MIND the Gap

A BLUEPRINT FOR CLIMATE ACTION IN BRITISH COLUMBIA

Summary Report

ALISON BAILIE • KAREN CAMPBELL • MATT HORNE
Alison Jamison • Josha MacNab • Ian Picketts • Rich Wong

November 2007

the PEMBINA institute

Mind The Gap

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Those 31 million tonnes are the gap.

Mind the Gap explains how to cut the rest.

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A Blueprint for Climate Action in British Columbia

Summary Report

"The science is clear. It leaves no room for procrastination. Global warming is real."
British Columbia Speech from the Throne, February 13, 2007

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About the Pembina Institute

The Pembina Institute creates sustainable energy solutions through research, education, consulting and advocacy. It promotes environmental, social and economic sustainability in the public interest by developing practical solutions for communities, individuals, governments and businesses. The Pembina Institute provides policy research leadership and education on climate change, energy issues, green economics, energy efficiency and conservation, renewable energy and environmental governance. More information about the Pembina Institute is available at http://www.pembina.org or by contacting info@pembina.org.

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1.1 Table of Contents

2. Introduction

To combat climate change, Premier Gordon Campbell has declared that British Columbia will cut its annual greenhouse gas emissions by 33 per cent or more below current levels by 2020. With emissions continuing to rise, this challenge is significant if we are to avoid new emissions and decrease current levels. That's at least 36 million tonnes of emissions that we will need to cut.

To date, the details announced in Premier Campbell's proposals will only reduce British Columbia's emissions by about five million tonnes – 31 million tonnes less than needed to meet the goal.

Those 31 million tonnes are the gap.

***Mind the Gap* explains how to cut the rest.**

Science is telling us that serious action is needed now to stem the impacts of global warming.

In 2007, B.C.'s estimated greenhouse gas emissions are 71 million tonnes, and they are projected to rise. Meeting our goal of cutting today's emissions by 33 per cent or more by 2020 means we'll need to cut a total of at least 36 million tonnes of greenhouse gases. Since the Premier's announcement, British Columbians have been asking one question: how do we get there?

The Pembina Institute wanted to help answer this question and determine what it would take for British Columbia to meet or beat this emission reduction target. In *Mind the Gap,* we look at the actions the B.C. government has announced to date, recognizing that not all of the B.C. government plans can be quantified, and more will be announced soon. Of those that we could count, we estimate that B.C. government commitments will result in almost five million tonnes of reductions.

We then looked at strategies for reductions from six different sectors of B.C.'s economy in order to determine where we can further cut our carbon emissions. We have found another 22 million tonnes of potential reductions, and offer recommendations on the changes needed in order for these reductions to happen.

2007 British Columbia Greenhouse Gas Emissions By Sector

Business and Industry 38%

Oil and Gas is another 21%

Personal Transportation is 14%

Homes and Buildings is 11%

Waste and Agriculture 11%

Electricity 5%

For each of the six sectors, we found the following:

Business and Industry – Action must be taken quickly to implement emission pricing – through carbon taxes and/or a cap and trade system in this largest sector of emissions.

Oil and Gas – As the single largest source in B.C., aggressive emission pricing and regulation will be required. Plans to increase production are a contradiction and must be reconsidered.

Personal Transportation – Gains from vehicle efficiency standards and low carbon fuels will be offset by more cars and more driving unless we push faster on efficiency improvements (in line with Europe or Japan) and begin to reduce driving demand.

Homes and Buildings – There are big possibilities for reductions if we can accelerate energy efficiency and encourage renewable energy developments.

Waste and Agriculture – Moving on the commitment to regulate methane will yield real short term results, but more is needed.

Electricity – Significant reductions are likely with additional regulation, but it is the smallest of the six sectors.

Finally, we consider further innovations in all sectors, but cannot quantify success to the same degree because the ideas depend on technology, innovation, and real commitment to change. Still, these innovations could contribute between eight and 16 additional million tonnes of reductions.

In total, we have found 39 million tonnes of reductions if the B.C. government and British Columbians are prepared to make real changes.

These changes will not happen without real leadership from the B.C. government, through laws, regulations and policies that will establish economic signals to ensure that polluting our atmosphere with greenhouse gases is no longer free. *Mind the Gap* is not a comprehensive roadmap to the solution, rather it is a blueprint or guide. The tools we propose have the potential to work. We look forward to some discussion, and even more action, on making it happen.

2007 – The Tipping Point

2007 may be remembered as a tipping point for climate change. It is the year that Al Gore received an Academy Award for his film 'An Inconvenient Truth' and the Nobel Peace Prize for his tireless effort to share the urgency of global warming. 2007 is also the year that the Intergovernmental Panel on Climate Change, a body of hundreds of scientists and other experts from around the world who advise the United Nations, shared in the Nobel Peace Prize. The Mountain Pine Beetle epidemic, now a fact of life in the British Columbia interior, is beginning to spread east toward forests in the rest of Canada. 2007 saw much of the seawall in Vancouver's Stanley Park closed because of damage from a winter windstorm. Warming rivers and shrinking glaciers are damaging our fresh water systems to the point where they may cease to provide suitable habitat for salmon. Finally, it is also the year that the B.C. government said it would take action on climate change.

In its February Speech from the Throne, the B.C. government said, in order to combat global warming, it would reduce provincial greenhouse gas emissions[1] by at least 33 % below the 2007 level by 2020. This announcement represents a major step forward by a provincial government in Canada. But, while some clear commitments have been made, the significant changes needed to achieve those targets and the strong government policies needed to drive those changes are still far from fully known. There remains a yawning gap between the GHG emission reduction targets that B.C. has established, and what we are currently on track to achieve. There are many tough actions that will need to be taken for us to not only meet the 2020 target, but also to move further to the deeper reductions that are required. Engaging us all meaningfully in this crisis is British Columbia's big climate challenge. In other words, how does British Columbia 'mind the gap?'

Citizens are supportive of the B.C. government's direction and want to see action, but the nature and extent of the needed change have not been clearly spelled out. Individuals, businesses and organizations have critical roles to play, and will be the ones making the on-the-ground changes to technology and behaviour. Citizen input will be critical to help design and support effective policy change in British Columbia.

However, while there is a role for all of us in bringing about the necessary changes, primary responsibility, leadership and commitment to the tough policies that will be required, must come from the British Columbia government.

The purpose of ***Mind the Gap*** is to put the reality of this challenge into perspective. Our goals in undertaking this study are twofold. First, we provide estimates of the reductions that can be achieved based on commitments and opportunities that exist today – recognizing where it is up to us, individuals, businesses and organizations, and where it is up to the British Columbia government. Second, we want to advance a public discussion of the changes that we will all need to make if we are to find the deep emission reductions that are required. To make the societal changes that are needed, the public must understand the

[1] Greenhouse gas (or GHG) emissions is used to refer to the six gases covered by the Kyoto Protocol: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6).

problem, participate in the solution, and inspire governments to take necessary action on global warming.

Our findings show that much can be accomplished, but the changes cannot be marginal – they must be substantial. Because of this reality, we want to ensure that British Columbia's climate actions are made in full recognition of the scale of change B.C. is aiming to undertake. By 'minding the gap' we hope our analysis will ultimately inspire and inform the most important question: What will we do to protect our climate?

Global Warming and British Columbia

According to the United Nations Intergovernmental Panel on Climate Change (IPCC), the global average surface temperature has risen by about 0.74°C over the past 100 years, and it is more than 90% certain that the past half-century's warming was mostly due to the build-up of greenhouse gas emissions from human activities. The IPCC has concluded that if no action is taken to curb greenhouse gas emissions, the global average surface temperature is likely to increase by a further 1.1 to 6.4°C between 2090 and 2099 compared to 1980 to 1999.[2] For all but the lowest end of this range, the impacts will be devastating and irreversible. Accordingly, the Pembina Institute and the David Suzuki Foundation have advocated the adoption of deep greenhouse gas reduction targets in Canada.[3]

In British Columbia, greenhouse gas emissions have risen approximately 30 percent since 1990. This is almost entirely due to population growth and very little to increases in per capita emissions. Meeting the 33% by 2020 target will mean that B.C. needs to reduce greenhouse gas emissions by 10% below the 1990 level by 2020.

Strategies and Policies

Strategies: Strategies are changes in technologies or behavior that are undertaken by people or businesses in B.C. Examples include installing a more fuel-efficient furnace or other equipment, using teleconferencing rather than flying, or installing specialized equipment to reduce leaks in natural gas pipelines.

Policies: Policies are the government rules that lead to the implementation of strategies. Examples include vehicle emission standards, building codes, carbon taxes, and cap-and-trade systems.

About the Study

Mind The Gap consists of two documents: the detailed report contains all of our research, assumptions, analysis and conclusions. This summary report presents the same information in an abbreviated form. In this study, we examined more than 30 important strategies to address global warming. We have grouped the strategies into six different sectors:

[2] References in this paragraph are from *Intergovernmental Panel on Climate Change, Summary for Policymakers*, in Solomon et al., eds, *Climate Change 2007: The Physical Science Basis, Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press, 2007), 2–3. Also available online at http://www.ipcc.ch. P. 5, 10 & 13.

[3] Matthew Bramley, *The Case for Deep Reductions: Canada's Role in Preventing Dangerous Climate Change* (Vancouver, B.C. and Drayton Valley, AB: The Pembina Institute and David Suzuki Foundation, 2005), 15–16. Also available online at http://climate.pembina.org/pub/536. Specifically, based on best available science, we have said that we need to see a reduction in Canada's GHG emissions to 25% below 1990 levels by 2020, and a reduction in Canada's GHG emissions to 80% below the 1990 levels by 2050.

- business and industry,
- oil and gas,
- personal transportation,
- homes and buildings,
- waste and agriculture, and
- electricity.[4]

These strategies mostly focus on individual and societal action, but their implementation will require government leadership, in particular, policies to place a meaningful cost on greenhouse gas emissions and fully enforced regulations. These strategies fall into two categories:

B.C. Commitments are strategies that have been identified by the British Columbia government in 2007 as part of the Speech from the Throne or the Energy Plan. Where possible, we have estimated reductions from these strategies. Where the government has announced policies (such as buildings codes and vehicle emission standards) in order to achieve strategies, we have evaluated the policy in conjunction with the strategy.

Minding the Gap includes more strategies, changes in technology and behaviour that go further than, or address sectors not covered by, the B.C. Commitments. Minding the Gap will require even more changes in the way we live our lives and the ways in which our businesses and industries operate. They will also require strong policies from our government to become a reality.

