LIU INSTITUTE FOR
GLOBAL ISSUES

January 2003

Forword to "A Sustainable Climate Policy"

Ratification of the Kyoto Protocol is a significant step for Canada. It demonstrates the political will to be part of the solution to the risks posed by global climate change. It presents an opportunity to re-tool our thinking and our actions towards achievement of a sustainable society that begins to limit the dependence on carbon fuels. It can be the kick-start to a period of innovation and creativity.

The task now is to get beyond the political wrangling and reach a widespread commitment to cooperative implementation. As an Institute dedicated to the search for better public policy, the Liu Institute for Global Issues has been involved in helping to inform debate and discussion around Kyoto. We are turning our attention towards finding answers and proposing ideas to assist in the implementation.

Under the leadership of Dr. Hadi Dowlatabadi, Academic Director of the Institute, we present a short primer of suggested proposals to inform practical policy development. We cover opportunities for change in the sectors of transportation, mining and manufacturing, electrical generation, and forestry-agriculture, as well as the relative merits of taxes versus permits.

These are not exhaustive treatments. They are designed to stimulate examination of alternative choices, leading to longer-term consideration of what can work and how to make it work. It is the beginning of what we trust will be a serious look at the best road map for a sustainable climate change policy.

Lloyd Axworthy, PC, OM, PhD
Director & CEO
Liu Institute for Global Issues

UBC
UNIVERSITY OF
BRITISH COLUMBIA
6476 NW MARINE DRIVE
VANCOUVER BC
CANADA V6T 1Z2
LLOYD AXWORTHY
DIRECTOR & CEO
TEL 604/822-9957
FAX 604/822-6966
lloyd.axworthy@ubc.ca

Vancouver, January 2003

LIU INSTITUTE FOR GLOBAL ISSUES

A Sustainable Climate Policy

H. Dowlatabadi, M. Bazylewich, D. Boyd, M. Boyle, A. Elias,
E Fraser, Z. Harkin, M. Kandlikar, J. Krzyzanowski, W. Mabee,
J. MacDonald, E. Mazzi, R. Pacheco, N. Rivers, K. Roberts,
J. Robinson, A. Russell, P. Shepherd, R. Van Wynsberghe

Liu Institute for Global Issues
January 2003

UBC
UNIVERSITY OF BRITISH COLUMBIA
6476 NW MARINE DRIVE
VANCOUVER BC
CANADA V6T 1Z2

www.ligi.ubc.ca

LIU INSTITUTE FOR GLOBAL ISSUES

The Liu Institute for Global Issues

Director and CEO
Lloyd Axworthy, PC, OM, PhD

Academic Director
Hadi Dowlatabadi, PhD, CRC Chair

Director, Centre of International Relations
Brian Job, PhD

Director, Centre for Human Security
Andrew Mack

Director, Centre for Public Opinion and Democracy
Angus Reid, PhD

Director, Simons Centre for Peace and Disarmament Studies
Jennifer Allen Simons, PhD

Deputy Director
Julie Wagemakers

Executive Summary

Climate change and greenhouse gas (GHG) emissions are far from the daily concerns of Canadians. A sustainable climate policy can only be built by explicitly addressing the core concerns of industry, communities and citizens. Here we present policy options that support core concerns while reducing GHG emissions from the transportation, industry, energy, and agro-forestry sectors.

We begin by examining the core concerns of industry and existing regulations, and then present policy options that could be employed to reduce GHG emissions while continuing to address pre-existing social, environmental and economic concerns.

The policy measures outlined in this document do not meet the Kyoto target. However, in contrast to the government program, we offer the potential to achieve over 70 million tons of CO_2 reductions at no cost to consumers or the government and without tradable permits.

Road Transportation

Our core concerns about automobiles are passenger safety and urban air quality. Heavier vehicles not only generate more CO_2, they also pose a disproportionate risk of injury to passengers of lighter vehicles. This vicious circle has partially fuelled the rising demand for heavier cars and SUVs. By requiring higher fleet efficiency as well as a minimum fuel efficiency standard in all personal vehicles we can reduce GHG emissions and eliminate heavier vehicles from the Canadian market.

Diesel engines offer an additional savings of 15-20% of CO_2 emissions if substituted for comparable gas engines. However, strict fuel quality and emissions standards are needed before the switch to diesel. Otherwise, promotion of diesel will lead to thousands of premature deaths in Canada due to poor ambient air quality.

