's ability to cost effectively cure market failures.

Another potential limit on the cost effectiveness of a carbon tax is the fact that it does not provide incentives to reduce emissions not covered by the tax. For instance, a carbon tax will provide no incentive to reduce greenhouse gases other than carbon dioxide. Although emission taxes might be applied to sources not covered by a carbon tax, in some cases this would be difficult to do effectively. The limited applicability of a carbon tax or emission taxes may limit the overall cost effectiveness of a program.

A major hurdle to carbon taxes and carbon coupon trading is likely to be industry's fear that either instrument will have greater impacts on the competitiveness of Canadian industry than their alternatives. While emissions trading usually involves a free allocation of emission rights to emitters, carbon taxes and coupons place both emission control costs and the full value of emission rights onto the emitter or carbon based energy user in proportion to its emissions. High emission sectors must pay for every unit of carbon emissions for which they are responsible.

This does not, however, mean that carbon taxes or carbon coupon trading will inevitably have greater impacts on the total costs and competitiveness of carbon intensive industries than cap and emission allowance trading or credit trading. The tax system can be used to return revenue from taxes or coupons to the carbon intensive sectors in ways that mimic the distributive effects of emission trading.

Cap and Emission Allowance Trading

So long as an emissions cap is lower than emission levels in a business as usual scenario, and so long as there is appropriate monitoring and enforcement, a cap and emission allowance trading for large point sources of greenhouse gases should effectively reduce emissions from these sources.

A primary advantage to a cap and emission allowance trading program as compared to carbon taxes or performance standards is the extent to which, once established, such a program creates a strong momentum to reduce emissions on schedule. Unlike credit trading, there is no need to continually develop new standards. Also, while we all have a self interest in mitigating climate change, under cap and allowance programs, holders of banked allowances or firms that have invested in emission reductions projects in order to sell allowances have a special self interest in tight regulatory standards. This increases the momentum in favour of continued emission reductions.

As compared to credit trading or reliance on prescriptive standards to reduce industrial emissions, cap and emission allowance trading can have very low transaction and administration costs. This depends on having tamperproof monitoring systems and automatic administrative penalty systems, but for most industrial greenhouse gas emissions these would not be prohibitively expensive.

Despite these strengths, allowance trading has several weaknesses. First of all, an allowance trading mechanism is likely only effective for large point sources. This is a relatively small portion of Canadian emissions.

Also, while a cap and emission allowance system creates a momentum in favour of emission reductions, establishing the system — in particular, developing a politically acceptable allowance allocation system — will be difficult. Political expediency may endanger short term environmental effectiveness. There is a risk that a cap may initially exceed allowable emissions in order to make it politically acceptable. This can substantially delay reduction of actual emissions.

Political expediency can also endanger long term cost effectiveness. Allocation methods based on historic emissions or historic production levels are attractive to existing industry players because they receive the entire allocation of allowances — a significant transfer of a valuable commodity. However, these allocations mean that new producers have to buy emission rights that were provided for free to others. This could encourage new facilities to locate elsewhere or could encourage industry to design new facilities in a way that avoids participation in the trading program. Allocation methods based on annual production levels can be designed to minimize prejudice to producers using carbon intensive production methods or manufacturing carbon intensive products, but attempts to do so will reduce the economic efficiency of a trading system in the long term.

It may be possible to assuage concerns regarding short term competitiveness, while at the same time ensuring long term effectiveness, by using a mix of allocation methods. For instance, allowance allocations may initially be based on historic emissions, minimizing immediate impacts on carbon intensive industries. Over time, however, allocations could be increasingly based on levels of production or could be auctioned. This would encourage a gradual shift to less carbon intensive industries without causing immediate dislocation.

Finally, allowance trading systems are limited in terms of the range of cost effective emission reductions that can be pursued by industry. While potentially very effective in achieving the most cost effective emission reductions among large point sources, emission reductions can only occur at the point sources within the scope of the program. Lower cost emission reduction at other locations may go unrealized.

