Delegates' Package

Carbon Pricing for a Sustainable Economy

Sheraton Eau Claire – Calgary, Alberta
October 29-30, 2007

the PEMBINA institute
Sustainable Energy Solutions

Presented with the generous support of:

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Welcome

Oct. 23, 2007

Greetings, and welcome to our conference!

We are very pleased to present *Carbon Pricing for a Sustainable Economy: Applying Market Forces to Climate Protection in Canada*.

As we all recognize, Canada is facing a carbon-constrained future. Products and services will increasingly need to be provided with a reduced carbon footprint, and there is growing interest in using carbon pricing to drive the necessary structural changes and technology deployment.

Experts are already debating the "right" price of carbon in Canada, and recent policy proposals have started to point Canada in the direction of carbon pricing.

We see this as an opportune moment to think through Canada's further policy options in an open, frank, and collaborative forum involving corporate leaders, governments and non-governmental organizations – all of whom have a stake in Canada's decisions on carbon pricing.

The Pembina Institute's mission is to advance sustainable energy solutions, and carbon pricing is a key policy tool to get us there. Since our founding in 1985, Pembina has played a leading and unique role as a bridge-builder and facilitator of industry-ENGO-government discussions. We hope that this conference is the start of a very important conversation about how best to use market forces for climate protection.

I'm really looking forward to hearing the perspectives of all our participants. Thanks so much for taking part in the conversation, and I hope that it's a rewarding experience for all.

Sincerely,

Marlo Raynolds, Executive Director
The Pembina Institute

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IMPORTANT NOTE

Please bring this delegates' package to the conference, as we will make reference to the summaries of the research papers in workshop discussions (see Appendix A).

1. Agenda and Participants' List

1.1. Agenda

The following agenda is an outline of the days' proceedings. A detailed agenda, including notes on facilitation, will be available upon registration. The facilitators will also take time to present and annotate the agenda during their inaugural address on Monday.

Conference Day 1: Monday October 29, 2007	
11:00 – 12:00	Arrivals and registration
12:00 – 12:45	Lunch
12:45 – 13:30	[A] Conference inauguration and welcome by the facilitators – Marlo Raynolds and Rob Abbott (plenary) — Setting up the issues: what do we hope to achieve over the next two days? — Introduction to the conference format and ground rules
13:30 – 15:00	[B] Working Session 1 **What do we expect from an effective carbon pricing system?** — What criteria and principles should we use in evaluating the success of a carbon pricing system?
15:00 – 15:30	Break
15:30 – 17:30	[C] Working Session 2 **First stream — How do we design for Canadian competitiveness and international harmonization?** (Specific criteria and attributes. How do we price for Canadian competitiveness and international harmonization?) **Second stream — Revenue recycling: if carbon pricing generates government revenues, how should these be spent?** (Design of collection, design of use. E.g. if you lower corporate taxes do you do it just for polluters, or for all companies?)
Earth Celebration: Monday October 29, 2007	
17:30 – 18:30	Reception, drinks and networking
18:30 – 21:30	Dinner and evening program

Conference Day 2: Tuesday October 30, 2007 / Sheraton Eau Claire	
07:30 – 08:30	Breakfast
08:30 – 09:00	[D] Presentation and overview of key outcomes from Day 1 (plenary) — Setting up the issues: where do we need to focus our attention today?
09:00 – 10:30	[E] Working Session 3 **First stream — Revenue recycling: if carbon pricing generates government revenues, how should these be spent?** **Second stream — How do we design for Canadian competitiveness and international harmonization?** — These will be with the same groups as working session 2, but opposite topics; groups will take the previous days' work as their starting point.
10:30 – 10:45	Break
10:45 – 11:30	[F] "Conversation café" — Discussions on specific topics, including public transparency, cross-sector partnerships for promoting carbon pricing, offsets etc. — Pick your table, or create your own
11:30 – 12:15	[G] Buffet lunch, report back from conversation café tables
12:15 – 13:00	[H] Town Hall (plenary) — Conclusions: where did we start and where have we landed? — Where do we go from here? — What are the next steps and outstanding issues?

1.2 Participants' List

Around 100 participants are registered for the conference from a range of industry sectors, provincial and federal governments, and expert fields. A full list of participants will be available on Monday at registration.

2. Conference Overview

2.1. Format and Objectives

Carbon Pricing for a Sustainable Economy will assemble leading voices for an engaging working session. The participants will include:

- executives and in-house experts from industry
- think tanks
- NGOs
- domestic and international specialists, and
- policy-makers.

Proceedings begin at noon on Monday, October 29 and conclude at 1 p.m. on Tuesday, October 30.

The conference's agenda is aimed at addressing the following question:

How do we develop a future carbon pricing system that is environmentally effective, administratively and economically efficient, fair to regions and to sectors, and capable of positioning Canada for future success?

There will be some plenary panel and expert presentations, but participants will spend the majority of their time in facilitated small group workshops that grapple with specific design questions and work to analyze, troubleshoot and refine a series of "straw dog" policy proposals. The format will emphasize dialogue and interaction, encouraging participants to apply their unique insights and experience in a collaborative solutions exercise.

The goals are to clarify the state of the debate, identify common ground, and – with all the key players at the table – vet and refine concrete design proposals that could form the basis for future policy.

Monday evening will be dedicated to a rejuvenating dinner and celebration: a chance to pause, relax, reflect, debate and network. All conference participants are invited to take part in the Pembina Institute's annual Earth Celebration, a linked event that includes a silent auction and entertainment. The Earth Celebration will be open to guests in addition to conference participants. Dress is **business casual.**

Ultimately, the organizers' aim is to foster a focused discussion on the kind of carbon pricing regime that might work best for Canada. Ideally, participants will lay the groundwork for future collaboration through these discussions. However, there is no expectation of reaching a formal "consensus position" agreed to by all or some participants.

2.2. Ground Rules

Carbon Pricing for a Sustainable Economy is intended to generate open, constructive and solution-focused discussion among a wide range of industry, NGO, academic and government participants.

The Pembina Institute believes that this type of collaborative, multi-stakeholder dialogue holds significant potential for identifying new insights and synergies, although there may be moments of uncertainty and unfamiliarity as well.

A set of "ground rules" can help to:
— harmonize expectations and set the tone of discussion;
— create a "comfort zone" that allows participants to express their thoughts freely, as expert individuals; and
— maintain focus and keep working sessions on track.

To that end, all participants will be asked to respect the following principles and "ground rules".

Attribution and Confidentiality

— Many conference participants have worked in a variety of institutional and sectoral contexts and should feel comfortable drawing on the full breadth of their experience in addressing the questions at hand.

— The conference will strive to create an environment in which participants may contribute as expert individuals outside of their institutional positions, should they wish to do so.

— To create a safe space for open discussion, Chatham House Rules will govern participation in all plenary and working sessions; under these rules, ideas generated during the conference may be used and reported, but may not be attributed to individuals or to organizations.

Formal Reporting of Conference Outcomes

— The Pembina Institute sees value in sharing substantive conference outcomes with a wider public – including industry, policymakers and opinion leaders – in order to inform and advance ongoing carbon pricing design work in Canada. These outcomes may include identification of new insights, potential areas of common ground, and areas requiring further study.

— Pembina staff will record key outcomes as rapporteurs in plenary and working sessions and will compile a complete conference proceedings document, without attribution of ideas to individuals or organizations (i.e., following Chatham House Rules). This document will be reviewed and approved by the Expert Advisory Committee and will be distributed to conference participants before being made available to the public.

— There is, however, no expectation of reaching a "consensus position" agreed to by all or some participants. Given the short timelines and the diversity of participant perspectives, such an expectation is likely not feasible and could also serve to limit open discussion.

Topics Excluded from Debate

— The conference has an ambitious agenda with just under ten hours of time allocated for plenary and working discussion. In order to make progress on this agenda, it is expected that all participants will accept two basic premises: that Canada needs to reduce its greenhouse gas emissions, and that carbon pricing is a valuable tool for doing so.

— Many participants may have views concerning existing carbon pricing proposals introduced by governments, and they should feel free to raise those in the context of the policy discussion. However, *Carbon Pricing for a Sustainable Economy* is not the appropriate venue to "lobby" government officials for specific changes to these proposals.

Role of Government, Media and Other Participants

— Given the diversity of participant backgrounds, it is understood that there may be individuals whose affiliation might make others leery about speaking freely. For example, this could include policymakers or experts working with media organizations.

— To the extent that government, industry, academics, NGOs and the media all have a role to play in solution-building, the Pembina Institute is keen to welcome participation from all expert individuals with an interest in constructive debate.

— As such, the conference will not distinguish any special status for government, political, media, or other participants. However, the conference organizers will make a special effort to cover the ground rules, possibly in one-on-one conversations, with any individuals whose participation may raise sensitivities as noted above.

— With respect to media, conference organizers have limited participation to experts or pundits with a long-term interest in climate change and carbon pricing. Like all others, they will be expected to adhere to Chatham House Rules. No news media were invited.

2.3. About the Pembina Institute

In October 1982, the Lodgepole sour gas well blowout led to the deaths of two people and to heavy air pollution in central Alberta that lasted for several weeks.