Industry

Competitiveness of the manufacturing industry is paramount in Canada's continued prosperity. Industrial cogeneration, which is the creation of energy through the burning of waste or surplus material on-site, offers significant cost savings and GHG controls. Partnerships between industry and utilities are needed to overcome the obstacle to widespread adoption of cogeneration in Canada, by allowing industry to sell energy back to the utilities. Provincial government interventions are needed to promote such partnerships.

For example, the cement industry exemplifies high GHG emissions from industrial *processes* rather than fossil fuel use. Often alternative processes to those currently in practice are already well known but there has been no need to adopt them. Cement manufactured using non-carbonaceous clinkers is cost effective and eliminates more than 3 million tons of CO_2 emissions. Many other cost effective opportunities abound in mineral processing and chemicals. Targeted Federal tech-transfer and loans offer an approach to bringing about changes in industrial processes at the lowest risk and cost to industry and government.

Electricity Generation and Use

Our goal is to provide an efficient and reliable supply of electricity. Cogeneration opportunities are not limited to industry. Modern small scale distributed cogeneration units are less expensive and more reliable than conventional central power plants and can double the useful energy extracted from fossil fuels – halving GHG emissions. Diffusion of cogeneration is only possible if existing utilities invest in and encourage third party investments in this technology and its full integration into the electricity grid. Doing so would reduce the cost of energy services and increase its reliability while reducing congestion on transmission lines (an added bonus) and GHG emissions.

Electricity, when generated from fossil fuels, should not be used for space or water heating. Heating space or water using gas versus electricity (generated using gas) emits 65% less CO_2. Furthermore, where gas is available, consumers can make the switch while reducing their energy expenditures. The CO_2 savings are even greater for electricity generated using oil and coal. In the energy sector, significant emissions reductions (and consumer savings) are possible through end-use fuel switching.

Forestry-Agriculture

Biomass waste from the Canadian agriculture and forestry industry could supply one quarter of the nation's energy needs. Some of this waste is already an environmental headache. Intensive animal husbandry already collects waste but fails to treat it adequately. By providing low-cost loans to build bio-digesters these waste streams can be processed to provide energy, soil nutrient recycling, air and water quality gains and GHG controls. Such initiatives would not impose a net cost on the government and could potentially control at least the equivalent of 15 million tons of CO_2 emissions.

Forestry and farming have needed significant contributions of cash to maintain incomes and sustain rural communities. GHG controls offer a new business opportunity for better management of forests and conversion of marginal lands to woodlands. Under favourable conditions, such activities can generate over $100 of net income per hectare. The Permanent Cover Program (launched in 1991) offers incentives of $40-80/ hectare for afforestation of half a million hectares in the Prairie provinces. Under unfavourable conditions this activity could lead to net losses exceeding the incentives. We should be aware of and prepared to make up lost income on these lands just as we have maintained farm incomes under adverse conditions to achieve food security. Climate security is a long-term goal that cannot be achieved without confidence in economic viability and commitment to long-term changes in land use and forest management practices.

Pitfalls in tradable permits

Tradable permits have been touted as the means of achieving cost effective and efficient CO_2 reductions in Canada. This assertion rests on a number of misconceptions: a) that tradable permits are why SO_2 controls in the USA have been less costly than anticipated, b) that tradable permits would not lead to CO_2 control costs impacting final prices to consumers, and c) that giving away permits to industry and buying permits overseas are sound public policy.

The SO_2 program (in the USA) was successful because contrary to all prior analyses low-sulphur coal was compatible with and less costly than high sulphur coals previously in use in the US mid-west. The costs of control will be passed on to consumers whether permits or taxes are employed. There is a significant risk of industry/manufacturing fleeing to the US when CO_2 permits are given away to industry with the potential to operate on either side of the border. Giving away permits will generate a windfall to such firms from the public coffer without leading to GHG reductions.

There is a high likelihood that we will fail to meet the Kyoto targets through domestic initiatives. While we have the option of making up the shortfall through purchasing permits internationally, we should only purchase permits that meet the dual tests of actual reductions from 1990 and reductions in emissions intensity. Purchasing permits that fail either test impoverishes Canada's economy and exacerbates the climate change problem.

Planning for the long term

It is important to distinguish the short-term challenge of meeting Kyoto targets from the long-term goal of climate stabilization. We have identified five strategies delivering more than 70 million tons of GHG reductions at no cost to the government and net savings to industry and consumers. Many additional opportunities may also be identified. We simply need to re-examine paradigms such as reliance on pure market mechanisms rather than limiting choices to those that are demonstrably superior for the environment, society and the economy.