Credit Trading

As compared to cap and carbon coupon trading or cap and emission allowance trading, credit trading is likely the easiest program to implement initially, although administratively it is the most complex of any trading program. Its chief virtues are that it makes initial implementation of an emission reduction program easier and it may realize the most cost effective emission reductions.

Unlike cap and trade programs, regulatory standards — the driver of environmental improvement in a credit trading program — can be implemented piecemeal. So long as the baseline from which emission reductions are measured changes to reflect changing regulatory standards, credit trading can also ease the implementation of such standards. Stringent standards become more easily implemented because credit trading provides an alternative to emitters if the standards prove too expensive or otherwise unfeasible. Credit generation activities may also pioneer new ways of reducing emissions, and may thus prove the feasibility or increase the political acceptability of more stringent standards.

In some ways, credit trading has a greater cost saving potential than its alternatives because any possible emission reductions may be included within the range of a credit trading system. For instance, while it would be difficult to include landfill gases in the scope of an emission allowance trading program, a landfill methane recovery project could easily be a generator of credits. To the extent that the emission reduction measures outside large industrial point sources are more cost effective than emission reductions at large point sources, there is a cost savings from credit trading.

However, credit trading has a number of drawbacks. The administration, enforcement and transaction costs in credit trading will negate some or all of the cost effectiveness provided by a potentially unlimited range of emission reduction opportunities. While transaction and government administration costs are a fraction of a percent of the cost of emission reductions in an allowance trading program, they will account for a far larger portion of those costs in a credit trading program. To be fair and efficient, government costs related to enforcement, credit auditing and administration need to be borne by those engaging in trades.

The problem of credit being given for non-additional projects may be particularly acute if, under the guise of credit for early action, credit is given for a reservoir of business as usual emission reductions that occurred prior to Kyoto.

No cap on emissions is created. Reducing emissions requires government to improve standards continually. Although credit trading makes these improvements easier, it still requires ongoing political will. In the context of greenhouse gases, where global emissions must eventually decline by well over 50% and Canadian per capita emissions will likely need to be reduced even further, the need for continuing political will is a major problem. The situation is analogous to the difficulties some governments have in reducing deficits. To avoid the short term pain of spending cuts or tax increases, governments make optimistic projections of revenue and promise balanced budgets. When the revenue projections prove to be overly optimistic, it is too late to take corrective action and meet deficit reduction targets. In the case of credit trading, there is the risk that governments will be overly optimistic regarding the effectiveness of a trading program, will defer the political pain of increasing the stringency of standards, and choose instead to believe in overly unrealistic projections that lead to Canada defaulting on its emission targets.

In any situation where a credit is used as an alternative to complying with a regulatory standard, use of the credit will only be as environmentally effective as strict compliance with the standard if the credit represents an emission reduction which is additional to what would have occurred in the absence of credit trading. However, it is impossible to determine accurately if a project is additional. An attempt to reject all projects which are not additional will lead to the rejection of projects which are cost effective but nonetheless additional. The problem for credit being given for non-additional projects may be particularly acute if credit for early action — credit for actions undertaken prior to regulating emissions — is given for projects which are not improvements on business as usual.

Although credit for projects that would have occurred anyway reduces the effectiveness of a given standard, it does not necessarily mean that credit trading reduces the effectiveness of an overall program. But to be equally effective, regulations will need to be made more stringent or credits will need to be discounted or retired to reflect uncertainty and the likelihood that credit will been given for non-additional projects. Use of credits from non-additional projects to comply with regulatory requirements will slow the rate of overall emission reductions and, if a sufficiently large number of credits from non-additional projects are recognized, could impede Canada's ability to comply with the *Kyoto Protocol*. To ensure that credits from non-additional emission reduction projects are not undercutting program's effectiveness, it is essential to closely track the program's impact on emissions. Also, if the use of credits for non-additional projects is concentrated in some sectors, they will have a distributional impact (increasing the emission reduction burden on other sectors) unless compensated for by stricter regulations in the sector using the non-additional credits.

To be equally effective, regulations in a credit trading program will need to be made more stringent or credits will need to be discounted to reflect uncertainty and the likelihood of credit for projects that would have occurred anyway.

