Making Progress on B.C.'s Climate Action Plan

2012

BRITISH COLUMBIA | LiveSmart BC

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Message from the Minister of Environment

The Honourable Dr. Terry Lake, Minister of Environment

British Columbia's world-leading Climate Action Plan was launched in 2008 with aggressive greenhouse gas (GHG) targets of a 33% reduction from 2007 levels by 2020 and an 80% reduction by 2050. This report on progress is our first opportunity to let British Columbians know if the Climate Action Plan is on track and while we recognize we are still in the early stages, the indicators are very positive.

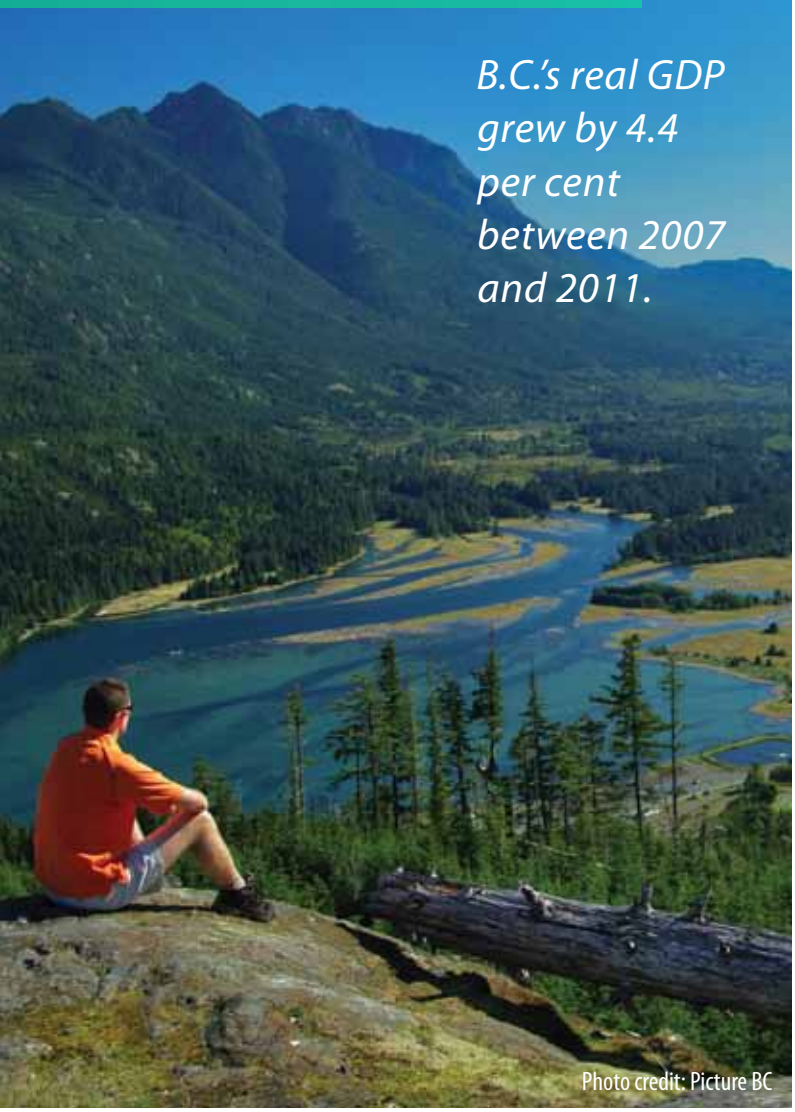
Provincial GHG's fell 4.5% from 2007 to 2010 while at the same time, our GDP growth outpaced the Canadian average, demonstrating that a strong carbon pricing policy that is revenue neutral can coexist with a growing economy. In fact the policy of taxing something undesirable (GHG emissions) and reducing taxes on something desirable (income) is leading to innovative clean technology growth and changes in behaviour as both companies and individuals make choices based on the carbon pricing policy. One example of personal decision making is reflected in the greater reduction in transportation fuel use in B.C. compared to the rest of Canada.

British Columbia's action on climate change has not gone unnoticed. Prominent articles in the Economist Magazine, the New York Times and the LA Times have pointed to the success of our policies and our economic growth. The Corporate Knights organization put B.C. among the leading provincial jurisdictions in addressing sustainability. British Columbians are proud to be leaders on environmental initiatives and our government has committed in both the Throne Speech and our "Canada Starts Here" jobs plan to "remain a climate action leader".

It's important to remember that while the government can put world-leading climate action policies in place, our real success is determined by the choices made by B.C. families and businesses every day. It's for this reason that I look forward to the opportunity to move the conversation forward regarding the evolution of these policies to ensure we are meeting the goals and aspirations of British Columbians.

Finally, I want to thank our B.C. Public Sector partners for their on-going commitment to carbon neutrality. Their leadership and determination is helping us move closer to our targets. I would also like to thank all British Columbians who know that by doing their part they are making a big difference for the health of our environment and our economy.

Highlights



B.C. is within reach of its 2012 interim target.

- B.C.'s greenhouse gas (GHG) emissions decreased by 4.5 per cent between 2007 and 2010, according to B.C.'s Provincial Greenhouse Gas Inventory Report. It is possible that B.C. will meet its 2012 interim target of a 6 per cent reduction below 2007 levels by 2012.
- In order to reach the 2012 target and those beyond, we will have to see continued emissions reductions as the economy recovers from the recession. This is not guaranteed.

Sales of the main fossil fuel types are going down in B.C.

- B.C. is seeing some positive signs that there is a structural shift starting toward greener options in our economy.
  - Sales of gasoline, diesel, natural gas, coal and oil have all gone down since 2007, and by more than the Canadian average.
  - Indications of behaviour change and greener choices are apparent with high rates of clean technology sector growth, hybrid vehicle adoption, and construction of green buildings.
- While B.C.'s emissions have been going down, its population growth of about 5 per cent from 2007-2010 has been above the Canadian average.
- It is too soon to know whether these signs will turn into lasting trends, or to know whether the progress we are seeing is the result of the climate actions B.C. has taken.
- There are challenges to B.C. being able to continue to make progress toward its greenhouse gas targets; in particular, continued emissions growth from the natural gas sector, new industrial projects, off-road diesel, and forest degradation will add to B.C.'s emissions levels if mitigation measures are not taken.

B.C. is continuing to take action across the economy to address climate change.

- The revenue neutral carbon tax provides an important incentive to increase efficiency and reduce emissions. Demand for fossil fuel has gone down since it was implemented. The carbon tax is one tool among the many that contribute to GHG reductions.
- The public sector is now carbon neutral, creating markets for green technologies, retrofits, and offsets, and showing that government is acting first to reduce emissions.
- The Province has provided local governments with tools to help them achieve GHG reductions in their operations and in their communities.
- Actions across sectors, such as the Clean Energy Vehicle Program, the Forest Carbon Offset Protocol, and financing options for building retrofits and technologies are going to continue to generate greenhouse gas reductions into the future.
- While B.C. has been implementing its strong climate action policy, B.C.'s economy has continued to perform well. B.C.'s GDP growth has been above the Canadian average for the period since the announcement of the Climate Action Plan (2007-2011), including during the global recession.
- Individuals, local governments, communities, businesses and others have all been contributing to achieving B.C.'s targets. Reaching the targets will require continued leadership from everyone.

From 2007 - 2010 B.C. saw:

- ***+5%** population growth*
- ***-4.5%** greenhouse gases*
- ***Declining** fossil fuel use*

***+48%** increase in clean tech industry sales (2008-2010)*

Adaptation is essential.

- Adaptation to climate change is the way to reduce the cost of the impacts that will continue to result from the stock of greenhouse gases already in the atmosphere.
- B.C. has established a solid foundation of knowledge and tools to support government, community, and business adaptation.
- Awareness of adaptation is increasing and some organizations and communities are routinely considering climate change in their decisions, although adaptation is not yet a mainstream activity in B.C.

There are measures in place that will deliver future results, but more will need to be done.

- Several Climate Action Plan policies were designed with a phase-in period to give people time to change their habits and equipment and avoid high transition costs. Net zero GHG electricity, the *Landfill Gas Management Regulation* for methane capture, and the revenue neutral carbon tax are just some examples of policies that will lead to greater emissions reductions once the phase-in period is over.
- Actions taken now, such as changes to the building code and to community design will lead to large greenhouse gas reductions in the longer term once the stock of older inefficient buildings, vehicles and equipment reaches the end of its useful life.
- Existing policies will foster continued progress, but more will need to be done.
- The challenge will be to continue finding innovative ways to reduce our emissions over time.

Success will have many benefits:

- A healthier environment with lower air pollution and resilient ecosystems.
- Strong leadership in addressing global climate change that will provide a model of success to other jurisdictions looking to take climate action.
- Improved human health and safety. Reduced exposure to risks and costs of climate impacts.
- Improved choices for families and businesses to take action, reduce emissions, and save energy costs.
- Compact and efficient communities that encourage social interconnection.
- A place for B.C. as a global innovator in business solutions to environmental problems.

B.C. will need to increase the rate of emissions reductions.

Climate change has important implications for British Columbians

Measurements of temperature and precipitation from around the world confirm that the climate is changing. Globally, a large majority of the warmest years on record have all occurred since 1997.

Extreme weather events are costly and more frequent.

The global reinsurance industry tracks the number of natural catastrophes worldwide. The trend in catastrophes caused by weather, water, or climate has increased over the last 30 years. A 2012 report from the Insurance Bureau of Canada states that "climate change is likely responsible, at least in part, for the rising frequency and severity of extreme weather events, such as floods, storms and droughts, since warmer temperatures tend to produce more violent weather patterns." Payouts from Canadian insurance companies for damages caused by natural disasters – including those related to weather and water – have doubled every five years since 1983.

The extreme weather events of greatest concern in B.C. include heavy rain and snow falls, heat waves, and drought. They are linked to flooding and landslides, water shortages, forest fires, reduced air quality, and costs related to:

- Damage to property and infrastructure;
- Business disruptions; and
- Increased illness and mortality.

These costs are borne by individuals, businesses, and governments.

Science links recent climate change to the greenhouse gases released to the atmosphere through human activities over the past century. Based on historic emissions, further changes are unavoidable. Continued emissions will add to the stock of greenhouse gases in the atmosphere, and are expected to cause substantial additional change within our lifetimes and beyond.

The ecosystems that support our economy and communities are at risk.

Ecosystems in B.C. provide clean water and air, timber, game, fish, scenery, flood control, and other goods and services that sustain communities and the provincial economy. Many of these natural goods and services would be costly or impossible to replace. Climate change will likely have profound impacts on many ecosystems in B.C. over time.

In many parts of B.C., snow packs are projected to decrease and snow is projected to melt earlier. This means less runoff in summer and less water for agriculture, hydropower, industry, communities and fisheries. Where glaciers contribute to stream flow, long-term loss of glacier mass will further exacerbate water shortages. The seasonal droughts of 2003 and 2009 demonstrated the vulnerability of community and irrigation water supplies.

"Climate change is likely responsible, at least in part, for the rising frequency and severity of extreme weather events." - *Insurance Bureau of Canada*

Climate influences the locations where individual species thrive. Scientists have already observed changes in the length of the growing season and in the historical distribution of plants and animals. Climate change will also influence the occurrence of fires, pests and diseases, potentially accelerating these shifts. The fires of 2010 consumed 330,000 hectares of forest in the B.C. interior, with damages estimated at $220 million. A 2011 report by the National Roundtable on the Environment and the Economy suggests that as a result of these various factors, timber supply could decrease by 5-8 per cent by the 2050s.

The ocean is warming along with the global atmosphere, and as it warms, sea water expands, causing sea level to rise. Melting land ice also contributes to sea level rise. Sea level rise will affect coastal ecosystems, communities, and infrastructure. As the ocean warms along the B.C. coast it becomes less suitable for some existing marine species, with new species moving in. In addition, the ocean is absorbing carbon dioxide from the atmosphere, becoming more acidic and less hospitable to marine life. These changes will likely affect fisheries and coastal tourism.

Building and infrastructure maintenance and replacement costs may rise as frequency and severity of events increase.

The overall cost of extreme events – based on insurable damage to buildings and infrastructure – is increasing. Climate change may explain a portion of this increase in costs. Other factors, like a growing population and higher asset values, also determine the cost of extreme events. As the climate warms, and our economy continues to develop, we will need to manage our exposure to extreme events to minimize future losses.

British Columbia's coastal communities already face flood risks related to precipitation and river flows, and climate change will add new risks from sea-level rise and storm surges. An estimated 3,000 to 12,000 B.C. homes near the coast could be at risk of flooding by mid-century. A 2011 report from the National Round Table on the Environment and the Economy estimated that, based on existing coastal flood protection measures, climate change could lead to estimated damages of more than $2,000 per British Columbian per year by the 2050s.

Forest fires affect buildings and infrastructure. The fires of 2003 – the worst fire season on record – destroyed more than 334 homes and many businesses. The total cost of these fires is estimated at $700 million. The climatic conditions that prevailed in 2003 contributed to the size of the fires, as did the build-up of forest fuel. Although it is currently not possible to link individual extreme events to climate change with precision, fire seasons are nevertheless expected to be longer in the future.

Not all climate change impacts on buildings and infrastructure will be so dramatic. For example, warmer winters can lead to more frequent periods of freezing and thawing. These contribute to wear and tear on roads, affecting longevity and increasing maintenance costs.

Photo credit: Picture BC

Climate change affects health and safety.

Extreme weather events -- heat waves, heavy precipitation events, droughts – have health and safety implications.

Heat waves are associated with heat stroke and an increase in respiratory illness. In the summer of 2009, during an eight-day heat wave, temperatures at Vancouver International Airport measured as high as 34.4 degrees centigrade. During this period, the Fraser and Vancouver Coastal Health Authorities registered 455 deaths (from all causes and ages), which is significantly higher than the average of 321 deaths during the equivalent calendar period in each year from 2004 to 2008.

The 2003 southern B.C. fire forced the evacuation of more than 45,000 people, and led to the loss of three lives. During the 2010 fire season, smoke blanketed the province, and both the City of Vancouver and the Government of Alberta issued air quality warnings due to smoke caused by the fires.

In 2010 flooding caused by heavy rainfall destroyed the highway leading into Bella Coola. About 175 people were evacuated from their communities, with residents of Kingcome Inlet evacuated by helicopter as water levels continued to rise. Such experiences, though short in duration, can result in long-term psychological impacts and personal and societal costs.

Climate change impacts are projected to intensify if the world stays on the current emissions pathway.

A report by the Intergovernmental Panel on Climate Change, prepared by 220 experts from around the globe and released in early 2012, indicates that globally during the 21st century:

- *It is likely that the frequency of heavy precipitation will increase over many regions.*
- *It is virtually certain that increases in the frequency of warm daily temperature extremes will occur on a global scale.*
- *It is very likely – 90 to 100 per cent probability – that heat waves will increase in length, frequency, and/or intensity over most land areas.*
- *It is very likely that average sea level rise will contribute to more extreme sea levels and extreme coastal high water levels.*

— IPCC

We can reduce future impacts through our actions today.

Everyone can contribute to action that will reduce the negative impacts of climate change.

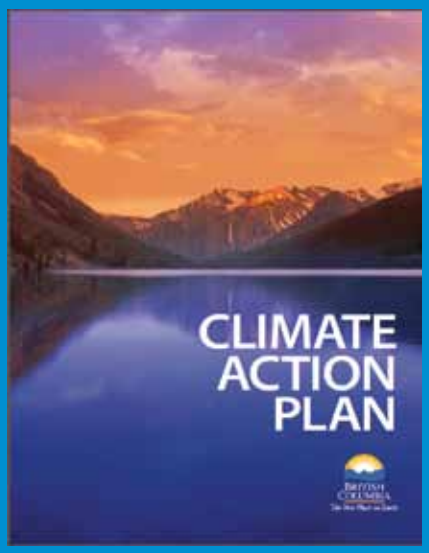
- Avoiding increases to the stock of greenhouse gases in the atmosphere at a global level will minimize the climate impacts we end up facing in the long run. At home in B.C., we can take action across the economy to reduce our emissions. Continued leadership in climate action along with our partners around the world will drive global emissions reductions.
- While some amount of future climate change is unavoidable, we can minimize negative impacts by preparing ahead of time. By ensuring that communities and businesses are more resilient to extreme weather events – for example by creating FireSmart communities – we can reduce the social and economic costs of these events. If we design new buildings and infrastructure with tomorrow's climate in mind, we will spend less on maintenance and our communities will be safer.

B.C. has taken action on both climate change adaptation and mitigation. The rest of this report will outline how these actions are starting to produce results across B.C.

Photo credit: Picture BC

Climate Action Timeline

Since announcing the Climate Action Plan in 2007, B.C. has taken strong action for transformative change.



2007

- Speech from the Throne commits to climate leadership
- 63 local governments become the first to sign the Climate Action Charter

2008

- Climate Action Plan released
- Eight pieces of legislation enacted, including GHG targets
- Revenue neutral carbon tax in place at $10/tonne of GHGs

2009

- B.C. completes work on provincial vehicle emissions standards regulation leading to federal standards for 2011
- *Reporting Regulation* for large emitters is passed

2010

- B.C. launches Adaptation Strategy
- Carbon Neutral Winter Olympics
- New LiveSmart funding for home and small business retrofits
- First progress report shows all Climate Action commitments complete or underway
- B.C. is the first carbon neutral government in North America

2011

- B.C. announces first LNG plants in the world to be powered by clean energy
- New Clean Energy Vehicle Program

2012

- Revenue neutral carbon tax at $30/tonne
- B.C. Forest Stewardship Action Plan for Climate Change Adaptation released
- First Interim GHG target of 6 per cent below 2007 levels

B.C. is within reach of its 2012 interim target

B.C.'S LEGISLATED GREENHOUSE GAS TARGETS:

33% below 2007 levels for the 2020 calendar year
80% below 2007 levels for the 2050 calendar year

INTERIM TARGETS:

6% below 2007 levels for the 2012 calendar year
18% below 2007 levels for the 2016 calendar year

Targets help to track progress and to calibrate policies to ensure that we are on the right track in our actions to prevent climate change. The most important thing is that we are reducing the emissions that add to the total stock of greenhouse gases in the atmosphere now and that we are adjusting our actions as needed to create a future society and economy that produce low levels of greenhouse gas emissions in the long term, in line with targets.