We have two categories for strategies under Minding the Gap: New Strategies are specific actions for which we were able to estimate emission reductions, while Further Innovation are non-specific actions for which we weren't. The second category recognizes that technologies, operations and even behaviour must evolve substantially over the next 12 years and beyond. Under the appropriate government policies, this evolution could lead to innovative solutions to reducing emissions that we cannot yet describe. Some of these solutions exist today, but we did not find sufficient research to estimate their likely effectiveness in B.C. For Further Innovation in each sector, we provide a rough range for potential emission reductions, based on our understanding of the emissions remaining after the New Strategies have been implemented and the general potential for further reductions. More research is needed to fully understand those strategies.

For each strategy, we describe the actions (for example, adding better insulation and other energy saving improvements to an existing home or reducing leaks in natural gas pipelines), estimate the reductions in greenhouse gas emissions and recommend possible policies that could help achieve the actions (see Appendix I for a summary of the recommendations).

[4] The impact of biological sinks (forestry and agricultural soils) on British Columbia's net GHG emissions have not been considered in this report. Considerable research is being undertaken in this area by the Canadian Forest Service, Natural Resources Canada, Agriculture and Agri-Food Canada, ForestEthics and others. We will strive to include this information in the future and we expect that the B.C. government will provide information on their plans for accounting for changes in B.C.'s biological sinks.

RECOMMENDATION 1: The B.C. government must enact policies to undertake all its announced strategies. Many initiatives have been announced but most of them lack details on implementation. The B.C. commitments need effective follow through by government policy so that individuals and business can act. We need to know what will be done, how it will be done, how success will be measured and what will be done if initial steps do not succeed.

In examining the different strategies, we acknowledge that these are inherently subjective tasks that rely on value judgments and can be perceived differently depending on how one considers action on global warming. We have attempted to make our analysis as transparent as possible. Appendix II includes a discussion of the general approach we used for estimating reductions and all of our data can be made available.

This analysis does not attempt to choose the best set of strategies, nor does it purport to be a comprehensive roadmap of how to get to the reduction targets. We see this study as identifying the box of possibilities, and sharing this information in the context of what is doable in B.C. This study has also made clear that the scope of change required to achieve the targeted reductions will be significant. Likewise, the necessary policies will also need to be unprecedented in nature and scale.

"If we do nothing to reduce emissions, they will continue to rise. If we take into account projected increases, by 2020 we will need to reduce emissions by 36 million tonnes, or 43%."

How Big Is the Gap?

2007 greenhouse gas emissions in B.C. are estimated to be 71 million tonnes of CO_2e[5] (CO_2 equivalence.) If British Columbians do nothing to reduce emissions, it is projected that by 2020, B.C. would be emitting 84 million tonnes, an increase of 18% (see Appendix III for description of the *Do Nothing* projection). The British Columbia government's reduction target of 33% of 2007 emission levels by 2020 means that B.C. will need to find 23 million tonnes of reductions in annual emissions to meet the target (33% of 71 million tonnes). However, if we do nothing to reduce emissions, they will continue to rise, so relative to Doing Nothing, we need strategies to reduce emissions by at least 36 million tonnes in 2020 (43% of 84 million tonnes).

"One million tonnes of CO_2e is the amount of greenhouse gas emissions produced in one year by about 200,000 cars." (offsetters.ca)

Mind The Gap has found that based on B.C. commitments announced to date, emissions will be reduced by five million tonnes from projected 2020 emissions (still leaving our 2020 emissions 11% *above*

[5] Emissions of the six types of greenhouse gases are presented using a common metric, CO_2 equivalence (CO_2e), which accounts for the relative contribution of each gas to global warming. 2007 estimate is based on 2005 values from Environment Canada. 2007. *National Inventory Report: Greenhouse Gas Sources and Sinks in Canada 1990–2005.*

the 2007 level). But we estimate that the rapid implementation of new strategies can reduce our emissions from projected 2020 levels by an additional 30 to 38 million tonnes in 2020. Of the 30 to 38 tonnes of reductions from new strategies, between 8 and 16 million tonnes come from further innovation.

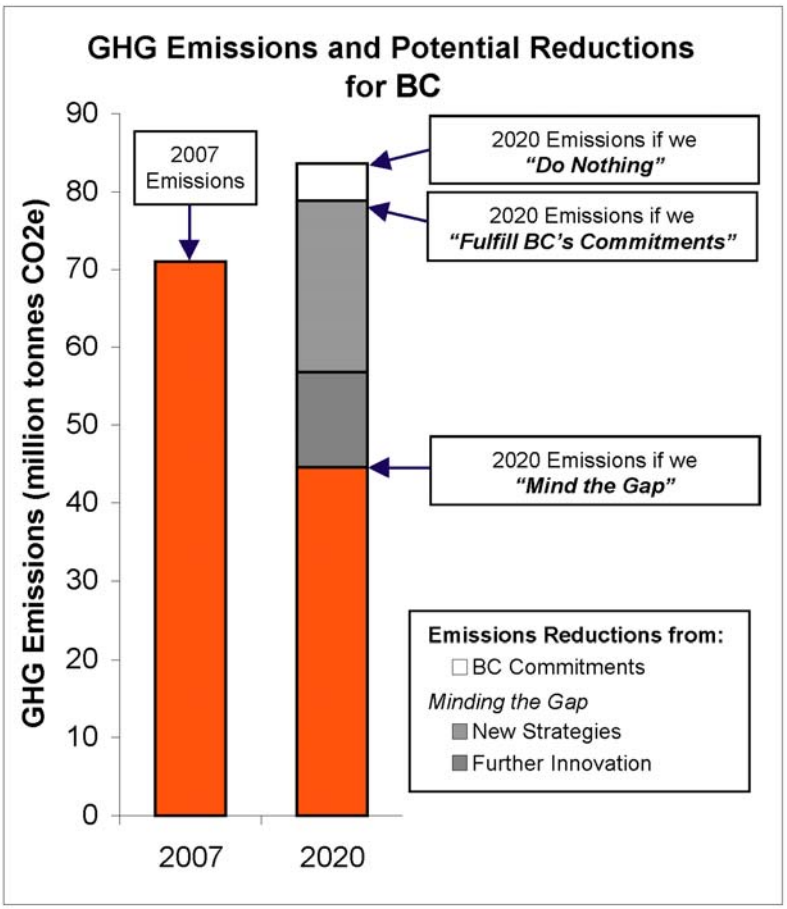


Figure 1: Greenhouse Gas Emissions and Potential Reductions for B.C.

NOTE: 'Fulfill B.C.'s Commitments' refers to implementing the B.C. government's announced strategies, based on public information available. 'Mind the Gap' refers to implementing the additional strategies identified in this report.

Interpreting the Charts

Charts like the one to the left are used to describe emissions and emissions reductions for all of B.C. and each of the six sectors.

The bar on the left always shows the 2007 emissions, while the bar on the right shows the emissions in 2020 under three scenarios:

- If we *Do Nothing* (the top of the white)
- If we *Fulfill B.C.'s Commitments* (the top of the grey)
- If we Fulfill *B.C.'s Commitments* and *Mind the Gap* by acting on all *New Strategies* and *Further Innovation* (the top of the red).

The charts can also be interpreted in terms of the emissions reductions achieved by:

- Fulfilling B.C.'s Commitments (the white block)
- Acting on the New Strategies (the light grey block)
- Pursuing Further Innovation for reductions (the dark grey block shows the mid-point of the range that we estimated)

How Big Is the Required Change? The Need For a Just Transition

This is a complex project – the change required will encompass all areas of our economy and will significantly transform our society. We will need to redesign our urban communities, our transportation systems, and the ways in which we produce and distribute the goods and services that we all rely on. This transition will have deep effects on communities, workers and families. We will need to find ways to cushion the effects on those of us who will be disproportionately impacted, and ensure that workers and communities do not bear an unfair

share of the burden of change. There is also a need to ensure that workers and communities obtain a fair share of the benefits that will result from a properly managed and just transition.

The B.C. government must actively recognize its unique role in ensuring a just transition. Workers and communities will need to be meaningfully engaged in the planning and implementation of this transition. Considerable public funds will be required to support the engagement of workers and communities, and to implement measures to help with the adjustment. The redesign of our communities will require a skilled workforce to rebuild and administer a new physical infrastructure – everything from new and retrofitted energy efficient buildings and transportation facilities to sewage and water systems. Public funds will also be necessary to support and retrain workers, displaced during the transition, to do the new jobs.

What Will It Cost?

We have not attempted a detailed evaluation of the cost of achieving these emission reductions. Our focus has been to quantify potential reductions from strategies and identify possible policies. Without knowing which policies will be implemented, costs cannot be estimated. But significant investments, by government, households, businesses, and organizations will be required.

It is clear that many of these investments will lead to savings over time – for example, using more energy efficient cars means that drivers will pay less at the gas pump. Some policies could also result in additional government revenue that could be used to invest in deeper greenhouse gas reduction strategies.

Even more importantly, not investing in strategies to reduce emissions will guarantee major costs, the mountain pine beetle epidemic being one example. These costs will escalate over time.

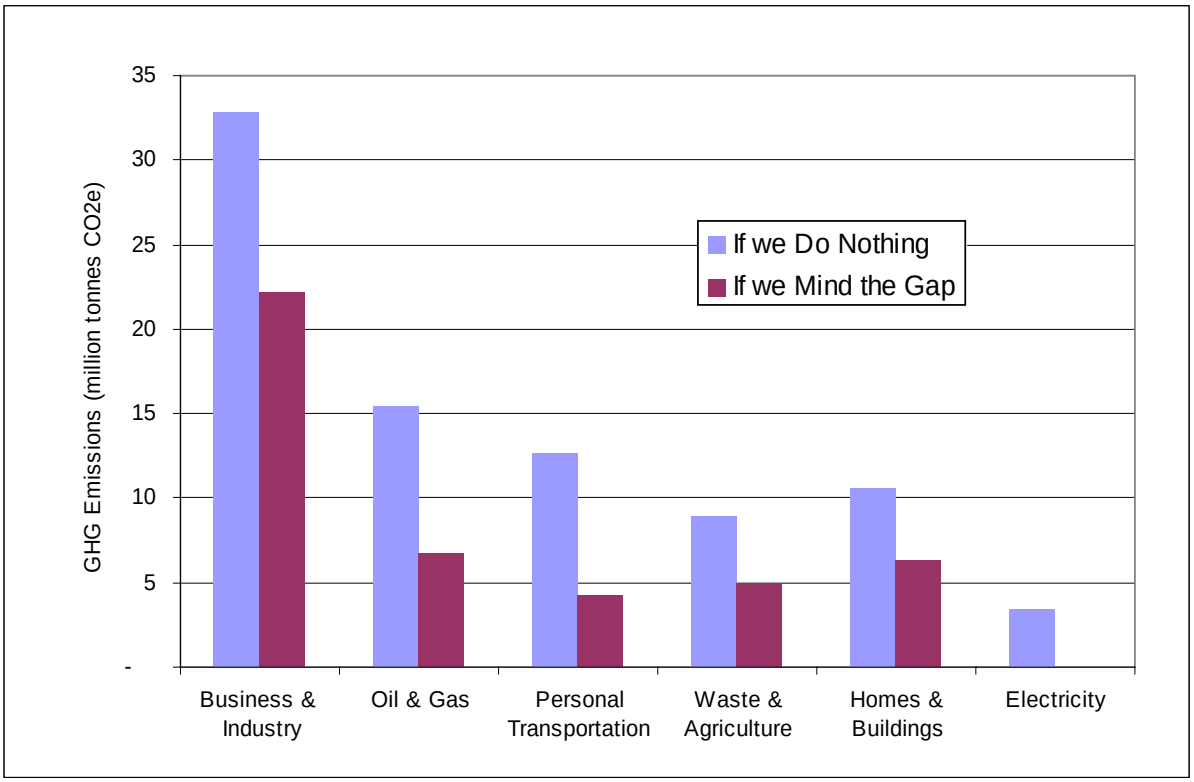
Progressive companies are now changing their operations to reduce financial risks related to greenhouse gas emissions. B.C. Hydro is a local example. If other B.C. businesses do not account for the costs of GHG emissions, their bottom line, and ultimately, jobs in the province, will be put at risk as other companies engage in a market place that recognizes these costs.

