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Royal Roads University

Climate Change Speaks Out and Talks Back
Sept. 24-26, 2001
Moderated by David Zussman

Participants

David Zussman, President, Public Policy Forum, Ottawa, Ontario
Stewart Cohen, Scientist, Meteorological Service of Canada, Environment Canada
Louise Comeau, Director, Sustainable Communities and Environmental Policy Department, Federation of Canadian Municipalities.
Danny Harvey, Professor, Dept. of Geography, University of Toronto
Al Howatson, Research Associate, Regulatory Policy Alternatives, Conference Board of Canada
Patricia Roberts-Pichette, Executive Secretary, Canada's Man and the Biosphere (MAB) Program

Day One: Sept. 24: **Context:** Discussion of the context, including the relevance of climate change to Canada, its impacts, economics, and priorities.

Day Two: Sept. 25: **Vulnerabilities:** Discussion of the vulnerabilities and risks associated with climate change, including environmental, health, and economic aspects; some discussion of response strategies.

Day Three: Sept. 26: **Response Strategies:** Discussion of Canadian response strategies, including components of such strategies, sector responsibilities, and cost implications.

Dialogue - Day One: **Context**

David Zussman

Welcome everyone. I would like to remind everyone that this is a pilot project, this is the first time in Canada that such an expert dialogue has been planned. I would like each of you to begin to introduce yourselves and your interest in climate change, starting with Danny, Patricia, Al, Stewart, Louise. Let's go!

Al Howatson

Thanks, David. I'm a Principal Research Associate at the Conference Board of Canada. I've been working on the economics and public policy aspects of climate change for about 4 years.

Louise Comeau

My interest in climate change started in 1990 when the issue first became visible in my work at Friends of the Earth. I believed it an important issue because it couldn't be solved by end of pipe solutions, because it was a long-term and irreversible issue and because I could work on it as a focus of my career over the next 25 years (15 now, so I better hurry it up!!).

Stewart Cohen

Thank you David. I work with the Adaptation and Impacts Research Group of Environment Canada and the Sustainable Development Research Institute at the University of British Columbia. My research during the last 15 years has focussed on climate change impacts and adaptation in Canada. I have also participated in international studies.

Danny Harvey

By way of introduction, my interest in climatic change is both as a scientist and as a resident of this planet with a vested interest in its future. Professionally, my work has focused on climate and carbon cycling modelling, and as I such, I am acutely aware that the climatic change problem has a sound scientific basis and is not some passing fad. This naturally leads to an interest in practical measures that can be taken to reduce the rate of build-up of greenhouse gases and eventually stabilize their concentration - hence, I have done some work pertaining to energy use and energy systems.

Patricia Roberts-Pichette

Patricia Roberts-Pichette, interested in environment for a very long time, and hence the extended interest to climate change. While many people think of ecology as applying to plants and animals (excluding humans) and human ecology as a different subject, I like to think of them combined. I have been at various times a university teacher, and public servant, and have served in the international arena in agriculture. In all my work I try to look at things ecologically. So it is from this perspective that I participate here.

David Zussman

Nice meeting you all. I am still waiting for one response so I will move on to my first formal question to you all.

Should Canadians be concerned about climate change?

Al Howatson

Yes. It's going to be a serious long-term problem. BUT, how concerned should Canadians be given all the other things we need to deal with? Health care, terrorism, recession.....

David Zussman

Al, you raise a very important question for all of us to consider. What do the others think about the relative importance of climate change, given all the other competing demands for governments, etc?

Stewart Cohen

Yes, Canadians should be concerned about climate change. There are two aspects: 1) direct potential impacts within Canada, and 2) effects on other countries that would indirectly affect Canada. Direct impacts include changes to ecosystems and our uses of them (such as water, forests, marine systems, etc.). Indirect effects could include the international flow of goods and services, and the fate of peoples in other lands who may be forced to migrate due to deteriorating environmental conditions in their countries.

Patricia Roberts-Pichette

Yes absolutely. It is not a matter of climate change beginning to occur, it has started already. If measured by changes in temperature, the northwest (Yukon, N. Alberta, SW. NWT), east of the Rockies has already increased by over 1C in the last 100 years. Some people have noticed changes in insect populations in S. Alberta which can in part be attributed to climate warming. One needs to remember that climate change is not even, not everything is changing at the same rate, or even in the same direction.

Louise Comeau

Canadians should be especially worried about climate change. We, as most societies, are adapted (to varying degrees) to existing climate. We have built our societies and economies around existing conditions. Major changes from the status quo create disturbances to security, quality of life and economic activity. Climatic change is expected to be more rapid than in previous climate regimes and more severe in Canada

because of our northern latitude. This alone should be of great concern because our capacity to adapt to extreme events will be challenged. Finally, Canadians need to be concerned because we are extremely wasteful in our use of resources and energy and therefore are important contributors to the problem. Major changes are required in energy mix and in our own values toward waste. Notions of scarcity will have to change: the question is not whether we have lots of fossil fuels. The scarcity we face is with respect to the atmosphere's capacity to cope with unlimited volumes of pollution.

Al Howatson

I agree with your last point, Louise. Scarcity of natural resources is not the issue. The ability of ecosystems to absorb the waste products of industrial societies is the real issue.

Danny Harvey

This question can be answered at several levels. The narrowest is to take a purely anthropomorphic, nationalist focus and examine the direct, potential impacts of climatic change on people living in Canada. Next, one can consider the impacts on people in other parts of the world. This could be of concern to us for moral reasons (i.e.: we are a large per capita contributor to the problems), for humanitarian reasons (i.e.: out of concern for the well-being of others, irrespective of our role in causing the problem), or for purely pragmatic reasons (i.e.: because we are indirectly affected by virtue of the fact that we are a trading nation, and tend to be a preferred destination for environmental and economic refugees, or could suffer if the possible desperation of some groups triggers instability and war). One can go further and find a basis for concern in the potential effect on other species and on ecosystems (i.e.: the potential loss of most or all of the coral reef ecosystems in the world given a 1-2 C global average warming, to which we are already committed; of the loss of major forest and wetland ecosystem). The foregoing outlines the possible frameworks for viewing the problem. Needless to say, I advocate taking into account the widest possible framework and range of impacts.

Louise Comeau

Al: then how does economics account for scarcity of ecological systems: all pricing is based on the wrong kind of supply, don't you think?

Al Howatson

Louise, we can work on either price or quantity. If we have some idea about the capacity of an ecosystem to absorb stress, then we can set quantity limits to pollution

and ration access (for example, through a system of tradable emissions permits). This will price the right to emit. Conversely, we can affect the price system directly, through taxes or fees.

Stewart Cohen

Al, I would also suggest that there is strong evidence that many communities and regions are vulnerable to extreme weather and climatic events now. During the 1990s, more than 20 events occurred with damages exceeding $1 billion US. These include hurricanes, winter storms, floods, fires, and in 1998, Canada and the eastern US experienced an Ice Storm that led to widespread electric power failures. These vulnerabilities exist today, in part, because of development choices. The interactions between climate change and development need to be considered together not just in terms of waste products, but also in terms of the way vulnerabilities to climate could change.

David Zussman

It is obvious that all of you feel that the issue is important for Canadians as well as others around the world. However, will it ever be possible to get the attention of citizens when climate change is such a slow moving issue (1C change over a century)?

Louise Comeau

In response to the question, why care relative to other issues?
My view is that the key here is to look to a package of solutions that meets the needs of a range of stakeholders or priorities. Political consensus comes only when key groups see themselves in the agenda/solutions. To that end, a focus on investment in key infrastructure, in innovation, in taking a pollution prevention approach is the key. Here at FCM we are working on getting people to do what makes sense today: clean water, clean air, clean soil, new approaches to municipal systems that prevent rather than clean pollution: greenhouse gas reductions are the co-benefit of what makes sense from a sustainable community development point of view.

Patricia Roberts-Pichette

The importance of climate change is not only is it going on in Canada, but over the rest of the world. This affects Canadians directly in many areas - food is one example. For example think of where Canadians get their food where temperatures are getting warmer, the landscape is getting drier - this increases demand for water locally and for whatever crops may be exported. This brings up the question of the haves and have-nots of water, and where it will come from or go to in the future. The answers to such questions will vary widely, but will affect Canadians deeply.

Parts of the indirect effects are the changes we are already seeing with respect to so-called unique weather events. I am not sure they are any more unique than they have ever been, but with our reliance on technology we may be in for a much rougher ride than our forebears - the ice storm in eastern Canada is a good example. It was not unique, but it affected more people more deeply than any previous one. This brings up the concern of insurance companies about the occurrence of such events in the future - whether storms, floods, droughts and how people will mange themselves to cope.

Louise Comeau

The other way to engage citizens is to focus on the environment/health links. My work has shown the citizens don't want the long list of environmental crisis trotted out day after day when in the end most are caused by the same fundamental problems. Let's take fossil fuels: acid rain, smog, toxics, climate change, deforestation (from exploration/production), etc., are caused by the energy source. Solutions that solve all at once and that protect health: that's what will catch people's attention.

Al Howatson

Louise, good point regarding your "package of solutions" that address needs/concerns of stakeholders. But what if this isn't enough? If Canada doesn't ratify Kyoto, this might be fine. If we do, we may need to do more than this. Should Canadians then incur $100 million - or $5 billion - of costs to deal with climate change - or should this be spent on health care, defence against terrorism, etc?

Patricia Roberts-Pichette

There is one concern we should address when considering the problem of why people are not interested. Not all people are environmentalists in any of the many definitions that word may cover. We all grow up with a certain ingrown experience of our environment, and how we see it is very much in terms of how long we have been alive and what change we have actually experienced. There seems to be a sort of baseline set up by the time we reach the mid-teens which we use to compare (unconsciously) everything else that goes on around us and think of in terms of 'normal' or 'unusual'. If we are growing up in the middle of enormous change - that is 'normal' for the person in such circumstances.

I have no problem about humans adapting to climate change (after all they are the single most successful species in the living world having adapted to living conditions in the harshest climates whether they be hot or cold, wet or dry)- it is the sublethal concentrations of the innumerable things we release into the environment (making a dreadful chemical soup which we have no way of controlling) that come back to haunt us, long distances, and sometimes generations later, setting up long term changes in

hormonal function, nerve function. But I do not think that is the topic of discussion. The adapting part may be very difficult for the mature in our society now - and is likely to put tremendous strain on economic theory and practise. Everything is changing, and we as human beings are helping the change by our profligacy with the resources the world provides - yes of course, that leads us back to problems of what to do with waste!