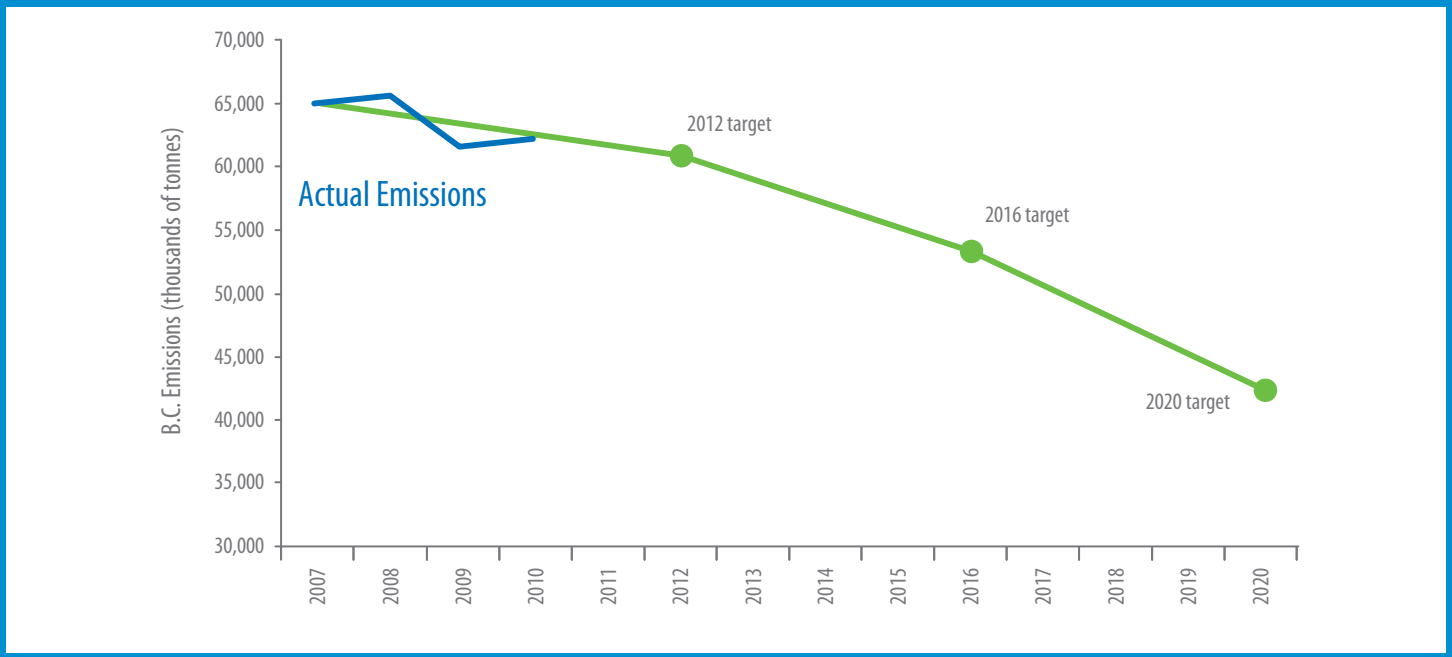
Over the period since 2007 when the Climate Action Plan was implemented, B.C.'s greenhouse gas emissions have gone down, demand for fossil fuels has gone down, and B.C.'s GDP growth has been above the Canadian average.

B.C.'s climate change policies are only some of the many factors with an impact on greenhouse gas emissions that B.C. and the world have experienced in the past five years. The global economic downturn and related impacts on B.C. industries, the building boom in advance of the Olympics, global oil prices, and the expansion in the natural gas sector are some of the many forces that act on B.C. emissions totals, with some leading to higher, and some to lower emissions. It is premature to say how much of the emissions reduction B.C. has seen is attributable to policy, and how much to other influences.

Emissions data used to assess progress relative to targets are available with an 18 month lag after year's end to allow for quantification and production of reports by Environment Canada.

The most recent emissions data in B.C.'s Provincial GHG Inventory Report show that B.C. emitted 62 million tonnes of greenhouse gases in 2010, a 4.5 per cent decrease since 2007, putting B.C. within reach of the 2012 interim target. In addition to reducing these emissions, B.C. can make progress by enhancing the effectiveness of forest sinks as stores of carbon dioxide (CO_2). Ongoing work in storing carbon through forest management offset projects (not included in the 4.5 per cent) provides through sequestration an additional climate action benefit that could be included in our progress towards targets (approximately an additional half of a per cent toward 2012). Continuing the track toward the target will depend on whether B.C. has been able to continue its downward emissions track as the economy has been recovering since 2009.

B.C. GREENHOUSE GAS EMISSIONS 2007-2010

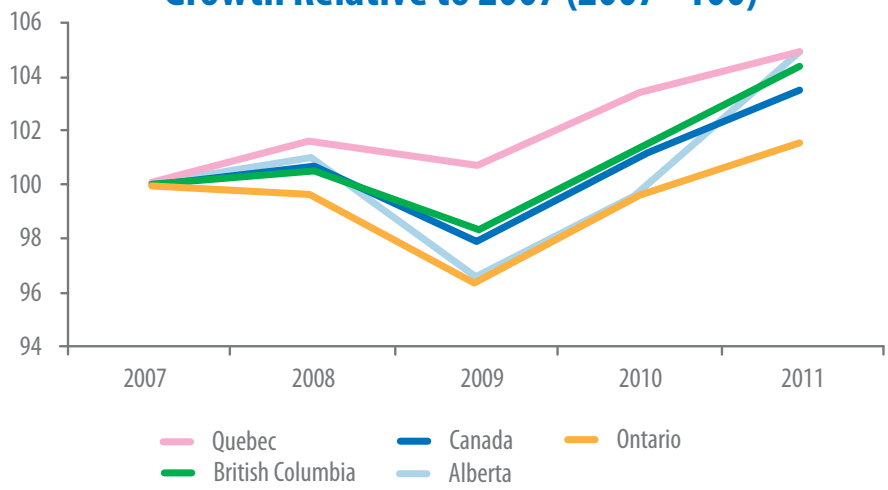


Source: B.C. Provinical Greenhouse Gas Inventory Report

CLIMATE AND ECONOMY

B.C. has taken strong climate action, including implementing North America's first broad-based revenue neutral carbon tax, and its economic performance remains above the Canadian average, with real GDP growing 4.4 per cent between 2007 and 2011. Climate action policies create opportunity for green business, help to grow the clean technology sector, and build B.C.'s competitive position in tomorrow's low-carbon economy. Some sectors do bear costs because of climate policies. While carbon pricing does impose a cost on industry, it is mitigated through reductions in corporate and personal income taxes, and other tax-relief that benefits the whole economy. Government is working with industry through its Green Economy Strategy so that foundational industries have more innovative, cleaner, more efficient production.

Real Gross Domestic Product (GDP) Growth Relative to 2007 (2007=100)



Source: CANSIM 379-0025 Preliminary Real GDP by Industry at Basic Prices. Subject to revision on release of Provincial Public Accounts.

B.C. is demonstrating signs of positive change towards a greener economy:

2.1x the Canadian average rate of hybrid vehicle adoption.

48% growth in Clean Tech Sector Sales (2008 – 2010).

Most active new market for adoption of district energy systems in Canada.

2,348 gigawatt hours of electricity saved through conservation programs in 2011, enough electricity for 215,000 homes for a year.

18,000 tonnes of CO_2 sequestered through afforestation in 2010.

>110,000 riders daily on the new Canada Line.

419,000 tonnes of emissions avoided in 2010 through the *Renewable and Low Carbon Fuel Requirements Regulation.*

Lowest GHG footprint of any major city in North America is in Vancouver.

30,000 older vehicles taken off the road by BC Scrap-It.

1st proposed LNG plants powered by clean energy.

20% of Canadian LEED Gold building projects registered since 2007 have been from B.C.

785,337 tonnes of CO_2 offsets have been retired.

8,400 small businesses have participated in LiveSmart BC's energy efficiency programs.

5% of eligible B.C. homes have done a LiveSmart BC retrofit.

B.C.'s GHG emissions went down 4.5 per cent between 2007 and 2010.

Signs of reduced fuel use

For B.C. to meet its 2012 interim target, emissions have to continue to fall, and not resume their upward path as the economy resumes its pre-recession growth. We will have to start seeing signs that something different is going on in B.C. compared to similar jurisdictions. Then we will know that our policies and behaviours, and not just external factors, are driving our emissions path.

Many of the largest external factors affecting B.C.'s emissions and fossil fuel use, such as the recession and oil price spikes, are common to B.C. and to all of Canada. In fact, B.C.'s economic experience during the recession in terms of GDP was very similar to, though slightly better than, the Canadian average. If these factors alone could explain the drop in B.C.'s fossil fuel use, you would expect to see the same changes reflected in Canada as a whole.

Instead, across the major fuel types, B.C.'s consumption of fossil fuels (not including consumption by the producer of the fuel) has fallen since 2007, and in each case by a larger amount than Canada's. In addition, where fossil fuel use in Canada shows a return to increases between 2010 and 2011 during the economic recovery, for key fuels B.C. did not see consumption growth for that year.

Several policies such as the revenue neutral carbon tax were deliberately implemented to have a phase in period that traded immediate emissions reductions in the short term for a smoother transition to more reductions over time. With only 2 to 3 years of data since B.C.'s Climate Action Plan was released and significant external factors such as the global economic recession, it is premature to say that these observed differences in fuel use are the result of B.C.'s climate change policies or that these early trends will continue. We do know that there are signs that something different is happening in B.C. that is changing our consumption of fossil fuels.

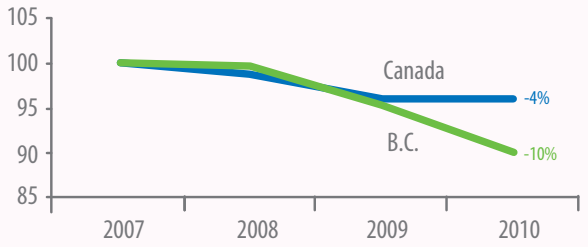
Also, the carbon intensity of transport fuels for a given volume is decreasing and renewable content increasing in B.C. because of the *Renewable and Low Carbon Fuel Requirements Regulation*.

Reductions in fossil fuel consumption can be the result of increased efficiency and switching to other fuels such as electricity. That B.C. has not seen a corresponding GDP decrease relative to Canada shows that we are still getting the same services from energy, allowing our economy to grow.

If B.C. can continue the behaviours that are driving declining fossil fuel use, making further progress in meeting B.C.'s greenhouse gas targets will be much easier.

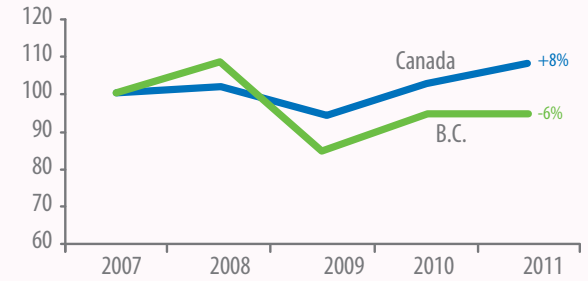
CONSUMPTION VOLUMES OF MAIN FOSSIL FUELS IN B.C. AND CANADA RELATIVE TO 2007 LEVELS : Source: CANSIM 128-0017, 134-0004

Natural Gas Demand 2007=100

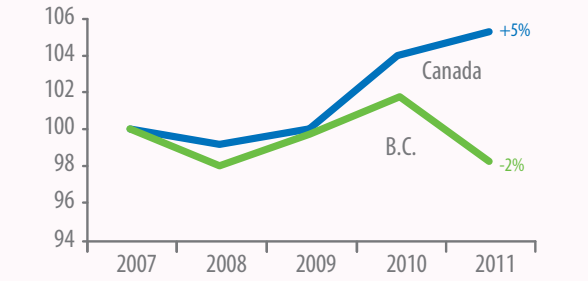


Does not include consumption by natural gas producers or natural gas used for electricity generation. 2011 data not available; demand increase expected for both B.C. and Canada. Natural gas consumption by natural gas producers is increasing in B.C.

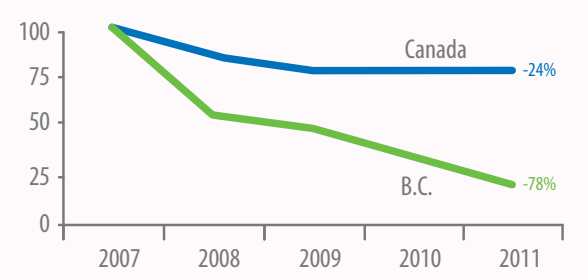
Diesel Sales 2007 = 100



Motor Gasoline Sales 2007=100



Light Fuel Oil Sales 2007=100

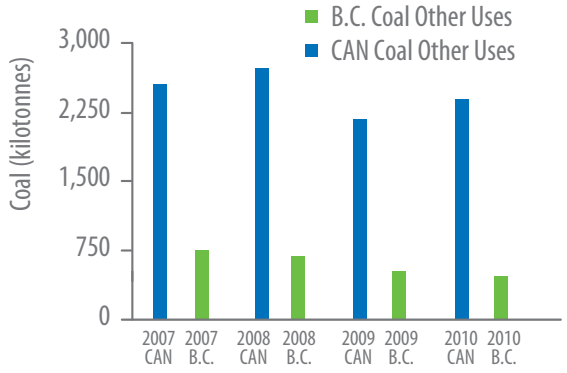


Part of the decline in light fuel oil use in B.C. is explained by a shift in refinery production to diesel because of low-sulphur requirements.

B.C. COAL USE

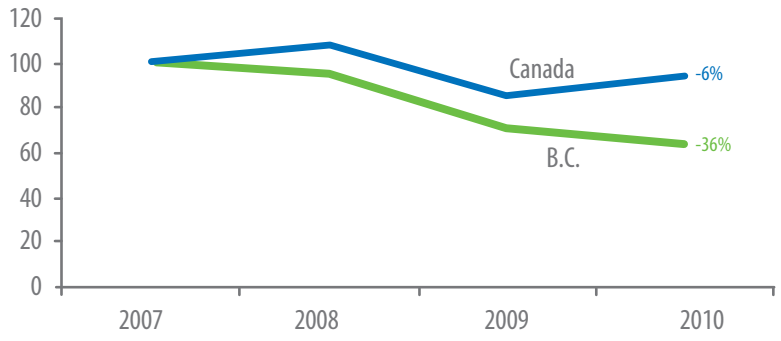
Coal is a very greenhouse gas intensive fuel. Coal use has been declining in many countries since 2007 because of increased market prices. Many jurisdictions, including Canada use coal mainly for electricity generation. B.C. does not have any coal-fired power plants and so has low coal use at 1 per cent of Canada's total. B.C. coal consumption had been steadily growing up to 2007, but saw a 36 per cent reduction from 2007 to 2010 (including coal use by coal producers). Canada for the same period saw a 6 per cent reduction in demand for the same non-electricity uses. Overall, Canada's reductions in coal use (a large contributor to Canada's emissions reductions) are driven by a 21 per cent reduction in coal use for electricity mainly because of coal power plant closures. B.C. still made larger percentage reductions in coal demand, with the majority coming from manufacturing (e.g. cement).

Canada and B.C. Coal Use (Excluding Electricity Generation)



Source: CANSIM 128-0017

Canada and B.C. Coal Use 2007 = 100 (Excluding Electricity Generation)



Source: CANSIM 128-0017

Accelerating the transformation for 2016, 2020, 2050

Photo credit: Picture BC

More will need to be done to continue progress toward the 2016, 2020 and 2050 targets.

The targets were designed in view of the fact that some emissions reductions take time to set in motion. A policy change today that is directed at vehicle efficiency may take five to ten years to generate large emissions reductions as people replace their existing cars. Similarly, policies targeted at buildings, industrial equipment, or urban densification may take decades, but can yield dramatic emissions reductions over time.

In light of this inertia, the greenhouse gas targets were designed with each target requiring a greater average annual rate of change than the one before. B.C. has reduced its emissions by 4.5 per cent from 2007 to 2010. In order to meet the 2012 target, we will need an annual reduction of 0.5 million tonnes in each of 2011 and 2012. To meet the 2016 interim target the average annual reduction will need to be 2 million tonnes. From then to 2020, it will need to be 2.6 million tonnes.

Policies already in place will start to generate significant emissions reductions nearer the end of this decade. *The Landfill Gas Management Regulation*, net zero greenhouse gas requirement for thermal power plants, and the federal light duty vehicle emissions standard all reach full implementation in 2016. Other policies such as the revenue neutral carbon tax will continue to generate new medium-term emissions reductions as emitters change their habits in response to a predictable incentive.