This event, and the inquiry that followed it, were the catalysts for a small group of local residents to band together to express their concern and press for higher safety standards in the oil and gas industry. As a result of their intervention, the regulations guiding sour gas development by the petroleum industry were changed dramatically. Empowered by the positive experience of citizen-led action, this group went on to found the Pembina Institute in 1985.

Today the Pembina Institute, a not-for-profit organization, has over 40 staff working out of offices in Drayton Valley, Vancouver, Edmonton, Calgary and Ottawa. The Pembina Foundation, a charitable non-profit organization, is the Pembina Institute's sister organization.

Our approach is best described as informed, practical, rigorous, adaptable and solutions-focused. Our method is collaborative where possible and challenging where necessary. Our team comprises professionals from many fields, including engineering, environmental science, biology, chemistry, urban planning, international development, political science, environmental law, geography, economics, business, communications, marketing and education. We ground our work with practical knowledge, research, and experience by working with (and bridging between) NGOs, governments, communities, companies, and individual experts.

2.4. The Pembina Institute as Facilitator

In 1992, the Institute co-founded the national Economic Instruments Collaborative (EIC), a pioneering industry-ENGO collaboration on the role of market mechanisms in mitigating acid deposition, ground-level ozone and climate change. The Collaborative published its report, *Achieving Atmospheric Quality Objectives Through the Use of Economic Instruments* in 1993, capturing a surprising level of common ground and highly concrete recommendations.

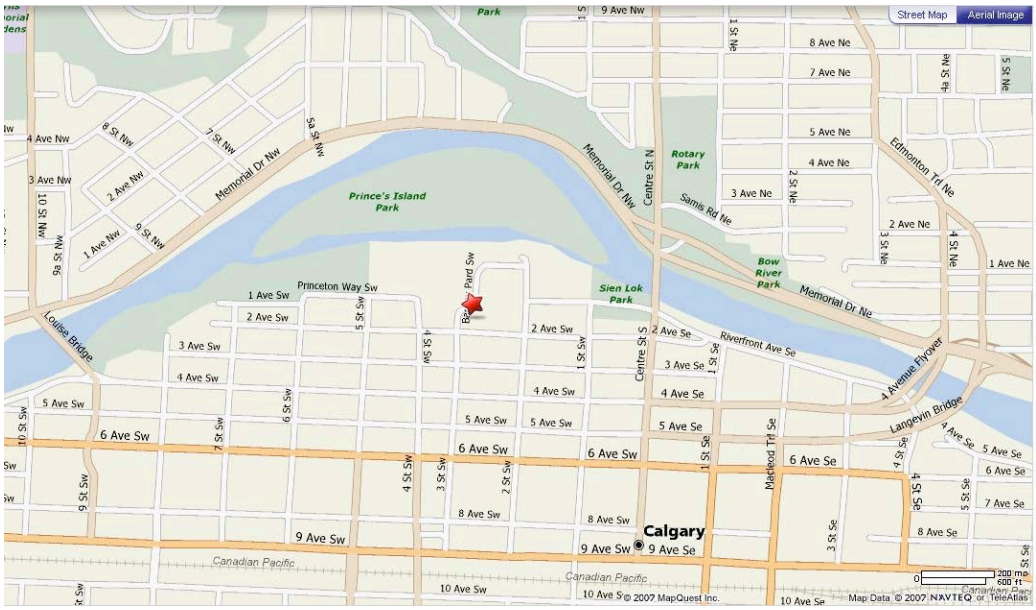
Since that time, the Pembina Institute has continued to play a leading and unique role as a bridge-builder and facilitator of industry-ENGO-government discussions and remains one of Canada's leading ENGOs working on ecological fiscal reform and climate change policy.

The collective credibility of conference participants and of the Pembina Institute as a facilitator present *Carbon Pricing for a Sustainable Economy* with unique potential to influence the terms of the emerging discussion about carbon pricing in Canada.

3. Logistics

3.1. Location

All conference events will take place at the Sheraton Suites Calgary Eau Claire:
255 Barclay Parade SW, Calgary, AB, T2P 5C2
(403) 266 7200



3.2. Transportation

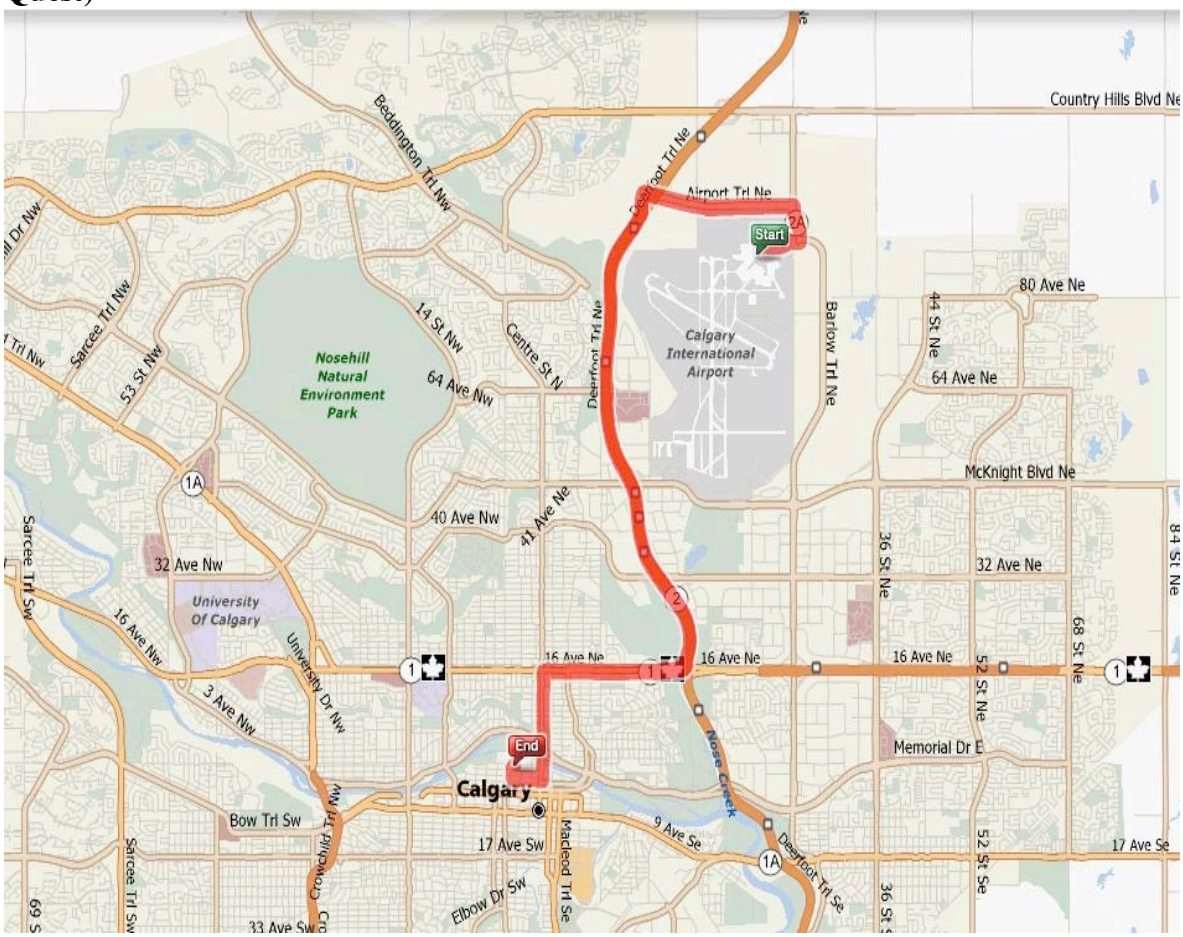
The Sheraton is centrally located in downtown Calgary, close to amenities and the river pathway system. It's also just a few blocks North of Calgary's Light Rail Transit (LRT) downtown corridor along 7 Ave. SW. Travelling eastbound, alight at 3rd St. W station; travelling westbound, alight at 1st St. W station.

To / from the airport:

— A taxi will cost about $30
— Sundog Tours offers an airport—downtown shuttle service for $15, leaving every hour on the half hour. The shuttle stops at the Sheraton. http://www.sundogtours.com/transp/airport.html for more information.
— Calgary Transit bus number 57 connects the airport to Whitehorn LRT station for connections downtown. The fare is $2.25. Total travel time is about 1 hour.

Driving directions from the airport are provided on the following page.

Map to Sheraton Eau Claire from the Calgary International Airport (Source: Map Quest)



- Start out going WEST on AIRPORT RD NE
- Turn SLIGHT LEFT
- Turn LEFT onto AIRPORT RD NE
- Turn LEFT onto BARLOW TRL NE / PROVINCIAL ROUTE 2A N.
- Turn SLIGHT LEFT
- Turn LEFT onto AIRPORT TRL NE
- Merge onto PROVINCIAL ROUTE 2 S / DEERFOOT TRL NE via the ramp on the LEFT toward CITY CENTRE
- Take the TRANS CANADA HWY / HWY-1 / 16 AVE N EAST / 16 AVE N WEST exit- EXIT 258
- Keep RIGHT at the fork to go on 16 AVE NE / PROVINCIAL ROUTE 1 W / TRANS CANADA HWY W
- Turn LEFT onto CENTRE ST N
- Turn RIGHT onto 3 AVE SW
- Turn RIGHT onto 3 ST SW / BARCLAY MALL SW
- 3 ST SW / BARCLAY MALL SW becomes BARCLAY PARD SW
  End at Sheraton Calgary Eau Claire:
  255 Barclay Parade Sw, Calgary, AB T2P 5C2, CA

3.3. Further Information

Should you need to get in touch with the conference organizer, don't hesitate to send us an e-mail or give as a call at any time.