Danny Harvey

On the question of dealing with other competing demands of government: the trick is to forge a response to climatic change that addresses the broadest possible range of issues, that leverages the broadest possible range of benefits. Two critical issues are gridlock and traffic congestion (at least in the Toronto area) and health care. Another is highway safety, with so many trucks. Another is security and sustainability of energy supply. Well, electricity generation and transportation together account for half of Canadian CO2 emissions.

So we get serious about supporting rapid transit in major urban centres (thereby addressing congestion, air pollution, and health issues) and in promoting greater use of rail for freight (thereby addressing safety and other issues). By serious, I mean a few $billion/year of direct federal funding, plus matching provincial funding. On the electricity side, it's long past time that we created the regulatory and financial environment that would allow wind energy to take off. Given the particular synergies between hydro (which we have lots of) and wind, wind energy could economically (when all externalities are accounted for) provide a good 30% of Canadian electricity needs. I could speak at great length about what is happening in Europe. Speaking of terrorism, a highly dispersed energy supply system is obviously much more resilient than concentrated supply, especially when some of it is nuclear power.

Louise Comeau

A focus on shifting energy sources so that coal is phased out of electricity and the internal combustion engine gives way to hybrids and/or fuel cells would take us most of the way to where we need to go. Renewable energy has to be the foundation of the way forward. Cost premiums are minimal when compared to the costs which you agree should be priced through access charges. I would argue we are paying costs today through health care, environmental services degradation, etc., Also, we all know that the economic studies severely underestimate the economic growth as a result of changes/innovations and overestimate the cost of compliance. When have the initial estimates of costs to comply been anywhere near the original estimates.

Louise Comeau

Danny, with respect to rapid transit: it's heartbreaking, but the analysis I did with NRCan's models showed $1 billion in investment would generate only 1 MT of reduction. The only way forward is massive changes to vehicle technologies and investment in freight alternatives. Even transit doesn't do much for carbon because you increase emissions from the increased buses and the vehicles are stilled owned and used by citizens in non-commute times.

Danny Harvey

Louise, with regard to whether investing a rapid transit pays off from a GHG point of view: There is a very recent study by the Toronto Board of Trade that looks at the prospects for greatly expanding the GO regional rail network in the Toronto area. They conclude that $22 billion over 20 years in GO and light rail transit is called for, and would reduce automobile use by 15-30% compared to the case without the investment. They calculate the congestion and health care cost savings alone to be comparable to the implied investment of $1.1B/year. But it is not enough for me - we need more subway lines in Toronto simply as a quality of life issue. 100 km over 25 years (easily justifiable if done in a coordinated way and integrated with GO transit for a change) is another $500 million/year. The total required investment is $1.6 billion/year. Including all the major cities in Canada, you see that we need a few $B/year. $1.6 B/year for the Greater Toronto Area (GTA) may sound like a lot, but it works out to be equal to FIVE MINUTES per day of income from all the people working in the GTA (the GNP of the GTA is $160 billion/year). If the investment saves an average of 5 minutes per person per day in commuting time, it is worth it from a time savings point of view alone. So it really is a quality of life issue, as well as a congestion, health care, regional pollution, and climatic change issue.

David Zussman

It is obvious to me that all of you are very aware of the problems. Let's look at the various scenarios from a regional perspective. For example, will British Columbia be better or worse off than Ontario, fifty years from now if we don't take any action?

Al Howatson

Before addressing David's new question, let me reply to Danny. I think that your proposed approach is probably the only politically feasible one. The problem then becomes getting all the ducks lined up - sequencing and prioritizing actions across a wide range of policy issues, and across 3 levels of government. Quite a challenge.

Stewart Cohen

The question of changes in comparative advantage (will BC be better or worse off than Ontario) is related to the question of 'winners' and 'losers'. When climate change is considered in a regional context, it is clear that impacts will not be felt equally by all parties and places. This has implications for policies on resource management and social transfers, but it isn't clear what these are. There is very little correlation between the location of greenhouse gas emissions and the location of climate change impacts. Canada's Arctic is already experiencing changes to permafrost and glaciers. Small Island States are threatened with Sea Level Rise. These are not the major emitters of greenhouse gases. The challenge will be to find a system of emission reduction incentives and vulnerability reduction measures that can be applied together.

Louise Comeau

With respect to B.C.: it will see real impacts of course from climate change, but the real issue is its increasing interest in energy exports. What we need is a focus on local energy supply through distributed energy systems. I have great concerns with the current focus on exports and do not believe it is sustainable in the long term.

David Zussman

Danny and Patricia, you haven't yet commented on scenarios. What do you feel are the worst and best case scenarios for Canada with reference to its regional impacts?

Patricia Roberts-Pichette

Scenarios are difficult to predict. First 1 - 1.5C in a century is a pretty big change. Perhaps we are not concerned because we can't see it, and the north is a long way away, but it does not get as cold in the winter any more, and permafrost is melting with the wid ranges that brings to landscape. Most of Eastern Canada is changing much more slowly than western Canada and certainly as things get drier it will have to take some of the responsibility for helping those who live and gain their livelihood there. We have taken on a scenario of importing much of our food because we like the variety, its lower cost, or some other reason. When those countries can no longer supply us, or supply us to the detriment of their own populations (because they have to pay interest on loans), we may find we can't get what we need or want.

What happens when the prairies can no longer produce the crops they once did? Because they once provided so much of the GNP and we can get what they once produced from somewhere else does such a path make sense in keeping a country together?

Yes, for those who are experiencing disaster because of climate change (enhanced or not by human intervention) the whole country has a responsibility to help.

It is also true that this is long term, and maybe we should be more concerned about the aboriginal injunction to take care of the 7th generation. Human beings are capable of perceiving change that occurs at greater than 5% per year, they are incapable of perceiving change at less than 3% per year. This is one of the reasons we find it so hard to convince people that climate change is real.

Danny Harvey

David asked me to comment on worst and best case scenarios of regional impacts in Canada. Since projected changes at the regional level are the least reliable, I prefer to start with a global and geological perspective. From AD 1000 to 1900, global average temperature fluctuated at most plus or minus 0.1-0.2 C. From 1900 to 2000, it rose by 0.6-0.7 C (and more in parts of Canada). During the next 100 years, global average temperature is projected to increase by another 2-5 C. The top end of this range - 4-5 C - is comparable to the difference between the last ice age and the climate of the early 20th century. This is an enormous change! And in the space of 100 years, rather than over several thousand years.

Within this context, potential effects in Canada include: drying of continental interiors (there are basic reasons for expecting the increase in evaporation to exceed the increase in precipitation on average), dieback of forests (possibly severe), a whole host of problems related to thawing of permafrost, and - in the longer term, sea level rise (we could very well commit ourselves during the next century to the irreversible melting of the Greenland ice cap - once its surface elevation drops, it keeps melting even if local sea level temperature returns to what it was before).

Stewart Cohen

In BC as well, much of the energy supply is from Hydro. Water resources will be affected by climate change in profound ways, including changes in streamflow amounts and timing, as well as possible changes in water quality. These changes will affect not only Hydro production but also fisheries, irrigation supply and demand, and requirements for flood control and navigation. The current context of water management requires that all of these uses be considered, and given the problems in the salmon fishery now, changes to streamflow could lead to reductions in Hydro power production in order to protect fish and continue to provide flood control. What a choice: protect fish and increase greenhouse gas emissions, or provide hydroelectricity at high levels of reliability and place fish at risk. And the story has many other dimensions to it (e.g. aquaculture).

Al Howatson

I have no idea whether B.C. or Ontario will be worse off in 50 years if we do nothing. The scientists on the panel might be able to guide us here. But the question gets to the asymmetries of costs and benefits, of both inaction and action. If nothing is done, some regions will bear disproportionate costs of a changed climate. If action is taken, some will bear greater costs, others gain greater benefits. Costs of action must typically be borne by this generation; the benefits will accrue to future generations.

Louise Comeau

Impacts will be asymmetrical as will costs of compliance: how do we manage this. Should there be compensation for Charlottetown because Alberta wanted to export fossil fuels?

Costs: are being born now because of climate impacts, so far only actions that save money have been taken. It seems to me that all generations will share in the costs/benefits (i.e. cuts in emissions now also clean the air).

Stewart Cohen

Al's point leads us to considering climate change response both from the perspective of insurance, and also as an investment in the future. We do that now, for reasons other than climate change. How can we best consider these in this context?

Insurance requires knowledge of probabilities of certain kinds of risks. Climate change will change these probabilities. That is a significant challenge for the setting of premiums, and deciding which risks can continue to be covered, and which ones may not.

Louise Comeau

Compensation, do we need a fund paid for from revenues from ecological pricing regimes to pay for adaptation to climate change across the country?

Al Howatson

Relating compensation for impacts to costs of compliance gets tricky. Impacts of climate change on Canada will come largely from what the rest of the world does, regardless of what we do.

Louise Comeau

But adaptation costs will have to be borne by Canadians: how should we do this? Should we allow for projects that are in response to melting permafrost, heaving roads, etc., in the north to be eligible for the Infrastructure Canada program? Should Emergency Preparedness Canada have an adaptation component so communities don't rebuild in the same place or to the same standard if climate regimes are changing?

Al Howatson

On compensation funds: As you know, Ministers of Finance typically don't like them. If they collect too much, what happens to the fund? If too little, do we raise the fee/tax? But the purpose of the emission pricing is (or ought to be) less for raising revenue than for an incentive to change behaviour.

Stewart Cohen

There are roles for both the public and private sector in providing financial assistance to overcome climate-related damages. It's not just about government funded infrastructure programs. It is also about the willingness of private insurance to provide coverage.

Louise Comeau

Then how are we to manage costs related to adaptation: Climate change is real, it is happening and we are committed to further warming and climate change no matter what. We must reduce emissions and adapt at the same time. We must pay for those impacts and it seems to me that some national process will need to be put in place to deal with the asymmetrical nature of these impacts like the equalization program. It is inevitable that if we price the use of the atmosphere, Alberta would pay more and that means it would contribute more to adaptation costs.

Al Howatson

Louise raises an interesting point about the proportion of resources devoted to mitigation compared to adaptation. That one is going to take a lot more thought and discussion.