In addition, government continues to develop and introduce new policies to follow the progress started by the Climate Action Plan. Initiatives that will help to increase the rate of change toward subsequent greenhouse gas targets include among others:

- B.C.'s Green Economy Strategy;
- The Clean Energy Vehicle Program which provides incentives for eligible clean energy vehicles and supports charging point deployment;
- Financing options for energy efficiency retrofits in buildings;
- Proposed energy efficiency programs for industry;
- Various offset protocols, including the Forest Carbon Offset Protocol;
- Building Code updates that will continue to increase the energy efficiency of buildings;
- The Northwest Transmission Line which will support electrification of B.C.'s proposed new mines;
- The *GHG Reduction Clean Energy Regulation* that allows utilities to provide incentives for natural gas buses, trucks and ferries; and
- The Carbon Offset Aggregation Cooperative (COAC) which reduces emissions in heavy duty diesel truck fleets and heavy equipment.

This report goes on to identify additional initiatives and progress made in each sector.

Challenges for B.C's Greenhouse Gas Targets

Apart from the task of reducing what we emit each year from current levels, there is the challenge that some kinds of emissions are actually growing. The following are areas that will create challenges for meeting B.C.'s GHG targets, regardless of emissions reductions in other sectors, if actions are not taken to mitigate emissions.

NATURAL GAS PRODUCTION

Production has been increasing steadily in the natural gas sector. Future production volumes are difficult to predict given selling prices and competition for new markets (such as through liquefied natural gas sales to Asia), but production is expected to continue to increase. There is the potential for an important part of this new production to come from the Horn River basin which has higher CO_2 content, resulting in more vented emissions per unit of production. Options to address natural gas sector emissions include electrification, carbon capture and storage, improved operations and maintenance to prevent leaks, and energy efficiency.

NEW INDUSTRIAL PROJECTS

In general, continued economic development leads to production that is less GHG intense as older operations are replaced by newer, more efficient facilities. This capital stock turnover is an opportunity to invest in new modes of production that deliver economic returns with fewer emissions. Rio Tinto Alcan is undertaking a modernization project that will reduce GHG emissions intensity by 40 per cent from current levels. However, in B.C., the scale of new significant projects coming online will add to B.C.'s emissions. There are new mines and other projects currently planned and proposed. Their emissions can be minimized by using the best technology and processes available, and with key infrastructure choices such as electrification supported by the Northwest Transmission Line.

OFF-ROAD VEHICLES

The GHG emissions from diesel in off-road equipment have increased 27 per cent in the twenty years from 1990 – 2010. This diverse sector includes mining, agriculture, logging and construction vehicles, as well as all terrain vehicles and snowmobiles. Off-road vehicles have an extremely slow turnover rate, with much of the equipment lasting decades. Emissions can be addressed through fuel or process switching (e.g. natural gas vehicles, electric conveyors), and equipment retrofits.

FOREST DEGRADATION

These emissions are not accounted against B.C.'s targets, but are an important contributor to climate change. B.C.'s forests have tremendous value because they store CO_2. However, in the past few years, because of stresses such as forest fires and the pine beetle outbreak, B.C.'s forests have been a net source of CO_2 emissions. Forest management practices can improve forest health and sequestration of CO_2.

Photo credit: Picture BC

Signature Policies

Government is implementing a suite of policies that create a foundation for transformational change across the province towards a greener, low-carbon economy, and that help prepare British Columbia for climate change impacts.

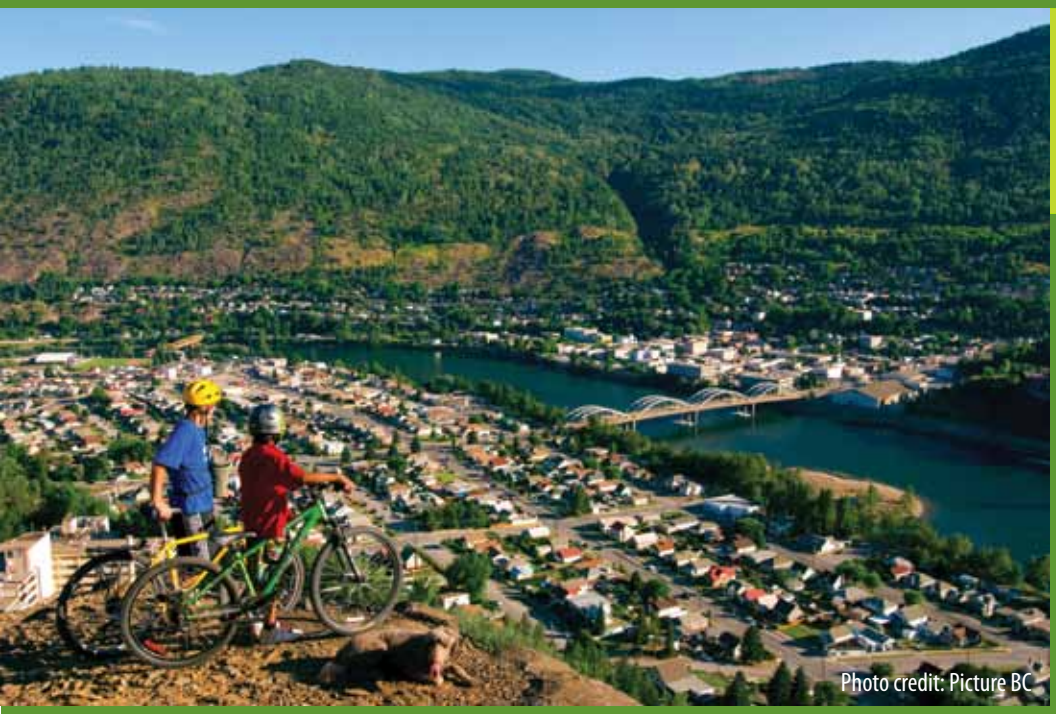
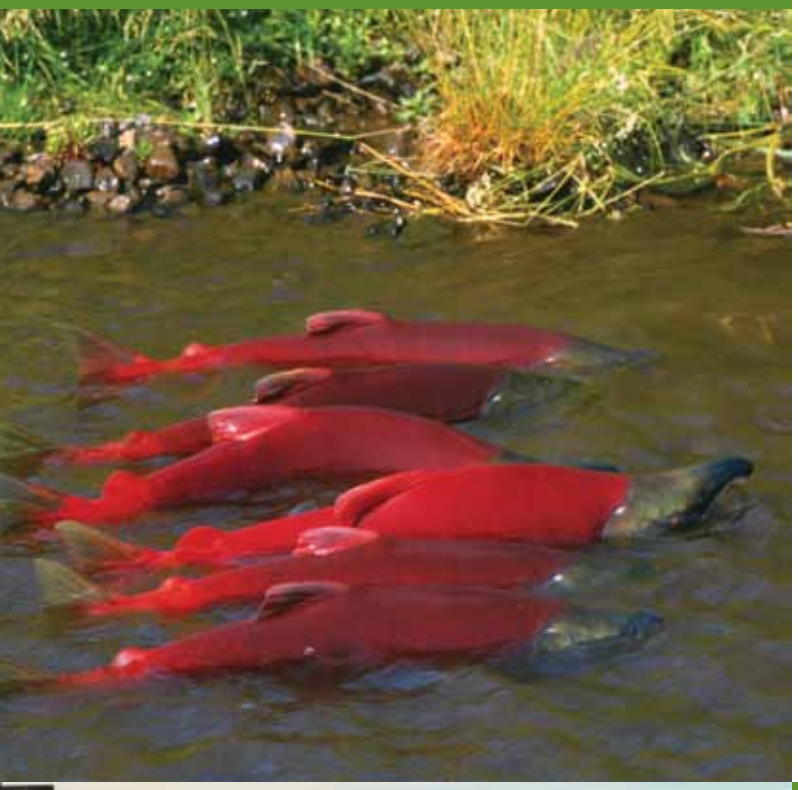


Photo credit: Picture BC

Adaptation: Preparing for climate change and its impacts



Preserving what we value

Reducing global greenhouse gas emissions will limit the rate and extent of climate change. As a result of past emissions, however, the climate is already changing, and some future change is unavoidable.

Climate change adaptation means adjusting to recent changes in climate and preparing for future changes, including more variable weather. It means recognizing that future forests, shorelines, water supplies, and other natural resources will be different from those of today, and taking those changes into account in our decisions and plans. It may also mean revisiting past decisions and current plans to look at them through a climate change lens.

The overall objective of adaptation is to help British Columbia achieve its goals – job creation, sustainable communities, green economic development – in the face of a changing climate.

What is being done

The Province is working with researchers, non-government organizations, business, local governments, and the federal government to advance adaptation across British Columbia.

1. Building knowledge and tools to guide decisions and help British Columbians understand what to expect

Climate change will affect different regions of B.C. in different ways. In order to adapt, decision-makers in the public and private sectors, and across civil society, need first to understand how climate change and sea-level rise, increasing storm intensity, changes in water availability, and other impacts will affect their region or sector.

TRANSLATING SCIENCE INTO SIMPLE LANGUAGE

Plan2Adapt is an online tool designed to help planners and other local government decision-makers understand how climate will change in their region, and how this could affect their communities. Developed by the Pacific Climate Impacts Consortium, it translates complex information about climate change and its impacts into simple language, generating easily understandable information about future temperature, precipitation, and other aspects of climate, and about the potential implications of these changes for infrastructure management, water supply, rain water management, urban forests, and other sectors. **http://pacificclimate.org/tools-and-data/plan2adapt**

In 2008, the B.C. government provided a $90 million endowment to the **Pacific Institute of Climate Solutions.** This directs up to $2 million a year towards regionally relevant climate science and results-oriented research. A portion of the endowment supports the Pacific Climate Impacts Consortium (PCIC), which produces detailed climate information for B.C., and information about impacts on forest ecosystems and major river basins including the Columbia and the Fraser. PCIC also works directly with stakeholders in B.C. to help them document and communicate this knowledge.

Adaptation tools help local governments, businesses, and other organizations understand climate change science, determine their specific climate-related vulnerabilities and key risks, identify and evaluate adaptation options, and develop adaptation plans. For example, local governments make decisions about land use, floodplain management, infrastructure, buildings, public health and safety, urban trees and landscaping and other values that are vulnerable to climate change. Several provincial ministries, local governments, and non-government partners, with funding from the federal **Regional Adaptation Collaborative** (RAC) program, have developed a suite of adaptation tools suitable for local government use. These tools are available on the new **ReTooling for Climate Change** website, an adaptation portal designed for local governments by the Fraser Basin Council.

The Ministry of Forests, Lands and Natural Resource Operations invested $5.1 million in research to support adaptation of B.C.'s forest management framework to anticipated effects from climate change. Research was guided by the **Future Forest Ecosystems Scientific Council.** Results include new tools to help forest managers identify future climate conditions, assess drought risk, and inform tree species selection decisions. Government and partners have also produced tools to help agricultural producers and other irrigators understand climate change impacts on water supply and prepare for more frequent shortages.

2. Building adaptation into government's business

Government ministries are considering climate change in plans and decisions – with the goal of ensuring that policies, programs, investments, and other initiatives are robust in the face of extreme weather events and medium-term to long-term climate change.

B.C. Parks is considering climate change impacts in its conservation program, increasing emphasis on managing landscapes, including maintaining and restoring connections between landscapes.

The Ministry of Forests, Lands and Natural Resource Operations' ***Forest Stewardship Action Plan for Climate Change Adaptation*** signals an important new policy direction for B.C.'s forest management. It outlines actions that will be taken from 2012 - 2017 to make B.C.'s forests more resilient.

The Ministry of Transportation and Infrastructure is considering climate change impacts in the design and cost of highway construction, in life-cycle cost of highway rehabilitation, and when improving highway safety and reliability.

The Ministry of Environment is addressing current and future pressures on water supply through the **Water Act Modernization** process.

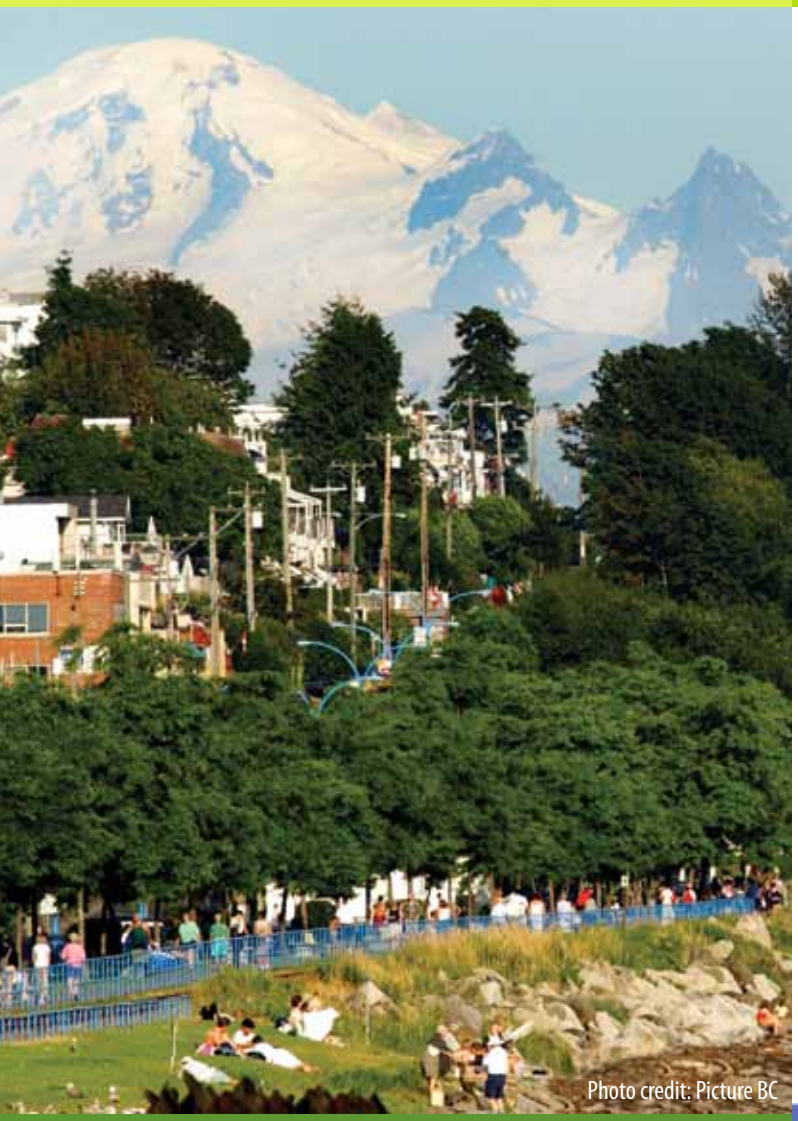


Photo credit: Picture BC

3. Building adaptation approaches for key sectors

British Columbia is using regional climate information to look more closely at how climate change affects key sectors, and to identify possible adaptation actions.

The completed **Climate Change Adaptation Risk and Opportunity Assessment** for the agriculture sector includes recommended actions to help agricultural producers prepare for climate change.

Vulnerabilities, risks, and opportunities have been assessed for **forests and rangelands** at multiple scales, and new policies have been introduced for climatically suitable reforestation.

The provincial mining industry has begun to factor risks from a changing climate into mine site design, operations and closure planning in order to ensure future environmental performance.

Moving Forward

British Columbia has established a solid foundation for adaptation by investing in regional climate science. Decision-makers are starting to use that science to explore the implications of climate change to their business areas, and to identify ways to manage climate-related risk. Successful adaptation means designing new buildings and infrastructure to withstand future extreme weather events, protecting communities from sea level rise and other new hazards, managing forests and other ecosystems so that they are more resilient, considering climate risk in investment and business decisions, and creating financial incentives and policies that promote these and other activities. Adaptation policies, programs, and actions will evolve over time as values, goals, and resources change, and as new information about climate change

PREPARING FOR SEA LEVEL RISE

Sea level along the B.C. coast will continue to rise, with some areas experiencing more sea level rise than others due to geologic factors. To help coastal communities plan, the provincial government has released new guidelines for the construction of protective sea dikes, and for identifying and managing low-lying coastal areas. The guidelines are based on current science and address technical questions related to sea level, dikes, and coastal adaptation.

While in some locations sea dikes may be the only adaptation option, there are other ways that communities can prepare for sea level rise. The City of West Vancouver, for example, has replaced sea walls with structures and plantings that soften wave action on the shoreline. To help communities make informed decisions over time, British Columbia – in partnership with the Atlantic Provinces – has developed a primer of coastal adaptation options and information about related costs.

South Delta - Aerial View. Reinforce and Reclaim Secenario (year 2100). 1.2 metres of sea level rise. One alternative to substantially raising sea dikes is to create offshore barrier islands, which combine with smaller dike upgrades to protect low-lying areas from sea level rise. Image credit: David Flanders, Collaborative for Advanced Landscape Planning, UBC

and its impacts becomes available. Government will continue to pursue the vision that British Columbia will be prepared for and resilient to the impacts of climate change and work with local governments, business, non-government organizations, researchers and other partners to find cost-effective adaptation actions that provide benefits today and for years to come.

West Vancouver's waterfront in 2006 (left) and in 2010 (right) after installation of natural dune grasses and sub-tidal reefs. Photo credit: The District of West Vancouver and Balanced Environmental Services

B.C. COMMUNITIES ARE ADAPTING

- Through its Communities Adapting to Climate Change Initiative (CACCI), the Columbia Basin Trust provided support to Elkford, Kimberley, Castlegar, Rossland, Kaslo and Central Kootenay Regional District Area D to develop adaptation plans.
- Metro Vancouver, Vancouver, North Vancouver, Surrey, Delta, the Capital Regional District, and Victoria are piloting a new adaptation guidebook developed by ICLEI – Canada.
- The regional districts in the Okanagan, through the Okanagan Basin Water Board, are producing a study of water supply and demand that considers climate change.
- Prince George has considered climate change impacts in its Official Community Plan, its Integrated Community Sustainability Plan, and in floodplain management.
- Saanich is implementing its community adaptation plan.
- The Cariboo Regional District, working with the Fraser Basin Council, identified climate change impacts on services, and developed an adaptation action plan.