The B.C. government must make tough choices on revenue to fund the necessary investments. Policy choices will also dictate how those costs are spread through the economy. The return on this investment will occur over time, and help protect future generations.

Minding the Gap, Sector by Sector

The possible reductions, and the challenges associated with each sector, are unique; and all are important. Emissions in British Columbia come from almost every sector of society from our cars, our furnaces and our garbage to small businesses, pulp and paper mills and the mining and oil and gas industries. Reductions will need to be found from all of these sources. No sector can be left behind. To illustrate, Table 2 shows how the mix of B.C. Commitments and Minding the Gap strategies leads to lower emissions in each sector. We begin with the largest sector in terms of emissions, and end with the smallest sector. Note that there are no emissions remaining if we mind the gap for the electricity sector – the strategies that we identified in this report can eliminate all the emissions from this sector.

Table 2 - Greenhouse Gas Emissions by Sector in 2020[6]



A Carbon Neutral Government: Major Leadership, Minor Gains

One of the key announcements by the B.C. government is its commitment to becoming 'carbon neutral' by 2010. This means that the government will need to eliminate all greenhouse gas emissions associated with its operations – including energy consumed in buildings and for government travel. While this commitment shows real leadership on the part of the B.C. government, the climate gains will be small when placed in context. In 2007, government-source greenhouse gas emissions account for 200,000 tonnes, or 0.2 million tonnes, less than one per cent of provincial emissions. While the impact of these reductions may be notable in terms of scope of government operations, the combined impact will not be significant in terms of actual emission reductions – they will be less than one percent of the reductions needed to 'mind the gap.'

[6] The Business and Industry sector excludes emissions from both the oil and gas production industry and the electricity industry. Because of their size, these two industries are considered as separate sectors. The Business and Industry sector includes on-road freight transportation, as well as air, marine, rail and off-road transportation. The Electricity sector includes emissions from net imports of electricity. Electricity emissions are shown as a sector here rather than included with Business & Industry and Homes & Buildings to reflect where electricity is consumed.

3. BUSINESS AND INDUSTRY

'No Pain, No Gain'

Emissions from business and industry, the largest of the sectors examined, account for 38% of B.C.'s total in 2007. This sector includes emissions from a diverse set of actors, ranging from small businesses such as coffee roasters and freight delivery companies, to cement manufacturers and pulp and paper mills. It includes all of the emissions associated with extraction, manufacturing, production and transportation of products to markets. Because the oil and gas industry is the largest of all of the industrial emitters, accounting for about one fifth of B.C. emissions, we have considered its impacts separately, in Section 3.

Business and industry can reduce greenhouse gas emissions by using more energy efficient equipment, switching to cleaner energy sources, or changing their mix of products. To achieve the large reductions needed in B.C., many businesses will need to re-evaluate and adjust their business operations to focus on limiting emissions throughout all steps in their processes – from primary extraction of materials to the transportation of the final product.

Activity in this sector is driven primarily by the private market and it will be difficult to accomplish real emission reductions without noticeable effects on the sector. Significant reductions will require changes in the way companies do business, and are currently constrained by existing capital stock and the lifetime of industrial equipment in use right now. For example, consider a pulp mill with a boiler that uses natural gas. The company could replace that boiler with one that is more energy efficient, thereby reducing GHG emissions. However, a new boiler will cost over $2 million, a sum that may not be reimbursed by energy cost savings for several years. As a result, the company may want to delay buying the new more efficient boiler until the existing boiler no longer works, which could be 20 years or more. So policies to encourage or require companies to buy more efficient equipment may be delayed by the age of existing equipment. On the other hand, such actions may be necessary to achieve the emission reductions needed. Effective policy solutions will need to account for and work to overcome the barriers in the current market system.

What Is A Cap And Trade System And How Does It Work?

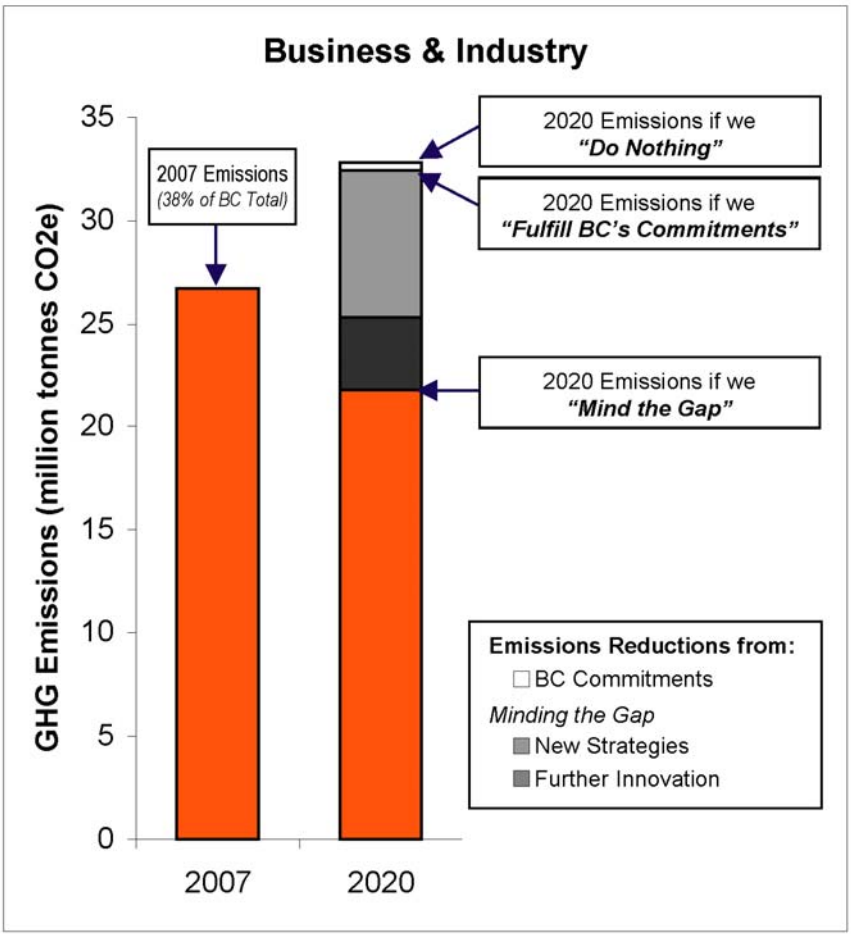
A 'cap and trade' system is one where the government would establish a limit on carbon emissions, and then require companies to obtain the *right to emit* greenhouse gases within that limit. Over time, the emissions limit would be ratcheted down to ensure a net reduction in emissions. Companies would need to prove their *right to emit* by ownership of emission permits each year. Once permits are obtained, companies would need to ensure their emissions are at or below their permitted allowance, but they could buy or sell emission permits to minimize overall compliance costs. This trading, would require that a new market be set up accurately track the permits, revenue, and emissions.

The B.C. government has made some commitments in this area, but these are few relative to the size of emissions in this sector and to announcements in other sectors. As well, they have yet to provide enough details for us to estimate the reductions. In terms of new strategies, we estimated reductions from four specific strategies for freight, business travel, off-road transportation and the manufacturing industry. Our estimate of reductions assumes that the government will implement strong regulations or emission pricing policies to achieve these strategies. Without significant policies, the reduction reported in Table 3 will not be achieved.

Table 3 lists the business and industry strategies that we reviewed. We estimate that 10 to 12 million tonnes of reductions in annual GHG emissions can be achieved through actions in this sector. Less than 0.4 million tonnes of reductions is estimated to result from B.C. Commitments based on details announced to date. Our research into New Strategies reveals that seven million tonnes would come from the specific new strategies we have identified. Finally, we expect that further innovation could lead to three to five million tonnes of reductions. Potential innovations include the use of low-GHG fuels in marine or rail, and substantial changes to the way we produce and transport goods. For example, by 2020 companies will need to rely more on the use and re-use of local materials, including local food.

Table 3 - Business and Industry: Strategies and Greenhouse Gas Reductions

Strategy	Reductions in Annual GHG Emissions Relative to *Do Nothing in 2020* ($MtCO_2e$)
B.C. Commitments	
Port and truck stop electrification	Less than 0.1
Low-GHG fuel standards for Freight Vehicles	0.4
Industrial Energy Efficiency Plan	Policy details have not been provided, potential reductions included with Manufacturing Industry below
Regional Market-based Mechanism to Reduce Emissions	
Minding the Gap	
Road Freight Technologies and Practices	1.5
Business Travel Management	0.1
Off-road transportation Efficiency Improvements	1.0
Manufacturing Industry – energy efficiency and GHG reductions	4.5
Further Innovation	2.6 - 4.6
Total Reductions	*10.1 – 12.1*
Total Emissions remaining in 2020	*20.7 – 22.7*
Comparison to provincial goal "reduce by 33% or more, relative to 2007"	*Reductions of 15% - 22%, relative to 2007*



NOTE: 'Fulfill B.C.'s Commitments' refers to implementing the B.C. government's announced strategies, based on public information available. 'Mind the Gap' refers to implementing the additional strategies identified in this report.

Recommendations

To take advantage of ingenuity, the real opportunities for Business and Industry can be found in emissions pricing policies such as a carbon tax and/or a cap-and-trade system. In targeted

areas or if emissions pricing gets delayed or weakened, the B.C. government should also consider regulations for this sector.