But what if Alberta doesn't have to buy much atmosphere because it sequesters GHGs in underground aquifers, or invests in sink projects in developing nations?

Louise Comeau

Whether Alberta pays a pricing charge through emissions trading, or a carbon tax or it spends the money itself on offsets, the impact is the same: it paid for its use of our atmospheric space. Your key point is if it spends the money itself on offsets, where does the money come from for adaptation. Internationally, we have a charge on a clean development mechanism project that goes into an adaptation fund. We could do the same. A portion of any tax/trading permit cost or offset spending would be collected as an adaptation fee.

David Zussman

Louise just mentioned that "some national process will need to be put in place to deal with the asymmetrical nature of these impacts like an equalization program". Just what process would work best that would constructively engage governments, industry, and citizens?

Louise Comeau

At FCM we have conducted a study of six possible climate impacts: sea level rise in Charlottetown, drought in Swift Current, forest fires in Hinton, permafrost melting in Norman Wells, flooding in La Baie. We have looked at risk to infrastructure and are now developing case studies on how municipalities should adapt their infrastructure to cope with possible changes. While the science may be less rigorous, a local focus has proved invaluable in getting folks interested in the subject of climate change.

Patricia Roberts-Pichette

I agree that the resources needed for action now should come from both public and private resources. That side of it does not worry me as much as the apparent lack of leadership at the most senior levels of government - federal and provincial. There is much more concern for trade and the bottom line than there is for the health and well-being of the population at large - and that $$ generated will take care of everything.

To make a real change in the public attitude governmental leadership has to be visible and believed. The public will take notice, if it understands that the problem is serious. One has only to look as what has been done with respect to recycling and cigarettes in the last 20 years through government leadership and determined public support.

We are capable of facing the climate change concerns, understanding that we may never 'perceive' climate change, and put the resources in place to do it so that succeeding generations may benefit - but governments must unite in leading the way.

Stewart Cohen

Examples of regional impacts include a) lower lake levels and water supplies in the Great Lakes-St. Lawrence, with side effects on hydropower production, navigation and water quality, b) within the western boreal forest, changes in fire frequency and severity would occur, though this depends very much on fire management. Growing seasons will be longer, but it isn't clear how farmers would react to this; it would depend on availability of land and water resources, and competition with other users of these resources. One should not assume that adaptation to these changes will be simple and direct, whether or not there are perceived changes to opportunities and risks.

David Zussman

To the scientists in the group:
One of your biggest challenges is communicating scientific results to a public that doesn't fully understand the issue and the language. Any suggestions about how the information transfer issue might be dealt with?

Stewart Cohen

Communication could be enhanced through a number of means. This e-dialogue is one example. Another could be through research that directly enlists the talents and knowledge of local managers and users of resources, or others who are actively engaged in community activities such as watershed stewardship councils. Such collaboratives provide an opportunity for mutual learning on this issue, as researchers and local knowledge holders learn from each other through partnership.

Louise Comeau

Excellent Stewart, that is exactly what we did on our infrastructure risk project: we had municipal engineers meet with the scientists working on specific regional impacts. It was very powerful and led to real increased understanding between the two groups.

Al Howatson

Communication is immeasurably enhanced when people perceive the risks and benefits in a situation. How many people now, compared with two weeks ago, are more knowledgeable about Afghanistan and major terrorist groups?

Patricia Roberts-Pichette

This is the nub of the question is it not? I suspect there are many ways, and it is not only tied up with better ways of packaging scientific information. That of course is one way, but the scientists who produce it are not necessarily the ones to do it. I would like to see some experimenting with models of various sorts, maybe some in the form of games, which have 'real data' and with intelligent systems, make predictions given assumptions or scenarios put into the model. I know that the Club of Rome in Canada is working on a global model which takes into account many of the things we have been talking about.

What I am suggesting could possibly be seen in part as an undated equivalent to the sort of thing Buzz Holling was doing with his students 30 years ago. The start must be the public seeing governments taking the problem seriously, showing what they are doing, showing how it is doing it, and challenging others to follow suite. The public will not accept tinkering at the edges as being serious. There are wonderful things some people and groups are doing, but they are isolated and do not appear as 'mainstream'

Anything of this nature will take time expertise and $$. It will require cooperation of the scientists, who must not be allowed to feel they are somewhat less than scientific in cooperating in such an endeavour. If I may make a comment: economists need not be right in their predictions, may not be right 50% of the time, but we still follow their advice. Somehow scientists must be right 99.9% if not 100% of the time to be believed - another problem to be overcome if the public are to be informed and believe the information to act appropriately.

Danny Harvey

The discussion has slowed down enough, that I feel that I can return to the opening question, "Why should Canadians be concerned ...". There has been a lot of discussion here about regional impacts in Canada. Whatever the human impacts in Canada might be, they will almost certainly be small compared to impacts in many developing countries - parts of the developing world are projected to be really hard hit. Food production might, at least initially, increase in Canada. It is consistently projected to decrease in large parts of the developing world (compared to the case with no climatic change). The prairies will probably get drier, but parts of the world that are densely populated, volatile and unstable today, and under water stress today, are consistently projected to get drier (namely, North Africa and the entire Middle East). 100s of millions of people are dependent in various ways on mangrove and coral reef ecosystems for their well-being - these are all threatened. The impacts of 0.5-1 m sea level rise will be minor in Canada compared to much of the developing world (Indonesia is a country of 1000s of islands and shore-based communities). Toronto will get hotter in summer, but we won't be pushing the physiological limits of human tolerance for heat (and we have air conditioners). Cities like Bombay and Cairo are already unbearable in summer.

Global warming, as I see it, risks creating a world of greater disparity between rich and poor. And the desperately poor will have increasing reason to see the rich, conspicuously over-consumptive West as being at least partly (or, perhaps in their mind, entirely) responsible for their miserable plight. This should concern us on humanitarian and moral grounds, but Canadians should also ask the question, "Is the kind of world that might be created by the unequal effects of global warming likely to contribute to ongoing terrorist threats by creating fertile conditions for the recruiting of terrorists?"

David Zussman

Let's try to bring this conversation to a close for today.
Given our dialogue this morning/ afternoon, what are your top three priorities for action regarding climate change?

Louise Comeau

Top three priorities are:

1. Invest in municipal infrastructure: waste diversion, landfill gas, community energy systems and combined heat and power, transit and community greening: see our budget submission.
2. Focus on adaptation: people have no sense of the risks of climate change until they are exposed to the impacts and how they have to adapt. Learning more here will raise understanding of the cost of climate change rather than just the focus on cost to mitigate.
3. Position the issue as another symptom of unsustainable development and its solutions as a package addressing environmental issues broadly.

Stewart Cohen

There are short term and long term options. In the short term, we must put incentives in place to reduce emissions and climate-related vulnerabilities, even if these measures appear to be modest. We have to start somewhere, and if a successful first step can be taken, it will encourage follow-up actions.

In the long term, we need to address how the climate change issue is related to development choices. Climate change needs to become an explicit part of debates about trade, security, water, energy, food, ecosystems/biodiversity, and international and domestic transportation.

Al Howatson

Priority 1: Developing some fairly detailed scenarios of international negotiations: what are the probabilities and implications for Canada?
Priority 2: Developing some principles for resolving the burden-sharing within Canada: how to share costs and benefits of adaptation and mitigation.
Priority 3: Determining the relative resources that should be devoted to adaptation versus mitigation.

Stewart Cohen

Regarding David's last point; our understanding of how climate change could affect societies around the world is still at an immature state. We need to pay more attention to this. The research community is so small compared to the enormity and complexity of this problem. We need more people with many different forms of knowledge to participate actively in this.

Patricia Roberts-Pichette

The three important points: 1.Leadership that is trusted - that is seen to be addressing the problems within its jurisdiction 2. Information using all the powers of good PR available - Yes, the Afghanistan example is a good one. This information must be available in appropriate form for all ages and stages of the population 3. Some practical way by which those who are acting and achieving results whether local national or international are recognized for their achievements. Focus should not be on local things only.

Danny Harvey

My top priorities all pertain to abatement - reducing our GHG emissions. Within that category, the highest priority has to be on energy using stock that is replaced most slowly, or on developments that become irreversible.

Since there is little prospect of rebuilding sprawling suburbs, that lock in dependence on the private automobile, my first priority has to be on land use planning and urban design - which clearly is not sustainable as practiced at present, and brings a whole host of social problems with it.

My second priority is on buildings themselves. The building codes have to substantially rewritten (not just to require more insulation, but to facilitate use of solar energy for hot water heating for example).

My third priority is rapid transit infrastructure which of course goes with urban planning and land use.

That isn't to say that there are not other important actions, but the above are the ones which, if neglected, lead to irreversible losses of windows of opportunity.

David Zussman

Thanks so much for your thoughtful participation. While we are awaiting the two last participants to give us their priorities, I want to remind you that tomorrow we will be looking at 'vulnerabilities'.

In particular, we will be talking about: What are the risks to individual communities? What are the risks of inaction and certain kinds of action? What is the magnitude of reduction necessary?

Thanks once again.

Dialogue - Day Two: **Vulnerabilities**

David Zussman

Welcome back to our e-dialogue. Today we are going to move the discussion along by looking at a related topic: Vulnerabilities.

In other words, what are the risks to individual communities and or regions?
As agreed, each of you has prepared a brief comment. Please join me now.
The audience is welcome to our ask questions after the first 90 minutes of this dialogue.
We are looking forward to hearing from you.

Al Howatson

I will leave to the scientists to provide estimates on vulnerabilities to communities/regions from climate change. Risks of inaction fall into three categories: 1) Risks to communities/regions if Canadian adaptation actions are not taken; 2) Risks if global action is not taken to mitigate; 3) Risks if Canadian mitigation is not taken.
The primary risks of action are potentially negative competitiveness impacts on Canadian industries, in comparison with U.S. competitors, if Canada ratifies Kyoto and the U.S. (even if it takes significant action) remains unbound by Kyoto.

Patricia Roberts-Pichette

Vulnerabilities

Vulnerability will vary widely from community to community and region to region. Geography will be a major determinant. Perhaps threats could be classified into: human, material/materiel, environmental (and then further subdivided).

Direct threats to humans will include health threats as pathogenic organisms or their carriers that are already in North America move north as climates get warmer (extra health costs); loss of coastal or low-lying communities from flooding; and costs associated with helping those most seriously affected (both inside Canada and outside) and the likelihood of vast numbers of refugees who have to be resettled. Conflicts over essential resources starting with water.