For questions relating to registration, payment, accommodation or logistics, please contact Sandra Gomez: 403 269 3344 ext. 124 or sandrag@pembina.org.

For any other questions, contact Jaisel Vadgama – 403 807 6566 (cell) or jaiselv@pembina.org – or Mike Kennedy – 780 862 8667 (cell) or mikek@pembina.org.

3.4. Carbon Footprint

In an effort to minimize the conference's environmental footprint, *Carbon Pricing for a Sustainable Economy* and Pembina's Earth Celebration are both "bullfrog-powered" with 100% green electricity.

The Pembina Institute and Bullfrog Power are partnering to promote the benefits of renewable power to Canadians. To learn more, please visit www.pembina.org/wind.

We also encourage conference participant to offset their travel-related CO_2 emissions, if applicable. Below, please find a list of Canadian and international organizations that provide high-quality carbon offsets. If you have any questions about offsetting emissions, please contact Matt McCulloch (Co-Director of Pembina's corporate consulting team): matthewm@pembina.org.

Canadian Offset Organizations

1. CarbonZero – Canadian domestic high-quality offsets.
2. Offsetters – Canadian re-seller of Climate Care offsets.
3. Planetair – Canadian operation that re-sells myClimate offsets. Planetair offers the option of purchasing 100% Gold Standard[1] offsets.
4. Baseline – Alberta-based organization that sells Alberta wind power.

International Offset Organizations

1. Atmosfair – offers 100% Gold Standard projects.
2. myClimate – myClimate's portfolio includes some Gold Standard credits.

[1] A Gold Standard offset comes from a project that meets the tests in the Clean Development Mechanism's Additionality tool, is either an energy efficiency or a renewable energy project, and contributes to sustainable development in an Annex II (developing) country.

4. Acknowledgements

The Pembina Institute wishes to pass on our sincere thanks to the conference's generous sponsors. This event would not have been possible without their support.

The organizers of Carbon Pricing for a Sustainable Economy also benefited from the invaluable guidance of an Expert Advisory Committee. The Committee provided timely and thoughtful advice on the Conference's design, its research agenda, and its organization. We are grateful for the contribution of each of the Committee members.

Expert Advisory Committee: Sponsor Members	
Delegate (/alternate delegate)	**Affiliation**
Bob Walker	Ethical Funds Company
Dianne Zimmerman	Suncor
Don Drummond	TD Bank Financial Group
Per Markestad	Statoil Hydro
Gary Holden / David Lawlor	ENMAX
Johanne Gélinas	Deloitte
Lloyd Visser / Bruce Wilcoxon	ConocoPhillips
Nelson Switzer	RBC
Shahrzad Rahbar	Canadian Gas Association
Timo Makinen	Shell
Wishart Robson / Brian Ross	Nexen
Expert Advisory Committee: Non-sponsor Members	
Delegate	**Affiliation**
Brett Gartner	Canada West Foundation
Donna Morton	Centre for Integral Economics
Mark Anielski	Anielski Management
Pierre Sadik	David Suzuki Foundation
Robert Hornung	Canadian Wind Energy Association
Stewart Elgie	University of Ottawa

5. Research Agenda Overview

Working in collaboration with academic experts and members of the External Advisory Committee, Pembina's team has assembled a series of short research and discussion papers for conference participants.

The papers examine three key dimensions of the carbon pricing question:

- **Policy design questions:** how to evaluate a carbon pricing policy's success; taxes, trading and hybrids; and revenue recycling.

- **The Canadian context:** Canadian carbon pricing policies; economic modelling of the effects of carbon pricing in Canada.

- **The global context:** international experience with carbon pricing; the effects of carbon pricing on international competitiveness.

The research papers range from 5-10 pages in length, and aim to provide an overview of academic thinking on the policy questions, or a factual summary of carbon pricing policies. These papers, compiled into a single package, will be forwarded as a separate document.

Below, participants will find 2-3 page summaries of each research paper. The summaries are considered **"required reading"** for the conference, as they establish a common basis of information for all participants. These summaries will be used in working sessions and plenary sessions to guide the discussion. Please do take the time to read the summary papers (below) in advance of *Carbon Pricing for a Sustainable Economy.*

If you have any questions or comments on the contents of the research agenda, please contact Mike Kennedy (mikek@pembina.org; 780-485-9610 x101). We would greatly appreciate having your comments on the any aspect of the research to date.

NB: although Advisory Committee members have provided substantial guidance on the research agenda, views expressed in the papers may be solely attributed to the Pembina Institute.

Carbon Pricing for a Sustainable Economy

Applying Market Forces to Climate Protection in Canada

October 29-30, 2007

Appendix A: Summary Papers

Summary

Amy Taylor
amyt@pembina.org

Policy Evaluation Criteria

This discussion paper identifies and describes a number of criteria that can be used to evaluate alternative carbon-pricing[1] policy options. A draft "straw dog" policy evaluation framework for Canadian carbon-pricing policies is also presented.

As with any other policy choice, alternative GHG reduction strategies must be evaluated to assess the best possible approach, or set of approaches, to achieve policy objectives. The resulting evaluation framework may also be used to evaluate the success of the policy, once implemented, in achieving its objectives over time.

In its 2005 Budget, the federal government laid out the five evaluation criteria it planned to use to assess environmental taxation policies: environmental effectiveness, fiscal impact, economic efficiency, fairness and administrative simplicity.[2] This paper takes that list as a starting point and adds several other criteria of interest in the context of carbon pricing, namely cost effectiveness, adjustment costs, impact on competitiveness, political feasibility and integration with global policies. Each criterion is described below.

Environmental Effectiveness

When assessing environmental policy options, this is the most crucial criterion. Environmental effectiveness seeks to determine to what extent the policy contributes to environmental improvement objectives. It can be measured directly through environmental measures (e.g., GHG emissions) or indirectly through changes in behaviour that lead to environmental improvements (e.g., increased use of public transit).

Fiscal Impact

This criterion considers the impact of a given environmental policy on the government's fiscal position, whether as a decrease or increase in government revenues. It could also include the impact of the policy on sound fiscal management, the efficiency of the tax system, or on the government's ability to adjust fiscal policy over time.

Economic Efficiency

Economic efficiency refers to the optimal allocation of resources across alternative uses. A decrease in economic efficiency — a market failure — occurs when prices do not reflect true and

[1] In this document, the word "carbon" is a shorthand expression that includes all six of the greenhouse gases covered by the Kyoto Protocol (of which carbon dioxide is the largest component).

[2] http://www.fin.gc.ca/budget05/bp/bpa4e.htm, Annex 4.

complete costs, as in the case of "environmental externalities" (these are market situations where environmental costs are not fully incorporated into prices but instead are borne by society as a whole). Where market failures exist, policy measures such as taxes can improve price signals, contribute to a more productive use of resources, stimulate technological innovation, and hence increase economic efficiency.

Fairness

Fairness concerns the distribution of the burden or benefit of an environmental policy amongt individuals, regions and sectors. In general, it is considered fair that polluters pay the costs associated with pollution that they create and that investors in environmental improvements receive the benefits of their investment. Other fairness principles include ability to pay and historical responsibility/recognition of early action.

Administrative Simplicity

Policies should avoid unnecessary complexity so that affected parties can understand and execute the policy's requirements and government administrative costs are minimized. Policy harmonization across various levels of government, or between jurisdictions, tends to reduce administrative costs. "Piggy-backing" new policies on existing monitoring or administrative structures would typically be simpler than creating new systems. Consistency over time also allows a policy to be administered more easily.

Impact on Competitiveness

Policies should be evaluated for both the negative and positive effects they may have on competition. The extent to which policies drive innovation and market creation is an important consideration. It is also important to assess the magnitude of negative impacts on those sectors of the economy engaged in competition at home or abroad.

Cost Effectiveness

This criterion concerns the economic costs (monitoring, enforcement and compliance costs, for example) associated with a particular environmental policy in relation to the environmental benefits achieved by the policy. A cost-effective environmental policy is one in which costs are minimized and the benefits of environmental improvements or the costs of environmental inaction justify the cost of pursuing the policy.

Political Feasibility

When deciding among policy options, the political feasibility of a particular policy choice can be an important consideration. Support from voters and existing precedents tend to increase the feasibility of a given policy, as does consistency with a government's philosophy.

Integration with Global Policies

For environmental issues of a global nature, such as climate change, it can be advantageous to coordinate domestic environmental policies with global or international policy regimes. Doing so may reduce domestic adjustment costs and lead to greater economic efficiency and environmental improvements. In such cases, it is useful to evaluate domestic policy options for their consistency with international policy frameworks.