RECOMMENDATION 2: **The B.C. government should establish a strong emissions pricing mechanism, such as a carbon tax and/or cap and trade system to address GHG emissions across the wide range of business and industry activities in B.C.** This mechanism must be applied broadly across the economy; in particular for B.C. it will need to cover emissions from small or medium sized companies, as well as from the large ones. The price will need to be sufficiently strong to motivate major change, and include funding to help with transitions for those most vulnerable.

These emissions pricing policies provide companies with clear market signals to inspire innovation in finding and implementing the changes needed for large emission reductions. The B.C. government, along with some neighbouring state and provincial governments, has recognized this need and has begun to design such policies.[7] It is essential that these policies include as many businesses and industries as possible and with sufficiently strong market signals. For example, the emission reductions that we estimated in the table above are based on taxes that lead to doubling of natural gas prices by 2020 or emission caps that limit emissions to 65 % or less of current levels for each company. The government will also need to signal that such taxes or caps will grow more stringent beyond 2020.

The government will also need to ensure that revenue that is generated from any emissions pricing policy must be used in the best way possible. The revenue, which could be significant, should fund both additional emission reduction strategies and support a just transition for those most vulnerable to the negative impacts of the changes. This will ensure that workers can be trained to participate in new businesses, and to ensure that small businesses, as well as households, are not at risk of energy poverty.

RECOMMENDATION 3: **The B.C. government should implement regulations to achieve specific actions to reduce emissions; these will drive companies to make changes in advance of, or as a complement to, emissions pricing.**

Regulations will also be an important measure to achieve the reductions for business and industry. Regulations are particularly important to address areas where the effectiveness of emissions pricing is limited, or to ensure that industries produce products that result in lower emissions by consumers. Regulations such as the low GHG-fuel standard are already being developed. Other regulations might focus on specific technologies, such as anti-idling devices in freight trucks, and drive companies to start making changes in advance of the implementation of the emission pricing.

[7] The British Columbia government, along with Manitoba, California, Washington, Arizona, New Mexico, Utah and Oregon, is designing a cap-and-trade system, through its participation in the Western Climate Initiative. B.C. Government News Release April 24, 2007. http://www2.news.gov.bc.ca/news_releases_2005-2009/2007OTP0053-000509.htm

4. OIL AND GAS

'The Biggest Single Source – And Solution'

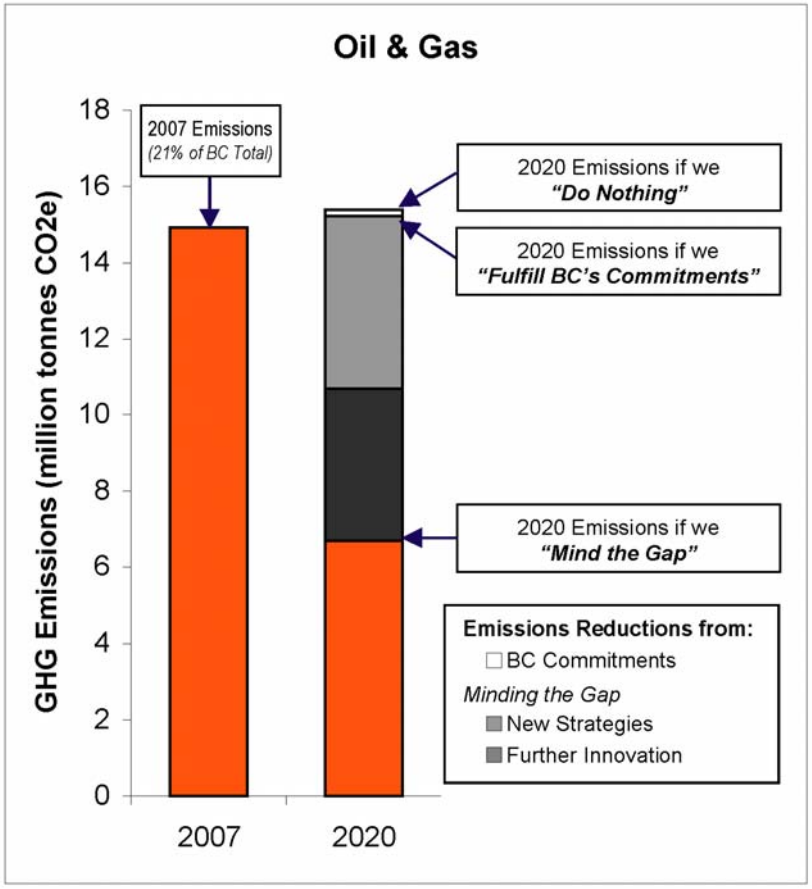
Emissions from oil and gas development are considered as a separate category because this industry is the largest single contributor in the province, accounting for 21% of emissions in 2007. This sector includes emissions from exploration and production, and the transport of natural gas and oil to our homes, buildings, workplaces and cars.

Oil and gas emissions have been identified by the B.C. government as a key issue. It has said that it will reduce emissions from oil and gas down to the 2000 level by 2016, approximately a 4.4 million tonnes of reduction in annual emissions by our calculations. And while the B.C. government has announced some strategies for this sector, we have found that there are more opportunities to achieve short term reductions than have been named by the B.C. government so far, as shown in Table 4. This industry's potential for additional reductions is increased if technologies to capture and store CO_2 emissions can be commercialized in the next ten years. These potential reductions are included under the estimate for Further Innovation in Table 4.

We estimate that eight to ten million tonnes of reduction in annual GHG emissions can be achieved through actions in this sector. Less than 0.2 million tonnes of reductions is estimated to result from B.C. Commitments announced to date, based on available information. Our research into New Strategies reveals that 4.5 million tonnes of reductions would come from the specific new strategies that we have identified. Finally, we expect that further innovation could lead to another three to five million tonnes of reductions through actions such as capture and storage of carbon dioxide and further improvements on energy efficiency.

Table 4 - Oil and Gas Production: Strategies and GHG reductions

Strategy	Reductions in Annual GHG Emissions Relative to *Do Nothing* in 2020 (MtCO2e)
B.C. Commitments	
Eliminate all routine flaring	0.1
Reduce flaring at test sites, well sites, and gas gathering	0.1
Reduce venting of fugitive gases	Government policy not available, reductions included under venting strategy below
Sequestration and Compressor Technologies and Policies	Details on announcement not yet available, potential reductions included under energy efficiency and venting strategies below.
Minding the Gap	
Reduce venting of fugitive gases	3.5
Energy Efficiency Improvements in Oil and Gas Plants	1.0
Further Innovation	3.0 – 5.0
Total Reductions	*7.7 – 9.7*
Total Emissions remaining in 2020	*5.7 - 7.7*
Comparison to provincial goal to "reduce by 33% or more, relative to 2007"	*Reductions of 49% - 62%, relative to 2007*



NOTE: 'Fulfill B.C.'s Commitments' refers to implementing the B.C. government's announced strategies, based on public information available. 'Mind the Gap' refers to implementing the additional strategies identified in this report.

This industry is of particular importance given that the B.C. government has also announced plans to expand oil and gas development outside of the northeast, to other basins in the province, found in and around Prince George, northwest B.C., the East Kootenays and Vancouver Island. It has also renewed its commitment to develop oil and gas off the B.C. coast. These initiatives present a contradiction and a challenge – it will be extremely difficult to reduce emissions while at the same time promoting new oil and gas development.

The ‘do nothing’ scenario that we have used does not include the opening up of these new basins. If new oil and gas basins are explored and developed between now and 2020, the projected emissions will be significantly higher than estimated here. This will be an important issue in British Columbia. If we are serious about reducing our GHG emissions, we must reconsider any plans to bring the oil and gas industry to new parts of the province.

Recommendations

The natural gas industry is highly competitive and the most effective policies for reducing GHG emissions will take advantage of market conditions. Our recommendations are focused on emissions pricing policies, with regulations to support.

RECOMMENDATION 4: The B.C. government needs to establish a strong emissions pricing mechanism, such as a carbon tax and/or cap and trade system to address GHG emissions from oil and gas operations.

The B.C. government must ensure that any emissions pricing policies, such as carbon tax or cap-and-trade, includes oil and gas operations. In particular, the design of any such policy must include GHG emissions from fugitive sources. Also, to the extent possible, the policy must seek to encompass all components of oil and gas operations, even emissions from smaller facilities and leaks throughout the operations.

RECOMMENDATION 5: The B.C. government should implement and enforce regulations to achieve actions to reduce emissions from oil and gas operations in advance of, or as a complement to, emissions pricing.

The government and natural gas industry need to acknowledge the likely delays in implementation of pricing policies and the challenge of overcoming market failures in this particular industry. Regulations may be necessary for limiting leaks from processing and transportation and other activities that are less responsive to pricing policies. The B.C. government will also need to invest in staff and other resources to ensure that strict and transparent enforcement of these policies occurs.

5. PERSONAL TRANSPORTATION

'On The Road To Breaking Even'

Personal transportation includes all personal road and air travel in B.C., accounting for 14% of emissions in 2007.[8] Almost all of these emissions come from personal vehicles; and, even though particular classes of vehicles are becoming more efficient, emissions continue to rise, due in part to British Columbia's increasing population, which means more cars and more driving. The increasing demand for larger and more powerful vehicles also contributes to the rise in emissions.

The B.C. government has already committed to adopt California's clean car vehicle efficiency legislation and low carbon fuel standard. These are positive steps which will slow the increase in emissions, but these measures are incapable of reversing the trend and will represent a false start if B.C. does not enact policies to ensure deep cuts in emissions. Even with full implementation of the vehicle efficiency standard and the low carbon fuel standard, emissions from personal transportation will rise by one million tonnes from 2007 levels (a 10% increase) by 2020. Highway expansion plans, such as those proposed in the B.C. government's Gateway Program, will cause emissions to rise even faster.

Searching for new opportunities beyond the B.C. Commitments leads to two key strategies. First, B.C. could push for even more efficient vehicles. While the California vehicle standard is an accomplishment in North America today, it is important to keep in mind that both the European Union and Japan have adopted or proposed more stringent vehicle emission standards. Second, B.C. should pursue strategies to reduce the demand for driving. These include building communities where the goods and services we need are closer to our homes and offices, and providing higher quality alternatives to the private vehicle, notably, improvements in public transit and other alternative transportation infrastructure. The need for deep emission reductions means that 'out of the box' approaches should be considered, such as making all public transit fare free.