Direct threats at the material/materiel level will include more rapid deterioration of built structures or manufactured goods (thus increasing maintenance, replacement, and insurance costs).

Direct threats from the environment include more severe and unsettled weather, with consequent effects on people and built structures: more floods, more droughts (with consequent loss of irrigation water), and loss of suitable habitat for food production in Canada - the Canadian shield is unlikely to replace the prairies for large scale cropping.

Louise Comeau

Key vulnerabilities include:
physical and psychological stress from community disruption and displacement from extreme events; economic costs from damage to social, economic and physical infrastructure; environmental costs from damage to forests, water, agricultural, and ecological systems.

Municipalities are particularly concerned about impacts on water resources, extreme events, and health impacts.

Stewart Cohen

Risks include species extinction, loss of habitats, health and property impacts from extreme events, changes in food production and food security, changes in availability of water, and a wide range of economic impacts. These do not include what might occur in regions if we consider the full range of responses various parties might take. We really don't understand what the possible responses might be in areas where there is competition for resources. The synergies from this could lead to surprises.

Danny Harvey

When I think of vulnerabilities, I think of the possibility of destabilizing the biological-physical life support system that we depend on, or off destabilizing the climate system, or of causing abrupt and unexpected changes. These are the kinds of things that could cause large negative impacts that aren't usually taken into account in the economic cost-benefit analysis of alternative global warming polices (not that I think that a cost-benefit approach has any validity here in the first place, for a variety of reasons). Particular concerns to me are: abrupt dieback of forests as critical thresholds are passed, or an abrupt re-organization of ocean circulation in the North Atlantic Ocean. The first represents a serious impact in its own right; the second could play havoc with our best-laid plans for minimizing the damage from global warming through adaptation.

David Zussman

Al, the risks are enormous as you have described them. Would you care to elaborate?

Al Howatson

David, I think the risks of inaction concerning adaptation and mitigation are well described by Louise and Patricia. Do you want an elaboration on the risks of action?

David Zussman

Al, yes, from the perspective of Canadian competitiveness and innovation.

Al Howatson

The main risk is to energy-intensive export industries with U.S. competitors. Costs of mitigation will depend critically on the design of instruments (e.g. a domestic emissions trading system) and the availability of international offsets. However, if these Canadian exporters are faced with constraints not shared by U.S. industries, costs of mitigation will increase overall production costs, and potentially reduce market share.

A second risk is "leakage". A Canadian energy firm, for example, may decide to investment in a country not bound by Kyoto, rather than Canada. So Canadian communities may lose the economic benefits of that investment.

David Zussman

You have all mentioned extreme weather effects. Does anyone know the general costs to the insurance sector (as a proxy of economic costs) for these types of effects?

Patricia Roberts-Pichette

Can't help out there, but ice storm costs were not small

Louise Comeau

Insurance premiums in hurricane vulnerable communities are increasing rapidly or coverage is no longer available. This is already happening in Florida and the Caribbean. Insurance companies have already noted the real increase in extreme weather events and the related costs. Some can be attributed to increases in population and value of property, but not all of the increased costs can be allocated to these components. Earthquake damage for example is not up; wind and water damage are.

The real costs to watch are those to government. Industry will cut its losses. Costs to provinces and the federal government from extreme events are skyrocketing.

Stewart Cohen

Recent studies of insurance payouts indicate that insured natural disaster losses in North America have increased during the 1990s. The ratio of property/casualty insurance premiums to catastrophe losses has declined in both the US and Canada.

Patricia Roberts-Pichette

Risks of doing nothing means that rates of change will increase, more intense weather events will take us by surprise, rates of decomposition will increase and so on. But because for the most part we will not notice the change on an annual basis, we will only know by looking back over time - senior citizens will see the change, the young in society will not. All this means that we leave our descendants with problems to clean up that were not of their making. Yes, every generation does that - but when populations were smaller, the resource demand was lower and most waste was organic and easily dealt with by natural means. The question is when and where does the human population begin to crash?

Risks of implementing reduction of greenhouse gases on a grand scale, and having all communities setting targets will mean costs for things we will not see except by

statistical analysis - and the costs at first will not be small. Profound changes in cultural norms will be essential.

David Zussman

Louise and Stewart, You both mentioned health costs as well as others. What are the specific health risks associated with climate change? This is an area of interest to many students.

Louise Comeau

Health risks:
Psychological: I believe the key element that is overlooked. The stress and insecurity from evacuations as a result of flooding, forest fires, for example, create feelings of insecurity and vulnerability.

I am not moved by discussions of increased insect vectors bringing diseases like malaria to Canada. We are a rich country and will manage this kind of risk.
Increased smog from heat waves and the impact on the elderly and the very young, on the other hand, is a very real risk that needs to be managed.
Finally, health risks can be limited by better emergency preparedness planning: all communities should be able to survive 72 hours without assistance: we are nowhere near that now.

Resiliency is another response: better design of infrastructure to tolerate extreme events is critical.

Stewart Cohen

Health risks depend as much on the state of health services as it does on changing probabilities of extreme events or expanded ranges of vectors that cause disease. Recent episodes of heat waves in Philadelphia and Chicago demonstrated that many deaths could have been prevented with better community services for enabling people without air conditioners to cool off. Apparently, in Toronto, these services were widely provided, and the death rate was relatively low. So adapting to changing health risks can be done, but there will be costs.

David Zussman

Louise, Could you expand on your comments regarding skyrocketing costs to governments?

Louise Comeau

If you look at the trends in expenditures in the last 10 years for Emergency Preparedness Canada the cost to government from extreme events: Saguenay and Red River floods as examples, has (I think with the numbers in front of me) tripled.
At the same time, if you look at how insurance companies report, they show the cost of a disaster and divide into insured and uninsured costs. The insured costs are declining, the uninsured costs are increasing.

It should be no surprise, and it will continue to be governments that pick up the tab.

This is why governments need to lead in terms of the response to climate change: at this time, a minimum should be the equivalent of what governments now spend on extreme events, smog and allergy related health care costs, and perhaps infrastructure spending.

Stewart Cohen

This raises the question of how both government relief agencies and private sector insurance companies will respond to changing levels of risk? Would this lead to changes in levels of protection, or to costs of premiums? What would the effects be on government budgets, and eventually, tax rates? These are all unknowns at this time.

Patricia Roberts-Pichette

Louise, I agree that for the older members of society, the stress will be great, but for young the change will be 'normal'. It is the secondary impacts of the things we put into our atmosphere that bothers me - the large increase in chronic respiratory disease in children for example. The health costs associated with that will be enormous. While we may be able to manage vectors of new diseases e.g. malaria, I would like to know how - I hope it does not mean going back to spraying with DDT still the cheapest method but at what cost? What is more bothering is that there are so many strains of malaria which are resistant to the common prophylactics now and how are they to be kept out?

Louise Comeau

A clarification on health: my reference to the young, was in fact on infants and those with respiratory challenges. This is why an integrated approach is required: fossil fuels cause air and climate damage and solutions solve both, or at least should.

Al Howatson

Stewart, I think that a key piece of the puzzle will be to estimate expected physical (and biological) changes, then translate those into expected damages, in order for both governments and the private sector to do proper risk management. Risk management will be easier for the private sector; the public sector must juggle many competing demands, and politicians must make investments that will only pay off long after they leave office.

Patricia Roberts-Pichette

Perhaps one aspect of amelioration against heat stress means changes in building codes to add air conditioners as standard equipment. There are costs involved here too - not least of which is the cost of hydro. I think this comes back to some of the things Danny was saying about alternate sources of energy - wind and solar especially. I for one would love to be able to use the heat generated in a garden hose lying in the sun for a couple of hours. It would certainly help reduce costs. There is probably already heat exchange technology that could use such heat for cooling. If much more pressure could be put on governments to support alternative sources and bring them to the market. We will not have oil forever anyway, so the sooner we insist on other sources the better.

Danny Harvey

Patricia: I'd hate to see air conditioners as standard equipment in houses (although it probably is). At the very least, building colour and reflectivity, windows awnings, features to facilitate natural ventilation, trees - all of these can reduce our need for cooling. We should also change our expectations a little - we are a society of spoiled wimps, after all, and it doesn't hurt to sweat a little. I see people with ACs running when there is no need at all!

Patricia Roberts-Pichette

Danny, I could not agree more. I have a constant fight with one son who wants and air conditioner - I won't have one! There are ways and means for ameliorating the situation right now in the building code for new housing. It will be very difficult retrofitting a lot of the post WWII housing stock by environmentally friendly means. I am a believer in fans, but there is also the hydro to consider.

David Zussman

Danny, tell us more about economic analysis when it is applied to climate change. Can it be done in the conventional way?

Danny Harvey

Traditional cost-benefit analysis is fine for analyzing alternative investments in factories, for example, when the benefits and costs can be directly compared (they are all financial), when the concept of discounting or diminishing future benefits according to the prevailing interest rate is valid (since the alternative to the investment is to put the money in the bank, so to speak), and when a single individual will pay current costs and reap future benefits. None of this applies to the global warming issue.

It strikes me as completely ludicrous to take future costs (even if they can be quantified in a meaningful way), discount them according to some interest rate, compare these discounted costs with the cost of avoiding the emissions that cause the damage, and deciding on that basis what is worth doing. Those suffering the costs are not the same as those who can make the choice now to avoid the future damage. It won't be much comfort to future generations knowing that their costs discounted to our generation were so small that it wasn't worth doing anything about it. Instead, we have to think of the well-being of future generations as being as important as our well-being, and not sell them short.

David Zussman

I have always been intrigued with the use of traditional economic analysis in the development of public policy. If we reject benefit cost analysis as inappropriate, how do we make the argument to decision makers?

Stewart Cohen

The public sector does have competing demands, but doesn't the private sector also have competing demands? The way insurance companies decide on premiums and what risks they will or will not cover has as much to do with their other lines of coverage (e.g. auto, life, etc.) and investments as it does with changing probabilities of extreme events that may affect property.

Private insurers and government agencies share risk. How will this risk sharing change within a scenario of climate change? How will this affect coverage for floods, hail, drought, severe storms (like the Ice Storm)? Will this influence how cities choose to zone land or build water and sewage distribution works? Can they use scenarios that may force them to look outside their historical experience?