Stabilization of climate change can be achieved if global GHG emissions are controlled to about 25% of today's totals. Achieving such lofty goals is only possible by rethinking industrial processes, land use, energy services and their delivery. As is evident here, there may be opportunities for redesigning our patterns of economic activity so that much higher social, economic and environmental goals are simultaneously met.

Metropolitan areas are where the majority of energy services are delivered. They are also where concentration of resources offer the greatest opportunities for co-generation, energy and chemical feed-stocks from waste, and the coordination of Canada's industrial metabolism. These rearrangements of our pattern of activity will mean a reorganization of status quo and will no doubt be resisted for that reason alone. However, Canada can lead the way globally by initiating a participatory transition program that utilizes her resources more effectively and with far lower impact on the natural environment.

Road Transportation

- *Road transportation accounts for approximately 25% of Canada's GHG emissions.*

Challenge

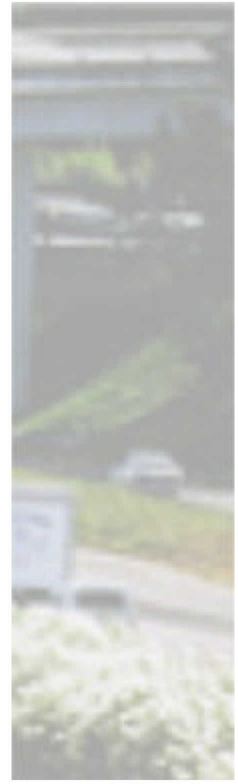
Reduce GHG emissions without jeopardizing improvements in vehicle safety and ambient air quality.

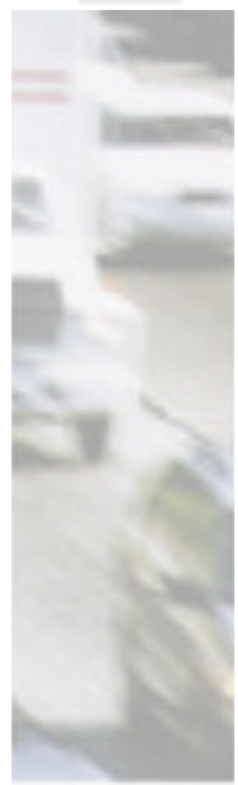
Mechanisms

Efficiency: The government hopes to reduce emissions from private automobiles by 5.2 million tons through improving new car efficiency standards by 25%. Vehicle weight is the single most important determinant of fuel efficiency. All else held constant weight is also the most important determinant of passenger safety in collisions.

The government can seek to raise fleet efficiency standards by 25%. This offers manufacturers flexibility in how to achieve this goal. Given the high demand for larger (higher profit margin) vehicles, it is likely that manufacturers will respond to the policy by adding much smaller vehicles (currently available in Europe and Asia) to their line-up in Canada while continuing to offer large trucks and SUVs. Sales of such highly efficient vehicles alongside existing larger offerings will permit meeting the new standards. However, this will also lead to a significant increase in risk of injury and death to occupants of the smallest vehicles.[1] All else held constant, occupants of a vehicle that is 1000 kg will suffer a 26% increase in fatalities compared occupants of a 1500 kg vehicle involved in a collision with a 2000 kg SUV.

Canada can improve the safety and attractiveness of small vehicles by reducing the *size* and *number* of the heaviest cars and trucks. We need a policy that seeks higher fleet efficiency while simultaneously imposing a minimum fuel efficiency standard on all vehicles. There is no need to delay before putting such a policy in place. In 2002, one quarter of vehicles on Canadian roads were more than 10 years old. Early action will lead to a greater road safety and GHG controls by 2012. If the average efficiency of all vehicles available for sale in Canada is improved by 25% from 2003 onwards, CO_2 emissions from private automobiles will decrease by more than 15 million tons of CO_2 in the 2008-12 compliance period.





[1] Heavier vehicles, in particular SUVs are already documented to cause disproportionate injuries and fatalities in collisions with smaller automobiles. In 1999, collisions with Light Duty Trucks and SUVs raised occupant fatalities in automobiles by 45%.