Table 1. Draft Evaluation Framework for Carbon Pricing Policies in Canada

Criteria	Measurement
Environmental effectiveness	- Near-term GHG emissions reductions sufficient to make an adequate contribution to national climate change goals. - At the individual level, behavioural change leading to lower emissions. - Deployment of low-emission technologies (at the individual and industrial level).
Cost effectiveness	- Minimization of costs of meeting environmental goals.
Competitiveness	- Minimization or mitigation of significant negative impacts on competitiveness.
Fiscal impact	- Government maintains sound fiscal management. - If revenue neutrality is a goal, maintenance of revenue neutrality.
Fairness	- Ability to mitigate impacts on low-income earners. - Equitable distribution of any related cost burdens or financial benefits. - Fairness across sectors and regions.
Administrative simplicity	- Minimization of administrative costs.
Integration with global greenhouse gas reduction regimes	- In a trading policy scenario: Canada's ability to link with international carbon markets (fungibility of Canadian credits). - In a tax scenario, harmonization of Canadian tax rates with those in peer countries. - Conformity with policies supported by international climate change agreements (e.g., with the Kyoto Protocol).

Summary

Amy Taylor
amyt@pembina.org

Comparing Tools

Carbon pricing[3] schemes are usually considered the least costly policy approach to reducing greenhouse gas emissions. These market mechanisms maximize economic efficiency by allowing the cheapest emission reductions to occur first, and by creating an incentive for companies to undertake all emission reductions that cost less than the cost of carbon.[4]

Carbon pricing can be achieved through use of taxes or fees levied on GHG emissions or on the carbon content of fossil fuels. Alternately it can be achieved through a cap-and-trade scheme for GHG emissions. This policy brief provides an overview of the two key policy options available for carbon pricing, along with a brief discussion of hybrids of the two.

The table below compares cap-and-trade and carbon taxation approaches.

	Emissions cap-and-trade	**Carbon tax**
Certainty Offered		
	In theory, offers certainty about the quantity of GHG reductions. In practice, governments may set a price ceiling (or "safety valve"), a practice that reduces certainty about GHG reductions.	In theory, offers certainty about the price of carbon. In practice, governments may decide to adjust tax rates frequently, thus reducing price certainty.
Environmental Effectiveness		
Polluter pays?	Yes, if targets are stringent, permits are auctioned and offsets[5] are only offered for incremental GHG reductions.	Yes, as long as the tax level is appropriate and tax exemptions and reductions are not offered.
Ease of increasing the carbon price or the quantity of reductions	Relatively easy to increase the quantity of reductions by decreasing the number of auctioned and gratis permits. However, the resulting effect on the carbon price would be uncertain.	Relatively easy to increase the carbon tax rate to a desired price level. However, the effect on GHG emissions of the new price level would be uncertain.

[3] In this document, the word "carbon" is a shorthand expression that includes all six of the GHGs covered by the Kyoto Protocol (of which carbon dioxide is the largest component). The abbreviation "CO_2e" refers to "carbon dioxide equivalent," a standard measure that incorporates all six of these gases.

[4] A comprehensive policy approach to reducing greenhouse gas emissions will require not only a carbon pricing scheme but regulatory policies (standards for vehicles and buildings) as well.

[5] Offsets are emission reductions that take place outside of the sectors covered by a cap-and-trade scheme.

Use and recipient of carbon price revenues	Money spent on offset credits[6] (credits generated from emission reduction projects outside the cap-and-trade system) remains in the private sector, is spent on immediate emission reductions, and can be a mechanism for financing emission reductions in poorer countries. Money spent on auctioned permits goes to government and may be spent on emission reductions.	Money spent on paying carbon taxes goes to government and may be spent on emission reductions. A carbon tax could allow for the purchase of offset credits[7] as a means to reduce taxable emissions, and to ensure that some money is redirected to immediate emission reductions, including reductions in poorer countries.
Economic Efficiency		
Consistent marginal incentive for emission reductions?	By creating a market, provides a single marginal price for emission reductions, maximizing economic efficiency. However, this is only true when governments use absolute targets; intensity targets result in different types of reductions being priced differently.	A common tax rate on all sectors provides a single marginal price for emission reductions, maximizing economic efficiency. However, if governments set different tax rates/exemptions for different sectors, the unique marginal price would be lost.
Applicability to individuals	Not easy to apply directly to individuals (except through "carbon credit cards"). Can be applied indirectly to individuals using an "upstream" system.	Easily applied to individuals directly, but effectiveness in encouraging emission reductions will likely depend strongly on visibility.
Simplicity of Administration		
	Can be designed to be simple (e.g., by auctioning 100% of permits) but allocating some permits free-of-charge would undermine the system's simplicity.	Can be designed to be simple, but sectoral exemptions or variations would undermine the system's simplicity.
Important Design Considerations		
Means of addressing distinct sectoral pressures	Flexibility to allocate permits free-of-charge according to sectors' "ability to pay." Allocation of free permits tends to be contentious, and can be vulnerable to lobbying.	Flexibility to recycle revenue in a way that reflects sectors' needs. Revenue recycling has the potential to be contentious, and can be vulnerable to lobbying.
Consistency with international GHG reduction regime	The current international regime (Kyoto Protocol) is a cap-and-trade architecture.	Some argue that it will be easier to achieve international agreement on an effective future regime (post-2012) based on carbon taxes.

A Combination of Pricing Approaches

While much discussion focuses on the option of pursuing a carbon tax *or* a cap-and-trade system, the possibility of a combination of pricing approaches also exists. For example, a cap-and-trade

[6] Determining the "additionality" (or incrementality) of offset credits — to ensure they represent genuine emission reductions — can be challenging.

[7] See previous footnote.

scheme for large industrial emitters could be combined with a carbon tax targeted at the residential, commercial and transportation sectors. With this type of a "hybrid" pricing scheme, a carbon price would be realized throughout the economy while large industrial emitters would benefit from internationally co-ordinated cap-and-trade systems.

Another option is to combine an economy-wide carbon tax with a voluntary cap-and-trade scheme for large industrial emitters that could benefit from a trading scheme.[8] The trading scheme could be integrated with international trading schemes, thus maximizing the pool of potential emission reductions and ensuring that the lowest-cost reductions take place first.

A recent proposal from an analyst at the consulting firm Deloitte combines a carbon tax with rebates for the cost of purchasing permits from cap-and-trade systems.[9] (For example, if the tax rate was \$40/tonne CO_2e and a firm bought a permit for \$30/tonne, it would only have to remit the difference of \$10/tonne to the government.) In this approach, the tax sets a price ceiling, offering financial certainty to emitters, while at the same time maintaining the environmental certainty of setting a cap on emissions through a cap-and-trade system.

[8] Frank Muller, *Comparison of Carbon Tax and Cap and Trade Emissions Trading Scheme,* (Institute of Environmental Studies, UNSW).

[9] Adam Whitmore, "Taxes and Trading: Better Together," *Carbon Finance* (September 14, 2007), www.carbon-financeonline.com/index.cfm?section=features&action=view&id=10741&linkref=cnews.

Summary

Mike Kennedy
mikek@pembina.org

Amy Taylor
amyt@pembina.org

Revenue Recycling

Governments that auction tradable permits or implement carbon[10] taxes stand to raise considerable revenue. The use of this revenue can significantly influence the economic efficiency, effectiveness and fairness of emission-reduction policies.

Revenue recycling[11] can reinforce the policy goals of the carbon price policy, mitigate impacts on low-income earners, reduce existing taxes and increase the political acceptability of the pricing scheme. The decision to pursue one revenue-recycling strategy over another will result in a unique set of impacts on the economy in terms of welfare,[12] employment, economic growth and total CO_2 emissions reductions. In general, revenue recycling can occur at three levels: broad-based, sector-specific and individual. [13]

Broad-based

Broad-based revenue recycling occurs when carbon pricing revenues are used to finance reductions in existing broad-based taxes, including payroll taxes, income taxes, sales taxes and capital taxes. The appeal of broad-based revenue recycling is its potential to achieve a so-called "double dividend." This dividend occurs when carbon pricing serves to remove a negative externality (greenhouse gas emissions) from the economy while at the same time raising revenues that are used to reduce the "deadweight loss"[14] from existing taxes on savings, employment and capital formation. While the theoretical debate over the realization of a double dividend is still open, many researchers have found that revenue recycling that reduces the deadweight loss associated with existing taxes can lead to positive impacts on the economy.

[10] In this document, the word "carbon" is a shorthand expression that includes all six of the greenhouse gases covered by the Kyoto Protocol (of which carbon dioxide is the largest component).

[11] "Revenue recycling" is returning revenues from revenue-raising fiscal instruments (i.e., tax or auction of tradable permits) back to society in the form of refunds, subsidies, credits or reductions in existing taxes.

[12] Welfare is the economic well-being of an individual, group or economy. Welfare is not measured directly but income is often used as a measure of one's welfare or economic well-being.

[13] For more detail on revenue recycling, including case studies of existing policies, please see *Carbon Pricing and Revenue Recycling – Discussion Paper* (available at www.pembina.org).

[14] Current fiscal policy includes taxes on "societal goods" such as labour, capital formation, sales and income. These taxes depress income, employment and sales and discourage capital formation. The resulting loss of business, work and savings is often referred to as the "deadweight loss" from the tax system.