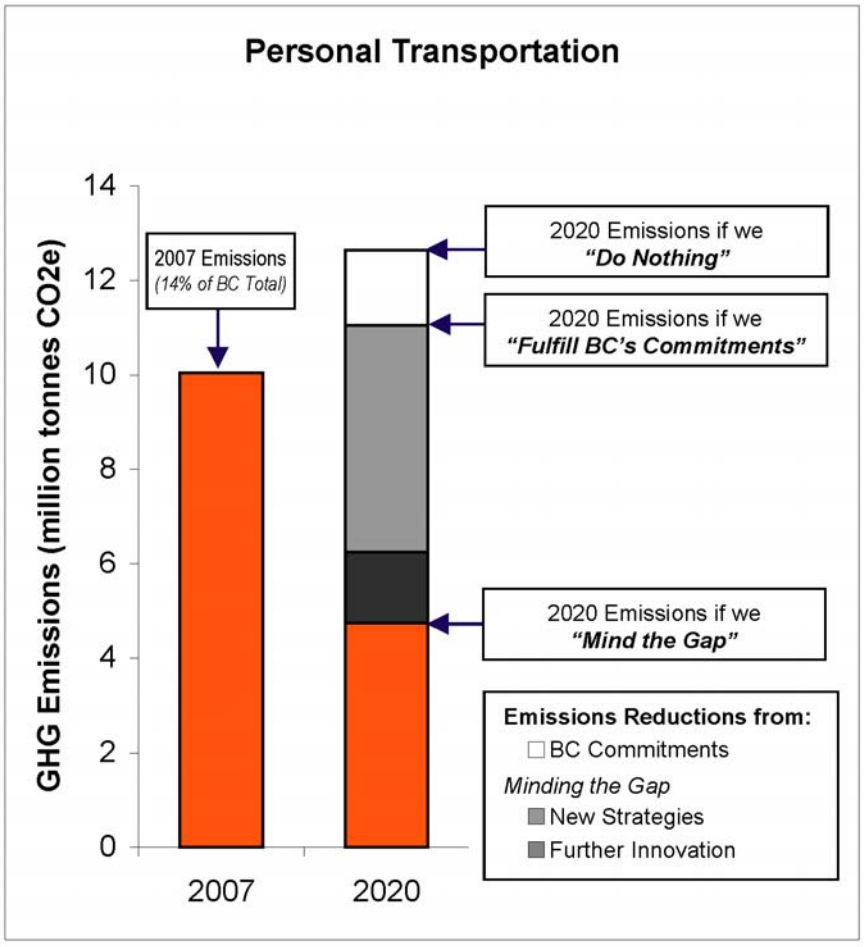
The issue of emissions from personal transportation has sparked a lot of interest and funding for research in new technologies, and in new low carbon fuels. Plug-in hybrid vehicles and hydrogen could hold great promise if they can be combined with extensive development of renewable energy. These further innovations are not without challenge but could contribute to B.C.'s reductions by 2020. In combination, the implementation of these strategies in parallel to the existing commitments could reduce emissions from personal transportation by between 43% and 63% from 2007 levels.

[8] Emissions from on-road freight transportation, marine, rail and aviation are all included under the Business and Industry sector above.

We estimate that seven to nine million tonnes of reductions in annual GHG emissions can be achieved through actions in this sector. 1.6 million tonnes of reductions would come from B.C. commitments announced to date. Our research into New Strategies reveals that five million tonnes of reductions would come from the new strategies that we have identified. Finally, we propose that further innovation could lead to another 0.5 to 2.5 million tonnes of reductions.

Table 5 - Personal Transportation: Strategies and GHG Reductions

Strategy	Reductions in Annual GHG Emissions Relative to *Do Nothing* in 2020 (million tonnes CO_2e)
B.C. Commitments	
Low-GHG fuel standards for light duty vehicles	0.3
California standards for light duty vehicles	1.3
Minding the Gap	
Going beyond CA standards	2.6
Sustainable Communities	2.2
Further Innovation	0.5 – 2.5
Total Reductions	6.9 – 8.9
Total Emissions remaining in 2020	*3.7 - 5.7*
Comparison to provincial goal to "reduce by 33% or more, relative to 2007"	*Reductions of 43% - 63%, relative to 2007*



NOTE: 'Fulfill B.C.'s Commitments' refers to implementing the B.C. government's announced strategies, based on public information available. 'Mind the Gap' refers to implementing the additional strategies identified in this report.

Recommendations

For most people, personal transportation decisions – what type of car to buy, whether to drive or take the bus, where to live – are not simply based on the cost. Many other factors influence these decisions – including availability of options and prestige. Our personal transportation recommendations are focused on regulations that ensure the availability of efficient vehicles, low GHG-fuels, and alternatives to driving. Price rebates and charges will play a role, as discussed below, but we emphasize regulations for this sector.

RECOMMENDATION 6: The B.C. government needs to enact energy performance standards for light duty vehicles that will take B.C. beyond the California vehicle standards.

California is often cited as a leader in North America on clean vehicles, so it will take even stronger leadership from B.C.'s government to push beyond the standards already established – but this is clearly needed to help achieve the 2020 provincial reduction target. As mentioned above, the European Union and Japan have already established stronger standards, setting a precedent for action in B.C.

RECOMMENDATION 7: The B.C. government, working with federal and industry partners, should establish a strong system of rebates and extra charges on all personal vehicles, based on their energy efficiency.

Regulations are focused on getting car manufacturers to provide car-buyers with more options for energy efficient vehicles but additional policies can help encourage consumer demand for those vehicles. The policies that are most effective and affordable to the public purse will provide both incentives for the least polluting cars – such as rebates for hybrid and other high efficiency cars and disincentives for the worst performers – additional charges on inefficient cars. Since car buyers tend to look at many different aspects when purchasing – including perceived prestige, fun, and safety – the rebates and extra charges will need to be significant to affect consumer choice.

RECOMMENDATION 8: The B.C. and local governments need to aggressively encourage sustainable community growth by requiring that new developments minimize greenhouse gas impacts, and developing alternatives to car travel.

The climate benefits of new energy efficient cars will be lost if people end up driving these cars more. And there is still the issue of addressing GHG emissions from the cars that are already on the road. To achieve reductions in the use of all personal vehicles, we recommend a two-pronged approach – developing alternatives to car travel and providing financial benefits to drive less that are complemented with higher costs for driving more.

Developing alternatives to car travel is daunting but we have many examples to learn from both in B.C. and beyond. To do this will require increased resources for co-ordinated community planning and transit patterns, as well as investments in alternative choices – more public transit, more safe and enjoyable bicycle and pedestrian trails, and more opportunities for car-pooling.

One first step toward sustainable communities would be for the B.C. government to require that new proposals for land-use development assess future GHG emissions, and where the lowest GHG option is not pursued, provide reasons for the other choice.

RECOMMENDATION 9: A system of charges based on gasoline consumption and/or distance traveled should be developed.

Another means to reduce car use is, unfortunately, through people's wallets. This can also be thought of as including currently-ignored environmental costs in market prices. A system of pay-as-you-drive car insurance could be instituted with the Insurance Corporation of B.C. (ICBC), or a carbon tax on gasoline could be introduced. These tax and insurance options could be implemented as a combined system. The initial goals of such a system would be to educate drivers on the connection between filling up at the pump and global warming, as well as providing revenue to fund alternatives to car travel, as described above.

Although a carbon tax on gasoline or changes in insurance rates could motivate drivers to drive less, recent research indicates that a very high carbon tax (relative to that we recommend for Business and Industry) would be required to motivate any change. Thus we focus on initiating a small but highly-visible charge for education and revenue generation, along with careful evaluation of the behavioural changes that result from such a charge.

6. HOMES AND BUILDINGS

'Just Scratching the Surface'

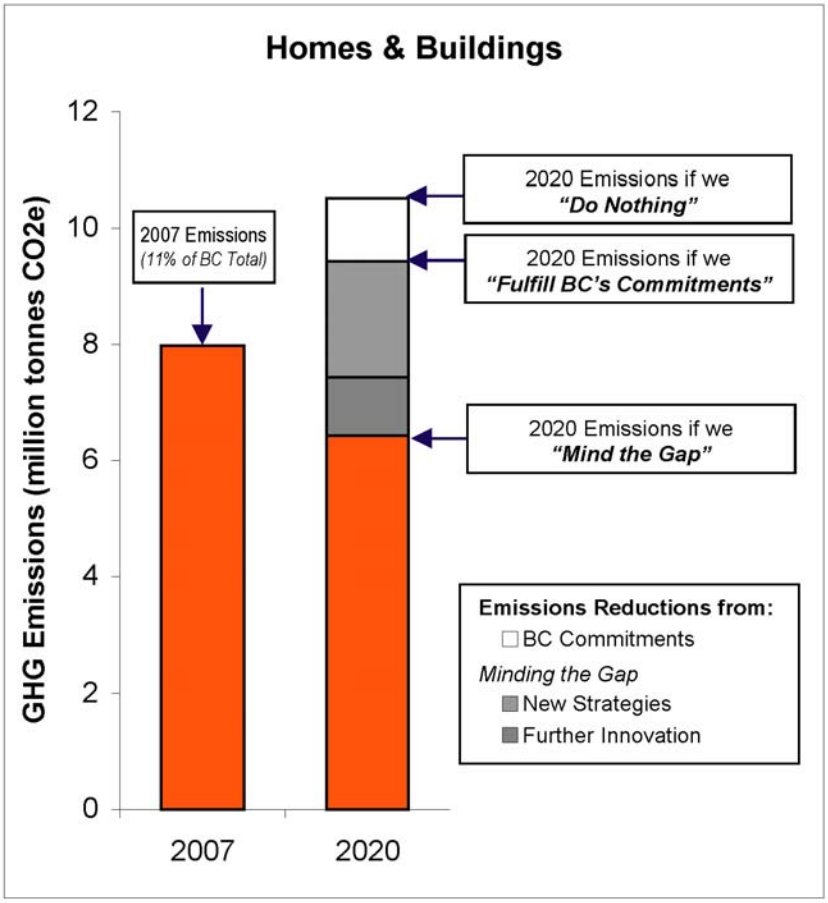
This sector accounts for 11% of B.C. emissions in 2007. It includes emissions from natural gas and oil used in homes, apartments, commercial and retail buildings. While the B.C. government has made a number of commitments to be achieved by 2010, particularly regarding the B.C. Building Code, there is still much more that can be done to make buildings a major source of emission reductions. Examples of successful strategies elsewhere include California, which has a target for all new homes to be zero net energy by 2020, or even more impressively, the United Kingdom, which plans to have carbon neutral buildings by 2016. B.C. has also committed to decreasing the energy consumed by existing homes and buildings through programs that provide information and rebates for retrofits that improve insulation, windows, furnaces and other components.

The commitments announced to date, however, only scratch the surface of GHG reduction opportunities available in this sector. There is much greater opportunity to lower the 'emissions footprint' of our homes and buildings, both individually and through neighborhood design. In particular, we need to make renewable energy a part of our everyday world in our homes and workplaces. New designs and innovation can lead to even more emission reductions through changes in the size of homes and buildings in the future, before they are built.