Credit trading can also reduce the effectiveness of a particular regulatory standard if emission exceedances or emission reductions are estimated inaccurately or if a credit generation projects leads to leakage. Baselines are inherently uncertain, and in some cases actual emission levels will be uncertain. Retrospective measurement of emissions in an open market trading program can reduce uncertainty as compared to prospective forecasting of emission reductions under an emission reduction credit trading program. However, uncertainty as to the emission reductions achieved by a specific project is inherent in credit trading. Whether such uncertainty will reduce the overall environmental effectiveness of a program will depend on whether credits are discounted to reflect uncertainty and the rigour of enforcement mechanisms and resources devoted to enforcement.

The current norms of environmental law enforcement in Canada are likely inadequate for a credit trading program. First, credit trading creates new incentives for non-compliance, and second, enforcing the validity of credits is significantly more complicated than simple enforcement of prescriptive regulations. In particular, it is difficult to provide a credible enforcement threat because of the need to assess whether credit generation activities at locations not usually regulated have been implemented as stated, and whether the protocols for measuring their impacts are sufficiently accurate.

Clean Development Mechanism and International Emissions Trading

The primary advantage of recognizing credits from clean development projects or allowing Canadian firms to use portions of other nations' allowable emissions is reduction of costs. While it is difficult to predict how Canada's emission reduction costs will compare with other nations', it is clear that marginal costs of emission reductions will be lower in some countries. Clean development projects may also have value in demonstrating to developing nations the compatibility of development and a low carbon future. Such projects may be effective in avoiding investments in developing countries which commit them to high emission patterns. They may thus increase the likelihood of these nations acceding to international emission limitations.

However, the clean development mechanism will tend to negate the environmental effectiveness of Canadian emission reduction commitments if the projects for which credit is given would have occurred in the absence of the clean development mechanism. Unlike the case of domestic credit trading, national emission inventories and national commitments will not provide a backstop to ensure that credit trading does not undermine Canada's commitments. Although limits on the use of clean development credits would help alleviate these concerns, lack of additionality would still weaken the effectiveness of Canadian commitments. From an environmental perspective, whether or not Canada integrates the clean development mechanism into a domestic program could depend on the acceptance of rules for measuring the reductions from clean development projects that are stringent and minimize potential for credit from projects that would occur anyway.

Trading of international emission allowances among nations with allowable emissions that are clearly below business as usual emissions, and that have well developed monitoring and enforcement regimes, raises few of the problems associated with the clean development mechanism. However, if international trading occurs with nations that do not abide by their international commitments, or that meet commitments through questionable monitoring, or that have budgets which exceed their business as usual emissions, the effectiveness of Canadian commitments is also endangered.

Unfortunately, the evolving international emission trading system is likely to allow use of international emission allowances that do not reflect real reductions in emissions. In particular, if Russia is allowed to sell the surplus international emission allowances assigned to it without taking any steps to reduce emissions, trading shifts from being a tool for reducing the cost of achieving a given emission reduction, to being a tool for reducing the costs of compliance with international law by avoiding real emission reductions.

Sequestration

Like the clean development mechanism, the primary benefit of sequestration is its potential to reduce the costs of climate change mitigation. Increasing sequestration levels can help mitigate climate change in the short term, while allowing time for less carbon intensive technologies to evolve and reducing the need to retire carbon intensive capital stock prematurely. Under the *Kyoto Protocol*, credit is available for afforestation projects, reforestation of agricultural and other areas that have been converted from forest, and possibly for soil sequestration projects.

The primary problem with using credits from enhancement of carbon reservoirs is that doing so may make a Canadian emission reduction strategy less effective in the long term. Unlike an emission reduction, which has a permanent impact on atmospheric concentrations, gains made by sequestration projects are reversible. Increased sequestration levels can literally go up in smoke in a summer of climate change induced forest fires. Farmers plowing a soil sequestration project can reverse gains. A tonne of carbon sequestered is never equivalent to a tonne of emissions reduced.