David Zussman

Stewart, do you want to answer some of your provocative questions about how to share risk?

Al Howatson

Danny, I concur that there are difficulties in using traditional cost-benefit analysis (CBA) to assess mitigation action. On the other hand, the task isn't made any easier by ignoring costs and benefits, either. Properly done, CBA at a minimum helps us to organize our thinking. But there are better frameworks, I think, such as decision analysis.

Regarding future generations: as long as the pace of technological innovation exceeds the rate of population growth, it is probable that future generations are going to be better off than we are anyway. The trade-off will be: what should be the level of resources devoted to adaptation/mitigation that would otherwise be allocated to other investments?

Patricia Roberts-Pichette

Probably one of the hardest things that has to be done is the coordination of responses across time and distance. There must be an integrated response with (within government) no one department doing anything that will reflect on environment (broadest definition) without the direct and indirect risks being assessed and countermeasures put in place. It will not be possible to deal with them all - it is not possible, but much more needs to be done in this area than currently. I suspect we have all seen long term environmental concerns overridden by economic immediate concerns. We cannot afford to continue this practice, but it will be hard to put into practise on the basis of best for humanity. But again human perception comes into play, because when some outcomes are apparent, those that predicted them have passed on, and those alive take them as the norm.

Danny Harvey

David: The alternative to economic cost-benefit analysis is to adopt a fiduciary trust framework: We have a moral responsibility to pass certain things intact to the next generation, like functioning ecosystems. This is idea is embodied in the UN Framework Convention - we are to avoid dangerous anthropogenic interference with the climate system, period. Economics is useful in deciding on the best way to meet a pre-

determined goal, not in deciding what the goal (i.e.: level of emission reduction) should be.

Stewart Cohen

I was hoping Al would respond to these, but I'll chip in my $0.02 here.
I feel that some coordinated approach between private and public agencies would be useful in establishing coverage and premiums for various weather and climate-related risks. Some risks (e.g. crop and flood protection) have never been profitable for private or public insurers because of the incentives created for 'maladaptation', i.e. it encourages behaviours that puts individuals in situations of known higher risks, because they expect financial assistance if the extreme event occurs. And yet, there are other reasons why it is good for these activities to occur in these locations.

So, how to share the risk among both the insurers and the property owners?
It seems to me that this requires a broad dialogue that involves regional/local governments, private and public insurance, and property owners to reach consensus on risk sharing.

Al Howatson

Stewart, sorry, I was thinking about some of the other comments.
Yes, "moral hazard" is an issue with public insurance schemes. And I think that you are right about the need for a broad-based dialogue on the relative roles of public and private risk-bearing. Hugely complicated.

Danny Harvey

Al: I am not saying that we ignore costs and benefits, otherwise we would do nothing. I oppose the practice of trying to convert everything to a common metric, then discounting it all at the same rate to the present. Your argument about technological progress applies only to those things that can be substituted by technology. Many things, like living organisms, cannot. Traditional economists see all sorts of inputs to well-being as being infinitely substitutable. This viewpoint is getting us into a lot of trouble - we end up undervaluing priceless ecological assets.

Louise Comeau

One solution is to ensure that insurance and Emergency Preparedness Canada payouts require adaptation. Currently, you can build in the same place, to the same standards

and if the wind knocks your house down again, they will pay you to put it back again, and again, etc.,

Re public/private: insurance firms are required to be profitable. They are required to manage risk to ensure that profitability. Higher risks will be managed: consumers will pay through higher premiums. Where coverage is no longer available, consumers will either be on the hook or will count on government bailouts.

Stewart Cohen

In addition to what Danny has said about Article 2 of the Framework Convention on Climate Change, the 2 other aspects of 'dangerous anthropogenic interference' are food production and sustainable economic development. So there are several objectives to achieve. In order to reach this balance between environment, economy and society, we need to think about how to include indicators that are hard to quantify in monetary terms, including ecological, community and social/cultural concerns. You can't discount a tree or a lifestyle the same way you discount a building or a factory. Are there other indicators besides GDP that could be given more visibility in the policy world?

Patricia Roberts-Pichette

Coming back to circumventing extreme climate events. When it comes to floods, we need to take much more seriously the idea on not building on flood plains. There only be a 1 in 100 years chance of a flood - but oh the damage when it comes. The there is forest cutting practices and how close one can go to a stream. It is the tree roots which hold things together at stream banks, and the cover and accumulated material underneath which allows the water to penetrate. Close cutting to streams allows for none of this water goes immediately into the rivers, sometimes straightened for human purposes, and the outcome predictable.

We always seem to be retrofitting to get 'nature' to do the job she once did and we took it away from her because we could do it better. There is a lot of redundancy built into natural systems, and that is what is needed to combat extremes.

Al Howatson

Danny: Agreed, that there are priceless ecological assets for which there are no substitutes. An economic understanding of sustainable development would see us pass on to future generations a stock of capital (physical, ecological, human and social)equal to what we enjoy. There can be substitutions amongst these forms of capital, but only to a limit. For ecological capital, in particular, there are clearly limits beyond which substitutions are not possible.

Danny Harvey

To clarify what Stewart just said, taking into account the need to maintain food production, allowing ecosystems to adjust, and not undermining development in the 3rd world are all things that need to be taken in to account in deciding how much warming is "dangerous". Open-ended climatic change at some point threatens all of the above. I don't see it as a question of finding "balance", but of deciding on a prudent upper limit to climatic change, and then making the necessary changes. Since these will not undermine human-well being or even overall economic growth (because of numerous non-climatic benefits of moving off of fossil fuels), there's nothing that needs to be "balanced".

The problem is dealing with the vested self-interest of a small part of our society, or in helping certain groups (like coal miners) make the necessary adjustments (to other occupations).

Stewart Cohen

To respond to Danny's concern about the word 'balance': I am referring to balancing objectives, i.e. we need to achieve all of these, but it requires that they are all explicit goals in any actions that are planned in response to climate change.

This suggests that no single quick fix option will work. We will need technological solutions that could lead to energy efficiency improvements, social measures that provide incentives for conservation of energy and materials, and adaptation measures that reduce vulnerability to climate and weather-related events. It also means that climate change needs to be considered in an explicit way in development plans.

Some may see opportunities coming from longer growing seasons, but these may not be consistent with long term plans already in place in some regions (e.g. wildliferefuges in Canada's North). Responses to climate change will have to be considered at different levels, international, national, and regional/local, and these dialogues must inform each other to reduce the risk of conflicting responses.

David Zussman

Louise, what is the magnitude of the reduction of greenhouse gas emissions?

Louise Comeau

The Intergovernmental Panel on Climate Change assesses the potential risks associated with a doubling of carbon dioxide concentrations in the atmosphere. Many no longer think a doubling is avoidable. In fact, many think it is the minimum we will face.

Discussions are focused on the level of risk we are willing to risk at different concentration levels. We are at 370 parts per million now. Do you want to bet on 450? 550? 650? 750? Preventing 450 is impossible now; in fact if you count all the greenhouse gases, we are almost there.

If we want to prevent a doubling from pre-industrial (about 550 for all the gases) then immediate cuts of 50 - 60 per cent are required globally. No chance of that.

Best guess: we will be lucky to hold tight at 650 and then perhaps decline over time to more acceptable levels. The impact: who knows?

Stewart Cohen

To follow up on Louise's point: The Intergovernmental Panel on Climate Change (IPCC) now expects that within around 30 years, we will see ecological risks and risks from extremes expand well beyond what they are now. At this point, CO2 would be at around 475-500 ppm. This is far less than the scenarios used in previous studies of impacts of a doubling of CO2 (around 570 - 600 ppm) that used to dominate the scientific literature 5-10 years ago.

This means that the 'safe landing' field has become smaller.

Patricia Roberts-Pichette

Louise you are right on. So far with the increase in carbon dioxide in the last 1-200 years, we have seen nothing obvious affecting tree growth, and there are plenty of experiments in greenhouses showing that plants grow much more quickly with extra carbon dioxide. But somehow they do not always translate well to the field - too many complicating factors. Well, why do we not see changes in tree growth? Not really known, but there may be some evidence that some sort of threshold is involved.

What will they tolerate (and different species will have different tolerances)in light of all the other nutrients they require, and what will happen when that threshold is reached. At what level of carbon dioxide will animal life be affected? It may not be, but given all the manmade chemicals in water and air, animals including humans may find over time an increased sensitivity to stimulants which today affect few people.

David Zussman

Can't we simply reduce GHG emissions by 50-60% as Louise has argued by introducing stringent energy efficient measures?

Al Howatson

Stewart, the world is awash in indicators. Tomorrow, the Conference Board will release its annual "Performance and Potential" report (see our website), comparing Canada's performance on 40 indicators (economic, environmental and social) with 6 comparator nations. The U.N., World Bank, OECD..., all produce indicators.

My basic concern is with their use in making decisions. I would prefer more attention to decision analysis; in particular, a structured process to elicit stakeholder values as a basis for formulating decision options.

Patricia Roberts-Pichette

I wanted to say a little on indicators. It all depends what one wants to indicate. There is a big search going on for one or two biodiversity indicators, looking specifically for something biological.

I cannot see anything being satisfactory in the way the search is currently being approached. There are very few species of animals or plants which are common to the whole of Canada which could be used.

I have a suggestion that might help in indicating something is going wrong in the environment by using three indicators - changes in human population numbers, rates of change in land use, and rates of change in transportation corridor area. Perhaps two others could be added - the quality of the water and air. The first three are all easy to measure on an annual basis, the last two on a more regular basis. Put them together and one can come up with an index of change that can be related to probable rate of environment change or the biodiversity change or ecological integrity for any place in Canada.

David Zussman

Al, could you elaborate on your call for a better form of decision analysis?

Louise Comeau

Reductions of the kind needed will not come from efficiency alone. The key is to shift the energy system to an efficient base upon which renewables can effectively meet demand. The cascading approach would back out fossil fuels by carbon intensity. This means: efficiency, renewables, natural gas, with minimum use of coal and oil.

Again, I return to the key point: eliminate coal from electricity supply and redesign vehicles to run as hybrids and on fuel cells. Fuel cells are also critical to stationary uses like buildings. Hydrogen will be key, particularly if supplied using renewable resources.

For the existing fossil fuel sector: carbon sequestration and maybe even gasification of coal (could take out co2 and just use the hydrogen) could have potential. It's important to allow this work to proceed because it will be key to engaging existing industries and there could be a breakthrough.