Homes and Buildings strategies primarily involve improvements in energy efficiency and renewable energy at a significantly accelerated rate. As such, the mix of policies needed to achieve those strategies must provide strong signals for developers, real-estate agents, owners, and tenants.

We estimate that four to five million tonnes of reductions in annual GHG emissions can be achieved through actions in this sector – one million tonnes of reductions would come from B.C. commitments announced to date, and two million tonnes of reductions would come from the new strategies that we have identified. We expect that further innovation could lead to another 0.5 to 1.5 million tonnes of reductions.

6.1 Table 6 - Homes and Buildings: Strategies and GHG reductions

Strategy	**Reductions in Annual GHG Emissions Relative to *Do Nothing* in 2020 (million tonnes CO_2e)**	
B.C. Commitments		
B.C. Green Building Code	0.9	
Incentives for retrofits of existing homes and buildings	0.2	
Minding the Gap		
Enhanced efficiency in new homes and buildings	0.4	
Enhanced retrofits of existing homes and buildings	1.2	
Solar hot water systems in homes and buildings	0.2	
Sustainable communities[9]	0.2	
Further Innovation	0.5-1.5	
Total Reductions	***3.6 - 4.6***	
Total Emissions remaining in 2020	***5.9 - 6.9***	
Comparison to provincial goal to "reduce by 33% or more, relative to 2007"	***Reductions of 13% - 26%, relative to 2007***	

NOTE: 'Fulfill B.C.'s Commitments' refers to implementing the B.C. government's announced strategies, based on public information available. 'Mind the Gap' refers to implementing the additional strategies identified in this report.

[9] The Sustainable Communities strategies lead to reductions in greenhouse gas emissions by having more compact housing and a shift to multi-unit housing. The emissions reductions are shown in this section, but recommendations are discussed with Personal Transportation.

Recommendations

The strategies discussed in the Homes and Buildings involve improvements in energy efficiency and renewable energy at a significantly accelerated rate. As such, we recommend a mix of strategies – regulation, price rebates and charges, and information. In all cases, these actions must provide strong signals for developers, real-estate agents, owners, and tenants.

RECOMMENDATION 10: The B.C. government should work with the building industry, plus natural gas and electricity companies utilities and Municipalities to implement and enforce leading-edge energy efficiency and renewable energy performance standards for all new and existing homes and buildings.

The promised B.C. Green Building Code, which will include energy efficiency standards for all new buildings by 2010, is a start; but this alone is not enough. Standards must be improved in two ways – by increasing the standards for new homes and buildings so even greater reductions are achieved, and by implementing standards for existing homes and buildings.

The B.C. government has stated that, "The new green building code will implement the highest energy efficiency standards in Canada." So far the details of the code have not been released, but we note that being the best in Canada still leaves much room for improvement. There are examples in Europe and the United States of building standards with more stringent requirements for energy efficiency, than are currently found in Canada. The B.C. government and the B.C. building industry need to show international leadership in developing and implementing building standards that focus on limiting GHG emissions.

In addition to increasing the stringency for new homes and buildings, creative policies that extend performance standards to existing homes and buildings need to be developed. For example, energy-efficiency renovations could be required whenever buildings are bought or sold to ensure those buildings meet an acceptable minimum standard. Older buildings cannot be allowed to avoid contributing to our GHG reduction targets. In addition to increased energy efficiency, new standards will need to set minimum requirements for on-site renewable energy, which should be ramped up over time. Integrating solar, biomass, waste heat, ground-source heatpumps, small hydro and small wind into our lives are key steps to develop net zero energy homes.

RECOMMENDATION 11: The B.C. government should investigate and implement a system of targeted price rebates and charges aimed at building construction and renovation.

Often the people designing and building B.C.'s homes and buildings do not install energy efficient or renewable energy options because of the higher costs of those choices, even if the costs will be entirely recouped by energy bill savings for the future tenants or owners. This recommendation targets the upfront costs to encourage the construction industry to implement these options. For example, developers could be charged a penalty for less efficient buildings (i.e. only slightly better than code), and be given a rebate or other incentive for very efficient buildings.[10] Once implemented these types of policies will

[10] U.S. cities such as Portland OR, Seattle WA, and Arlington VA all have similar policies.

provide the market signals that help spur highly efficient and net-zero buildings. They also make it easier to continue advancing the building code requirements.

RECOMMENDATION 12: A modest carbon tax should be applied to home and building energy bills, levied in proportion to the emissions generated from heating, cooling and all other services in the building.

A highly visible but modest carbon tax (compared with our Business and Industry recommendations) on GHG emissions will complement the previous recommendation by providing an ongoing price signal to building occupants and owners. The revenue from such a tax could be used to educate home and building owners on small steps that could be taken to further reduce emissions, fund programs that directly work with owners to audit and upgrade existing buildings.

These two goals – education and revenue generation – could be achieved with relatively low charges (similar to public benefits charges that are added to electricity bills in many U.S. states). As with personal transportation, research to date has shown that a very high tax would need to be charged to provide sufficient rationale for significant improvements in energy efficiency or increased use of renewable energy.

Mandatory Energy Performance Labeling for Homes and Buildings

Although not one of our core recommendations for homes and buildings, it will be important for the B.C. government to require performance labels on all new and existing homes and buildings. Understanding the energy efficiency and GHG emissions from existing homes and buildings is a key step in identifying further reductions. It will also help ensure that the benefits of improvements are known over time and provide consumers with a tool to evaluate and demand better buildings. Natural Resources Canada has developed a rating system for residential buildings and is researching a similar system for commercial buildings, and B.C. has already committed to a pilot program for new building labeling.

7. WASTE AND AGRICULTURE

'Good News – Simple Measures Can Yield Big Results'

Greenhouse gas emissions from waste and agricultural operations account for 11% of emissions in 2007 – about two-thirds of these emissions are methane release from landfills, and remainder come from animals and agricultural soils. This is a good news sector, as it contains a number of opportunities for reductions that can be achieved without high cost.

The B.C. government has indicated that landfill regulations to require additional methane capture will be forthcoming.[11] This commitment could be significant and achievable; but we have not calculated its impact on emissions because the regulation details have not yet been provided. We have estimated potential reductions from methane capture at landfills, but we can not currently estimate the extent that the future regulation will capture this potential. We have also estimated the reductions that would result from decreasing the amount of methane-generating waste that is sent to landfills.

We do not have specific reduction estimates for strategies to reduce emissions from agriculture, although work is underway on such strategies elsewhere. For example, research being conducted in Washington state indicates large potential for reductions, often with associated financial benefits to farms by converting waste products to energy. These waste-to-energy opportunities could provide energy for farms or, where possible, it could be sold into the B.C. grid for profit.

Reducing greenhouse gases from waste and agriculture will require the design and, most importantly, enforcement of strict regulations. Regulations can reduce the amount of waste that we send to landfills and ensure that methane gas capture technologies are installed and operated correctly.

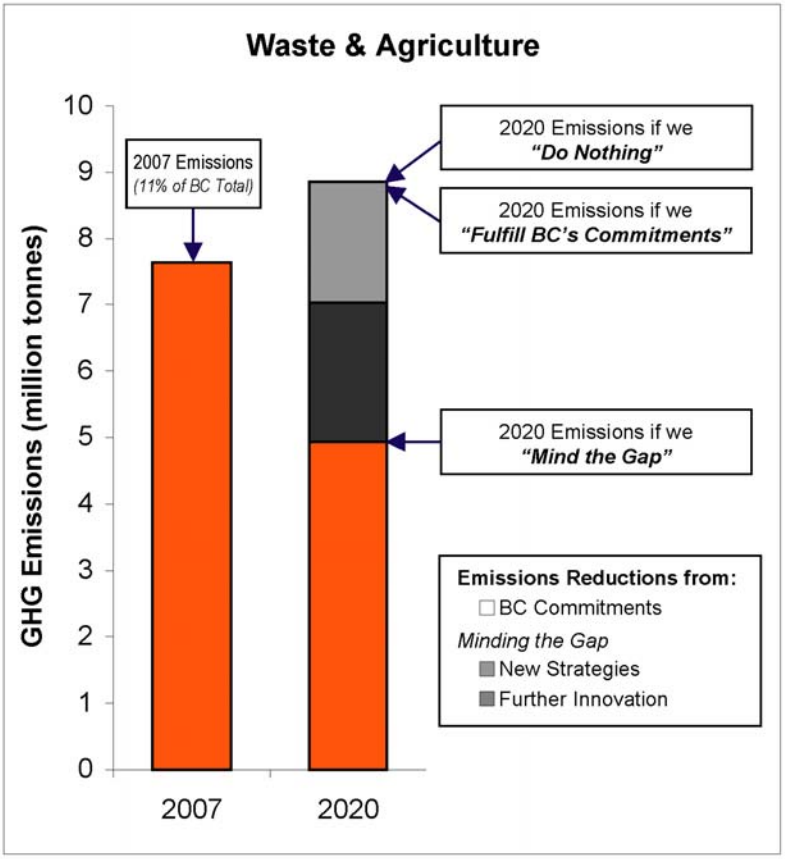
We estimate that three to four million tonnes of reductions in annual GHG emissions can be achieved through actions in this sector - two million tonnes of reductions would come from the new strategies for waste operations. Further innovation, such as biocovers for small landfills and processes that convert agricultural emissions to produce energy (waste-to-energy), could lead to additional reductions of roughly two to three million tonnes .

Table 7 - Waste and Agriculture: Strategies and GHG reductions

Strategy	Reductions in Annual GHG Emissions Relative to *Doing*	

[11] Existing regulations require that large landfills capture methane; these could be extended to medium and small landfills.

	Nothing in 2020 (million tonnes CO_2e)
B.C. Commitments	
New requirements for methane capture at landfills	Policy details have not been provided, reductions included under methane capture strategy below
Minding the Gap	
Methane capture at landfills	0.8
Reductions of Waste sent to landfills	1.0
Further Innovation	1.6 – 2.6
Total Reductions	*3.4 – 4.4*
Total Emissions remaining in 2020	*4.4 – 5.4*
Comparison to provincial goal to "reduce by 33% or more, relative to 2007"	*Reductions of 29%- 42%, relative to 2007*



NOTE: 'Fulfill B.C.'s Commitments' refers to implementing the B.C. government's announced strategies, based on public information available. 'Mind the Gap' refers to implementing the additional strategies identified in this report.

Recommendations

We recommend regulation as the most effective means to deal with landfill waste emissions - there are relatively few landfills to regulate and the B.C. government has experience with regulations. We have less certainty about the types of solutions for the agricultural sector, so our recommendations for policies are less specific.