Although national monitoring of carbon reservoirs may indicate that Canada will need to take additional actions as a result of such reversals, it may be too late to meet Canada's emission targets cost effectively, and the companies that used credits from sequestration may no longer be in business or able to pay the costs of reestablishing carbon sinks. Similarly, to negate totally the impacts of an emission source on global atmospheric concentrations of carbon dioxide, the amount of carbon sequestered must, in perpetuity, be additional to the level of sequestration that would otherwise occur. If firms use credits from sequestration projects that are not additional in perpetuity, they are transferring the cost of emission reductions to future generations.

For these reasons, if a Canadian trading program recognizes credits from sequestration projects, they must be discounted to reflect their limited value as compared to credits from emission reductions.

Combining Programs

If the evaluation of different instruments could be summed up in a sentence it would likely be: "While there are many instruments that can be used to reduce emissions cost effectively, there is no panacea." A number of program designs combine attributes of different instruments.

Carbon Tax or Carbon Coupons with Credits

The Economic Instruments Collaborative recommended use of a carbon tax combined with a mechanism for credits for reductions in net emissions not covered by the program. Thus, for instance, a large point source might reduce its carbon tax bill by financing a project to capture methane from landfill. Similarly, if a coupon trading program is established, credits could be used in lieu of coupons. In this case producers of fossil fuels may be able increase production by purchasing or generating credits that offset carbon in the fossil fuels they produce.

In such a program the range of credit generating activities is limited. To avoid double counting of tax benefits or to ensure the integrity of carbon coupon trading program, credit generating activities would need to be limited to clean development projects, sequestration projects or projects that reduce emissions which are not caught by the carbon tax or coupon trading program.

Use of a hybrid coupon/credit or carbon tax/credit program has the following advantages:

- The scope of sources covered by the program is wide.
- It may reduce the cost of fossil fuel energy as compared to a carbon tax or carbon coupon trading, and this may mitigate any competitiveness impacts on carbon intensive industries.
- As compared to credit trading it removes the administrative cost of government developing progressively more stringent regulatory standards to drive the demand for credits.
- In the case of credits combined with coupon trading, the existence of scheduled cap reductions gives the system a momentum lacking in credit trading programs.
- To the extent that credits are not used, transaction costs and government enforcement costs are low.
- Since credits represent loss of government revenue, there is an incentive for government to enforce credits vigorously.

However, a combined tax or carbon coupon and credit system also has disadvantages:

- Depending on the extent to which credits are used, it imports problems associated with credit trading. Non-additional credits will reduce the effectiveness of a given carbon cap. This is particularly problematic in the case of clean development credits, where national emission budgets do not provide a check on program effectiveness.

- To the extent credits reduce government revenue from carbon taxes or coupons, credits reduce the potential economic spin-offs to other sectors.
- Depending on the extent to which credits are used, enforcement costs and transaction costs are increased as compared to a coupon trading or carbon tax program.
- It does not create any incentives for cost effective demand side management in many sectors which pay the tax or are covered by the carbon cap. For instance, neither distributors nor producers of gasoline will have any incentive to implement transportation demand management. Separate mechanisms to ensure demand side management in these sectors would be necessary.[1]

Cap and Emissions Allowance Trade Combined With Credit Trading

Another hybrid system could combine a cap and emission allowance trading program for point sources, but allow point sources within the scope of the cap to hold a combination of allowances and credits to cover their emissions. Thus a firm could purchase allowances from other point sources within the program's scope or, if lower cost emission reduction opportunities exist at sources outside the cap, it could purchase credits generated at other locations.

By itself, an emission allowance and credit trading program only puts the burden of emission reduction measures on those sources subject to the cap. There would be a continuing need to develop regulatory standards and undertake other initiatives for sectors not affected by the cap. Firms subject to these prescriptive regulations — for instance, small point sources, or to a limited extent manufacturers of goods subject to efficiency standards[2] — might be allowed to use credit trading as a compliance option. Eventually, the smaller point sources might be included within the cap.

This would have the following advantages:

- Industrial emitters would not be restricted to industrial emission reduction measures. Depending on where the lowest cost emission abatement measures

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[1] See Chapter 9, under the heading "Design Issue 22: Trading in a Competitive Electricity Market"

[2] See Chapter 8, under the heading "Regulations as a Source of Demand" in Design Issue 1.

lie and the transaction costs associated with credit trading this would potentially lower emission abatement costs.