Biodiesel fuels: The government hopes to have 500 million litres of biodiesel used per year by 2010 (saving 2 million tons CO_2). The savings here come from both the fuel being produced from biomass and from the inherent efficiency of diesel technology. Compression ignition (diesel) engines offer between 15-25% CO_2 emissions advantage over conventional gasoline engines. Diesel is in widespread use in trucks and busses in Canada. In addition, 3% of private vehicles are diesel fuelled. However, diesel combustion is a major contributor to NO_x and respirable particulate matter (PM 10 and PM 2.5) in the ambient environment. Diesel combustion products have been implicated in precipitating or exacerbating pulmonary stress, asthma and identified as being carcinogenic. Developing a policy that relies on diesel technology will lead to increased urban air pollution and significant adverse health impacts.

Canada should establish strict fuel quality standards for diesel and biodiesel fuels, and emission standards for diesel engines. If public health is to be protected, such standards need to implemented before incentives which increase the number of diesel-powered vehicles.[2] Our fuel and emissions policy can be timed to coincide with the availability of Euro IV compliant diesel vehicles by model year 1996. Consumer acceptance of clean biodiesel can be enhanced through partnership with municipal governments ensuring busses switch to this technology delivering GHG reductions and better ambient air quality in Canada's metropolitan areas. If all diesel powered vehicles in use in Canada were converted to bio-diesel, CO_2 emissions would decline by 50 million tons. Achieving this goal requires significant government investment, but a major beneficiary would be the domestic agriculture sector – an area where the government supplements farm incomes by between 20 and 300% annually. The difference here is that the subsidy does not lead to competitive grain exports, but domestic benefits in lower CO_2 emissions and better ambient air quality.

In the longer term

The challenge for controlling emissions from transportation can be met by one of two approaches: a) mode switching and higher reliance on public transport, b) zero-net-carbon energy sources. The former requires a masterplan for urban and regional planning and substantial attitude changes in public attitudes towards personal mobility. The latter requires switching to bio-based fuels and/or green hydrogen and electric vehicles. These have significant private interests behind them and are morel likely to have the sustained momentum needed for the transportation system to make the dramatic changes necessary for the more drastic GHG controls that will be needed to stabilize the climate system.

[1] The UK policy to promote GHG controls in private vehicles has led to a doubled market share for new diesel cars in less than two years to 26% of new registrations. However, no vehicle currently on sale in the UK meets the Euro IV standards that define a new threshold pollution control from this technology. Euro IV at 0.02 g/kWhr will be in force from October 2005. it represents an 86% improvement in PM emissions from today's standards.

Mining and Manufacturing Industry

- *Mining and manufacturing accounts for approximately 17% of Canada's GHG emissions.*

Challenge

A major concern of any country imposing GHG controls is loss of competitiveness and flight of manufacturing industry abroad. This is a particularly severe challenge for Canada because over 85% of trade is with the USA who is not bound by the Kyoto Accord. While the Canadian government hopes to help industry meet their share of GHG controls, they also need to recognize that policies will be scrutinized by US competitors in search of evidence to support claims of non-competitive subsidies and retaliatory actions further hampering Canadian competitiveness.

Mechanisms

Efficiency through cogeneration: While high energy prices are often singled out by industry as significant stumbling blocks toward competitiveness, energy is rarely significant cost to industry that warrants careful attention to efficiency. Canada has a vast supply of fossil and renewable energy land enjoys low energy prices. The vast majority of boilers in Canada are simple cycle units and could be upgraded to combined cycle operation and co-generation improving fuel use efficiency by as much as 100% (i.e., 50% reduction in CO_2 emissions). The barrier to wide spread adoption of such changes in industrial energy management lies in: a) the need to have resources and attention dedicated to this issue, b) regional coordination of heat and power production and demand. More than 25% of electricity generated in The Netherlands is now from cogeneration units located on industry premises. These units meet industry needs for power as well as provide power to meet local electricity demand. The economics of such operation is highly scale dependent and larger units can only be justified if the excess power and heat production by industry will find a ready market in the region. The success of the program in The Netherlands is due to the partnership between local power utilities and industry in regional energy planning.

Canada can launch this program through disseminating information about this new business model, and provincial legislation encouraging non-utility power generation and utility marketing of such power. Because of the higher efficiency in fuel use, this program is cost saving and for every 1000 mega watts of installed cogeneration units, 2.8 million tons of CO_2 emissions can be avoided.

Changing the cement process: 2.8% of all CO_2 emissions in Canada are from cement manufacturing. Half of these emissions are from the energy used to grind and heat material used to manufacture cement. The other half is due to the decomposition of limestone to lime used to make cement.