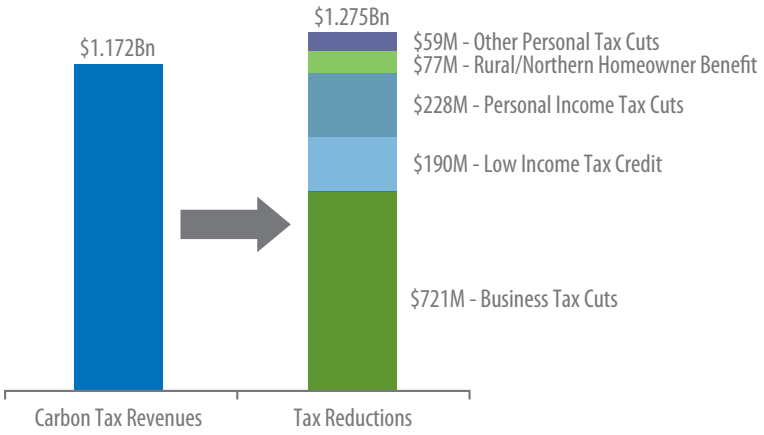
British Columbia's revenue neutral carbon tax

B.C. implemented North America's first broad-based, revenue neutral carbon tax in 2008. The primary objective of the tax is to provide the structural incentive in the economy necessary to encourage greenhouse gas reductions. Where there is a cost to previously free greenhouse gas emissions, businesses and individuals will find economical ways to reduce them.

The carbon tax was introduced at a rate of $10/tonne of carbon dioxide equivalent (CO_2e), with $5/tonne annual increases. This phase-in was designed to allow individuals and businesses time to make changes to reduce their emissions and their carbon tax costs. The rate will make its final scheduled increase on July 1, 2012 to $30/tonne.

The carbon tax is designed to be revenue neutral to government. Every dollar in revenue is recycled back into the economy, with supports for those least able to adapt to a carbon price, and cuts to personal and business taxes that help to increase the efficiency of the economy. The result is that B.C. has lower taxes on things we value, like income, and instead taxes things that we would like to reduce, like GHG emissions.

Projected Total Carbon Tax Revenues and Tax Cuts for 2012/13



Source: BC Budget 2012.

The carbon tax was designed to work with other policies in all sectors. Acting alone, it will not be enough to allow us to reach our greenhouse gas targets. Complementary policies work with the broad structural economic incentive of the carbon tax to encourage early action and the adoption of new technologies, provide supports for behavioural change, and encourage the development of technologies for the longer term.

The carbon tax applies to combustion of all fossil fuel types in B.C., as well as tires and peat. This amounts to coverage of 70 per cent of B.C.'s total GHG emissions. All sectors and activities (e.g. home heating, fuelling a vehicle, generating electricity etc.) are treated the same. The tax does not apply to process, venting, or fugitive emissions. Schools and local governments can receive grants based on the amount of their carbon tax payments, and the greenhouse sector received one-time $7.6 million carbon tax relief in 2012.

Budget 2012 announced a review of the carbon tax that will include all aspects including its impacts – both positive and negative – on B.C.'s economic sectors.

B.C.'S CARBON TAX COSTS AS OF JULY 1, 2012:

61 cents per 100km travelled for an average gasoline car.

To fill the gas tank from empty:

- $2.80 for a compact car
- $3.30 for a mid-sized sedan
- $5.10 for an SUV
- $0 for electric vehicles

To heat the average B.C. home for an average month:

- $6.80 for a natural gas furnace
- $8.40 for an oil furnace
- $0 for electric heating

Families' costs are offset by income tax cuts and other benefits such as the Northern and Rural Homeowner Benefit. Government also provides programs for families to reduce their emissions and save costs including the LiveSmart home retrofit program, the clean energy vehicle incentive program, and Scrap-It BC.

Carbon Pricing: The International Experience

In the past few years, jurisdictions around the world have continued to introduce a variety of carbon pricing systems ranging from the B.C. style carbon tax in Ireland, to the far reaching emissions trading program planned to begin this year in Australia. This progress is expected to continue in the coming years as planned carbon price systems come on-line and countries take action to reach their greenhouse gas targets.

B.C. has been a leader through the implementation of its revenue neutral carbon tax. Numerous jurisdictions have visited B.C. to gain insights into the B.C. carbon tax for the design of their own carbon price systems.

B.C. has also invested in the Western Climate Initiative, and was its first Canadian co-chair. In particular, B.C. contributed significantly to the design of a regional cap and trade system. Quebec and California are currently implementing this system with the first allowance auctions set for 2012. B.C. has indicated that it will not be implementing cap and trade on the same timelines as Quebec and California. The carbon tax will continue to provide a structural incentive in B.C. to reduce GHGs while B.C. monitors how cap and trade is implemented, the effectiveness of the carbon price, and its impact on economic competitiveness before deciding whether B.C. should join this system.

B.C. is continuing to work with other jurisdictions to encourage the expansion of carbon pricing internationally, share lessons and coordinate efforts to achieve greater environmental and economic benefits.

GHG emissions tend to be emitted by activities that also place other costs on society. A secondary effect of pricing carbon is to yield important societal benefits in other areas, as well as quality of life improvements:

- More fuel efficient vehicles emit fewer air contaminants, with better health outcomes such as reduced asthma symptoms.
- Less driving means less congestion, less time spent in traffic, fewer traffic accidents.
- More efficient homes that are less expensive to heat often are more comfortable.
- Improved maintenance, monitoring, processes and equipment at industrial facilities can reduce other pollutants and reduce costs.

Photo credit: Arc Resources

Carbon Pricing Around the World

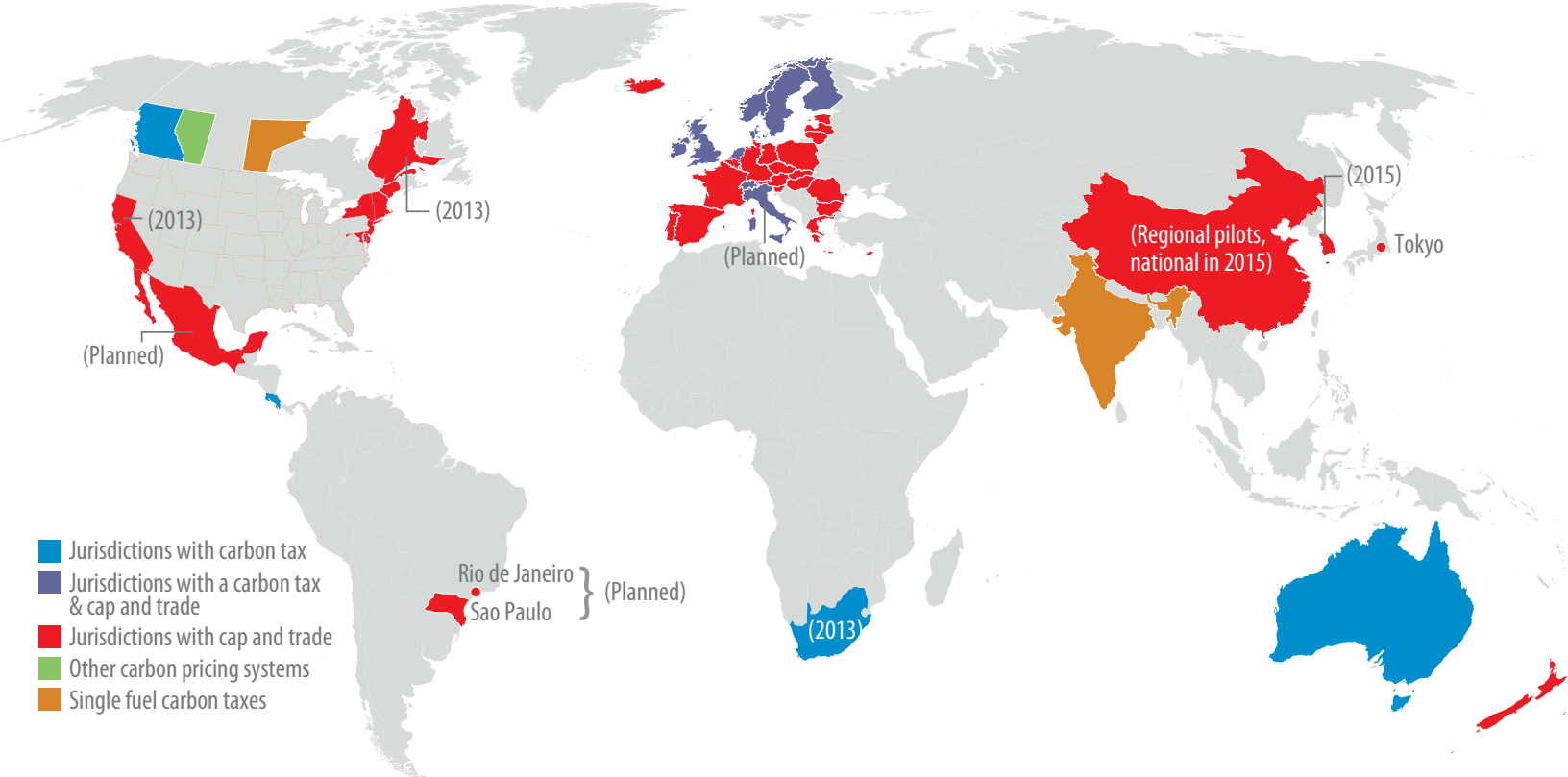


Photo Credit: REM Technologies

CASE STUDY: AIR FUEL RATIO CONTROLLERS IN THE NATURAL GAS SECTOR

An air fuel ratio controller is a B.C.-invented technology that can be applied to increase the efficiency of a compressor by between 10 and 20 per cent. These units reduce emissions by approximately 500 tonnes per unit per year.

Financial models show that placing a price on greenhouse gas emissions is a key part of the financial case for investing in these units. The air fuel ratio controller reduces engine emissions, and therefore the operator's future carbon tax costs.

Cumulatively, these units have saved an estimated 100,000 tonnes of emissions since 2007.

B.C.'s carbon pricing experience

B.C. has implemented North America's first broad based revenue neutral carbon tax and completed the design for the cap and trade system that Quebec and California are currently implementing. B.C. is continuing to assess and tailor policies to meet changing provincial needs, and maintain a leadership position as international action evolves.

We now have four years of experience with a carbon tax. Several factors prevent definitive assessment of its effectiveness at the present time:

- Emissions data are only available up to 2010, covering only two full years of carbon tax implementation.
- Emissions during the period were significantly affected by external factors, notably the global economic recession. It is not yet possible to distinguish emissions reductions caused by policy from those caused by other factors.
- The carbon tax was deliberately implemented at a low rate to avoid high adjustment costs for emitters. These low rates traded some emissions reduction effectiveness in the short term for a smoother transition to higher rates over time, with the intention that greenhouse gas reduction effectiveness would increase as rates increased, and as people had time to adjust their habits and equipment in response to the carbon tax incentive.

There are positive signs that B.C. is experiencing a shift toward less fossil fuel use and lower emissions while continuing to grow its economy. Emissions in B.C. went down by 4.5 per cent from 2007-2010, while GDP growth through 2011 was above the Canadian average. At the same time B.C. is attracting green investment and green technologies with twice the Canadian average adoption of hybrid vehicles, 20 per cent of all Canadian LEED gold building registrations since 2007, and a 48 per cent increase in clean technology industry sales from 2008-10.

The revenue neutral carbon tax covers fossil fuel combustion. B.C.'s fossil fuel sales have decreased since the carbon tax was implemented for all of the main fuel types. The decrease was greater than that experienced by Canada in all cases, and as such cannot be explained by the recession or global oil prices alone. We cannot say definitively that this different behaviour in B.C. fuel consumption is the result of the carbon tax or of B.C.'s suite of climate change policies. However, seeing a divergence between B.C. and the Canadian average behaviour and indicators across so many of the fuels and sectors covered by the carbon tax does suggest that the carbon tax may be starting to provide the broad structural incentive in the economy that was intended.

Complementary policies continue to be essential to target activities that are less responsive to a carbon price or where other forces (e.g. high growth) mean that the current carbon price is not a strong enough incentive. For example, consumption of fuel by the fuel producer (e.g. natural gas used to fire a compressor at a gas plant) is covered by the carbon tax and continued to increase after 2008. These emissions are staying relatively constant over time per unit of natural gas produced.

Each dollar invested in offsets leverages approximately 8 private sector dollars.

British Columbia Carbon Offsets

What is an offset?

Carbon offsets are greenhouse gas reductions that would not have happened under a business-as-usual scenario – that is, if the project producing the reduction had not received an offset credit. A carbon offset represents one tonne less of greenhouse gas in our atmosphere. The offset representing the reduction is created when an organization receives support to invest in real emission-reducing activities. It must be demonstrated that the offset payment was a critical fact in the decision to undertake the project. Carbon offsets are an internationally recognized method for taking responsibility for greenhouse gas emissions.

Offsets in B.C.

In 2008, the B.C. government set the target for all public sector organizations to become carbon neutral, which created awareness and incentives for emission reduction projects. The Province passed *the B.C. Emission Offsets Regulation* and created Pacific Carbon Trust to regulate and develop the provincial offsets market. The Pacific Carbon Trust is a Crown corporation established to deliver high quality B.C.-based offsets and help clients meet their carbon reduction goals.

Offsets purchased by Pacific Carbon Trust are subject to a rigorous third-party double audit process to ensure that projects are real, quantifiable and meet requirements in *the B.C. Emission Offsets Regulation.*

Pacific Carbon Trust supports innovation, new jobs, economic opportunities and technologies in communities across the province. The revenue from offset sales can help make clean technology projects a reality, resulting in economic and social benefits, an economy ready to compete in a carbon-constrained world, and emissions reductions. Since 2007, Pacific Carbon Trust's offset investments have leveraged an estimated $300 million dollars of private sector investment across B.C.

Pacific Carbon Trust's offsets – the Pacific Carbon Standard – is the third largest standard, by value, in North America. This is largely a result of the work to build the policies, business community, and offset supply to meet B.C.'s Carbon Neutral Government requirements. B.C. is now well situated to attract international investors who are purchasing offsets for voluntary and regulatory markets. That means jobs and other economic benefits for British Columbians, and support for cleaner technologies to take root in our province. Additionally, forestry offset projects bring new revenue streams to the B.C. forest sector, while providing other environmental benefits.

The future of B.C. offsets

Pacific Carbon Trust will diversify its portfolio with innovative new B.C.-based projects that support clean initiatives and sustainable economic development both in B.C.'s clean tech and traditional industrial sectors. The corporation will also continue to identify ways to improve its systems and operations to meet the needs of its clients, including the development of an offset advisory panel that will provide advice and guidance on the structure and diversity of Pacific Carbon Trust's offset portfolio.

Kruger Biomass gasification. Photo credit: Nexterra Systems Corp.

CASE STUDY: KRUGER PRODUCTS

Number of tonnes GHGs reduced : 15,000 per year

Kruger installed the first biomass gasification plant in the Canadian pulp and paper industry. Developed by Nexterra Systems Corp., the installation converts local wood waste into clean-burning syngas, providing steam for the tissue mill. Kruger's clean-tech project decreases the mill's carbon emissions by up to 50 per cent annually.

Kruger's project won a 2011 Leadership Award from the Canadian Industry Program for Energy Conservation.

THE INTERNATIONAL OFFSETS MARKET IS DEVELOPING

Around the world, more and more jurisdictions are developing carbon markets. With increasing demand for carbon offsets in existing and new markets such as California, China, South Korea, Australia and other regions, B.C.'s growing expertise in this market will pay dividends in future.

Other Carbon Neutral Organizations:

- 2010 and 2014 Winter Olympics
- Google and Microsoft
- HSBC Bank and VanCity
- FIFA World Cup and NHL 2012 Playoffs
- Harbour Air & Helijet (offer carbon neutral flights)

Carbon Neutral Government: Leading by example

North Island College's Trades Training Centre. Photo credit: North Island College

Becoming carbon neutral

In 2010, B.C. became the first jurisdiction of its size in North America to be carbon neutral for its public sector operations – meeting its annual commitment under the *Greenhouse Gas Reductions Targets Act*. Through 2011, B.C.'s public sector organizations (PSOs) continued to build on that achievement, improving their asset management, investing in emission reduction projects and working to transform how they deliver core public services in a way that conserves energy and ultimately saves money and reduces carbon pollution.

Carbon neutrality is about reducing energy use and achieving net-zero greenhouse gas emissions – recognizing that government shows leadership by demonstrating technology and behaviour changes that reduce carbon pollution. The commitment covers all public sector organizations including government offices, schools, post-secondary institutions, Crown corporations and hospitals. For B.C.'s public sector, achieving carbon neutrality involves measuring, reducing energy use cost-effectively, offsetting, and reporting on actions to reduce emissions from 7,500 buildings, and from fleet vehicles, equipment and paper. Additionally, core government (agencies and ministries) have had carbon neutral business travel since October 2007.

What is being done

Leading by example, public sector employees across B.C. are taking tangible action to:

- Reduce greenhouse gases (and associated energy costs) through innovative capital retrofit projects such as the state-of-the-art energy efficient heating, ventilation and air conditioning system that Royal BC Museum installed in the First People's Gallery in 2011;
- Engage their colleagues and customers in understanding climate risks and taking action to conserve energy through behaviour change such as the Insurance Corporation of British Columbia's Curb the Carbon Program;
- Transform how B.C. delivers public service in a new low-carbon economy such as through the University of Victoria's revolving sustainability fund;
- Promote sustainability education and action programs; and,
- Reduce government's building footprint and travel requirements while saving money and supporting better public sector employee satisfaction through the Leading Workplace Strategy and Tele-presence sites.