Danny Harvey

David, Ralph Torrie and I did a study some years ago on what it would take to reduce Canadian emissions to 50% of the 1990 level by 2020, which means to about 1/3 or less of what they would be in 2020. A combination of everything we could think of that seemed feasible and reasonable, except for the switch to hydrogen, just did it. We assumed a phase-out of nuclear by then and no new large-scale hydro power. I still believe that everything we considered is reasonable. The Canadian government should in fact be targeting a real reduction of 50%, rather than phoney reductions of 5% through the Kyoto "flexibility mechanisms". Compliance with Kyoto would then come as a by-product of a long-term strategy that would put us in a very strong competitive position. The growth of the wind energy industries in Denmark and Spain (the latter from zero in 1995) are two examples.

Al Howatson

David, it is not so much a better form of decision analysis; rather, making better use of the "front end" of it. Steps typically include: modelling the decision problem; modelling uncertainties; and modelling preferences. More attention to the first part, without necessarily doing the quantitative aspects of the 2nd and 3rd steps, can yield a lot of insight.

Stewart Cohen

Al, at what point can others outside of the modelling community assess the assumptions about preferences, etc. that go into economic and/or decision analysis tools?

Al Howatson

Stewart, this will depend upon the overall "openness" of the decision analysis. Corporations do their own, typically not open. Some government agencies might do theirs privately, some openly. I would hope that some "open" decision analyses could be done in this area.

Stewart Cohen

There are few examples of economic analyses of climate change impacts. Those that have been done are highly sensitive to assumptions about adaptation. It is not clear that there are real opportunities for them to convey their views on whether such assumptions are reasonable.

Al Howatson

Stewart, I see two options here. One is to have "experts" input assumptions, but in an open forum. The other would be some pooled consensus of stakeholders determining input to the assumptions.

David Zussman

We have all agreed that risk to communities in Canada is real. These risks, however, are many and diverse and difficult to quantify. We have also agreed on the necessity for building resilience, adaptation and mitigation. Three tools have been identified: decision analysis, fiduciary trust, and expanded stakeholder participation. Can we now open the 'screen' to the audience for their questions?

To clarify how to post questions:
Step 1: Go to the e-dialogues Question Forum.
Step 2: Enter the Question Forum.
Step 3: To post a question, do so by adding a "new topic", include the general question area under Subject, and then post your question in the message box. Click on "Add New Topic" to post the question.

David Zussman

This message brings our latest dialogue to a close. To our audience, you are invited to post questions which will be addressed at tomorrow's continuing dialogue.

"So, where do we go from here?"

Dialogue - Day Three: **Response Strategies**

David Zussman

Welcome to Day 3 and the last day of our first e-dialogue at RRU. We have two questions from the audience to discuss before moving to our panel dialogue.
First question to all panelists: 1. Are demand side management programs a realistic adaptation strategy?

Louise Comeau

Water conservation programs are an excellent example of both a mitigation and adaptation strategy. Water conservation reduces water demand, cuts energy consumption related to providing those water services and helps adapt to water resource impacts as a result of climate change, particularly for those facing drought.

Another for floods: making surfaces more permeable reduces storm water runoff today and cuts infrastructure costs, but also increases a community's resilience to flood events.

Moving to a more disbursed energy system where energy is used more efficiently on site also is an adaptation as it increases resiliency to extreme events and helps communities be more self sufficient. It also contributes to community economic development because money spent on energy stays in the community rather than going to pay large utilities and fossil fuel firms outside of the community.

Patricia Roberts-Pichette

David, I do not feel confident in replying to a question of this type.

Al Howatson

I don't see DSM measures as a means to help Canadian communities adapt to the effects of a changing climate. Canada could either shut down its energy systems completely, or carry on as normal - neither would have much impact on climate since we produce 2-3% of world GHG emissions.

On the other hand, DSM measures should play a part in an overall mitigation strategy.

Stewart Cohen

There are many possible approaches to adaptation, and conservation and improved efficiency in use of energy and materials should certainly be part of the portfolio of responses. There is evidence that CO2/unit GDP is already decreasing in many countries.

Stewart Cohen

Al's point about Canada's emissions being only a small part of global emissions does not really address the adaptation question. If Canada improves its efficiency in the usage of energy and materials, it will also reduce its vulnerability to disruption in the flow of these inputs. Such disruptions can occur due to extreme weather events affecting the production and transport of goods and energy (e.g. 1998 Ice Storm), or because of climatic shifts that alter seasonal transport routes (e.g. winter roads in the Arctic, navigation in waterways during seasonal low flow periods).

David Zussman

Second Question:

Hi there, panel! Guy Dauncey here, in Victoria. As background, I'm an author and consultant, and co-author of the new book "Stormy Weather: 101 Solutions to Global Climate Change". When you were discussing the costs of coping and dealing with climate change, I wonder how you respond to my critique of the usual "top-down" econometric modelling, as practiced e.g. by the Bush Administration, which they used to prove to their own satisfaction that Kyoto would ruin the US economy.

A more wise and sophisticated approach uses a more wide-ranging analysis, that includes:
* Tax and policy initiatives that promote efficiency and renewable energy, and encourage domestic emissions trading;
* The benefits that will accrue from technological innovation and competitiveness
* The benefits and avoided costs from reduced air pollution (acid rain, asthma, smog, mercury pollution) when we shift away from coal, oil and gas;
* An allowance for the mounting costs of climate change damage and mitigation measures

* The benefits of international emissions trading
* The impacts of reductions initiatives for methane, N2O and the other gases
* And the role that other initiatives can play to reduce GHGs, such as carbon credits, tax shifts, and global agreements to promote solar energy, etc.

US analysis (e.g. by the International Project for sustainable Energy Paths) suggests that the US would benefit by $200 billion by implementing Kyoto; the Tellus Institute and the Union of Concerned Scientists studies estimate a saving of $4 - $7 per ton of carbon saved.

Any thoughts?

Louise Comeau

Couldn't agree more about the critique of top down methods: a total bottom up approach isn't realistic either, however. The "truth" is somewhere in between: there are significant opportunities that the top down approach doesn't show and more barriers to action than the bottom up approach shows.
I believe the time is long past when we should just get going. My experience here at FCM has been that when you just get folks going they actually find real opportunities and they find more then they ever thought possible.

Danny Harvey

With regard to Debbie Neilson's question (which I read in full), she wonders if the benefits of DSM will be lost as people use the money they have saved for things like travel. What she is referring to is called the "rebound effect", and has been extensively analyzed by economists using a variety of approach (top-down and bottom up). There was a special issue of the journal "Energy Policy" (Vol 28, around pp 300-400) on this question. The paper I found to be most convincing is by J.S. Laitner. He concludes that, for the economy as a whole, the effect is only 2-3% i.e.: a programme that would save 30%, saves only 29% instead.

With regard to Guy Douncey's question on macro-economic or top-down models, the results that they get are entirely dependent (and predictable from) the input assumptions. What is interesting is to determine which set of input assumptions in the macro-economic models give the same results as obtained from the engineering, bottom up analysis. Key references in this regard are a report by Repetto and Austin of the World Resources Institute (The Costs of Climate Protection: A Guide for the Perplexed). There was an earlier interesting study in this regard by Irving Mintzer, also, I believe, of WRI.

Al Howatson

Guy: Thanks for your question.

Economic modelling, whether "top-down" or "bottom-up" depends critically on a host of assumptions going into the analysis. I have seen analyses which demonstrate everything from heavy mitigation leading to net positive effects on OECD economies, to substantial losses.

The best single volume source of recent econometric studies is the ENERGY JOURNAL, special edition last year on the costs of the Kyoto Protocol. A dozen or more studies by world-leading researchers.

We can take up individual bits of your reply as the dialogue continues. This will have to do for a short answer.

Stewart Cohen

Guy's point about the costs and benefits of Kyoto is important. I do not believe there is a consensus around such cost estimates despite the general feeling that Kyoto will 'cost' the Canadian economy.
What is needed is inclusion of estimates of damages avoided, and consideration of the opportunities afforded to alternative energy sources and other industries that would see increased business activity as it adapts to the new instruments that Kyoto brings on.

The focus on how traditional energy sources and industries might be economically hurt by Kyoto is only part of the picture. Even here, these industries may also find benefits in adjusting to new markets/opportunities brought about by Kyoto instruments. What is not known is how well these instruments will work, and how their performance will be monitored, and non-compliance penalties enforced.

Patricia Roberts-Pichette

This is a rather long and complicated statement to keep in mind for a really thoughtful comment. As a first response, it seems an appropriate strategy. However, the savings and changes seem to be things unto themselves - there should be positive spin-offs into health care and in fact all other areas of human endeavour that impact on the environment. It would seem to have the long term in view, with the encouragement to innovate with pay-off in both short and long run to the environment and human well-being. There is one question which is not asked - will governments be innovative enough to implement such a strategy? How will human needs to 'acquire' be satisfied? That is, how do we deal with human greed?

David Zussman

I believe all of you have responded to the audience questions. At this point, could you now provide all of us with your initial thoughts on 'response strategies'?

Those in the audience - please follow along and post your comments and questions. They will be addressed during the last 30 minutes of our dialogue.

Patricia Roberts-Pichette

So where to now? Given the magnitude of the task, and the fact that results will not be readily obvious for some time, the governments, both federal and provincial, must lead, and make their leadership more than words. It the provincial governments are not prepared to work with the federal government, then the federal government must go alone. This cannot be a "do as I say but not as I do" approach. Aspects which should be addressed immediately on use of alternate energy sources, public transport, disposal of waste, etc., and $$ to encourage research into these areas and their application in building codes and taxation policy to encourage change. Climate change initiatives cannot be divorced from agricultural, fisheries, forestry, transportation, public health, and etc., initiatives, and economic initiatives must be assessed through an environmental perspective to identify possible long term impacts. Environmental risk assessment of all government activities at whatever level, must become much more widespread.

Danny Harvey

Now I'm going to jump in with my initial, brief answer to the questions that David had posed for today's discussion.