Cement can be manufactured equally well using a high proportion of ceramic and clay minerals – saving CO_2 emissions from heating and decomposition of limestone.[3] Choosing an alternative recipe for cement is cost effective and compatible with design standards in the construction industry.

The diffusion of this approach to cement manufacturing is hindered by consumer awareness as well as the vertical integration of the industry and the related issue of access to suitable sources of non-carbonaceous minerals. Canada can encourage the move away from carbonaceous cement manufacturing through specifying eco-cements for government projects and coordination of the activities of cement manufacturing and sources for lime substitution and filler materials. Canada's industry can improve its efficiency and change its process to non-carbonaceous minerals with government backed bond issues reducing solid waste disposal challenges, protecting ecosystems which would otherwise be quarried for limestone, and reduce CO_2 emissions. More than 50% of emissions from this industry can be eliminated if we switch to new cement recipes – as much as 7 million tons by 2010.

In the longer term

The challenge for controlling environmental impacts from industry lies in closer scrutiny of its metabolism. This metabolism is defined by the: inputs, intermediate products, final goods and fate of industrial activity. Many industries generate "waste streams" that others would consider an "input" to their production processes (e.g., sulphate slurries, fly ash, slag, …). It is possible to improve the industrial metabolism of Canada through a three step process: a) by planning where industry is located and creating "development parks" where complementary industries are co-located. b) by encouraging green design in industrial processes and c) by requiring that products be designed with cradle-to-cradle impacts in mind.

[3] Even more novel formulations use magnesium minerals that actually absorb CO_2, leading to no net CO_2 emissions.

Electricity

- *Electricity accounts for approximately 15% of Canada's GHG emissions.*

Challenges

Reducing GHG emissions while meeting growing demand, including difficulties associated with situating new plants, new transmission lines, maintaining supply reliability, minimizing environmental impacts and keeping costs to a minimum.

Mechanisms

Changing demand by switching fuels: Electricity is an energy vector and while it is often used in residential and commercial applications for space and water heating, it is far from the best solution if natural gas is also available. When electricity is generated in fossil-fuelled power stations, more than 65% of the energy in the fuel is lost in conversion to electricity and typically a further 10% is lost in transmission to end-users. While it is true that electric appliances are efficient at the point of use, gas-fired appliances are more than twice as efficient when all the energy conversion losses are included. When gas can be used for home heating instead of coal-generated electricity (70% of thermal output in Canada)[4] each unit of heat delivered will be associated with a 75% reduction in CO_2 emissions. This CO_2 saving is associated with energy cost savings by consumers and the investments involved have payback periods ranging from 2 to 10 years.

Traditionally, electric and gas utilities have competed for customers – regardless of total environmental impacts and economic costs. The use of electricity for heat has been further boosted by developers who save money in buildings by not providing gas and ventilation. Canada can promote more rational use of fuels through a three step program: a) require building codes to include gas supply,[5] b) provide information campaigns and financial incentives for switching to gas for space and water heating, c) constrain electric water and space heating to applications where no alternative is available.

The proposed strategy leads to an increase in direct emissions from the residential and commercial sectors, but when all emissions associated with space and water heating are included there is a 60-75% reduction in CO_2 emissions. An additional benefit of this strategy is to lower demand for electricity and reduce the pressure to expand generation and transmission capacity. This strategy can reduce CO_2 emissions by 20 million tons at no cost to citizens or the government.

Currently consumers are allowed to choose between mid-efficiency furnaces (78-80% efficiency) and high efficiency furnaces (90-97% efficiency). Heating services can be delivered at least 18% more efficiently if mid-efficiency furnaces were no longer available for sale in Canada.

[4] The majority of electricity produced in Alberta, Saskatchewan, New Brunswick and Nova Scotia is from coal power plants. In PEI all power is from oil.

[5] It is likely that in the future, hydrogen will be used as an energy vector, initially mixed in with natural gas (as Hithane) and later perhaps in pure form. New building codes for gas distribution should use material that is suitable for conveyance and control of Hithane and H_2.

Changing supply through distributed co-generation: As noted above, more than 60% of fossil fuel energy used to generate electricity is lost in cooling towers. With co-generation more than half of that wasted energy is captured for heating or cooling offsetting energy used to perform these functions. Advances in cogeneration technology and power electronics permit their economic installation and dispatch with high demand for heat and power (e.g. hospitals, recreation centres, shopping malls, greenhouses, and large apartment buildings). Promoting distributed co-generation not only leads to more efficient use of fuels (and lower CO_2 emissions) but also more reliable electricity supply, less congested gas pipelines at peak demand (where gas is used to generate electricity in central power stations), and less congested on transmission lines.