Measuring emissions provides the basis for managing energy use and costs. With two years of complete reporting, the public sector has a solid baseline of emissions data to inform energy and asset management decisions. While it is early to identify year over year patterns, when controlling for differences in annual temperatures, these baseline data show a slight downward direction for emissions.

The Government of B.C. is committed to credible carbon neutral policy and continuous improvement of how the program is delivered. Following an engagement with directly impacted stakeholders, the province has committed to providing an annual $5 million carbon neutral capital fund to support energy efficiency in schools, to continuously improve the tools and processes organizations use to measure and report their emission data, and to eliminate the costs of measurement.

Being carbon neutral across the public sector demonstrates climate action leadership and has sustainability and educational benefits across B.C. Many public sector organizations including schools have started environmental education programs for both students and staff, who in turn pass the knowledge and experience back to their families and communities. A number of public sector organizations champion environmental programs such as water conservation, waste reduction, and pesticide reduction initiatives that are out of scope for the purposes of carbon neutral government but that have broader sustainability and climate benefits. Responsibility for carbon pollution is beginning to resonate with the close to two million staff, students or visitors who work at, learn in or use public sector buildings every day.

At George M Dawson Secondary School, in the Haida Gwaii School District, a team of students built a greenhouse using recycled wood from a local dock for plant beds. Photo credit: School District 50

At least **5%** estimated annual energy savings through the Public Sector Energy Conservation Agreement

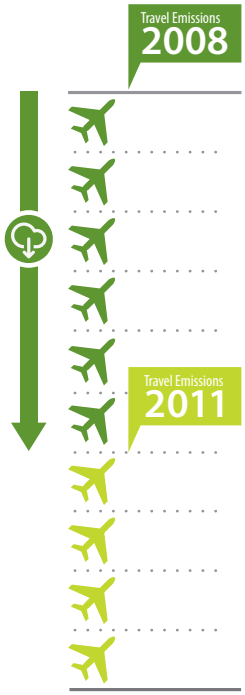
107 LEED Gold projects underway or completed since 2007

64% of all PSOs have performed energy retrofits on existing owned buildings

70% of all PSOs have replaced fleet vehicles with more fuel efficient models since 2009

Moving forward

By taking a leadership position and seeing this commitment through, B.C. continues to demonstrate that energy and resource conservation is achievable, saves money and has co-benefits like cleaner air and a more active population. Through this program, B.C.'s public sector will continue to work towards achieving greater emissions reductions and energy savings year over year, and becoming a catalyst for widespread uptake of alternative energy, sustainable building design and innovative business practices.



Core government achieved a 60 per cent reduction in travel emissions between 2008 and 2011.

- Reductions from behaviour change and the use of technology across core government.
- Remaining emissions not reduced through other measures are reduced through offset purchases at $25/tonne.

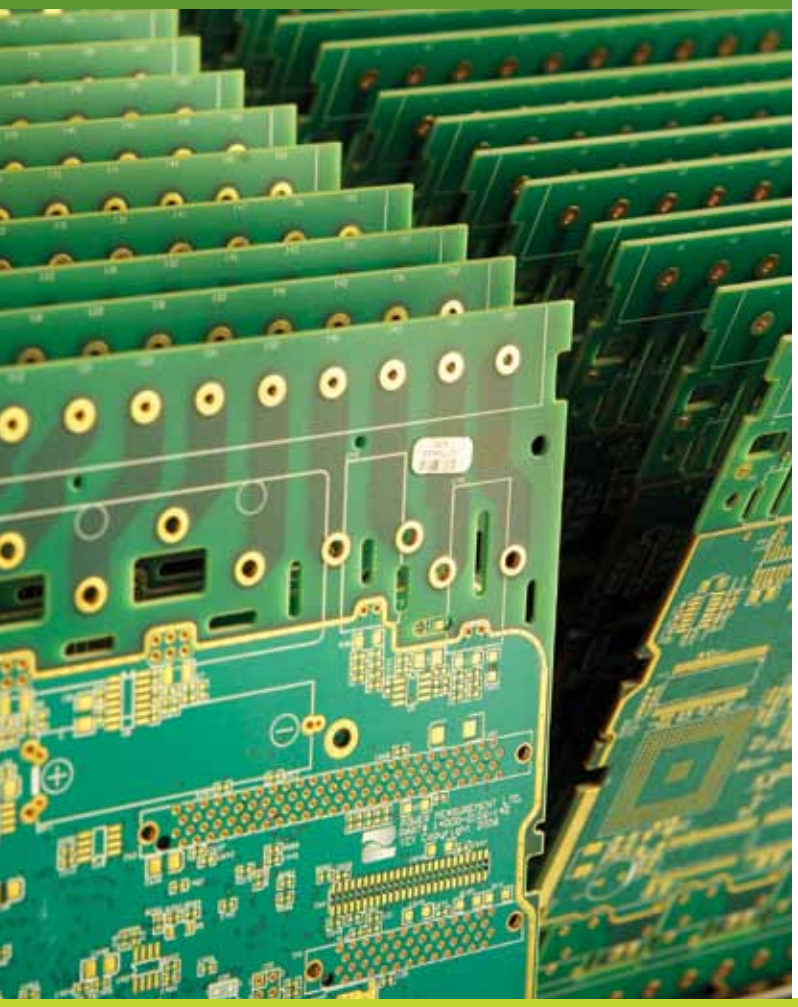
University of British Columbia district hot water system

CASE STUDY: UBC

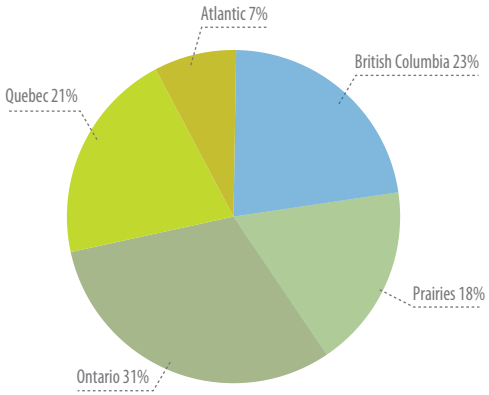
In 2011, UBC completed the first phase of one of the largest steam to hot water conversions in North America. This 9 phase, 5 year, $88 million project will replace aging steam heating infrastructure with a modern hot water district energy system and save the university $4 million a year in operational and energy costs. By converting to hot water the university will avoid approximately $42 million in infrastructure upgrades required for the antiquated steam heating system. UBC was able to develop a business case that outlined the savings potentials and anticipated emissions reductions to transition to a cleaner energy system. This system will enable UBC to meet its ambitious climate targets and provide for research and alternative energy sources to be connected to the UBC grid.

The conversion project has a payback period of almost 25 years, but the lifetime of the system is much longer – it is a major investment that will last 60 to 80 years. The project includes 14 kilometers of insulated piping, 131 energy transfer stations across campus and a 52-megawatt, natural gas-powered hot water peaking plant to be built in 2013. When completed in 2016, the project will reduce UBC's steam system energy use by 24 per cent and GHG emissions by 22 per cent (11,000 tonnes). The first phase, complete as of January 2012, connected 13 buildings and includes waste heat recovery from the new bioenergy facility. The total cost of Phase 1 was $5 million and is estimated to reduce natural gas consumption by 20,000 gigajoules per year.

Driving Innovation



Clean Tech Companies by Region in Canada (%)



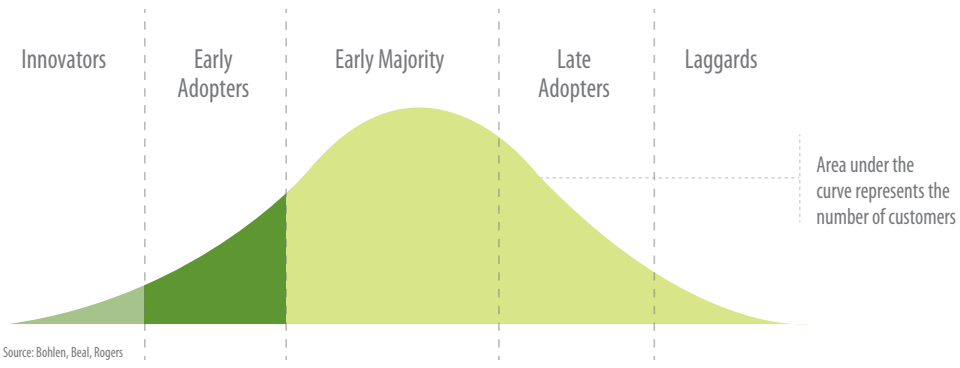
Source: 2011 Canadian Clean Technology Industry Report, Analytica Advisors

Addressing climate change requires a fundamental transformation of B.C.'s economy. This transformation is about innovation: finding new technologies and business practices that drive efficiency, use cleaner forms of energy, and provide different products and services. Strong environmental policies, like B.C.'s revenue neutral carbon tax, challenge industry to reduce its greenhouse gas emissions, but give it the flexibility to be innovative in finding business solutions to achieve environmental outcomes. The challenge for B.C. is to facilitate this process of innovating new solutions, deploying new technologies, and then showcasing them to growing global markets.

Clean technology is at the heart of our green economy, providing options for all sectors to reduce their emissions. B.C.'s clean tech industry is globally competitive and has a strong reputation for excellence. Clean tech is also creating new industries in B.C. This province has solid research and development facilities, a strong institutional knowledge base and modern private sector assets. This supports B.C. in its development of technologies that are transforming B.C.'s foundational industries while creating new ones. From bioenergy innovation to sustainable design practices to green transportation, B.C.'s clean tech cluster can deliver low-carbon solutions.

There were 117,160 direct and 48,840 indirect full-time equivalent green jobs in B.C. in 2008 -- making up 7.1 per cent of British Columbia's total employment. A 2012 KPMG report states that B.C.'s technology sector is the province's 2nd fastest private sector job creator over the previous decade and the 3rd largest contributor to GDP – more than any resource sector. The rate of growth of B.C.'s technology sector is 20% higher than Canada's overall.

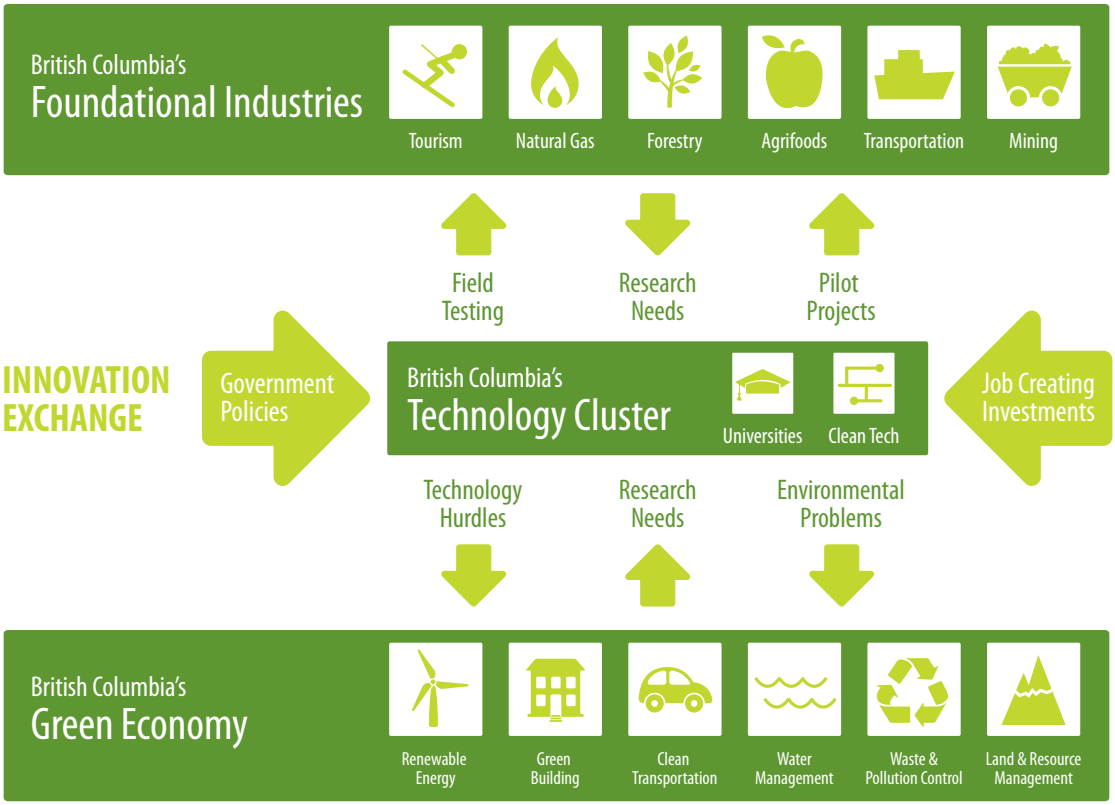
Technology Adoption Lifecycle



Source: Bohlen, Beal, Rogers

TECHNOLOGY ADOPTION

Carbon pricing is an effective policy tool to influence long term capital investment decisions towards lower emission outcomes. However, adoption of new technologies faces its own series of barriers and typically requires supportive public policies in order for these technologies to move past the early adopter phase. By creating a favourable environment to innovate, finance and demonstrate clean technologies, B.C. intends to accelerate the adoption process while developing a reputation internationally as a clean tech hub.



Source: BC Green Economy Strategy

What we are doing

B.C. is focusing on clustering the right educational, governmental and industry groups in areas where there is the most opportunity to develop these new technologies. Doing so will help the public understand the value of clean tech, while giving B.C. businesses a competitive advantage that will help them export their clean tech solutions around the world.

Venture Capital Programs encourage investors to make equity capital investments in strategic areas including clean tech, in exchange for a 30 per cent refundable B.C. income tax credit.

The **Innovative Clean Energy Fund** supports the development of clean power and energy efficiency technologies in the electricity, alternative energy, transportation and oil and gas sectors.

The **B.C. Renaissance Capital Fund** is a Crown corporation that pursues technology investments in four sectors, including clean tech.

The **revenue neutral carbon tax** price signal creates an incentive to reduce fuel consumption, increase fuel efficiency, use cleaner fuels, adopt new clean technologies, and drive invention and innovation. It also creates a favourable tax environment by lowering corporate and other taxes.

The ***Clean Energy Act*** objective to generate 93 per cent of electricity from clean or renewable sources encourages innovators to explore new ways of producing energy that decrease GHG emissions in B.C.

B.C. government leadership in **Carbon Neutral Government** supports innovation. It has demonstrated the associated financial and organizational benefits of using clean technologies to reduce greenhouse emissions, while creating a market for low-GHG goods and services.

The **Public Sector Energy Conservation Agreement** provided funding for energy conservation projects in public sector buildings. It helped foster the development of B.C. clean tech businesses that focus on building energy efficiency and renewable energy.

Government is implementing the **Legislative Committee on the Bio-Economy 's** recommendations to foster the forestry sector's expanded production of bio-products in ways that will expand job opportunities and benefit the environment.

Strong environmental policies including among others the ***Renewable and Low Carbon Fuel Requirements Regulation*** and efficiency-related building code amendments drive innovation in business solutions.

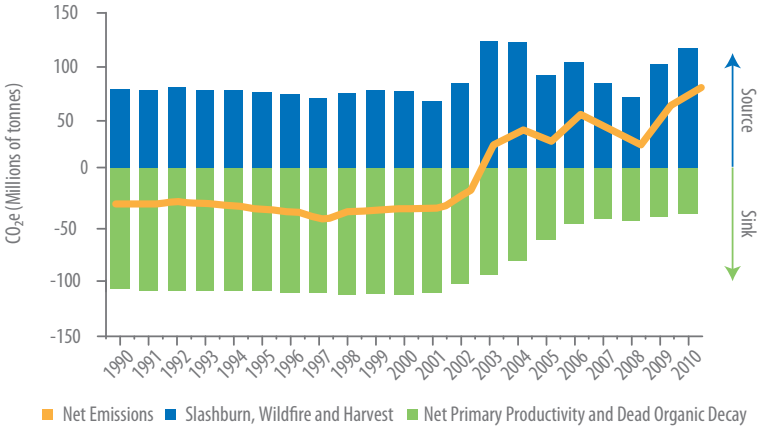
The B.C. government's upcoming Technology Strategy will support and advance innovation across a range of sectors throughout the province.

Moving forward

B.C. is taking strong action on climate change here at home, but success will ultimately require global action to address a global environmental problem. B.C. can play a leadership role internationally, not only in showcasing leading environmental policies but also in being a jurisdiction that is renowned for its ability to innovate, finance and deploy clean technologies. Our natural resource sector can become the foundation for these technologies, as our sectors like mining, forestry, natural gas, and agriculture show how to deliver commodities at higher value with lower environmental impact. B.C. can then position itself to export markets globally as a jurisdiction with leading environmental policies and business solutions to meet them.

Forest sinks as stores of carbon

Forestry Land Use Emissions Sources and Sinks



Vast amounts of carbon are stored and cycled through B.C.'s forests. Forests both take up and store carbon dioxide through growth and release it when they burn or decompose. The mountain pine beetle outbreak, forest fires, and increasing harvesting aimed at retaining timber value from impacted mountain pine beetle stands caused B.C.'s forests to become a net source of greenhouse gases from 2003 onwards.

Currently, net deforestation is included in the B.C. greenhouse gas inventory data totals, while emissions associated with forest land use are reported but not formally included in these totals. The main reason for this is the large annual swings in emissions on forestry lands, which have little to do with land management and policy but rather are due to events like fires and pest infestations, and would distort the accounting of B.C.'s progress to its greenhouse gas targets.