RECOMMENDATION 13: B.C. and local governments need to advance zero waste goals by expanding regulations that ban certain materials in landfills, require composting and recycling to be offered, and require Extended Producer Responsibility[12] programs.

MetroVancouver has taken steps in advancing zero waste goals – reducing the amount of waste generated and sent to landfills – often by combining technology and regulation. Such efforts need to be strengthened and expanded to other areas of the province. B.C. can learn

[12] Extended Producer Responsibility (EFR) policy extends the traditional responsibility of manufacturers of products (i.e. worker and environmental protection during production) to include responsibility of the product and packaging after it has been used. Examples include reducing the amount packaging that is used and manufacturers that will take-back and recycle items after use by consumers.

from advances in other parts of Canada and the world to further limit waste sent to landfills – many communities provide curb-side collection of compostable materials and Sweden, for example, bans organic material in its solid waste.

In addition, the government should set targets to reduce wood waste in landfills, and enforce the use of landfill gas recovery and flaring systems in existing medium and large wood waste landfills, as per its Wood Residue Management Strategy.

RECOMMENDATION 14: B.C. and local governments must also commit to significantly increase tipping fees to encourage materials recovery.

In addition to regulations that ban materials, rebates and charges can be used to further limit waste. Increasing tipping fees can help encourage alternatives that focus on recovering and using materials that otherwise would compost in the landfill.

RECOMMENDATION 15: The B.C. government should work with the agriculture sector to develop a system of incentives and future regulations to capture emissions from agricultural activities.

Agricultural activities were not examined extensively in ***Mind the Gap***, though we should note that the potential emission reductions from this sector could be significant. Some ideas, such as waste-to-energy technologies, can provide additional business opportunities by selling any excess energy produced. As with other sectors, once the opportunities are understood, the B.C. government will need to move quickly to develop effective incentives and regulations to encourage action. One way to do so would be to make agricultural projects eligible for 'offset' credits under a cap and trade or carbon tax system.

8. ELECTRICITY

'Looks Good But Size Matters'

Greenhouse gas emissions from electricity account for five per cent of provincial emissions, but all of those emissions could be eliminated. This sector includes all electricity production and use in the province, including hydro electric power generation, natural gas power generation and the emissions from power that we import from other places such as Alberta and Washington State.

The B.C. government has announced a number of strategies to reduce emissions from electricity production – more so than for other sectors. While this potential to reduce all emissions associated with electricity production and net imports in B.C. is good, overall, these reductions won't be particularly large, given the relatively small GHG contribution that electricity makes in B.C. As shown in Table 8, the government has committed to specific targets to electricity conservation and renewable generation. It has also announced that all new and existing electricity produced in B.C. will be required to have net zero greenhouse gas emissions by 2016, and we additionally suggest similar standards for any electricity imports.

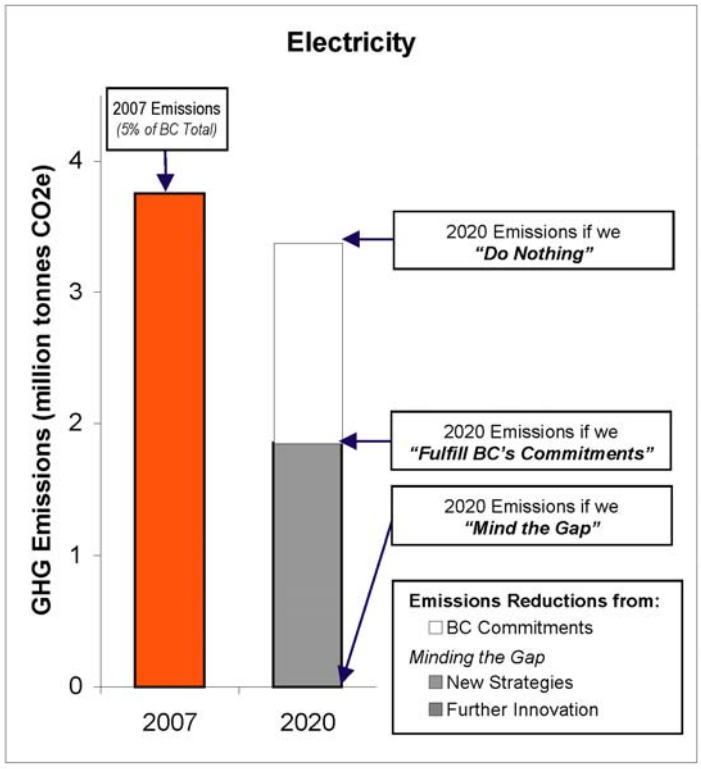
Although the government announcements and the estimated GHG reductions indicate that the electricity sector is well in hand, we note that strong policies are still required to implement the announced strategies and pursue the new strategy. Most of our recommendations focus on additional design details to ensure effective implementation of the existing B.C. commitments.

Electricity imports represent an additional imperative that must also be considered given that we are increasing the amounts of electricity imported from other places. We have therefore included recommendations to specifically address the GHG impacts of our electricity imports as well as our own production.

We estimate that 3.4 million tonnes of reductions in annual GHG emissions can be achieved through actions in this sector – 1.5 million tonnes of reductions would come from B.C. commitments announced to date, and 1.9 million tonnes of reductions would come from the new strategies that we have identified.

Table 8 - Electricity: Strategies and GHG reductions

Strategy	Reductions in Annual GHG Emissions Relative to *Doing Nothing* in 2020 ($MtCO_2e$)
B.C. Commitments	
Meet 50% of new electricity needs with conservation	0.3
At least 90% of Electricity Generation will be clean or renewable	0.3
Net Zero GHG from Electricity Generation	0.9
Minding the Gap	
Reduce GHG emissions from electricity imports	1.9
Total Reductions	*3.4*
Total Emissions remaining in 2020	*0*
Comparison to provincial goal to "reduce by 33% or more, relative to 2007"	*Reductions of 100%, relative to 2007*



NOTE: 'Fulfill B.C.'s Commitments' refers to implementing the B.C. government's announced strategies, based on public information available. 'Mind the Gap' refers to implementing the additional strategies identified in this report.

Recommendations

Although the government announcements have provided direction for the electricity sector, we recommend specific steps to ensure that each of the initiatives are effective. Most of our recommendations focus on regulation – we feel this approach allows the B.C. government to take advantage of its existing relationships with companies in this sector.

RECOMMENDATION 16: The B.C. government, working with B.C. Hydro, Fortis B.C., and the B.C. Utilities Commission, need to establish interim targets (every 2 to 3 years) for electricity conservation. Responsibility for meeting these targets must be clearly defined, and penalties for non-compliance must be enforced.

The interim targets will focus on meeting the B.C. government's commitment to meet 50% of new electricity needs with conservation.

RECOMMENDATION 17: B.C. Hydro and the B.C. Utilities Commissions need to revise the design of the B.C. Hydro Standing Offer Program to expand clean generation opportunities. Revisions include: i) remove the size limits (currently limited to systems that are between 0.05 MW and 10 MW), ii) increase the prices that will be paid for low-impact renewable generation, and iii) include transparent information on the pricing structure and the length of contracts under this program.

The goal of the B.C. Hydro Standing Offer Program is to expand the use of renewable generation in B.C. and to meet the B.C. government's commitment that at least 90 percent of generation in the province be clean or renewable. Proposed revisions would ensure that the standing offer will be effective in encouraging investment in new low-impact renewable generation.

RECOMMENDATION 18: The B.C. government needs to define a policy on carbon offsets, particularly addressing additionality, rigorous quantification through third-party verification, double-counting concerns, and transparency.

The B.C. government has committed that by 2016, all electricity generation in the province will have net zero GHG emissions. Since it is likely that some natural gas-fired power plants will still be operating then, these plants will need support in becoming net zero GHG emitters. The most common approach used in other jurisdictions, such as Oregon, is to allow power plants that use natural gas or coal to purchase offsets to counter their own emissions.

A strict policy on offsets is required to ensure that the offset purchases reflect real emission reductions. This policy will also potentially have implications for any cap-and-trade system and government commitment to be carbon neutral, which will likely require offsets. See box, *Carbon Offsets: Short Term Steps Toward Longer Term Solutions.*

Carbon Offsets: Short Term Steps Toward Longer Term Solutions

In some cases, it is unlikely that a GHG emitter can find all of the desired reductions from changes in their own emissions. A good example of this is the B.C. government which has committed to become 'carbon neutral' by 2010, or Vancity, who have also committed to being carbon neutral. These organizations will first need to reduce emissions as much as possible from their own operations. Then the remaining emissions will need to be 'offset'. A GHG offset allows a government, individual, business, or organization to cancel out, or 'offset', a portion of their emissions. By paying for the offset, the purchaser provides investment for a project that will reduce emissions elsewhere. For example, an individual, company, or government can offset the emissions from its travel by investing in energy efficiency projects that will reduce GHG emissions somewhere else. Where offsets are acquired, the purchaser will need to meet high standards to ensure that the money invested leads to *real, additional* emission reductions that can be verified by a third party. *Additionality* requires that only emission reductions that depend on the ability to sell offsets are recognized as offsets

RECOMMENDATION 19: The B.C. government needs to engage the public to develop clear guidelines for the technical and legal requirements regarding the potential future use of technologies to capture and dispose of GHG emissions.

Another option for power plants that use natural gas or coal is to reduce GHG emissions by capturing the emissions and disposing of them underground. These technologies are still under development and many questions remain. The key questions include: will the technology capture the emissions as expected, will there be unplanned consequences –

environmental or other, and will emissions that are stored underground remain there permanently or will they leak? Faced with these uncertainties the B.C. government will need to propose standards for responsibilities then engage with the public in implementing a satisfactory approach.

RECOMMENDATION 20: The B.C. government must move quickly to determine the most effective policy for moving toward elimination of the GHG emissions associated with electricity imports. To aid this, the B.C. government needs to work with all companies that import electricity to develop a tracking system for these emissions.

The B.C. government has committed to being self-sufficient in electricity by 2016. However this does not mean that we will stop importing electricity from Alberta or the United States. It means that we will export more electricity than we import. The hydro dams in B.C. provide us with valuable electricity but due to changing water flows, the amount of electricity provided throughout the year varies. During low water periods or for other economic reasons, B.C. will continue to import electricity but will try to balance this with greater exports at other times. This recommendation ensures that our imported electricity will not add to global GHG emissions.

9. CONCLUSION

'No Sector Can Be Left Behind!'

It is possible to both meet, and exceed, the B.C. government's GHG emission reduction target – or find the required 36 million tonnes in annual emissions of greenhouse gases. In order to meet this challenge, the change required will encompass all areas of our economy and will significantly transform our society – no sector can be left behind.