Canada can promote distributed cogeneration by stipulating fair energy exchange contracts between independent producers and local utilities. Consumers would benefit by having lower cost energy services. With a 25% diffusion of distributed cogeneration in Canada (replicating the experience in The Netherlands from 1987-97) Canada can reduce CO_2 emissions by 15 million tons at no cost to consumers or the government.

In the longer term

There are two approaches to dramatically lower GHG emissions while meeting growing electricity demand: a) carbon sequestration from fossil fuel power plants and b) greater generation using renewable resources.

When fossil resources are used to provide incremental generation, there will need to be carbon separation and sequestration. This approach is being pioneered in Alberta. The development of this technique is also critical to the success and possible transition to a hydrogen-based economy.

Canada is blessed with vast renewable energy resources. The economics of renewables hang on their capital costs and timely generation. High reliability and falling costs of renewables have made them the winning option in remote locations. The challenge for tomorrow is their successful incorporation into the mainstream power system.

Windmills are the most promising renewable technology today. Their main drawback however is intermittent power production - they need backup capacity either in the form of storage or conventional generation to pick up the slack when they cannot generate power (i.e., when there is too little or too much wind). Normally, this would be an expensive proposition as the windmills would need fossil capacity investments as backup. In most Canadian provinces however, hydro is the dominant mode of power production. By modifying how hydroelectric plants are operated, it is possible to accommodate a high fraction of intermittent supply capacity without the need for investment in expensive backup or energy storage capacity. Given the schedule of hydro plant upgrades and expected changes in precipitation and seasonal flows it is important for Canada to pioneer the development of electricity systems incorporating renewables while helping water management and hydroelectric production.

Forestry-Agriculture

- *Forestry-agriculture accounts for approximately 10% of Canada's GHG emissions.*

Challenge

The existing agro-forestry priorities have been to: a) provide food security for all, b) promote prosperity of rural communities, and c) protect environmental quality and valued ecosystems. The challenge is to modify agricultural and forestry activities to reduce GHG emissions (or capture atmospheric CO_2) while continuing to promote these existing goals.

Mechanisms

Reducing emissions with biodigesters: GHG emissions from farming and forestry are often small fluxes over vast areas. This makes controls difficult, unless critical insights permit new production techniques that improve productivity while reducing emissions. No-tillage agriculture exemplifies such a new technique but it is already in wide use.

Animal waste management from intensive (as opposed to extensive) farms already jeopardise water and air quality. Biodigesters are a well known technology that not only control water and air quality issues related to waste management, but would also lead to dramatic reductions in GHG emissions and provide energy (methane) and nutrient recycling to fields. The environmental impacts of intensive animal husbandry are at crisis level. By adding GHG emissions standards to environmental standards for treatment of waste streams from intensive operations the government can achieve its environmental goals with a high benefit to cost ratio. The incremental costs of biodigesters (as opposed to holding ponds) should be eligible for low-cost federal loans. Such a program will have no net cost on government, protect the welfare of farmers, and provide substantial improvements to rural environmental quality.

Capturing carbon through afforestation: Afforestation and reforestation are seen to offer substantial promise in low cost reduction of atmospheric CO_2 by turning marginal farmland into carbon-rich forests.

The Permanent Cover Program (PCP) encourages farmers to replant marginal farmland by investing a total of $74 million, with the goal of covering 522,000 hectares of marginal farmland in the Prairie provinces. This works out to a program cost of approximately $140/hectare. Note that the actual subsidies paid out to farmers are significantly lower in most cases – reports range from $40 to $80/hectare. This program was established in 1991. However, there are other mechanisms that should be considered that might provide incentive to replant marginal lands.

The chief mechanisms for generating afforestation/reforestation on marginal agricultural lands are:

Annual rent for land conversion practices: Landowners can receive cash or credits for turning vacant/underused land into forests. Experiences in Brazil, the U.S and Canada have shown that this approach is effective.

Carbon refund scheme: Provides a financial incentive to landholders to conduct their own forest inventory, and rewards increasing inventory precision with additional carbon offsets.