The challenge is for B.C. to find ways to drive good policies and projects that address climate change by improving the quality of our carbon sinks, despite the fact that for good reason these emissions sources are not yet formally counted in greenhouse gas inventory totals.

What's been done

Protocol for the creation of forest carbon offsets in British Columbia (FCOP): Adopted in 2011, this method of accounting for increased carbon storage in forests ensures that forest enhancement projects in B.C. meet the highest domestic and international quality standards. Given the importance of the forested land base in the province, this protocol is a key element in sustaining B.C.'s reputation as a leader in climate action in North America.

Wood in construction: Greater use of wood in construction increases carbon storage in the built environment. The 2009 *Wood First Act* requires wood to be considered as the primary building material in all new publicly-funded buildings. B.C.'s Building Code was amended in 2009 to increase the maximum height for wood-frame residential construction from four to six storeys. The "Tackle Climate Change: Use Wood" campaign is promoting the carbon benefits of wood construction.

Policies that address climate change mitigation and adaptation in B.C.'s forests bring with them a suite of co-benefits that improve biodiversity, cultural heritage resources, recreation resources, soils, forage, fish, and wildlife.

18,000 tonnes of CO_2 removed through afforestation in 2010

52% drop in deforestation emissions from 1990 to 2010

50% of carbon removed from forests through harvesting turned into long-lived forest products like lumber, which sequester carbon

>1,400 tonnes CO_2/hectare stored in a high volume Pacific Maritime ecozone forest

<500 tonnes CO_2/hectare stored in the Boreal Plains ecozone forest

What we are doing

Mitigation through adaptation: In 2008 the Future Forests Ecosystems Scientific Council was established to guide adaptation of B.C.'s forest and range management framework so that it continues to maintain and enhance the resilience and productivity of B.C.'s ecosystems as our climate changes. This sector is unique in that many of the ways to address forest adaptation (e.g. replanting) have direct GHG reduction effects as well. Work is currently underway to find program partners interested in replanting Crown land damaged by wildfires, pine beetle and other factors not related to commercial timber harvesting. Pacific Carbon Trust has indicated its intent to purchase up to 100,000 tonnes of CO_2 emission reductions generated from this project.

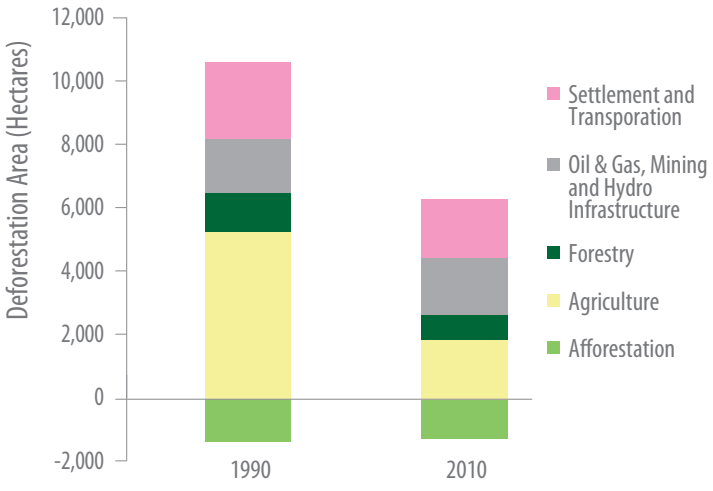
Preparing for change: In 2012, the Ministry of Forests, Lands and Natural Resource Operations released its Forest Stewardship Action Plan for Climate Change Adaptation. The Action Plan sets out short and long term actions aimed at ensuring healthy forests and providing a sustainable renewable resource for our communities now and for future generations.

Science updates: Forest carbon accounting involves complex simulations. Research by the Canadian Forest Service and the Ministry of Forests, Lands and Natural Resource Operations indicates that greenhouse gas emissions from deforestation, harvesting, and wildfire may be overestimated in B.C. Scientific research is occurring to validate and implement the updates in the carbon accounting models.

Moving Forward

B.C. has taken early steps to manage and account GHG flows from forest carbon. These steps will help B.C. to prepare for expected international changes in accounting for forest carbon emissions that would include land use and sinks. Inclusion of these emissions in national and provincial inventories would improve the business case for replanting, conservation and other projects.

Afforestation and Deforestation



Source: Environment Canada 1990-2009 National Inventory Report.

EMISSIONS PATHWAY: NET DEFORESTATION

With 2.9 million tonnes of emissions in 2010, net deforestation (deforestation minus afforestation) represents 5 per cent of B.C.'s total GHG emissions. Deforestation is the permanent change of forest land to non-forest land, while afforestation is the change of non-forest land to forest land. Net deforestation is included in B.C.'s provincial GHG inventory.

Emissions can be controlled in the short term by reducing the amount of area deforested, focussing reductions in areas with larger or faster growing trees, minimizing the footprint of development sites, and/or providing incentives to keep areas forested. Afforestation, such as planting of unused industrial sites, can sequester a substantial amount of carbon dioxide over time while providing co-benefits such as watershed management and green space in urban areas. B.C.'s *Zero Net Deforestation Act* sets out a legal framework that could be implemented to address this issue.

CASE STUDY: TIMBERWEST FOREST CARBON OFFSET PROJECT

Vancouver Island is home to a forest management project that is among the first to use B.C.'s Protocol for the Creation of Forest Carbon Offsets in British Columbia (FCOP), protecting a carbon sink. TimberWest and Pacific Carbon Trust have helped to protect 26,000 hectares of carbon-sequestering old-growth forest and offset 600,000 tonnes of CO_2 which have been validated by a third party.

This project also provides multiple ecosystem benefits by enhancing habitat currently protected for red- or blue-listed species located in the area, including the marbled murrelet, northern goshawk, Vancouver Island marmot and other fauna and flora.

Had this forest not been conserved via the project, it would most likely have been logged or developed. This project is enabled by FCOP's standards, creating a model for others to use and laying the groundwork for B.C.-based offset sales in international markets.

Forest carbon is an increasingly significant component of climate action, and FCOP will ensure that forest carbon offsets developed in B.C. meet domestic and international quality standards. Given the importance of the forested land base in the province, this project is a key element in sustaining B.C.'s reputation as a leader in climate action in North America.

Communities taking action

Photo credit: Picture BC

88 per cent of British Columbians live in urban settings. Many of B.C.'s communities have earned reputations as some of the world's most liveable places. This is, in part, a result of natural assets and recent planning decisions. The challenge currently facing communities is how to maintain this reputation and continue to grow sustainably to protect the very attributes that make them so liveable. Communities of all sizes have an important role to play in sustainability through progressive and innovative approaches to land use, transportation, buildings, and infrastructure.

Local governments have control and influence over a significant percentage of British Columbia's total GHG emissions. By actively applying sustainable land use principles, local governments can help shape the behaviour of all community stakeholders leading to the wise use of resources and making it easier for citizens to adopt a more energy efficient and low carbon lifestyle.

Important sub-national leadership is also underway at the community level to address environmental and energy issues. This leadership is evident in B.C. local governments' commitment to setting GHG reduction targets, measuring emissions and continuing to move forward collaboratively in pursuit of their climate action goals. Within communities, business, NGOs, and individual citizens are, themselves, taking actions that clearly demonstrate their own commitment and leadership on climate change.

Progress to targets and the challenge of leadership: the Climate Action Charter

180 of 189 B.C. local governments have signed onto the Climate Action Charter (the Charter), a partnership between the Province, the Union of B.C. Municipalities and B.C. local governments, demonstrating their shared commitment to take climate action at the community level. As signatories to the Charter, local governments have voluntarily committed to making progress on:

- carbon neutrality;
- measuring their community wide emissions; and
- creating complete, compact and energy efficient communities.

The Charter commitment to carbon neutrality in their corporate operations means that local governments are **measuring** their emissions, identifying strategies and actions to reduce these emissions, **balancing or offseting** the remaining ones, and finally **reporting** on their overall progress. To date, over 100 local governments are actively measuring their corporate energy use and emissions.

Local governments are also able to monitor community-wide emissions with their own Community Energy and Emissions Inventory (CEEI) report. These reports provide a baseline measure for each B.C. community. Most local governments have identified initial policies and actions that they feel will reduce their GHGs, and are now beginning to report out, both corporately and community-wide, on the progress they are making towards their GHG targets.

What's being done

Policy tools: Under the Charter, local governments are implementing a range of climate actions, both in their own corporate operations and community-wide, to reduce their GHG emissions. These actions include using a growing number of tools that encourage:

- alternative development standards and integrated decision making that promotes increased density in selected land use patterns;
- mixed use developments;
- alternative transportation opportunities; and
- processes that support fast-tracking of low impact, affordable development.

Policy innovation in these areas is an important part of how local governments are affecting sustainable outcomes in their communities.

Citizen engagement: Local governments have engaged residents and other community interests to set targets and take action in many ways. Community engagement is a vital part of local government planning and decision making in a variety of both traditional and new planning processes.

Adaptation: Consideration of the future impacts of climate change on communities is a key part of local government land use and infrastructure decision making. By applying an adaptation lens to decisions, including green infrastructure considerations, communities will increase their resiliency to climate-related impacts such as more extreme weather events, sea level rise and wildfires . The British Columbia Government's Living Water Smart plan and the Water Balance Model are two tools that help local governments keep water in mind, factoring water quality, stormwater management and flood protection measures into their neighbourhood plans.

Technology: Local governments are embracing clean technologies and working with partners in other governments, academia, energy utilities and industry to undertake innovative infrastructure initiatives such as integrated resource recovery and district energy systems.

Monitoring and Reporting: Local government and academic partnerships are leading to advances in the use of existing (e.g., CEEI and Census) data to help visualize low carbon futures for communities. This approach helps inform the type and extent of new policies and actions required for local governments to meet their reduction targets.

Communities Moving Forward

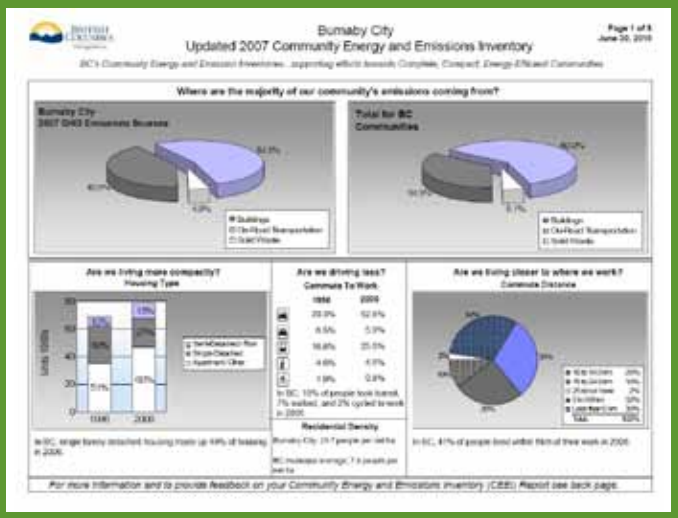
Local governments in British Columbia will be at the forefront of a low carbon economy. Communities are where the citizens of B.C. will experience the shift to a lower carbon future first hand with new innovations like electric vehicle charging stations, wide ranging alternative transportation options, local solutions to increase food supply, greener building design, use of renewables such as solar, wind and biomass, green space and urban forests, and diverse and affordable housing. Forward-thinking decisions will prepare communities to be more resilient as they face the challenges and opportunities presented by climate change.

CLIMATE ACTION UNDERPINS SUSTAINABILITY

The many co-benefits to climate action reinforce other community objectives including: enhanced green space, habitat preservation, cleaner air, water availability, community cohesion, inter-connected green space, recreation opportunities, improved biodiversity, more affordable housing options and increased opportunities for physical exercise.

COMMUNITY ENERGY AND EMISSIONS INVENTORIES (CEEIs)

CEEIs are the first such grouping of all sub-provincial or state local government reports in North America, providing energy consumption and GHG emissions data to support each community's voluntary commitment under the B.C. Climate Action Charter. CEEI reports coincide with the Province's own baseline year of 2007, enabling provincial and community-wide actions to benefit from each other's momentum.



COMMUNITY ENERGY AND EMISSIONS MODELLING (CEEM)

CEEM enables local governments to better understand the energy and GHG implications of future development scenarios for their communities. Such modelling is used explicitly to support the development or review of GHG targets, policies and actions in Official Community Plans, Regional Growth Strategies, Community Energy and Emissions Plans, and Integrated Community Sustainability Plans.

TAKING ACTION IN CORPORATE OPERATIONS

The **Carbon Neutral Kootenays** project is the first multi-regional collaboration of its in kind, involving three Kootenay regional districts, their member municipalities, First Nations and the Columbia Basin Trust.

The **City of Dawson Creek** won a 2011 Community Energy Association award for its Internal Carbon Fund commitment of $100/tonne of GHGs (based on the City's annual corporate greenhouse gas inventory) to support emissions reduction projects.

The **City of Coquitlam** has undertaken a total of 39 energy conservation measures since 2008, reducing annual building GHG emissions by 899 tonnes or approximately 13 per cent of total corporate emissions, while reducing energy costs by $175,000 annually.

The **City of Fernie** achieved major GHG reductions in 2010 as part of its Aquatic Centre energy retrofit, saving $76,000 per year and helping move forward on the City's commitment to become carbon neutral in corporate operations by 2012.

The **Township of Langley's** thermal extraction system at the Aldergrove Water Treatment Plant is an innovative system that extracts 100 per cent renewable energy from groundwater pumped through the water treatment plant to heat and cool their 750 m^2 building.

The **Town of Ladysmith** set the pace in organics recovery in 2006 and 2007 with their award-winning organic curb-side collection program.

The **City of Surrey** is developing an organic waste biofuel processing facility that will produce a fuel-grade renewable natural gas from food and yard waste diverted from landfill. The renewable gas produced will be used as a fuel source for Surrey's compressed natural gas (CNG) fleet of vehicles that collect the organic waste, creating a "closed-loop" system.

TAKING ACTIONS COMMUNITY-WIDE

The **District of Elkford's** Official Community Plan, developed in 2010, was the first in B.C. to incorporate both an integrated Climate Change Adaptation Strategy and a Greenhouse Gas Reduction Strategy.

In 2009, the **City of North Vancouver** expanded its award-winning Lonsdale Energy Corporation district energy system to include more than 50,000 m^2 of residential and institutional space.

A small, northern community, the **District of Houston** has a longstanding commitment to environmental protection and conservation, in particular, the promotion of alternative energy sources such as geothermal, solar and biomass energy.

The **City of Colwood** is undertaking the most significant retrofit program of its kind in Canada to demonstrate whole community change to clean and renewable energy sources, including solar hot water systems and ductless split heat pumps in up to 1,000 of its 6,000 homes, as well as electric vehicle charging infrastructure.

In 2008, **the City of Vancouver's** municipal solid waste recovery system in Delta collected 38,971,000 m^3 of landfill gas; 82 per cent was put to beneficial use, with surplus gas flared. In addition, as part of a multi-faceted approach, the City used social media to actively seek input from its citizens on its Greenest City Action Plan.

The **District of North Cowichan** provides local industry with a property tax exemption for up to 10 years where industry can demonstrate a 25 per cent reduction of GHG emissions as a result of the construction of new improvements that have a value of at least $50,000.

Pacific Institute for Climate Solutions
Knowledge. Insight. Action.

As part of the Climate Action Plan, the B.C. government created a $90 million endowment at B.C.'s four research-intensive universities to undertake solutions oriented research and develop innovative ways to address climate change and climate impacts.

The Institute's main objectives are:

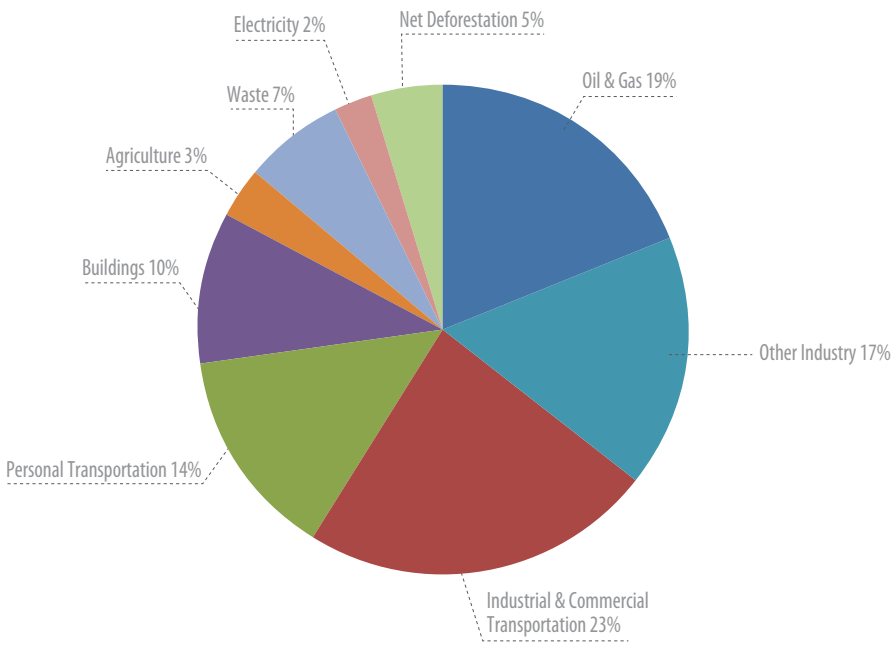
- understanding the magnitude and patterns of climate change and its impacts;
- evaluating the physical, economic and social implications;
- assessing mitigation and adaptation options and developing policy and business solutions;
- evaluating and strengthening educational and capacity-building strategies to address climate change; and
- communicating climate change issues to government, industry and the general public.