Canada's response to the global warming issue should be to develop a comprehensive, long-term (30-50 year) strategy for reducing its emissions by 50% or more compared to present. Focusing on short-term, interim commitments (i.e.: the Kyoto protocol) will not help us in the long run. Compliance with Kyoto should come about as a byproduct of the long-term strategy. This strategy should involve a combination of (I) financial instruments (a C or pollution tax, and/or transfer payments to cooperating provinces, and/or subsidies for clean energy), (ii) regulations and standards, (iii) investments in rail transportation infrastructure (especially within large urban areas), and (iv) long term research, development, and demonstration of emerging technologies. These all will yield significant benefits in addition to do our share to minimize future climatic change.

Al Howatson

I agree with Danny's point that we need a long-range response to a long-range problem. My suggestion:

1: Develop some fairly detailed scenarios of international negotiations: what are the probable outcomes and implications for Canada, especially vis-a vis U.S. action?
2: Develop principles for resolving the burden-sharing within Canada: how to share costs and benefits of adaptation and mitigation?
3: Determine the relative resources that should be devoted to adaptation versus mitigation.
4. Proceed with low-cost mitigation and adaptation activities that make sense under a number of outcomes and that carry benefits in other areas (air, urban transport, buildings)

Stewart Cohen

I feel that Kyoto instruments can complement the domestic activities that Danny has outlined. The technology transfer programs promoted by Joint Implementation and the Clean Development Mechanism could be very significant for developing countries, and we need to provide them the incentive to develop in a clean and efficient manner. Emissions from developing countries will far exceed developed country emissions unless technology transfer occurs quickly.

Louise Comeau

Canada's response strategy should focus on sustainable development through pollution prevention. The key is to develop a set of responses that achieve environmental improvement in a range of areas while at the same time contributing to economic efficiency, innovation and productivity. I believe that package includes a focus on the following:

1. Core infrastructure: investment in upgrading and making more efficient water, waste, energy and transportation infrastructure. Water services, for example, are extremely electricity intensive. Waste generates significant greenhouse gas emissions from landfills, but also because resources are not returned to manufacturers for re-use. Recycling a tonne of aluminum cans reduces greenhouse gas emissions by 10 - 12 tonnes of equivalent CO2. On the energy side, we believe investment in community energy systems using combined heat and power and a commitment to buying electricity made from renewable energy are key. Transportation and land use policies that drive travel patterns are central, but long term. In the short term, higher fuel efficiency standards for vehicles and trucks are key; investment in transit over the long time is critical.

2. Emissions trading: cap and trade system so that large emitters can begin to reduce emissions.
3. Consumer incentives to create demand for green electricity and hybrid and fuel cell vehicles will be important.

Al Howatson

I would agree that the Kyoto Mechanisms offer great potential for low-cost reductions (for OECD) and technology gains for developing nations. I doubt, though, that even massive tech transfer will reduce projected GHG emissions from these countries. They will also need to come within a cap within the next few decades.

David Zussman

Perhaps, I can move to our first question for this session. How can Canada do its share to respond effectively to climate change? Some of you have already started to address this, but for the sake of our audience, let's delve deeper into the options and recommendations.

Where possible please articulate the costs and benefits of your recommendations. Thanks.

Patricia Roberts-Pichette

Danny, you are right when you say adhering to Kyoto will not help us in the long run. I like your other suggestions.

One aspect of Kyoto and its follow-up that bothers me is the idea that trading emissions and planting trees will help. Trading emissions might be OK for a short interim period, but in effect it just takes the emissions from one place and puts them somewhere else - the total amount emitted does not change. Re planting trees - it sounds good, but one estimation I heard was that it would take the planting of an area the size of British Columbia annually to keep Canada in about the same place.

When it comes trees, they are only taking up more carbon dioxide then they release when they are growing most actively - probably in the age range (that would make a difference) of between 20 and say 60 years. Once they are fully mature (or to the old growth stage), the carbon dioxide uptake and release again comes into balance.

David Zussman

Is it a case of one method, one tool or one process being better than another, or because the problem is so huge, we need action at multiple levels, multiple tools and instruments?

Danny Harvey

Stewart has raised the issue of the Kyoto mechanisms, which include forest carbon sinks, and joint implementation in developing countries. I have nothing against these things, but if you do the math for something like stabilizing at 450 ppm CO2 (which will already entail significant damage), you see that we must do ALL - we do not have the choice of only reducing our emissions, or planting trees, or helping the developing world limit the increase of its emissions. So when I say that we need to reduce our emissions by 50% over 30-50 years, that is in addition to replanting forests and, along with other developed countries, providing the technology and resources to vastly limit the growth of developing country emissions.

David Zussman

Louise, and others, what are some of the technologies? What government incentives could be put in place?

Al Howatson

To respond to David’s request, the first three of my recommendations are in effect "planning, negotiating and management" actions. The costs are largely the time and energy of key stakeholders. The benefits? The outputs will be essential, I think, to arrive at a politically and economically feasible course of action.

On my 4th recommendation, lots of work has been done here by last year's Issue Tables and the Analysis and Modelling Group involved in the National Climate Change Process. See the website of the latter for studies and reports.

Patricia Roberts-Pichette

David, I am not much of an economist and I agree that I should be. Let me however give something for everyone to ponder - I am sure someone can add find the figures if they wish to.

Think what we spend annually on the exploration of space? What is the cost of Canada's contribution? How much does it really contribute to our daily living apart from

nation pride in having had astronauts go into space, and providing the Canadarm I and II? Space will still be there in 100 years and so will the ultimate particles of such scientific interest today - fascinating as they are to scientists. But if we do not clean up our act vis-a-vis the environment, human beings may not be here in 100 years.

Where are human priorities? A graph on research $$ spent on the world of the ultra large (e.g. space) through the medium (life and environment i.e. the world around us - most of this middle section is spent on medicine) to the ultra small (e.g. neutrinos and other ultra small entities) is U-shaped. Is this appropriate?

Stewart Cohen

I do not know the cost implications of response options for Canada.
Regarding Patricia's point about Kyoto, I think it's important to re that Kyoto has a number of mechanisms, and emissions trading and sinks are only a part of it. Technology transfer incentives could become very important if developed countries would provide enough support.

The question about caps and limits and domestic reductions versus instrument reductions is also important, because of concerns about equity. Can widespread support for Kyoto or other agreements like this be achieved without minimum limits on domestic emission reductions? These are policy questions, rather than scientific questions. For science to influence decision making, there will need to be a broadening of the dialogue on the various tradeoffs that need to be considered for Canada to respond to this effectively.

One important tradeoff to consider will be how the use of 'sinks' would affect food and lumber/paper production. A second would be the side effects of technology transfer programs on international trade in various commodities, as well as on the well-being of people in developing countries (e.g. would this actually promote international equity and reduce potential conflicts).

Louise Comeau

Canada's share: the international negotiations have (albeit roughly)tried to resolve this by establishing different targets for countries based (as I say roughly) on their perceived marginal costs of compliance. Canada has argued that we have fewer reduction options given our low GHG fuel mix for electricity and our reliance on exports: of course it's very cold here and it's a big country so of course our emissions must be higher relative to others. Of course this is hogwash, but there you have it. This is why we have a lower target than the U.S. and Europe.

The Kyoto target then is roughly a reflection of our relative costs of compliance. It may not be a big target as it relates to atmospheric needs, but it is a huge target domestically that will build the foundation for the deeper cuts that we agree are needed.

Studies indicate that Canada could grow up to 1 per cent less than expected if it meets the Kyoto target. That means instead of growing 35 per cent over the next decade or so we would grow 34 per cent. Of course the number is within the range of uncertainty and of course underestimates additional growth that would come from new investments. And the numbers reflect no analysis on the costs to the economy from climate impacts.

Canada is a developed country, relative to other countries are emissions are very high on a per capita basis, we are wealthy and we have opportunities to invest. Our share has been determined to be six per cent by 2012 for now and we should move quickly to meet our international obligations.

Danny Harvey

With regard to technologies and incentives, lets deal with electricity generation and transportation, which together account for 50% of Canadian emissions.

As a mentioned on Day 1, wind energy is competitive with coal if the external costs of coal (2-7 cents/kWH) are taken into account. So we should push wind to the limits imposed by its fluctuating nature. This is normally regarded as 20% of total electricity supply, but with so much hydro in Canada, we should be able to get 30% or more from wind. If the wind component is oversized for peak (which otherwise provides backup), we can get a larger fraction, albeit at larger cost. If that isn't enough to get coal off the system altogether, we use gas combined cycle. Shifting from present coal to advanced gas (50% efficiency) reduces emissions per kWh by a factor of 3.5 or so (when the different emission factors are also taken into account). Eventually, fuel-cell-turbine hybrid will give 70% efficiency - a factor of almost 4 reduction from coal. So we can almost completely eliminate emissions from electricity generation with available, cost-effective technology.

For transportation, we invest in rapid transit to keep kilometers travelled constant as the population grows (i.e.: reduce per capita km by 30% over the next 30 years or so) and bring in improvements to automobiles that double fuel efficiencies. The technologies that can do this already exist and have been demonstrated, so we can probably do more. We also tax gas guzzlers to shift consumer preferences, and increase the price of gasoline as required. So we cut transport emissions at least in half.

Al Howatson

To build on Patricia's point, it is difficult for people to sacrifice today (incur costs) for benefits tomorrow. It's easiest for one's own family (think of your children). It's far more difficult when we must sacrifice for those long distant in time and space. That's the major difficulty in getting attention on climate change: the costs tend to be immediate and local; the benefits tend to be spatially and geographically distant.

Louise Comeau

In response to Al: this is why the focus must be on solving today's problems: acid rain, smog, heavy metals in the air, with solutions that also reduce greenhouse gas emissions. Danny's list is exactly that kind of list: get coal out of electricity and move away from the internal combustion engine.

Stewart Cohen

Al's comment suggests the importance of education and outreach on climate change. There's a lot of communication about climate change, but how much of this is actual dialogue among different parties with different roles to play?

Danny Harvey

I want to re-emphasize Louise’s point: The actions needed to address global warming provide immediate, local benefits. The global warming benefit is icing on the cake. Shifting to rapid transit is not just an air pollution issue, it is also a quality of life issue - less time commuting, less stress in congestion, more time with our families. We deserve it! What we have today is primitive.

Patricia Roberts-Pichette

Technologies and strategies.
It may not be a matter of development of new technologies and strategies but of implementing of those that already exist (even if somewhat old) which will give the research community time to change focus and improve what is there. We need to be brave enough to do it.

So often one hears of new Canadian (environmental) technologies not being made operational in Canada, but having to prove themselves somewhere else first. There was for example much innovative work supported by the government during the oil crisis of the early 1970s. I have seen examples of some Canadian innovation in other countries, and very little of it in Canada.