Voluntary reduction: To incorporate carbon captured through agriculture and forestry into the national inventory and a domestic emissions trading system, the existing *Voluntary Challenge and Registry (VCR)* could be expanded to allow input of forest inventory data.

Carbon pooling consortiums: Effective where markets for carbon have been established, the formation of local carbon pooling consortiums allows risk (market downturns, forest fires, insect outbreaks) to be shared among a number of landowners while fostering community cooperation. This is similar to existing cooperatives established by farmers around cash crops.

The mechanisms listed above assume a viable market for carbon or GHG credits. A simple evaluation of the economic returns attached to replanting marginal farmland was conducted. Ranges of maximum and minimum values were tested for a series of variables including: establishing and managing the trees on the site, the potential revenue from timber produced, and the potential value of carbon sequestered. Preliminary analyses show that returns may range from revenues of approximately $112 per ha under optimal circumstances, to losses of up to $186 per ha as a worst-case scenario.

It should be noted that the current level of subsidy offered by the PCP could cover the majority of potential losses that may be incurred by this scheme. Given positive circumstances, the returns to the farmer would be higher than under the PCP, and indeed approach the overall cost of the program itself.

In the longer term

Canada has vast land and forest resources fully capable of producing biomass energy exceeding fossil energy consumption today. The question is, at what cost (environmentally, socially and economically)? It is clear that bio-based liquid fuels (e. g., ethanol and biodiesel) can significantly reduce emissions from the transportation sector. Moves are afoot to explore how to use forest biomass as feedstock to the chemicals industry. Genetic manipulation of farm and forest cultivars offers the possibility of enhanced carbon capture through to biological production of chemicals that are currently derived from fossil fuels or involve significant emissions during manufacturing. A bio-based economy – much more advanced but similar in principal to our forefathers – holds the long-term key climate stabilization.

Learning from Experience

Taxes versus Permits

Most people believe marketable permits for greenhouse gas emissions will not impact their pocketbooks, while taxes would. This is a misconception. Taxes and permits achieving the same GHG controls have the same impact on prices faced by consumers. Furthermore, taxes and permits generate equivalent incentives for reduction of GHG emissions. Despite these similarities there are some key differences between them:

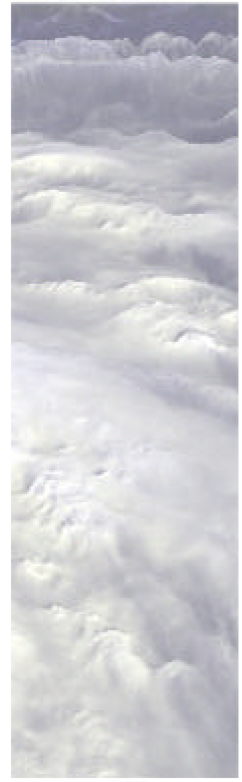
- ***Permits*** guarantee a strict limit on emissions. This is an advantage when the level of impacts rise steeply beyond the quantity of permits issued. The drawback to using permits is that their prices can vary dramatically depending on market glut or scarcity. This uncertainty in permit prices undermines a consistent incentive to invest in GHG reductions. Permit exchanges are strong promoters of this approach.
- ***Taxes*** guarantee the cost of emitting GHGs and by extension the benefits of investing in GHG controls. Taxes have to be set ahead of time, and will likely lead emissions to overshoot or undershoot the Kyoto target. This leads to their periodic but predictable adjustment assuring long term emissions staying close to long-term targets.

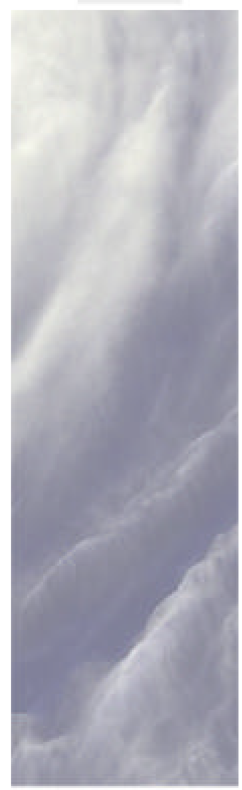
Political perspective: there are three reasons to favour permits.