In Europe, six countries — Denmark, Sweden, Finland, the United Kingdom, the Netherlands and Germany — have implemented policies that shift taxes onto carbon/energy. The policies include a variety of schemes to recycle the resulting revenues; taken together, these carbon/energy pricing policies total €25 billion annually.[15] A study of these reforms found that five of the six countries experienced modest economic gains as a consequence of their carbon/energy tax shift, while one country, the United Kingdom, experienced a neutral economic outcome.[16]

Case Study: Carbon Pricing in Germany

Germany's ecological fiscal reform policy was designed to simultaneously reduce greenhouse gas emissions and increase employment. The reform, introduced in 1999, involved increased taxes on electricity, gasoline, fuel oil and natural gas, phased in over a four-year period. The revenue generated from these taxes is used to finance reductions in social security contributions from both employers and employees. To address concerns about the impacts of this policy on competitiveness, the policy includes provisions that reduce the taxes paid by energy-intensive industries. When the increased taxes were introduced, energy-intensive companies paid just 20% of the standard tax rate; in 2003, this increased to 60%. The policy addresses negative impacts on low-income earners through increased children's allowances, an increased "income-tax-free" threshold and a reduction in tax rates for low-income earners.

Sector-specific

As the name implies, sector-specific revenue recycling occurs when revenue is targeted at a particular sector. Governments can choose to transfer the revenue back to those who have paid the carbon price, using criteria such as investments in qualifying technologies or the achievement of environmental performance targets; the revenue can be used to provide support to other sectors to facilitate further emissions reductions (for example, funds could be invested in the deployment of renewable energy technologies or in public transit infrastructure).

The best-known example of a pricing policy involving sector-specific revenue recycling is Sweden's tax on nitrogen oxide (NO_x), which has been in place since 1992. Under this system, energy-producing entities are subject to a charge on NOx emissions that is equal to SEK 40 (C$6.15) per kg of emitted NO_x. The revenue from the charge is returned to companies in proportion to the amount of energy they produce. Thus, a plant that achieves substantial emissions reductions per unit of energy produced can receive a refund that exceeds the charge paid on the emissions. The effect on the sector as a whole is neutral, but the policy design creates an incentive for all plants to reduce NO_x emissions per unit of energy produced.

In Canada, both Quebec and Alberta have introduced carbon pricing policies that will involve some elements of sector-specific revenue recycling, although neither province has fully implemented the policy. Alberta's greenhouse gas (GHG) regulation allows covered facilities to

[15] Mikael Skou Andersen. "The environmental tax reforms and considerations in member states" COMETR (Competitiveness Effects of Environmental Tax Reforms), Work package 1 (March 2007).

[16] Paul Ekins. "An assessment of ETR on the competitiveness of selected industrial sectors" COMETR (Competitiveness Effects of Environmental Tax Reforms), Work package 3 (March 2007).

meet the target by making financial contributions at a rate of $15/tonne to the Climate Change and Emissions Management Fund. The fund will be used to finance strategic projects or technologies aimed at reducing greenhouse gas emissions in the province. In Quebec, fossil fuel distributors are subject to a modest carbon tax as of October. 1, 2007.

The revenue from the tax — expected to be about $200 million per year — will be dedicated to funding GHGreduction (some of which will be sector-specific) and public education activities included in the province's 2006 Climate Action Plan.[17]

Individuals

Revenue from a carbon pricing scheme can also be recycled to individuals. In this case, the revenue is transferred to households through direct payments to qualifying households or as compensation for undertaking qualifying activities. For example, governments might opt to mitigating negative effects of carbon pricing on low-income earners through rebate programs; provide tax incentives for carpooling or telecommuting, or provide subsidies for household investments in energy efficiency.

[17] CBC News. "Quebec petroleum companies to pay green tax" June 15th 2006. http://www.cbc.ca/canada/montreal/story/2006/06/15/qc-kyoto20060615.html#skip300x250 (accessed August 27, 2007)

Summary

Clare Demerse
clared@pembina.org

Canadian Policy Experience

In establishing regulations for greenhouse gas (GHG) emissions, the federal government and a few provinces have introduced scope-limited carbon-pricing systems alongside other policies in order to incite emissions reductions. Quebec has introduced carbon taxes with the express purpose of raising revenues for dedicated emissions reduction measures. This summary paper provides an overview of these and other key initiatives to date.

Federal

The Government of Canada's current proposal for regulating GHG emissions from heavy industry sets a facility target of 18% improvement in emissions intensity in the first effective year (2010). Annual intensity improvements of 2% are required thereafter. New facilities are exempt from targets until the fourth year of operation. Compliance options include on-site reductions, emissions trading with other regulated facilities, purchases of domestic offset credits and limited purchases of international project-based credits.

A fifth compliance option allows facilities to pay into a capped technology fund, consisting mainly of a "deployment and infrastructure" component, to be spent on "investments that have a high likelihood of yielding greenhouse gas emission reductions in the near term."[18] The technology fund can account for up to 70% of a facility's regulatory obligation in 2010, but the cap tightens annually thereafter. The rate for payments into the fund (the effective "price") rises from $15/tonne CO_2e in 2010 to $20/tonne in 2013, whereupon it is fixed to the annual rate of nominal GDP growth.

Note that these regulations are intended as one component of a climate strategy that would stop GHG emissions growth by 2010–2012, and reduce total annual Canadian emissions by 20% between 2006 and 2020. (This is equivalent to an increase of 2% between 1990 and 2020.) If adopted, the approach would be subject to review in 2012.

British Columbia

In April 2007, British Columbia joined the Western Regional Climate Action Initiative (WRCAI). The group's membership also includes Manitoba and six U.S. states. Ontario, Quebec and Saskatchewan have observer status. WRCAI aims to develop "a design for a regional market-based multi-sector mechanism, such as a load-based cap and trade program" by August

[18] Government of Canada, *Regulatory Framework for Air Emissions*. http://www.ec.gc.ca/doc/media/m_124/report_eng.pdf. p. 12.

2008.[19] Key policy design details, pricing levels and implementation timelines are yet to be determined. Within the WRCAI architecture, British Columbia maintains a goal of reducing emissions by 33% between 2007 and 2020.

A second carbon pricing initiative in British Columbia relates to risk allocation for future regulatory compliance costs of GHG emissions in the electricity sector. Bidders have the option of transferring responsibility for GHG liabilities to BC Hydro, by adding an offset cost to bid prices. At maximum emissions intensity (1.2 t CO_2e /MWh) and over a maximum time period (40-year term), the cost is about $24/tonne CO_2e.[20]

Alberta

Alberta's regulatory framework for industrial GHG emissions took effect in July 2007. Established facilities with annual emissions above 0.1 Mt/yr are immediately required to reduce emissions intensity by 12% below a baseline. New facilities are exempt for three years; they must then reduce emissions by an additional 2% vis-à-vis their baseline each year. Compliance options are equivalent to those in the federal system, except that offset credits may only be generated in Alberta, and no caps are placed on the technology fund. As a result, emitters can treat fund payments as a $15/tonne tax on excess emissions.

Ontario

Ontario's Environment Minister has noted that, "Ontario supports the absolute emission targets that define both the [WRCAI] and RGGI."[21] However, Ontario has not joined either group. (The Regional Greenhouse Gas Initiative or "RGGI" is made up of seven northeastern U.S. states aiming to stabilize fossil-fuel-fired electric generation emissions between 2009 and 2014 and then achieve a 10% reduction by 2018. Like the WRCAI, it includes provisions for emissions trading.)

Quebec

As of October 1, 2007, fossil fuel distributors in Quebec pay a tax on CO_2 emissions. The value of the tax is set annually by dividing budget requirements of the Green Fund — an entity created to finance climate action initiatives in Quebec — by the province's total CO_2 emissions from fossil fuel use.[22] Revenues are expected to reach $1.2 billion between 2007 and 2012. According to the provincial government, this carbon tax is the first of its kind in North America. When estimated using 2005 emission levels, the tax level is approximately $3/tonne.[23] Importantly, Quebec's climate strategy does not depend on GHG emissions reductions resulting

[19] The text of the Western Regional Climate Action Initiative Memorandum of Understanding is available at http://www.governor.wa.gov/news/2007-02-26_WesternClimateAgreementFinal.pdf.

[20] British Columbia Hydro and Power Authority 2005 Resource Expenditure and Acquisition Plan, Supplemental F2006 Call Evidence. See "Direct Testimony of Mary Hemmingsen" for a description of BC Hydro's approach and Table 2 (p. 257) for a pricing schedule.

[21] "Ontario to Explore Joining Forces with U.S. States on Climate Change Initiative." News release, available from http://www.ene.gov.on.ca/en/news/2007/033001.php.

[22] Gazette officielle du Québec, 20 juin 2007, 139e année, no 25. p. 2260.

[23] The Pembina Institute calculation using Quebec's 2005 energy-related CO_2 emissions (61.4 Mt) and a Green Fund budget of $200 million.

from tax-induced fuel conservation. However, targeted Green Fund expenditures are responsible for a significant portion of the province's overall GHG emissions goals (a reduction in emissions of 1.5% between 1990 and 2012).[24]

[24] With the help of $350 million in federal funding, Quebec says it can make a further 3.8 Mt reduction to reach a "Kyoto-like" target of 6% below 1990 emission levels by 2012.