Since inception, PICS has become internationally visible, and works with other university, non-government, and government organizations. Nearly three dozen research projects have been funded, and nearly five dozen graduate-student and post-doctoral fellowships have been awarded along with over two dozen internships at various agencies. Multiple White Papers and Briefing Notes for practitioners have been published, and the world's first free, interactive online animated short course on basic climate science ("Climate Insights 101") has been posted on the internet. PICS has also sent expert scientists, economists, and others into the community to interact directly with citizens on climate change issues.

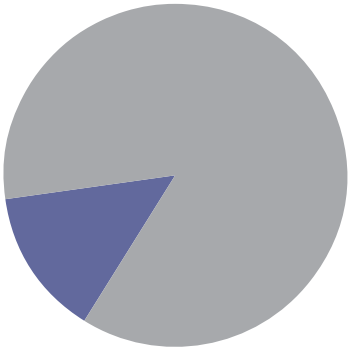
Actions in every sector

Government is taking action to support GHG reductions in each of the Province's major sectors.

B.C. Greenhouse Gas Emissions - 2010
Total: Approx. 62,000 kilotonnes $C0_2e$



Sector Progress: Personal Transportation



Personal vehicles (including passenger cars, motorcycles, and light trucks weighing less than 4.5 tonnes) were responsible for 14 per cent of B.C.'s greenhouse gas emissions in 2010 (or 36 per cent of emissions from the transportation sector). Given that the average passenger vehicle lifespan in B.C. is 13 years, it can take decades to turn over the entire personal vehicle fleet to fully realize the emission reduction potential associated with the more fuel efficient vehicles entering the market today. There are currently 2.6 million personal vehicles licensed in B.C. and 56 per cent of these vehicles are older than 10 years. Challenges in this sector are compounded by the fact that the built environment that sets transportation patterns can have a 100 year time horizon.

What's been done

Vehicle GHG emissions standards: Increasingly stringent federal greenhouse gas emissions standards (aligned with the U.S. Environmental Protection Agency standards) for passenger vehicles and light trucks took effect for the 2011 model year. British Columbia, along with California, played a key role in seeing a national program come to fruition through a coordinated sub-national effort to regulate in this area. The federal standards are expected to achieve a 14 per cent reduction in GHGs relative to 2010 by 2020 in B.C.

Renewable and Low Carbon Fuel Requirements Regulation: This regulation targets a decrease in the carbon intensity of the transportation fuels supplied to the B.C. market by 10 per cent by 2020 (see also Goods Movement Sector).

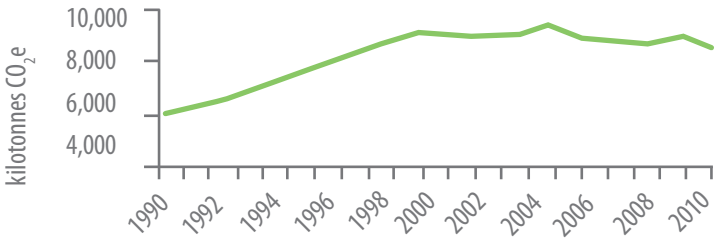
Canada Line: The Canada Line (a rapid transit line connecting downtown Vancouver to the International Airport) was completed in time for the 2010 Winter Olympics as part of a larger $14 billion Transit Plan.

Investments in cycling infrastructure: Over $148 million has been committed to develop and enhance cycling infrastructure in more than 75 communities throughout B.C. between 2001 and 2015. 60,000+ trips are made by bike each day in Vancouver.

Tax incentives: PST exemptions were provided to kick-start the adoption of hybrid and other eligible fuel efficient vehicles from February 2005 to July 2010.

Climate change vulnerability assessments: Assessments have been conducted for select sections of B.C.'s highways.

B.C. Personal Transport Emissions (kilotonnes)



What we are doing

Clean Energy Vehicle Program: A new $14.3 million Clean Energy Vehicle Program (announced in November, 2011) is providing B.C. consumers with incentives for eligible clean energy vehicles (plug-in electric, extended range electric, hydrogen and compressed natural gas) and includes an aggressive charging point deployment project.

Continued investments in transit: As part of the $14 billion Transit Plan, construction on the Evergreen Line is underway, to be in service by summer 2016.

SCRAP-IT BC program enhancements: An additional $2.5 million has been invested in the Scrap-It BC Program to continue to help move older, higher polluting vehicles off the road.

110,000 passengers ride the Canada Line each day

30,000 older vehicles have been taken off B.C. roads through the SCRAP-IT program, leading to a cut of 200,000 tonnes in greenhouse gases

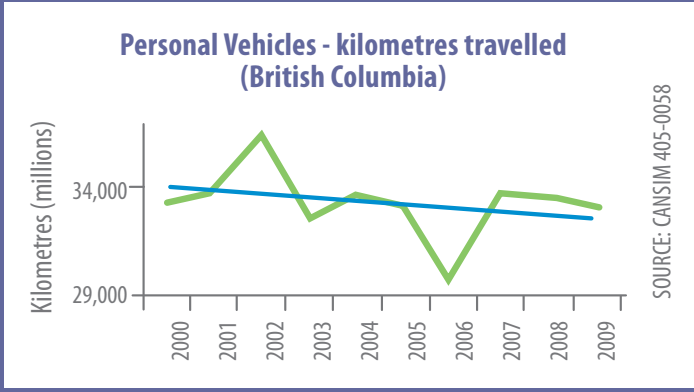
2.1x the national average with respect to hybrid vehicle adoption

0.7% increase in BC Transit passenger trips over the previous year (2011/12 preliminary results)

360 million boardings within the TransLink system in 2011, an increase of over 5% from 2010 (preliminary results)

Moving forward

Continued improvements in fuel efficiency, reducing per-capita vehicle kilometres traveled and lowering the carbon intensity of transportation fuels (including electrification) will be critical in further reducing emissions from personal transportation. Preliminary analysis has shown that 1 million electric vehicles could be on B.C.'s roads by 2030, an ambitious but achievable goal. It will be important to continue to develop the infrastructure to support this market transformation. Continued work with local governments and other community partners to create complete, compact, mixed use, connected communities, along with ongoing investments in public transit, will be key to shifting people to more sustainable transportation options.



Emissions Pathway: Personal Vehicles

GHG emissions from vehicles are determined by three factors: fuel efficiency per kilometre, carbon content of fuel and total distance driven. GHG emissions standards adopted by Canada and the United States are expected by themselves to decrease total personal vehicle emissions in B.C. by about 6 per cent by 2016 relative to 2010. B.C.'s *Renewable and Low Carbon Fuel Requirements Regulation* is expected to reduce B.C. vehicle emissions by a further 3.5 per cent by 2016. The current downward trend in total distance traveled will result in a sizable GHG reduction but an even greater rate of reduction will likely be needed for B.C. to meet its 2016 and subsequent targets.

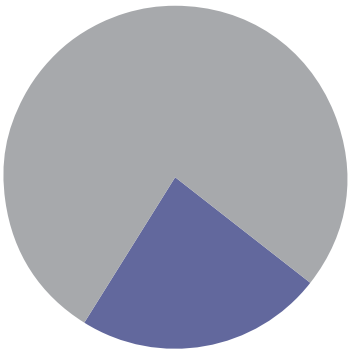
Although standards have been set for fuel efficiency and carbon content of B.C. fuels, distance travelled is determined by a complex set of variables. Analysts believe that demographic factors and individual time limitations are important factors for the downward trend in total distance travelled in the U.S. Urban configurations, transit and other transportation alternatives, and the price of fuel are other key factors.

CASE STUDY: MOVING PEOPLE – 2010 OLYMPICS

The 2010 Olympics gave Metro Vancouver a look at the probable transportation scenario 30 years into the future, with strict restrictions on road use in downtown Vancouver and more space given over to people and non-motorized private transportation. TravelSmart thinking during the Games helped people consider other ways of getting around, without necessarily using single-occupant vehicles or public transit during rush hours. Methods such as teleworking, car sharing, ridesharing and even altering commuting patterns to avoid the "peak of the peak" periods also gained popularity, putting the region on course to achieve the goal of reducing the percentage of "driver-only" trips to less than 50 by 2040. Overall, the 2010 Winter Olympics saw the Canada Line's ridership increase 118 per cent to an average of 228,190 per day for 17 days, with a single-day record of 287,400 on February 19, 2010.

Actions in personal transportation and goods movement that result in cleaner, more efficient vehicles improve health outcomes as a result of fewer smog forming pollutants, and bring cost savings as less money is spent on fuel. Reductions in overall kilometres travelled reduce vehicle collisions (and insurance claims). More compact communities and efficient transportation networks result in less time spent commuting.

Sector Progress: Goods movement, aviation, rail, marine & off road transportation



Goods movement (via heavy duty vehicles, marine, air, and rail), off-road vehicles (including road building, construction, logging, mining, agriculture tractors, ATVs and snowmobiles), personal air, marine and rail travel, and public transit accounted for 23 per cent of provincial greenhouse gas emissions in 2010, making this sub-sector the most significant source of provincial emissions. The transport of goods is fundamental to B.C.'s economy – approximately $30 billion in exports were shipped by rail, ship, or trucks from B.C. in 2010. As the vehicles in this subsector tend to have even greater longevity than personal vehicles it is important to make smart decisions in capital investments in this sector.

What's been done

Renewable and Low Carbon Fuel Requirements Regulation:
This is the most comprehensive and innovative carbon and alternative fuel related regulation in Canada. Fuel suppliers are required to decrease the carbon intensity of the transportation fuels supplied to the B.C. market by 10 per cent by 2020, and include a minimum renewable content in fuels supplied.

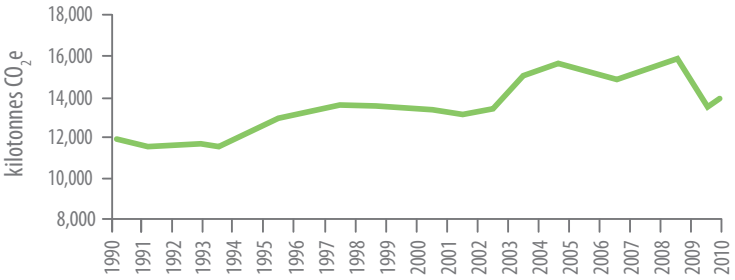
Weight exemptions: Regulatory amendments that allow the use of long-combination vehicles (trucks with two trailers) on designated highways, provide a weight exemption up to a maximum of 225 kilograms for vehicles carrying an auxiliary power unit, and expand the divisible load permit program result in less truck traffic on our roads and lower GHG emissions.

Port & truck stop electrification: B.C. has invested in clean technology at truck stops, ports and airports. The Port of Prince Rupert was the first port in Canada to offer shore power for container ships.

Pacific Gateway Program: The Gateway Program has improved the movement of goods and people with efficient transportation choices. The program has also helped reduce idling, improve air quality and reduce emissions.

Weigh2GoBC program: This $4.2 million program uses electronic screening to allow B.C.-based commercial carriers to bypass inspection stations along Highways 1, 5, and 97, accelerates the flow of goods through the province, saves carriers money, and reduces emissions (~166,800 kilograms GHG reduction between October 2009 and May 2012).

B.C. Industrial/Commercial Transport Emissions (kilotonnes)



What we are doing

Greenhouse Gas Reduction (Clean Energy) Regulation: This new regulation allows utility companies to deliver natural gas transportation programs including incentives for purchase of natural gas vehicles (buses, trucks, ferries); build, own and operate natural gas fuelling facilities; and provide training and upgrades to natural gas maintenance facilities.

Carbon Offset Aggregation Cooperative: The B.C. government provided $2 million in funding for COAC (see Case Study).

National heavy duty GHG emissions regulation: B.C. is working with Environment Canada to develop GHG emissions standards for heavy duty vehicles. These standards will align with U.S. EPA standards, and take effect for the 2014 model year.

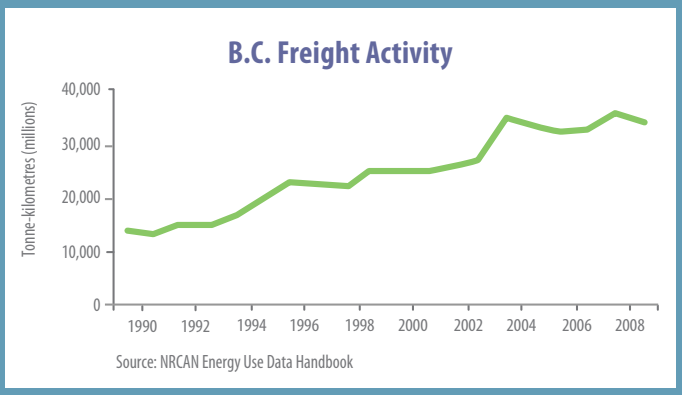
419,000 tonnes avoided emissions in 2010 through the *Renewable and Low Carbon Fuel Requirements Regulation*

55,000 tonnes per year expected GHG reductions from the Carbon Offset Aggregation Cooperative

37,000 tonnes of greenhouse gas emissions offset by Harbour Air since 2007

Moving forward

Additional efforts are needed in moving towards a seamless and efficient transportation network where products the world needs get to market and individuals have the ability to get from one destination to another with minimal impact on the environment. Smarter fuel choices, improvements in vehicle efficiency, maximizing the efficiency of the entire goods movement chain (including intermodal efficiencies), port electrification and strategic infrastructure investments will be key in realizing the full emission reduction potential in this large and diverse sector. Specific efforts will also be needed to address emissions from the off road, marine, rail and aviation sectors. Although the revenue neutral carbon tax and the *Renewable and Low Carbon Fuel Requirements Regulation* provide basic policy coverage in these areas, additional opportunities including fuel switching and retrofitting will further help drive down emissions from these areas.



Emissions Pathway: Goods Movement

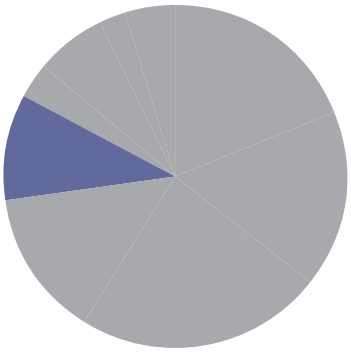
GHG emissions from heavy duty trucks are among the largest and fastest growing sources of emissions in British Columbia comprising 11 per cent of B.C.'s total emissions inventory in 2010 (increasing from 8 per cent in 1990). Demand for on road freight transportation has been rising steadily for the past two decades in B.C. Freight activity (a measure of transporting one tonne of goods one kilometre) more than doubled for the trucking sector between 1990 and 2008. The reasons for this can be attributed to a combination of factors. First, there are simply more goods being shipped over longer distances to service a growing and more affluent population. Second, many goods that used to be shipped via rail are now being shipped by truck. Finally, many warehouses operate on a 'just in time' delivery system, meaning more frequent trips by trucks (often not full to capacity, and often making the return trip empty). Increasing the efficiency of the overall freight system will be an important factor in ensuring that gains made through more stringent emissions and fuel standards are not negated by increasing freight activity.

Photo credit: COAC

CASE STUDY: CARBON OFFSET AGGREGATION COOPERATIVE

The Carbon Offset Aggregation Cooperative (COAC) was launched in 2011 to assist its members in reducing fuel consumption, and selling the resultant carbon offsets under a first-of-its-kind in the world, verified carbon offset protocol. The existing COAC membership represents over 55,000,000 litres of diesel usage per year. With an expected 10 per cent fuel economy improvement achieved through retrofits and driver training, the expected emission reduction is 13,400 tonnes – increasing to 55,000 tonnes per year as membership expands. Members not only have access to low interest funding to install fuel saving devices on their vehicles and equipment, they can also access training in fuel efficient operations – vehicle operators can significantly improve fuel efficiency through changes in their driving habits.

Sector Progress: Buildings



B.C.'s buildings produce 11 per cent of the province's GHG emissions. Since 66 per cent of the 2050 building stock is already built, policies that drive energy retrofits of existing buildings will be crucial. Because buildings built today will stand for decades, new building designs need to strive for the lowest emissions possible. Higher density construction is also important – apartments produce significantly lower emissions per household than single detached homes on average.

What's been done

LiveSmart BC Efficiency Incentive Program: This program for homes ($95 million over five years) provides rebates for energy efficiency upgrades which reduce energy costs and emissions.

LiveSmart for Small Business: LiveSmart BC has assisted over 8,000 small businesses to save energy with free energy advice, free lighting installation and energy efficient product rebates.

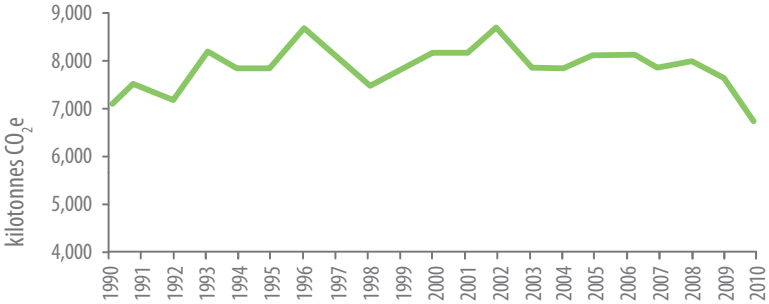
Building Code amendments: B.C. continues to advance green building. A 2011 amendment requires high water efficiency toilets in new residential construction, in addition to a new regulation allowing local governments to require new single family homes to be built "solar hot water ready."

Increased density: The Province has provided local governments with new tools to foster small lot development with low environmental impact.

Public sector LEED Gold requirement: Since 2007, Government has required that all new public sector buildings target LEED Gold certification.