- As compared to credit trading, it removes the administrative cost of government developing progressively more stringent regulatory standards to drive the demand for credits.

- The existence of scheduled cap reductions gives the system a momentum which tends to be lacking in credit trading programs or plans to reduce emissions through prescriptive standards alone.

- To the extent that sources use only allowances for compliance and have automatic tamperproof monitoring systems in place, transaction costs and government enforcement costs are low. To reflect the higher enforcement costs associated with use of credits, government might charge a trading fee for credits used.

- It is possible for the program to evolve. The program could begin as a cap and allowance trading program, with credit trading allowed as protocols are developed and emitters gain sophistication with trading concepts. Alternatively, regulatory standards could be initially applied with credit trading where appropriate. After sources and other stakeholders have gained familiarity with trading and brokerages have developed, a cap and emission allowance trading program could be implemented to reduce transaction costs.

However, it also has disadvantages:

- Allowing point sources within the scope of a cap to meet their cap by reducing emissions at other locales reduces the environmental impact of any given cap because there will be a larger supply of non-additional emission reductions which are used to meet the cap. The larger potential for non-additional projects could be reflected in either a discount applied to credits or more aggressive cap reductions.

- It will be more difficult to define a schedule of cap reductions which can be trusted to achieve a given emission reduction. This is because the widespread use of credits introduces uncertainty into the emission reductions that will be achieved by a given schedule of cap reductions. Because credit will likely be given for some non-additional projects and because of the uncertainty regarding credit values, there is a risk that the schedule of cap reductions would need to be adjusted if a given cap proved ineffective in achieving real emission reductions.

- Depending on the extent to which credits are used, enforcement costs and transaction costs are increased as compared to a credit trading program.

- If credits are given for clean development or sequestration projects, the problems associated with clean development or sequestration projects as compared to domestic emission reduction projects are introduced into the trading program.

- In the absence of other measures, the burden of emission reductions falls mainly on point sources within the scope of a cap. No general incentives are created for area and mobile sources to reduce their emissions (although credit generators might create such incentives).

Allowance and Credit Trading Combined With Coupon Trading or Dedicated Carbon Taxes for Mobile and Area Sources

The last of a combined credit and emissions allowance trading program's identified weaknesses — failure to incorporate area and point sources within the scope of the program — can be overcome by combining the program with economic instruments specifically designed for area and mobile sources. Possible options are:

- Establish a carbon tax on fossil fuels used by area and mobile sources and dedicate this to funding emission reductions. A dedicated fund could simply purchase credits. The drawback to this is that it does not necessarily create a cap on emissions from this sector. A tax could, however, be adjusted periodically so that a steadily increasing percentage of emissions from the transport sector are offset. Also, in the absence of other measures, it has a disproportionate impact on the poor, who tend to spend a larger percentage of their income on motor fuels and home heating.

- Establish a system of carbon coupon trading for distributors of fuels to mobile and area sources. The premium that the distributors charge as a result of the limited supply of fossil fuels would need to be taxed back (or the coupon auctioned). Coupons for distributors and allowances for point sources would be fully tradeable with each other. Credits could be generated from sources not covered by either system and used in lieu of allowances or coupons.

Drawbacks to this system follow:

- As in the case of a combined credit and carbon tax/coupon system, this system reduces the incentives for demand side management.

- If point sources are allocated free allowances, there may be inequity as between point sources and mobile areas sources. Since gasoline retailers will be increasing the price of gasoline to reflect the limited supply of allowances and coupons,[3] the full value of coupons will be paid for by gasoline purchasers while point sources receive free allowances.