1. Perceptions – the public believes that permits do not impact their pocket book, but taxes do.
2. Grandfathering – permits can be given away to existing emitters mollifying the opposition of large emitters. Such schemes create rights to emitters at significant cost to taxpayers. At a permit price of $10/ton of CO_2, giving away 85% of the emission permits (as proposed by the Canadian government) is equivalent to a gift of $4.85 billions per year from public coffers to the industry. For their part, the industry will have to pay for the remaining 15% of permits at a cost of $0.85 billion per year. All of these costs will be borne by consumers either through taxes to the government or through increased prices on products.
3. Impressive results – tradable permit markets (most notably the SO_2 market in the US) have delivered emissions controls at costs far below expectations.

Public policy perspective: there are three reasons to favour taxes.

1. Green taxes are preferred because existing tax structures hinder economic growth by placing a tax burden on employers and wages rather than consumption. Carbon taxes can be used to reform the overall tax structure. Taxes on GHG emissions can be used to offset existing taxes. This can stimulate the economy while leaving pocketbooks unaffected and creating the incentive to reduce GHG emissions. At a tax rate of $10/ton of CO_2 there would be a $5.7 billion per year shift in taxes from income taxes to activities that emit greenhouse gases.
2. Stable prices and price expectations lead to more effective investment strategies. The weather, economic performance and proximity to the end of a commitment period can have significant influences on permit prices. Such price volatilities lead to inefficient investments. Taxes can be held to a pre-specified course to support better decision-making.
3. Transaction costs in collecting taxes or securing permits detract from the efficiency of these instruments. Published broker fees for trade in carbon emission permits are over 25%. Tax collection is significantly less expensive.





In practice both pollution taxes and tradable emission permits have shown impressive results when well planned. However, given the short time horizon for meeting Canada's Kyoto commitments, there is a high likelihood that permit prices will be much higher than the base price of $10/ton CO_2. Such a high price scenario can be avoided if the government does not hold fast to its GHG control commitments and allows more emissions than planned. But under such a scheme, the more natural approach is to use taxes not permits.

Taxes are the best way to balance the cost of meeting Kyoto commitments and the impact of this policy on Canada's people and economy. We can start with a tax at $10/ton of CO_2 in 2003 and monitor its impacts on social and economic indicators and GHG emissions. The tax level can then be adjusted through time to achieve a sustainable transition away from GHG emissions. Our ultimate target for climate stabilization is not 6%, but 80% below 1990 emissions.

Pitfalls in tradable permits

Profiting by moving manufacturing abroad: By allocating rather than auctioning a significant portion of emissions permits to large emitters the government hopes to secure industry acquiescence. However, Canadian and US industries and markets are highly integrated and where industry can move production south of the border, they will do so, selling their permits for a windfall financed through public funds generating no reductions in total GHG emissions. If permits are to be allocated to industry there need to be strict accountability for net global reductions in GHG emissions (rather reductions within Canada).

Paying for non-existent reductions abroad: By offering to buy GHG allowances overseas the Canadian government can limit the upper limit of costs to local industry. However, opportunities for net reductions in GHG emissions overseas need to be carefully evaluated. Buying allowances from economies that have collapsed since 1990 does not result in net global reductions in GHG emissions. They simply lead to transfer of funds from Canadian citizens to former Eastern block governments.

For more information on how Canada can reduce its GHG emissions to meet Kyoto targets, contact the Liu Institute at http://www.ligi.ubc.ca.

About the Liu Institute for Global Issues

The Liu Institute pursues interdisciplinary and policy-related research and advocacy on global public policy issues related to human security. Its research agenda embraces international relations, human security, peace and disarmament, global public opinion and democratization, the environment, conflict and development, and global health and international justice issues.

The Institute draws together researchers, educators and policy experts from the extended community of the University of British Columbia. It's mission is to influence public policy decisions through its research and other activities.

The core objectives of the Liu Institute are to:

- Promote greater understanding of critical global policy issues;
- Shape public debate on these issues, and;
- Generate productive academic and policy dialogue.

The Liu Institute currently houses four research organizations:

- The Simons Centre for Peace and Disarmament Studies
- The Centre of International Relations
- The Centre for Public Opinion and Democracy
- The Centre for Human Security

The Liu Institute has six ongoing research programs, in addition to those initiated within the four research centres. They are led by program heads and deal with the following issues:

- Global Environment
- Development, Conflict and Peacebuilding
- Globalization and Health
- International Legal Framework
- Corporation Social Responsibility
- South-North Issues

Liu Institute Report 03-002: **A Sustainable Climate Policy**

Liu Institute for Global Issues, University of British Columbia
6476 NW Marine Drive
Vancouver, BC, CANADA V6T 1Z2