The need for innovation underlies all of this work. Not only will we need to innovate in the technologies we use to achieve GHG emission reductions, we will also need to innovate in the way we live our lives, travel to our workplaces and purchase goods and services. Above all, we need innovations in the ambition and scale of government policies that must drive these changes.

While the B.C. government's commitment to take action on climate change has been a major step forward in 2007, the true accomplishment remains to be seen – when the actual reductions are being measured, year by year, between now and 2020 and beyond.

To date, the B.C. government announcements add up to five million tonnes of the 36 million tonnes of reductions that need to be found. This is a good start. We look forward to giving more credit as real reductions can be measured and counted over time. Bold government leadership will be essential to help us 'mind the gap' through policies to ensure we achieve the additional millions of tonnes of reductions that we have identified. This will be no small feat.

In this report, we have estimated a possible 22 million tonnes of reductions in new strategies, and the additional possibility of eight to 16 million tonnes available through further innovations. Reductions of this magnitude will be necessary to achieve our goal. We believe that our recommendations for additional government policies are an important first step not only to help us 'mind the gap,' but close the gap between the unsustainable world we humans have created and the increasingly taxed limits of our natural world.

10. APPENDICES

APPENDIX I. Recommendations

The research that we completed for ***Mind the Gap*** strongly demonstrates that major changes are needed – and we know that strong policies must be deployed for major changes to occur. Our first over-riding recommendation is

RECOMMENDATION 1: The B.C. government must enact policies to undertake all its stated commitments to climate action for our province.

But we still need to go further. We have included recommendations throughout the report, summarized below.

Business and Industry

RECOMMENDATION 2: The B.C. government should establish a strong emissions pricing mechanism, such as a carbon tax and/or cap and trade system to address

RECOMMENDATION 3: The B.C. government should implement regulations to achieve specific actions to reduce emissions; these will drive companies to make changes in advance of, or as a complement to, emissions pricing.

Oil and Gas Production

RECOMMENDATION 4: The B.C. government needs to establish a strong emissions pricing mechanism, such as a carbon tax and/or cap and trade system to address GHG emissions from oil and gas operations.

RECOMMENDATION 5: The B.C. government should implement and enforce regulations to achieve actions to reduce emissions from oil and gas operations in advance of, or as a complement to, emissions pricing.

Personal Transportation

RECOMMENDATION 6: The B.C. government needs to enact energy performance standards for light duty vehicles that will take B.C. beyond the California vehicle standards.

RECOMMENDATION 7: The B.C. government, working with federal and industry partners, should establish a strong system of rebates and extra charges on all personal vehicles, based on their energy efficiency.

RECOMMENDATION 8: The B.C. and local governments need to aggressively encourage sustainable community growth by requiring that new developments minimize greenhouse gas impacts, and developing alternatives to car travel.

RECOMMENDATION 9: A system of charges based on gasoline consumption and/or distance traveled should be developed.

Homes and Buildings

RECOMMENDATION 10: The B.C. government should work with the building industry, plus natural gas and electricity companies, utilities and Municipalities to implement and enforce leading-edge energy efficiency and renewable energy performance standards for all new and existing homes and buildings.

RECOMMENDATION 11: The B.C. government should investigate and implement a system of targeted price rebates and charges aimed at building construction and renovation.

RECOMMENDATION 12: A modest carbon tax should be applied to home and building energy bills, levied in proportion to the emissions generated from heating, cooling and all other services in the building.

Waste and Agriculture

RECOMMENDATION 13: B.C. and local governments need to advance zero waste goals by expanding regulations that ban certain materials in landfills, require composting and recycling to be offered, and require Extended Producer Responsibility programs.

RECOMMENDATION 14: B.C. and local governments must also commit to significantly increase tipping fees to encourage materials recovery.

RECOMMENDATION 15: The B.C. government should work with the agriculture sector to develop a system of incentives and future regulations to capture emissions from agricultural activities.

Electricity

RECOMMENDATION 16: The B.C. government, working with B.C. Hydro, Fortis B.C., and the B.C. Utilities Commission, need to establish interim targets (every 2 to 3 years) for electricity conservation.

RECOMMENDATION 17: B.C. Hydro and the B.C. Utilities Commissions need to revise the design of the B.C. Hydro Standing Offer Program to expand clean generation opportunities.

RECOMMENDATION 18: The B.C. government needs to define a policy on carbon offsets, particularly addressing additionality, rigorous quantification through third party verification, double-counting concerns, and transparency.

RECOMMENDATION 19: The B.C. government needs to engage the public to develop clear guidelines for the technical and legal requirements regarding the potential future use of technologies to capture and dispose of GHG emissions.

RECOMMENDATION 20: The B.C. government must move quickly to determine the most effective policy for moving toward elimination of the GHG emissions associated with electricity imports.

APPENDIX II. Estimating Emission Reductions

For each of the B.C. Commitments and New Strategies, we describe the technologies or behavioural changes that are needed and estimate the reductions in greenhouse gas emissions. We consider what will happen if large numbers of people or businesses use these technologies or undertake the changes. Substantive changes in government policy, business investments and personal decisions will be required for these new strategies to occur.

In terms of estimating the tonnes of emission reductions, we used the following general approach.

First, we reviewed the literature to find examples of how technologies and actions can change the 'Do Nothing' scenario (see Appendix III) to reduce greenhouse gas emissions For the *B.C. Commitments*, this involved talking with government and often making assumptions about the intent behind any commitments.

Second, we set up simple and transparent spreadsheets to show how quickly these new technologies and actions could replace or alter our course from 'Doing Nothing.' We used the spreadsheets to include emissions for the projected population and economic growth in B.C. and how technologies and behaviour are likely to change without any specific actions to reduce greenhouse gas emissions. We also estimated the expected lifetimes of existing technologies, including buildings, homes, vehicles and industrial equipment. These technologies will continue to use energy and produce emissions until they are replaced by new technologies. We calculated the emission reductions by comparing

a. the emissions from the mix of technologies and behaviour if we do nothing

with

b. the emissions from the mix of technologies and behaviour if we enact the changes in the particular strategy.

For some strategies, we had to be careful that we did not introduce errors by double counting the emission reductions. For example, one strategy is to introduce more fuel efficient cars. Another strategy is to require that all cars use ethanol or other fuels with low GHG emissions. The emission reductions will differ depending on whether only one of these strategies is implemented or if both are implemented together. We have noted in the descriptions below whether the estimated emissions reductions assume that other strategies have been implemented.

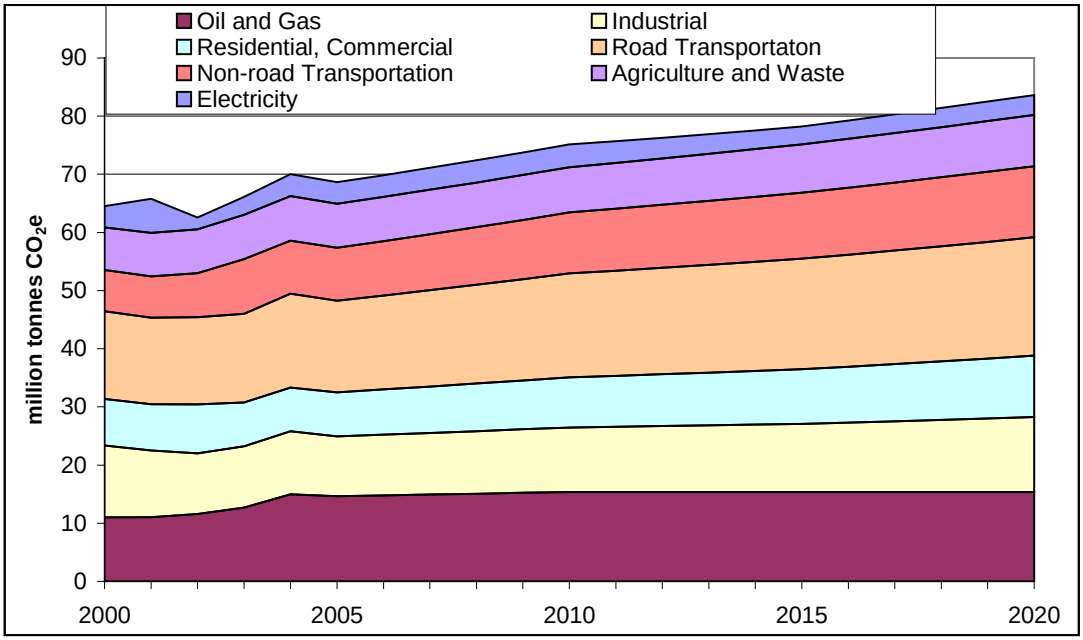
Third, we asked experts to review our estimates and we made revisions based on their feedback.

We are happy to provide the details of this analysis, on request.

APPENDIX III. The Do Nothing Scenario

Estimating future emissions if we *Do Nothing* requires answers to questions that cannot be answered definitively. How will B.C.'s population, land-use patterns, and economic structure over the next 13 years and beyond? What types of buildings, cars, and other energy-consuming equipment will be purchased, how will it be used? Our approach for answering these questions is to rely on publicly available estimates of future energy and emissions provided by public agencies, including Natural Resource Canada and the B.C. government. These agencies provide information that is widely reviewed and attempts to represent likely future conditions.

Table 9 - B.C. Historic (2000-2005) and projected (2006-2020) Greenhouse Gas Emissions.



Source: Pembina estimates based on Environment Canada (2007) through 2005, Natural Resource Canada (2006) with population growth adjustments, plus estimates of GHG emissions associated with electricity imports from National Energy Board website and GHG intensity from US Energy Information Administration and Environment Canada (2007).

We used Environment Canada's information on greenhouse gas emissions for historic emissions from 2000.[13] This report provides GHG emissions by province and major emitting source, following international guidelines for inventory reports. For trends in future emissions, we started with projections provided by Natural Resources Canada in the report, *Canada's Energy Outlook: Reference Case 2006*.[14] This report provides estimated projections for greenhouse gas emissions by province and activity (including non-energy

[13] Environment Canada. 2007. *National Inventory Report: Greenhouse Gas Sources and Sinks in Canada 1990–2005.*

[14] Natural Resources Canada. 2006. *Canada's Energy Outlook: Reference Case 2006.*

related emissions). We noted that the assumptions for population growth and natural gas production used by B.C. Statistics and B.C. Ministry of Energy, Mines and Petroleum Resources differed from those used in Canada's Energy Outlook. So we adjusted the projections in this analysis to be consistent with the B.C.-government assumptions. The historic and projected GHG emissions are shown in Table 9.

B.C.'s emissions are expected to be about 71 million tonnes of carbon dioxide equivalent (MtCO2e) in 2007 and increase to 84 MtCO2e in 2020, an 18% increase over 13 years.