Summary
Mike Kennedy
mikek@pembina.org

Review of Canadian Modelling

Due to the paucity of firsthand Canadian experience with carbon[25] pricing, economic modeling can play a very useful role in estimating the impact of carbon pricing scenarios on the Canadian environment and economy.

In recent years, numerous economic–energy models have been used to analyze the impact of different carbon prices on such variables as emission levels, economic welfare, employment and GDP in Canada. The four studies below were chosen for inclusion in this brief as they present recent, relevant modelling and employ a variety of modelling techniques.[26] The differences in the analyses examined in this brief lie in the choice of model, the scenarios examined, and the economic impact variables measured. For qualitative results of the modelling studies, see Appendix A.

Dissou (2006).

Yazid Dissou's 2006 research[27] examined three methods of carbon permit allocation under a cap-and-trade system:

- A grandfathered gratis allocation (GFA)
- An output-based gratis allocation (OBA), where permits are provided based on industries' current emission intensity (ratio of emissions to economic output)
- An auction of permits with revenue recycling to reduce payroll taxes (RPT).

The cap-and-trade system considered in Dissou's study was designed to achieve a 190 Mt emission reduction[28] by 2010.[29]

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[25] In this document, the word "carbon" is a shorthand expression that includes all six of the greenhouse gases covered by the Kyoto Protocol (of which carbon dioxide is the largest component). The abbreviation "CO_2e" refers to "carbon dioxide equivalent," a standard measure which incorporates all six of these gases.

[26] For more detail on the four modelling exercises presented here, see the Pembina Institute report "Economic Effects of Carbon Pricing in Canada," available at www.pembina.org.

[27] Yazid Dissou. "Efficiency and sectoral impacts of output based emission allowances in Canada" *Contributions to Economic Analysis and Policy* vol. 5, no. 1 (2006), article 25.

[28] This represents 6% below 1990 levels from year 2000 emission levels.

[29] The "Kyoto gap" (emission reductions needed to reach the target) at that time was 240 Mt. However, Dissou considered 50 Mt of that total as "non-priceable" because of the difficulty of using cap-and-trade to control these

Dissou found that the economic welfare costs[30] associated with the OBA approach were 70% higher than the costs of RPT. However, the economic welfare costs of an OBA were lower than the GFA approach, because GFA does not raise public revenues. The study also found that OBA produces the most even distribution outcome (distribution of costs) for energy intensive sectors, but results in the worst distributional outcome for fossil fuel producers. Finally, Dissou found that RPT achieves emissions reductions at a higher marginal cost than does OBA.

M.K. Jaccard and Associates (2007)

In a 2007 report for Natural Resources Canada, M.K. Jaccard and Associates (MKJA) examine the impact of a carbon price on all greenhouse gas (GHG) emissions, energy consumption, emission reduction costs, GDP, and consumer welfare for sectors, provinces and Canada as a whole.

On the costs of reduction, the study concluded that "[m]ost sectors show small reductions in the expected resource costs at the lower GHG charges as actions take place that reduce financial expenditures without imposing significant intangible costs. Sometimes cost reductions even become greater as the GHG charge increases because the higher charges stimulate more actions that reduce financial expenditure."[31]

According to MKJA, resource costs associated with reaching emissions targets increase with increases in the carbon price. However, prices of $50/tonne CO_2e and lower will result in cost-efficiencies for the economy for all time periods studied. The study also found that, at carbon price levels ranging from $10 to $250/tonne CO_2e, 39–51% of Canadian emission reductions to 2020 occur in Alberta.

National Roundtable on the Environment and the Economy (2007)

In June of this year, the National Round Table on the Environment and the Economy (NRTEE) released a technical brief to the Minister of Environment in response to his request for advice on long-term GHG and air pollutant reductions. The NRTEE focused on the pricing levels needed to achieve a 45–65% reduction in Canada's total GHG emissions from 2003 levels in 2050.[32]

The NRTEE concluded that, to meet the GHG reduction targets suggested in this study, the immediate implementation of a clear, consistent and long-term carbon pricing policy is critical. Any delay in the implementation of such a policy may put some long-term GHG targets beyond

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emissions. As such, his study examined all "priceable" emission reductions needed to reach Kyoto while excluding international permits in the first commitment period.

[30] Economic welfare costs refer to reductions in producer and consumer welfare, which results in the erosion of producers' and consumers' ability to purchase a set quantity of goods or services.

[31] M.K. Jaccard and Associates Inc (MKJA). "Cost curves for greenhouse has emission reduction in Canada: The Kyoto period and beyond" Report prepared for Natural Resource Canada, Office of Energy Efficiency (2007), pg. vi.

[32] NRTEE. "Interim Report to the Minister of Environment" (NRTEE, Ottawa ON, 2007) also available online at: http://www.nrtee-trnee.ca/eng/programs/Current_Programs/Energy-Climate-Change/ECC-documents_e.htm

Canada's reach, and will mean that future emission prices will need to be significantly higher than if there were no delay.

Snoddon and Wigle (2007)

Snoddon and Wigle examined the impact of individual provinces pursing climate policies, focusing on the interaction of federal and provincial schemes under four scenarios that include federal/provincial regulations and tradeable carbon permits priced at $30/tonne.[33] This study is based on 2001 input–output data[34] and examines the impacts of Kyoto-level emission reductions with 2010 as the base year.

The study found that regulations alone were relatively ineffective because of leakage between provinces. A federal permit scheme was found to have a smaller aggregate welfare loss and a more even sharing of costs across provinces relative to other schemes.

Information Gaps

Despite the important modeling work completed to date, a number of information gaps still remain. For example, relatively few modelling studies have been conducted to date on the effects of carbon pricing in Canada in the 2012–2020–2050 timeframes. Information on the projected impacts during these timeframes is critical for informing current domestic decisions and international negotiations. Further investigation is also needed to determine the emissions sources for which carbon pricing policies will be the most efficient means of controlling emissions, and the emissions sources for which regulations will be most efficient, due to market failures. Finally, all the analyses cited here were conducted without explicitly accounting for the presence or absence of a carbon price imposed domestically by major trading partners.

[33] Tracy Snoddon and Randall Wigle. "Going it alone on climate" Economics Department, Wilfred Laurier University (Waterloo, Ontario April 30, 2007).

[34] Input–output data refers to a matrix representation of the national economy to predict the effect of changes in one industry on others, and by consumers, government and foreign suppliers on the economy.

Appendix A: Quantitative Results of Modelling Exercises

Table 1. Impacts in 2010 of the three tradable permit allocation methods relative to no policy action for emission reductions (a "business as usual" scenario), Dissou (2006).[35,36]

Variable	Permit Allocation Method		
	GFA	OBA	RPT
Carbon permit price ($/tonne CO_2e)	48	76	50
Economic Welfare[37]	-2.9	-2.1	-1.3
GDP at market prices	-2.2	-0.6	-1.1
GDP at factor cost	-2.5	-0.8	-1.5
Employment	-0.7	0.4	0.5
Household consumption	-2.3	-2.1	-1.2
Total real investment	-8.9	-3.5	-7.3
Total real exports	-1.9	1.2	-0.6
Total real imports	-4.1	-2.0	-3.1
Real exchange rate	1.7	1.4	1.9
Industrial abatement of CO_2e (Mt)	175	170	175
Household abatement of CO_2e (Mt)	15	20	14

Table 2. Impacts in 2030 of the three tradable permit allocation methods,relative to no policy action for emissions reductions (a "business-as-usual" scenario) Dissou (2006).

Variable	Permit Allocation Method		
	GFA	OBA	RPT
Carbon permit price ($/tonne CO_2e)	56	91	60
Economic Welfare	-2.9	-2.1	-1.3
GDP at market prices	-2.9	-1.9	-2.0
GDP at factor cost	-3.3	-2.3	-2.5
Employment	-1.0	-0.3	-0.1
Household consumption	-2.3	-2.1	-1.2
Total real investment	-5.9	-5.1	-5.5
Total real exports	-4.8	-2.2	-3.6
Total real imports	-4.2	-3.1	-3.4
Real exchange rate	1.3	1.2	1.4

[35] In Tables 1 and 2 a positive number indicates depreciation.
[36] Results in Tables 1 and 2 are measured as percent changes from the base case unless otherwise noted.

[37] Economic welfare represents producer and consumer surplus, which refers to the difference between what consumers or producers are willing to pay and the actual price of a good or service.