Non-Compliance Fees vs. Credits

All of the above programs which use credits in one way or another could instead charge a non-compliance fee, or what the Ontario CO_2 Collaborative called an atmospheric user fee, on each tonne of emissions which exceeded amounts permitted by allowances, coupons or standards. If the fee is used to reduce emissions and is set at a level equal to the cost of reducing emissions by a tonne, the effect is essentially the same as a credit. The difference is simply who administers emission reductions. Under the Oregon CO_2 Standard, emitters have a choice of supplying their own credits to offset excess emissions, or they can pay a fee dedicated to funding emission reductions. There are, however, several differences:

- In an open market trading program, private sector credit purchasers have an incentive to purchase more credits than may be needed to offset an exceedance (because of the risk that a credit may be found invalid). By comparison, if a government administers an atmospheric user fee there is no incentive to over comply and achieve greater emission reductions than required.

- Placing responsibility for the funding emission reductions on a government agency could potentially increase the likelihood that additional projects will be chosen; however, there is also the possibility that other government agencies may cut back on some programs secure in the knowledge that the climate fund will fill the void.[4]

- Government administered funds for emission reduction have the potential to be more cost effective than privately administered credit purchases in that they can target projects with multiple social benefits. However, to the extent that they are flexible enough to target multiple social benefits, the costs per unit of carbon dioxide emission reduction may be higher, and the potential for funds being used for partisan political purposes is higher.

In summary, several broad-based market instruments in combination may be among the most effective, equitable means of reducing greenhouse gas emissions.

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[3] See Chapter 10, under the heading "How Cap and Carbon Coupon Trading Works"

[4] This is a common complaint with Forest Renewal BC, and the Habitat Conservation Fund, two BC government administered funds dedicated to projects that are supposed to be additional to government programs and regulatory requirements.

Nonetheless, there continues to be no panacea. Each program has advantages and disadvantages.

Next Steps...

What are the next steps? Where do Canada and British Columbia go from here? For the immediate term the answer is obvious. We need to begin implementing many of the no-regrets measures that have been ignored for years. More stringent energy efficiency standards, a tax system which does not subsidize fossil fuels or energy use, more intelligent transportation planning — the list goes on. A host of measures have been identified by the Climate Change Task Force, the Rational Energy Plan and the Ontario CO_2 Collaborative. Many of these measures will be essential whether or not broad-based market instruments are used. Many of these measures can be implemented immediately.

Implementation of many broad-based market instruments is also possible in the short term. Measures such as the relatively low carbon tax advocated in the Rational Energy Plan can be implemented while more significant measures are evaluated and developed.

It is especially important to take steps that avoid investments in long lived carbon intensive capital infrastructure. Investments in freeways, urban sprawl, coal burning industrial plants and other carbon intensive capital that is expensive to retire prematurely will increase the costs of future emission reductions. Measures ranging from growth management and sustainable transportation planning to carbon taxes or the environmental assessment of carbon intensive investments need to be taken to guard against inappropriate investments while other instruments are being developed. In many cases, these measures will need to remain in place because market instruments are unlikely to ensure investments in, for instance, sustainable forms of urban development.

We need to accellerate experimentation in measures such as credit trading. The development of stringent performance standards in carbon intensive sectors are essential first steps to developing a demand for credits.

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TURNING DOWN THE HEAT

Turning Down the Heat is intended to assist in the search for ways to reduce Canadian greenhouse gas emissions. It examines the potential role for emissions trading in implementation of Canada's greenhouse gas emission reduction commitments under the *Kyoto Protocol*.

Under trading programs, individual polluters are given flexibility in how to reduce their emissions. Where an emitter can, at a low or negative cost, reduce emissions or energy use beyond what is required by regulation they can sell an emission reduction credit or an allowance to a polluter who cannot reduce their emissions as easily. The purchaser of the credit or allowance is then allowed to emit more. The theory of emissions trading assumes that by placing increased choice of control measures in the hands of emitters, emissions will be reduced at the lowest cost.

Emissions trading has often been promoted as a panacea, an alternative to regulation, and a new way to reduce emissions that will be politically easy and achieve emission reductions at the lowest cost.

Turning Down the Heat finds that, while there is potentially a large role for emission trading, it is none of the above. It is one tool — albeit a potentially important one — among many to reduce greenhouse gases.

Turning Down the Heat will be of interest to anyone concerned with climate change and how greenhouse gas emissions can be reduced.

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