Where could we not go with wind and solar power - how much could we reduce the dangerous ice fogs in the Arctic it we were to supplement the current diesel generators them with wind and solar power as appropriate?

Public transportation is a societal good and should be supported by society as a whole - car owners and non-owners alike - because of the direct and indirect benefits that accrue to the whole community.

Then there is land fill. We should change our thinking not garbage, but a resource to be mined. Why not put into operation a law which says that every community is responsible for disposing with its own waste. The fight to do that would be unimaginable, but think if enforced what the outcome would be? To start with less packaging, more things that will decompose more quickly, opportunity for developing more innovative ways of using what currently makes up community waste.

Al Howatson

To respond to Louise: The overall costs to Canada of lost economic output may not be large, but it’s the relative impacts than matter. That is, what industries and regions may be vulnerable to mitigation actions, and how will their vulnerability be accommodated? (I've heard most of the options, but some decisions need to be taken).

On technological solutions: many that show low engineering costs may not get implemented for all kinds of other reasons: risks of implementing new technology; the need to utilize existing capital stocks, etc. The trick is to find incentives for implementing solutions without excessive private or public cost.

David Zussman

I would now like to move to the second of our two formal questions for today. What are the key elements of a Canadian response strategy that has to be put in place? Moreover, who should be responsible for their implementation?
Have fun!!!

Stewart Cohen

We've heard a lot about the what (e.g. reduce coal use, invest in public transit), but not much about who. This question is much harder, because implementation includes financial commitment up front. Many debates over public transit continue to get bogged down in details over types of technologies, routes, costs, and burden sharing of the costs.

If climate change response could be seen as an investment portfolio, with many different components, then it is clear that there need to be many investors. Governments will have to implement a number of these measures, and these will have to be joint efforts across all levels of government (federal, provincial/territorial, regional/municipal). The private sector must get involved as well. There have been many examples of public/private partnerships in traditional activities (e.g. fossil fuel exploration/development), and the success of the GLOBE conferences demonstrate that the private sector is interested in expanding their participation in new technologies in environment and energy, as well as participating in emission trading (e.g. BC Hydro has made public statements on this).

Louise Comeau

Domestic strategy:

1. Invest in core infrastructure 2. Emissions trading for large emitters 3. Consumer incentives for green power and efficient/alternative technology vehicles Implementation: all orders of government: Infrastructure Canada is one model for the core infrastructure investments. Emissions trading to engage industry; established by federal government, not sure how the provinces play on this one. Consumer incentives: federal, but could be matched with provincial incentives. Provincial: standards for waste management, land-use, water management, building codes, electricity. Federal government can have national guidelines on these things, but the provinces can only make them regulation. The federal energy efficiency act can be used for consumer products, but it is residual: only applies where provinces don't have legislation.

Danny Harvey

David, I had decided to lump your original questions together, so everything I've said addresses your 2nd question (response strategies).

As for who should do it, jurisdiction for many actions (building codes, appliance and equipment efficiency standards, land use planning) falls at the provincial level. The federal government mainly has the carrot of financial transfers, plus there is a lot it can do with the tax system (even if it is afraid to do what economists favour, and impose a C tax). The federal government can also develop model standards and codes, rather than having it done 10 times by 10 different provinces. There are ways that the feds can directly fund municipalities.

Which brings me to another point - the key role of municipal governments, as the level of government closest to individual energy users. The City of Toronto has done a lot through its Better Buildings Initiative, an approach that is now being scaled up through the Federation of Canadian Municipalities.

Individuals can do a lot to (50% difference in direct emissions), but I see most people as being far too selfish. But every little but helps.

Al Howatson

David, my response to your question would be my 4 points made at the beginning of the dialogue.

Implementing actions will require varied responses from the full range of economic actors - 3 levels of government, corporations, citizens, and R&D agencies. No time to get into specifics.

David Zussman

Since we have less than 15 minutes available for the panel dialogue, could you give some consideration to a final word or comment that captures your areas of commonality?

Louise Comeau

Do what makes sense today and that contributes to sustainable community development and quality of life.

Focus on coal out of electricity and the internal combustion engine.
Mitigation and adaptation must be managed simultaneously; there will be costs from climate change itself that we must increasingly incorporate into our assessments of options

We are in this for the long haul.

Al Howatson

One point noted by several panelists is the need to take actions that serve multiple purposes: that reduce GHGs as well as protect health, improve urban transit, strengthen water services, etc.

The challenge (in my opinion) will be getting policy co-ordination across 3 levels of government (and more, if international).

Stewart Cohen

I agree with Danny about the important role that municipalities have played and will play. The 20% Club is a great example. But they won't be able to do this without help from other investors. And on top of this, municipalities continue to face budgetary challenges on various fronts (schools, health services, changing boundaries).

Perhaps municipalities could organize multi-level responses and call on others for participation. There could be different levels of leadership on different aspects of the climate change issue (e.g. municipal leadership on urban transit).

Danny Harvey

A final word? Just do it!

Louise Comeau

Just a response on the municipality points: we are in: we have 90 communities in our partners for climate protection program and believe we can contribute a quarter of the Kyoto target. Our plan includes the key points I have raised: waste diversion, community energy systems/combined heat and power; green power procurement, water conservation, transit investments, community greening, etc., For more you can see our web site at: www.fcm.ca

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Patricia Roberts-Pichette

Again I come back to the necessity of having all levels of government leading, encouraging and with strategic support. Communities no matter how committed cannot do everything on their own. This is a national issue and needs to be addressed nationally. Canadians if convinced by the senior levels of governments of what is needed, will do what is expected - they have before, they will in the future. Trust the people.

David Zussman

One person in the audience has posted the following:
"It is amazing looking at some of your posts. Many of you advocate using an emissions trading system. It is only a temporary solution. The one BIG problem is that you are CONDONING further pollution. Why do I not see any of you advocating a tax on pollution system?"

Would any of the panelists care to respond?

David Zussman

We have also received another question-

"Seems as though the issue of subsidies to coal and oil production should be factored in here. If the same amount were spent on wind, hydro, or solar, what would the impacts be on GHG emissions?."

A reply?

Al Howatson

Some analysts would recommend a carbon tax. However, a tradeable emissions system with auctioned permits will lead to the same outcomes. Both tax and permit systems can also be adjusted to recycle revenue, or to compensate "losers".

In general, a "new tax" in North America is treated like leprosy. However, the actual target (policy objective) is probably of greater importance than the means of achieving it. "If you don't like the destination, no means will satisfy you."

Danny Harvey

I've never liked emission trading, except between international governments as a means of creating a modest financial transfer to developing countries for the purchase of advanced technologies, and as a means of creating competition among governments for the most effective and low-cost domestic emissions reductions programmes (see my paper in Global Environmental Change, Vol 5, pp.415-432).

Domestically, I much prefer a carbon tax offset by reductions in payroll taxes. This is what most economists seem to prefer and is what some European countries are doing. Tax pollution rather than employment, and you get less pollution and more employment.

Patricia Roberts-Pichette

Emissions trading I do not condone emissions trading but may have to accept it as a start. I do not think if it is implemented it should continue for more that five years.

Stewart Cohen

I don't know that any of us is 'condoning' further pollution. What we're after is mechanisms that will reduce pollution. For these mechanisms to work, there will have to be buy-in from many different parties, including the 'consumer'.
None of this will be easy, and no single mechanism on its own will do the job at the global level, or here at home.

Is there a role for emissions trading? Economists seem to like this. Of course, we will not know if this works unless it's tried at least on a pilot basis at the international level for a few years. There will need to be a monitoring system in place in order for an accurate assessment of this mechanism to be made. But I also feel that many other things should happen concurrent to any trading system be set up.

Al Howatson

On the question of subsidies, the "level playing field" study produced by the federal government a couple of years ago found that the renewables sector is not disadvantaged by the tax system in comparison with oil and gas.

Subsidies have often arisen over time for a variety of purposes - energy security, preservation of employment, etc. Removing them takes considerable political courage.

Patricia Roberts-Pichette

Hydro does produce GHG emissions, and when the building of dams is factored in, other problems as well. Increased spending on solar and wind energy should greatly reduce GHG emissions. We should not forget about using recycled materials. Yes GHGs will be produced, but they will produce energy on the way to release.

Danny Harvey

There seems to be a lot of disagreement as to whether fossil fuels are directly subsidized or not. But I think one thing people can agree on is that external costs are not included in the price that the consumer sees, and I regard this as an indirect subsidy. There is less agreement on the magnitude of the externalities, but the lower bound estimate is sufficient to make renewables and energy efficiency much more competitive than at present.

David Zussman

Many of you mentioned the importance of dialogue in dealing with trying to address climate change. As a last question, do you have any concrete suggestions how this might be achieved?

Stewart Cohen

During Day 2 (Tuesday), we discussed the role of researcher-stakeholder partnerships in research, and how this would promote cross-cultural learning, and perhaps subsequent concrete actions on reducing vulnerabilities and emissions.

These partnerships should extend to professional communities (e.g. engineering, water management, accounting, energy, insurance, parks, health, financial industry, etc.). These professional umbrella organizations could be a useful forum for considering options for response.

Al Howatson

How do we interest someone in dialogue on anything? Sometimes it can be party chit chat, or something of academic interest. Here, presumably, we want dialogue to further appropriate action. I suggest that in the latter case, people will discuss something when they see that their interests are involved. You say that this is going to cost me how much? What are the benefits to me? What are the risks that are involved? These are the questions that citizens and business leaders ask, and on which they will engage.

Al Howatson

On reflecting on my last comment, spoken like a true economist! It was Adam Smith who said "It is not from the benevolence of the baker, or butcher or brewer that we get our dinner - but from their own self-interest".

Patricia Roberts-Pichette

The dialogue is and has been important in bringing the problems associated with climate change to people's attention. The question arises "If it is so important, why isn't anyone (meaning governments) doing anything about it?" If governments' most influential friends cannot persuade them to take the bull by the horns, then elections and holding the elected to account are the way. Are people convinced enough to organize to do this? Where are people's hearts in this matter?

David Zussman

Al, that is an interesting way to end our dialogue.

Stewart Cohen

The definition of self-interest changes over time. Climate change could become an explicit part of 'self-interest'...some day.

David Zussman

Thanks to all of you for participating in this unique experiment.