Table 3. Loss of GDP and Consumer Welfare under GHG charges for Canada, $1995

Loss in Gross Domestic Product (millions)										
	Carbon price ($/tonne)									
	10	**20**	**30**	**40**	**50**	**75**	**100**	**150**	**200**	**250**
2010	-1,789	-449	971	3,390	4,773	7,831	10,865	18,617	26,921	35,485
2015	-4,053	-1,081	-677	1,757	4,889	8,823	12,853	23,129	34,228	45,806
2020	-6,024	-2,746	-2,335	1,146	4,551	8,994	13,141	24,210	36,692	49,350
2030	-8,596	-4,989	-4,468	119	3,829	8,739	12,416	23,483	36,674	50,017
Loss in Consumer Welfare (millions)										
2010	2,498	4,954	7,362	9,708	11,999	17,637	23,279	35,548	45,805	57,096
2015	3,849	7,623	11,292	14,861	18,354	27,011	35,678	52,958	70,215	87,541
2020	4,627	9,153	13,546	17,822	22,016	32,412	42,789	63,447	84,079	104,814
2030	5,302	10,479	15,503	20,392	25,188	37,057	48,887	72,436	95,970	119,674

Table 4. Reductions in annual national emissions under different carbon prices (Mt CO_2e).

Emission Reductions										
	Carbon price ($/tonne)									
	10	**20**	**30**	**40**	**50**	**75**	**100**	**150**	**200**	**250**
2010	7.5	13.7	19.9	28.6	36.3	56.4	77.0	97.4	111.8	122.0
2015	11.6	24.6	33.2	44.0	58.9	90.9	120.4	151.9	171.9	186.8
2020	15.7	30.1	43.8	60.4	76.3	118.6	160.0	203.6	230.5	249.4
2030	23.8	45.3	67.0	90.9	113.6	172.5	231.4	295.0	333.6	360.3

Table 5. Results of the NRTEE analysis

Variable *	**Scenario 1**	**Scenario 2**	**Scenario 3**	**Scenario 4**
Carbon permit price ($/tonne)				
2010	$10	$10	$10	$10
2015	$15	$15	$15	$15
2020	$25	$75	$25	$75
2030	$75	$160	$100	$225
2050	$200	$160	$350	$270
Change in Emissions relative to 2003 levels				
2025	+2%	-23%	-9%	-31%
Impact on GDP				
2010	-0.1%	-0.5%	-0.3%	-0.5%
2015	-0.1%	-0.5%	-0.3%	-0.5%
2020	-0.6%	-1.2%	-0.5	-1.1%
2030	-0.9%	-1.5%	-1.1%	-2.1%
2050	-0.8%	-0.5%	-1.5%	-0.8%

***See scenarios next page.**

Scenario 1: 45% emission reduction from 2006 levels by 2050 , "slow" start

Scenario 2: 45% emission reduction from 2006 levels by 2050, "fast" start

Scenario 3: 65% emission reduction from 2006 levels by 2050, "slow" start

Scenario 4: 65% emission reduction from 2006 levels by 2050, "fast" start

Table 6. Welfare Impacts (% change from a 2010 base year)

	FReg	FPer	FReg/FPer	PReg/FReg
Newfoundland	-0.76	-0.7	-0.79	-0.7
P.E.I.	4.48	-1.77	-1.86	4.39
Nova Scotia	0.49	-0.54	-0.5	0.45
New Brunswick	1.35	-1.01	-1.00	1.43
Quebec	-1.89	-0.78	-1.35	-2.50
Ontario	-1.76	-0.73	-0.65	-1.61
Manitoba	-1.40	-0.68	-0.6	-1.33
Saskatchewan	2.82	-0.77	-0.78	2.72
Alberta	3.52	-0.41	-0.38	3.60
British Columbia	-1.53	-0.65	-1.69	-2.57
Canada	-0.08	-0.7	-0.92	-1.01

Table 7. Emission Reduction Impacts (% change from a 2010 base year)

	FReg	FPer	FReg/FPer	PReg/FReg
Newfoundland	-2.93	-11.36	-11.37	-2.8
P.E.I.	4.21	-9.39	-9.64	3.78
Nova Scotia	-3.46	-29.42	-29.25	-3.34
New Brunswick	-0.78	-17.42	-17.48	-0.24
Quebec	-1.82	-11.21	-12.36	-3.6
Ontario	-1.31	-15.87	-15.65	-0.8
Manitoba	-5.54	-17.10	-16.96	-3.01
Saskatchewan	-0.03	-30.52	-30.01	0.07
Alberta	-1.6	-31.05	-30.71	-1.54
British Columbia	-1.47	-14.66	-17.73	-4.76
Canada	-1.47	-22.76	-22.81	-1.58
Qty. of Purchased Permits (Mt)	285.5	71.3	70.9	257.6

Summary

Mike Kennedy
mikek@pembina.org

International Policy Experience

This brief summarizes European, American and multilateral carbon pricing systems that are proposed or already operational, noting the key lessons learned.

Tax Systems

Norway

Norway levies taxes on fossil fuel production and consumption, with different rates in different sectors. The system was first introduced in 1990, targeting just a few sectors, but has been expanded since. Rates currently range from $17/t CO_2 (energy consumption in the pulp and paper industry) to $62/t CO_2 (gas production).

Over the period from 1990 to 1999, carbon taxes are credited with about 1/7 of Norway's 14% reduction in emissions intensity — i.e. a reduction of 2%. The modest magnitude of this effect has been attributed both to extensive exemptions and to inelastic demand in sectors targeted by the tax.[38]

Importantly, Norway's experience with carbon pricing politics suggests that it is easier to increase taxes on regulated industries than it is to begin taxing new emissions sources. Thus, policymakers may find they can "buy" flexibility to responsively adapt future policy by designing initial carbon pricing schemes with low tax rates applied to a broad base, rather than high taxes targeting specific sectors.[39]

Sweden

Sweden taxes fuel consumption based on carbon content alongside other taxes on energy. The base rate is currently $150/t CO_2 (having started at $30/t CO_2 in 1991), but industrial fuel consumers pay $75/t CO_2.

[38] Annegrete Bruvoll and Bodil Merethe Larsen, "Greenhouse gas emissions in Norway: do carbon taxes work?" *Energy Policy*, 32, issue 4 (2004): 493-505.

[39] Odd Godal and Bjart Holtsmark, "Greenhouse gas taxation and the distribution of costs and benefits: the case of Norway," *Energy Policy*, 29, issue 8 (2001): 653-662.

Rates are set within an overall policy of environmental tax shifting so that carbon taxes at least partially replace other fiscal measures. Between 1991 and 2000, carbon taxes are estimated to have reduced Sweden's emissions by 20 to 25 percent more than would have been the case under "conventional" policies.[40]

Notably, electricity generators are exempted; instead, non-industrial electricity consumers pay separate taxes on electricity.[41] Biofuels are also fully exempted. As a result, the policy has led to a significant increase in the use of biomass for heating, as well as fuel switching from liquid fuels to electricity in the industrial sector.[42]

United Kingdom

Since 2001, the U.K. charges a levy on key energy commodities including electricity, natural gas, liquid fuels, coal and coke. Oil, steam and waste products are excluded. Levies are paid by suppliers at the "point of supply" and range from $0.009 to $0.024 per kWh equivalent. Notably, revenues are used to finance reductions in employment insurance contributions as well as to fund energy efficiency and renewable energy initiatives. The levy is an "official" element of the government's climate change program.

Boulder, Colorado

The municipality of Boulder, Colorado, was one of the first North American jurisdictions to adopt a carbon tax in 2006. Like Quebec's levy on gasoline and diesel, Boulder's tax is intended primarily to raise revenues for climate change initiatives rather than to provide a market-based incentive for emissions reductions. Rates are set based on a revenue collection objective of $1,000,000 per year between 2007 and 2012. Average households pay $1.33/month; average businesses pay $3.80/month.[43]

Trading Systems

Clean Development Mechanism

The Clean Development Mechanism (CDM) provides a means to link national trading systems with cost-effective emissions reduction opportunities in developing countries that also generate positive local benefits. CDM architecture is notably designed to ensure additionality of tradable credits through a robust set of guidelines. The UNFCCC estimates that emissions reductions worth over 1 billion t CO_2 will be generated and traded by 2012.

[40] Bengt Johansson, "Economic instruments in practice 1: Carbon tax in Sweden," paper prepared for the OECD. Available online at http://www.oecd.org/dataoecd/25/0/2108723.pdf

[41] Denmark has a similar policy, intended to eliminate competitive advantages that might accrue to foreign electricity exporters not subject to fuel consumption taxes.

[42] ibid.

[43] Carolyn Brouillard and Sara van Pelt, "A Community Takes Charge: Boulder's Carbon Tax," February 2007. Available online at: http://www.bouldercolorado.gov/files/Environmental%20Affairs/climate%20and%20energy/boulders_carbon_tax.pdf

Emissions reductions are generally project-based, covering opportunities such as landfill gas capture, urban transit systems, catalytic efficiency improvements and renewable energy. Current supply is dominated by China (61%), India (12%) and Latin American (10%).[44]

European Union Emissions Trading Scheme

The European Union Emissions Trading Scheme (EUETS) is intended to achieve the European Union's aggregate Kyoto Protocol emissions targets at the least overall cost to EU economies, by providing flexibility in where those reductions are achieved.

Annual emissions allowances are allocated to EU member countries under burden-sharing agreements; "Competent Authorities" (i.e., regulators) in each country further allocate allowances by facility. Facilities then comply with emissions limits on-site, by trading allowances with other regulated facilities anywhere in the EU, or by obtaining Certified Emissions Reductions (CERs) through UNFCCC flexibility mechanisms.[45]

In the EUETS trial phase from 2005 to 2007, member states share 2.2 billion t CO_2 in annual allowances. In the second phase from 2008 to 2012, they will share 1.9 billion t CO_2 in annual allowances. Auctioning is limited to 5% of total supply in Phase I, and will be capped at 10% in Phase II.

Prices are determined through spot markets and forward contract markets. Phase I allowances have hit €30/t on the spot markets, but given clear oversupply, now trade at around €0.09/t. Prices for Phase II allowances currently reside around €20-30/t, based on the known tightening of supply.

Notably, the dramatic drop in Phase I allowance costs has led to windfall profits for some electricity generators. The power sector was expected to achieve a significant proportion of emissions reductions in many countries — and operators raised prices to pass on costs that never materialized.[46] Evidently, low allowance costs have also eliminated the incentive to exceed emissions targets and generate tradable credits.

Regional Greenhouse Gas Initiative

The Regional Greenhouse Gas Initiative (RGGI) is the first U.S. cap-and-trade system, covering electricity sector emissions from nine states. Generating plants with capacities exceeding 25 MW are covered; compliance begins in 2009.

Notably, the RGGI design includes features to help reduce price uncertainty, particularly through rules related to offsets. After a "market settling period," if allowance prices exceed \$14/t CO_2, domestic and international offsets may be used to cover up to 20% of a facility's targets. If prices fall between \$7/t and \$14/t, only domestic offsets are accepted, and may be used to cover up to

[44] Karen Capoor and Philippe Ambrosi, "The State and Trends of the Carbon Market 2007," World Bank Institute (2007), p. 3.

[45] CERs obtained through the Clean Development Mechanism (CDM) or Joint Implementation (JI) may account for no more than 20% of total facility allowances. In most countries, the cap is lower e.g.,. 8% in the U.K. and 12% in Germany.

[46] Bryan Bateman, "European Union Emissions Trading Scheme," brief prepared for the Pembina Institute, 2007.

5% of total targets. If prices fall below $7/t, domestic offsets are permitted at "half-strength" (i.e., 1 t of offsets buys 0.5 t of compliance) and may be used to cover 3.3% of targets.[47]

Also in the United States, the Western Climate Initiative (WCI) envisions a regional cap-and-trade system, but details have not yet been established. Separately, the U.S. Climate Action Partnership (USCAP) has called for the use of trading mechanisms as a means to price carbon.

[47] RGGI, "Regional Greenhouse Gas Initiative – Memorandum of Understanding." (2005). Available online at: http://www.rggi.org/docs/mou_brief_12_20_05.pdf.

Pricing and International Competitiveness

Summary

Amy Taylor
amyt@pembina.org

Mike Kennedy
mikek@pembina.org

Concerns about competitiveness are often raised in relation to carbon pricing. This brief considers three of the key questions:

- What do we mean by competitiveness?
- How does carbon pricing affect competitiveness? When are new opportunities likely and when are difficulties likely?
- What policy options are available to designers of carbon pricing systems to mitigate impacts on competitiveness?

What Do We Mean By Competitiveness?

Carbon pricing will be undertaken in Canada primarily as a means of reducing greenhouse gas emissions. However, carbon pricing policies must also be consistent with other objectives, including that of sustaining overall economic well-being and quality of life. These concepts are often associated or expressed in terms of competitiveness.

Competitiveness implies different things for companies, sectors, regions and countries. At the level of companies and sectors, measures of relative success may be good proxies – for instance, Cosbey and Tarasofsky suggest defining competitiveness as capture of market share.[48]

At the level of regions and nations, however, economic success is not a zero sum game. Krugman argues that domestic *productivity* is more important the relative terms of trade when it comes to the overall wellbeing of nations[49], and as such, national and regional competitiveness might be more usefully defined as capacity for economic success.

In the context of carbon pricing, then, the pricing system must contribute to the national and regional capacity for economic success. However, this may not necessarily mean that the market share of specific companies and sectors remains unchanged.

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[48] Aaron Cosbey and Richard Tarasofsky. 2007. *Climate Change, Competitiveness and Trade.* (London: The Royal Institute of International Affairs). p. 3. Also available online at http://www.iisd.org/pdf/2007/climate_trade_competitive.pdf.

[49] ibid.

How Does Carbon Pricing Affect Competitiveness?

Opportunities

At the company level, carbon pricing can lead to increased competitiveness as businesses respond to new price signals with innovation and market creation.[50] Lash and Wellington argue that agile firms can maintain market share if they respond to carbon constraints "better [than] their competitors." Company-level capacity to innovate can (and will) be influenced by the specific design of carbon pricing systems.

At another level, entire sectors may benefit from relative cost advantage or market creation as a result of carbon pricing. In Canada, industries that may enjoy net benefits include the services sector, agriculture and forestry, automobile manufacturing, renewable energy and construction.[51]

Difficulties – The "Non-Party Problem"

In other sectors, expectations are that carbon pricing will simply lead to increased costs and declining market share relative to foreign companies not subject to the same pricing regime ("non-parties").

How significant are these concerns? Cosbey and Tarsofsky review a broad range of studies which suggest that, "in most cases [competitiveness impacts associated with environmental regulation] are moderate, but not in all cases."[52] In other words: it depends.

A recent report by Carbon Trust examining the European Union's emission trading scheme identifies three key variables: energy intensity, market power and opportunities for low-cost abatement. The greater the energy intensity (or the carbon intensity of fuels used), of a given sector, the greater its vulnerability to carbon pricing. Meanwhile, the greater the market power or opportunities for low-cost abatement in a given sector, the lower its vulnerability.[53]

These may interact in unexpected and highly local ways. For instance, in the electricity sector, provincial regulatory structures, which vary widely, have substantial influence over utility market power; the availability of abatement technology is highly dependent on the supply mix, which again varies widely among provinces.In Canada, it's also notable that sectors with particularly high energy intensity — energy production and power generation — have geographic ties, either to a resource or to consumers. These ties reduce mobility, and hence should serve to reduce vulnerability.[54]

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[50] Michael Porter and Class von der Linde. "Green and competitive: Ending the stalemate" *Harvard Business Review* vol. 73, issue 5 (1995): 120-134.

[51] John Lash and Fred Wellington. "Competitive advantage on a warming planet" *Harvard Business Review* vol. 85, issue 3 (2007): 94-102.

[52] Ibid.

[53] Carbon Trust. "The European Emissions Trading Scheme: Implications for industrial competitiveness" (April 2004) available online at: http://www.carbontrust.co.uk/Publications/publicationdetail.htm?productid=CT-2004-04&metaNoCache=1 (accessed September 20, 2007).

[54] Cosbey and Tarasofsky also point out that studies in the 1990s which found little support for the "pollution haven" or competitiveness-induced-migration hypothesis ran into this difficulty: certain vulnerability factors correlate with mitigating factors such as energy intensity and resource immobility in the resource sectors.

Finally, to the extent that competitiveness-related migration or the "pollution haven" effect does occur, this also serves to undermine environmental effectiveness, since production (and associated emissions) simply shift to jurisdictions with less stringent regulation. In the context of carbon emissions, this is often referred to as "carbon leakage". Given that given that greenhouse gases have the same effect on atmospheric warming no matter where they are emitted, the "leakage" problem is particularly important in the context of climate change.

What Policy Options are Available?

Multilateral Environmental Agreements are one of the best ways to avoid "non-party problems" related to carbon pricing. Simply put: localized producer disadvantage disappears if rules are globally consistent. Of course, negotiating globally consistent rules is far from straightforward. Historically, most transboundary environmental issues (including whaling, wetland protection, trade in endangered species, biological biodiversity and ozone depletion) have been the subject of multilateral environmental agreements.[55]

There are also important opportunities for sector-specific or regional initiatives. In Canada, many "non-party problems" occur with specific reference to the United States. Continental co-operation on vehicle fuel efficiency standards, for instance, could be an effective means of overcoming major competitiveness concerns in Canada's automotive sector.

"Non-party problems" may also be avoided through the design of carbon pricing systems. For instance, the price could be applied at the point of consumption rather than production. In Denmark and Sweden, carbon charges on electricity are separated from primary pricing systems and levied on electricity consumers, so as to equal the playing field for domestically produced and imported electricity.

Finally, a number of mitigating measures are available to governments wishing to impose carbon prices, either to lessen costs related to carbon pricing or other costs of doing business. Three options of note are mentioned here:

- Revenue recycling: revenues earned from carbon pricing may be recycled back to affected sectors in a variety of ways, including through reductions in other taxes. Governments can also use carbon pricing as part of a broader environmental fiscal reform initiative that shifts to taxes on pollution rather than on production.
- Implementation strategy: predictable, long-term price regimes and targets can help to create certainty and facilitate investment.
- Border tax adjustments (BTA): BTAs can target specific instances of sector- and company-level international competitiveness concerns. Charges or refunds can be applied to "level the playing field" between domestic goods subject to carbon pricing and foreign goods operating under different conditions.

[55] Jack Caldwell. "Multilateral environmental agreements and the GATT/WTO regime" *in* Trade and Environment, the WTO and MEAs: facets of a complex relationship, The Heinrich Boll Foundation (Washington, D.C., March 29, 2001).