Energy efficiency regulations: *New Energy Efficiency Act* standards are in place for water heaters, furnaces, boilers, lighting and motors. British Columbia is chairing the Pacific Coast Collaborative project on developing harmonized standards with California, Oregon and Washington State.

B.C. Buildings Emissions (kilotonnes)



What we are doing

On-bill utility financing (encompassing programs such as pay-as-you-save): The government is developing a regulation under the *Clean Energy Act* to establish a financing model that allows home or building owners to undertake energy efficiency retrofits with no upfront payment, and to pay some or all of the costs over time out of savings on their utility bill. Payment responsibility can be transferred to new building occupants or owners when the first borrower moves away.

Building Code updates: B.C. is considering harmonization with national proposals for increased energy efficiency for both large, complex buildings and housing/small buildings.

Energy and Water Efficiency Act: This proposed *Act* would expand energy efficiency standards to include systems and water efficiency, building upon the existing legislation focused on individual products. It would also set administrative penalties to ensure manufacturers, distributors and retailers comply with energy performance standards. Finally the *Act* would enable industrial businesses to compare their own energy efficiency against a sectoral baseline, driving innovation and cost savings.

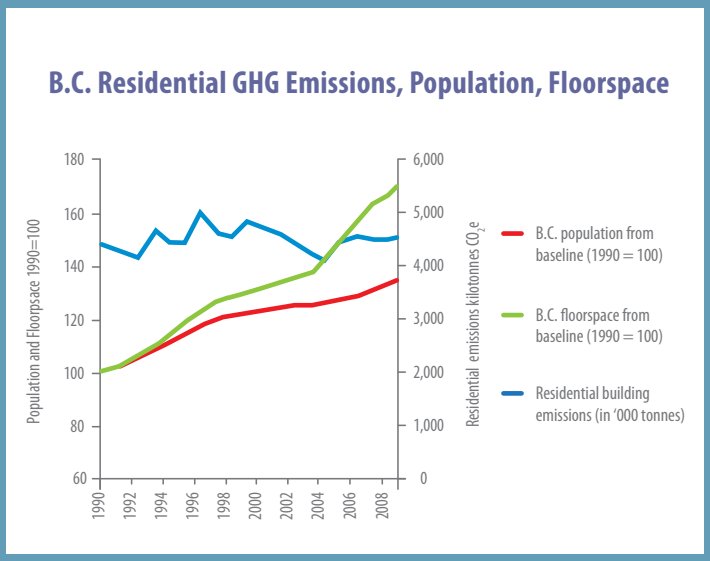
Carbon Neutral Government: B.C.'s Carbon Neutral Government commitment incents the deployment of clean, energy efficient technologies in public sector buildings, and has led to exploring the use of such buildings as district energy "anchors" that can help build community energy systems.

Moving Forward

Working together, by 2050 B.C.'s building stock can achieve world-class energy efficiency, with new buildings as close to carbon neutral as technology and economics allow, and with energy efficiency retrofits of existing buildings supported through financing, incentives and regulations. The sector can also achieve energy savings through increased efforts to reuse and recycle older buildings in place of demolition. Buildings in B.C. will need to be designed for extreme events and future climate, reducing maintenance costs over their lifetime.

>100,000 households have taken advantage of the LiveSmart BC Energy Efficiency Incentive Program

6,900-11,500 estimated jobs created in B.C. communities because of LiveSmart BC retrofits



Emissions Pathway: Residential Buildings

Emissions from residential buildings have been relatively stable over twenty years. Building emissions are affected by population, the size of homes, the type of energy used (e.g., gas or electric) and the efficiency of the home itself.

Population has grown and floor space has grown at an even faster rate. The stability in emissions shows that there has been an efficiency increase, but not enough to reduce emissions.

Because of increasing population and floor space, and the lag time in the effects of efficiency standards for new homes, this sector faces challenges in achieving deeper reductions in the near term. Actions taken today will make an important contribution toward B.C.'s longer term targets.

In order to continue progress towards the 2050 target, B.C. will need to:

- Address the challenge of increasing floor space (communities' current focus on creating density and affordable housing will target this over time);
- Improve the efficiency of existing buildings with targeted measures, incentives and financing;
- Improve the efficiency of new homes through building code improvements; and,
- Address the carbon intensity of B.C.'s home energy usage.

Green building practices can reduce occupants' energy consumption and increase their comfort and health. They also reduce costs for energy and water use, waste disposal and maintenance, while increasing property values.

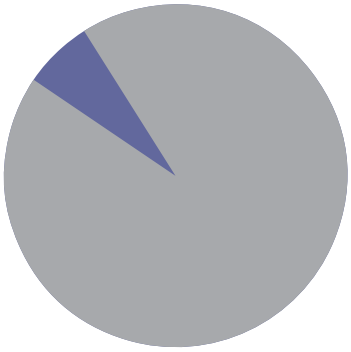
CASE STUDY: UNIVERCITY DAYCARE

The UniverCity Childcare Centre at Simon Fraser University is the first daycare worldwide to meet the Living Building Challenge™ — the world's most ambitious green building rating system. The facility will:

- Generate as much energy as it uses;
- Recycle or collect as much water as it consumes;
- Be free of toxic materials; and,
- Obtain the majority of its materials within a 500 kilometre radius.

The facility cost 15 to 20 per cent less to build than conventional childcare facilities currently being built in the region.

Sector Progress: Waste



B.C.'s waste sector produced 4.1 million tonnes of GHGs in 2010 (6.6 per cent of B.C.'s total) with 3.87 million tonnes from solid waste disposal, 0.16 million tonnes from wastewater handling, and 0.08 million tonnes from waste incineration. Approximately two thirds of landfill waste emissions are from municipal sources; the remainder are from industrial wood waste. Landfill waste emissions come not only from current waste production but from legacy waste created over the last 100 years.

The 35 largest landfills account for more than 90 per cent of all disposed municipal solid waste in B.C., and emit approximately 90 per cent of the solid waste disposal emissions. Methane emitted from the anaerobic decomposition of organic matter in landfills (e.g., food scraps, yard waste, paper) is 21 times more potent a greenhouse gas than CO_2. B.C. currently diverts only 35 per cent of its waste, and a significant amount of the waste at landfills consists of recyclable and compostable material.

What has been done

B.C. is addressing waste emissions through waste diversion (recycling and composting) and methane capture at landfills.

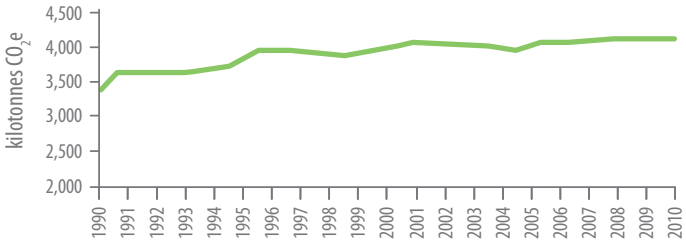
B.C.'s *Recycling Regulation* requires producers to manage the collection and recycling of specific products, including beverage containers, paint, lead acid batteries, tires, household hazardous waste, electronic equipment and large appliances. B.C.'s 2009 *Guide to Integrated Resource Recovery* provides guidance to local governments on maximizing the recovery of value from waste resources.

B.C.'s 2002 *Organic Matter Recycling Regulation* governs the production, quality and land application of certain types of organic matter to protect water and soil quality and foster the beneficial usage of organic material.

The Household Organic Waste Composting Project Profile created by the Green Communities Committee enables local governments to use the GHG reductions from waste diversion projects to balance their corporate emissions.

B.C. has identified opportunities to either mine the **wood waste in landfills** for use in bioenergy facilities or capture and beneficially use the methane released. Because of the use of wood waste for bioenergy production, very little wood waste is currently being deposited in landfills.

B.C. Waste Emissions (kilotonnes)



What we are doing

B.C.'s 2009 *Landfill Gas Management Regulation* requires the province's larger municipal solid waste landfills to assess their methane emissions. Those over the threshold of 1000 tonnes of methane emitted annually must install an approved landfill gas capture system with a 75 per cent capture rate target in 2016.

Under B.C.'s ***Recycling Regulation,*** producers of packaging and printed paper will be required to implement a recycling program for these products by May 2014.

Government is developing a **waste sector offset protocol** that will provide guidance to account for, report and verify GHG emission reductions associated with the diversion of eligible organic waste from anaerobic landfills to other eligible end diversion methods.

200,000 tonnes of methane diverted annually from Vancouver landfill in 2010

Almost **1 Million** British Columbians have access to curb-side organic pick-up

Moving Forward

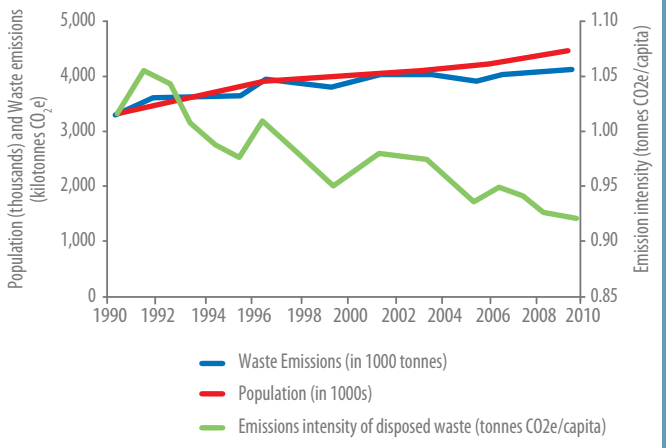
B.C. will need to continue its efforts to reduce waste and extract as much value as possible through recycling and recovering energy from residual waste materials. Methane capture will be critical to reducing GHG emissions from legacy waste in existing landfills.

Seven35 townhome project. Photo credit: www.ArchitecturalPhotographer.com

CASE STUDY: SEVEN35 TOWNHOMES

Seven35 is a LEED Platinum collection of sixty stacked urban townhomes developed by Adera Development. It has a sewage heat recovery system – the first private wastewater heat recovery system in North America. It can produce up to 120,000 British Thermal Units of heat per hour, reducing annual GHG emissions by 150 tonnes.

B.C. Waste Emissions and Population



Emissions Pathway: Waste

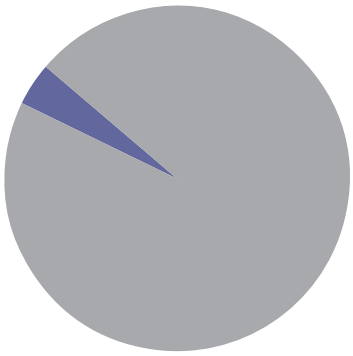
Emissions from the waste sector have increased moderately since 1990. Waste emissions are affected by factors like population, average waste production, level of organic and recyclable waste diversion and landfill emission capture rates.

Waste diversion has increased by 15 per cent per capita. However, B.C.'s population has been steadily increasing and total waste generated per capita has also increased slightly. As a result, the increases in waste diversion have not been enough to stop the growth in waste disposal in landfills.

B.C.'s landfills have made progress in the capture (and usage) of methane in landfills, reducing the emissions intensity of each tonne of waste at the landfill. The province has implemented a 75 per cent methane capture target at its largest landfills starting in 2016. This along with increased efforts to reduce and divert waste will be required to achieve desired emission reduction levels.

Since the B.C. government started requiring local governments to manage municipal solid waste and certain producers to manage their post-consumer product waste, recyclable materials and valuable resources have been diverted from our landfills. This has created additional jobs, extended the lifespan of landfills, reduced pressures on natural resources and improved air and soil quality.

Sector Progress: Agriculture



In 2010, B.C.'s agriculture sector produced 3.3 per cent of the province's GHG emissions. These emissions arise from enteric fermentation, manure management and agricultural soils. (Fuel usage emissions are included in the transport sector.) The recent downward trend in emissions was caused primarily by smaller cattle herd sizes, and is likely to reverse as herd sizes recover.

Most of B.C.'s agricultural emissions come from small sources dispersed across the province. Making significant emissions reductions would require a large number of small producers to make changes in practices and new investments in energy efficiency and/or renewable energy systems.

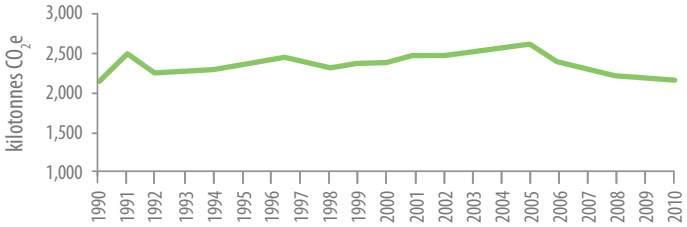
What's been done

Building awareness and improved energy management: The B.C. Agriculture and Food Climate Action Initiative developed a farm energy efficiency assessment and screening tool that was incorporated into the Ministry of Agriculture's Beneficial Management Practices program. As part of this process, 47 farm energy assessments were conducted across the province to assist producers with evaluating and improving energy efficiency. Funding was received through Growing Forward, a federal-provincial-territorial initiative.

Anaerobic digestion: The B.C. government and Growing Forward helped fund a Feasibility and Economic Benchmarking Study for anaerobic digestion to raise awareness. Two anaerobic digesters have already been constructed on B.C. farms, and two more are expected to begin construction later this year as a result of the study. The B.C. Agriculture Council launched Cowpower, which incents construction of new anaerobic digesters by enabling electricity consumers to pay into a fund to support such construction.

Renewable Energy Feasibility Studies: The Ministry of Agriculture, through Growing Forward, in conjunction with the B.C. Agriculture Council, is fostering the mobilization of renewable technologies at appropriate B.C. farms by funding feasibility studies for wind, solar thermal and geo-exchange technologies.

B.C. Agriculture Emissions (kilotonnes)



What we are doing

Greenhouse Offset Protocol: The Government of B.C. is currently developing a B.C. Greenhouse Offset Protocol to guide the design, development, quantification and verification of offsets in the B.C. greenhouse sector.

FortisBC biogas sales: Fortis BC is facilitating the sale of agricultural biogas from Fraser Valley Biogas with the potential of 50,000 gigajoules annually.

Carbon tax relief for greenhouse sector: In 2012, the B.C. government provided greenhouse vegetable and floriculture growers with one-time carbon tax relief of $7.6 million to allow producers to focus on maintaining their competitive edge and building B.C.'s half billion dollar-a-year greenhouse industry.

Farm energy advisor: With funding through LiveSmart BC, the B.C. Agriculture and Food Climate Action Initiative has put in place an advisor to assist farmers with identifying and implementing energy savings opportunities.

Environmental Farm Plan Program: The Ministry of Agriculture has incorporated educational materials related to greenhouse gas reduction and climate change adaptation into the environmental risk assessment program offered to producers throughout the province. Through Growing Forward, incentives are being offered to encourage adoption of these beneficial management practices.

Agroforestry pilot: The Ministry of Agriculture, through Growing Forward, is partnering with provincial and federal agencies, local government and industry to implement a silvopasture pilot. The project looks at the integration of trees, forages, and livestock – studying potential productivity gains, economic costs and benefits, carbon sequestration, and effectiveness in drawing livestock away from riparian habitats.

47 energy assessments made on B.C. farms to demonstrate ways to reduce energy usage and emissions, and save money

28,200 tonnes of GHG reductions are produced annually through Pacific Carbon Trust offsets from five offset projects in the BC greenhouse sector for thermal curtains and fuel switching

Moving Forward

B.C.'s agriculture sector will continue to address climate change into the future with both mitigation and adaptation actions. Voluntary emission reductions will be achieved through knowledge sharing, offsets development and technical and financial support for emission reductions. On-farm adaptation practices will be shared and regional climate adaptation strategies will be developed with producers and local governments. The Ministry of Agriculture and other agencies will integrate climate adaption into key business lines.

CASE STUDY: SUNSELECT GREENHOUSES

Most vegetable greenhouses in B.C. use large volumes of natural gas for heating and CO_2 enhancement. SunSelect[1]'s greenhouses in Delta and Aldergrove have switched from natural gas to waste biomass for heat. In Delta, SunSelect developed and now uses innovative new technology to capture up to 5 tonnes/hour of CO_2 from their waste biomass combustion process to use inside the greenhouse as a carbon friendly alternative to natural gas produced CO_2. The captured CO_2 is delivered directly to greenhouse fruits and vegetables to enhance their growth in the most natural and sustainable way.

The $5 million system was partially funded by the Government of British Columbia's Innovative Clean Energy Fund and the Government of Canada's Sustainable Development Technology Fund.

CASE STUDY: BC AGRICULTURE ADAPTATION RISK AND OPPORTUNITY ASSESSMENTS

In 2012, the BC Agriculture Council's Climate Action Initiative completed a series of ground-breaking adaptation risk and opportunity assessments for B.C. The assessments gathered perspectives from agricultural producers and specialists in five regions on the potential impacts shown by climate projections and the capacity to adapt to associated risks and opportunities.

The reports identified approaches, tools and resources required to better support adaptation. Key findings include:

- For each region and commodity group involved, climate change will increase the complexity of managing farms.
- Climate projections of particular concern to producers include increased variability, shifts in precipitation patterns (increased flooding and drought), and extreme weather events.
- Potential opportunities for enhanced production (such as warmer conditions) will also come with costs and risks.
- Supporting adaptation will involve new approaches to policies, planning and decision-making at all levels.

The reports are available at www.bcagclimateaction.ca

Implementing emission reduction strategies can lower farm energy costs, diversify revenue streams from the sale of offsets or renewable energy, improve nutrient recovery through anaerobic digestion, and reduce vulnerability to fuel cost fluctuations. Sustainable agricultural practices that reduce greenhouse gases often go hand-in-hand with those that improve soil health, enhance water management and quality, and reduce vulnerability to climate impacts.

Sector Progress: Industry


Photo credit: Picture BC

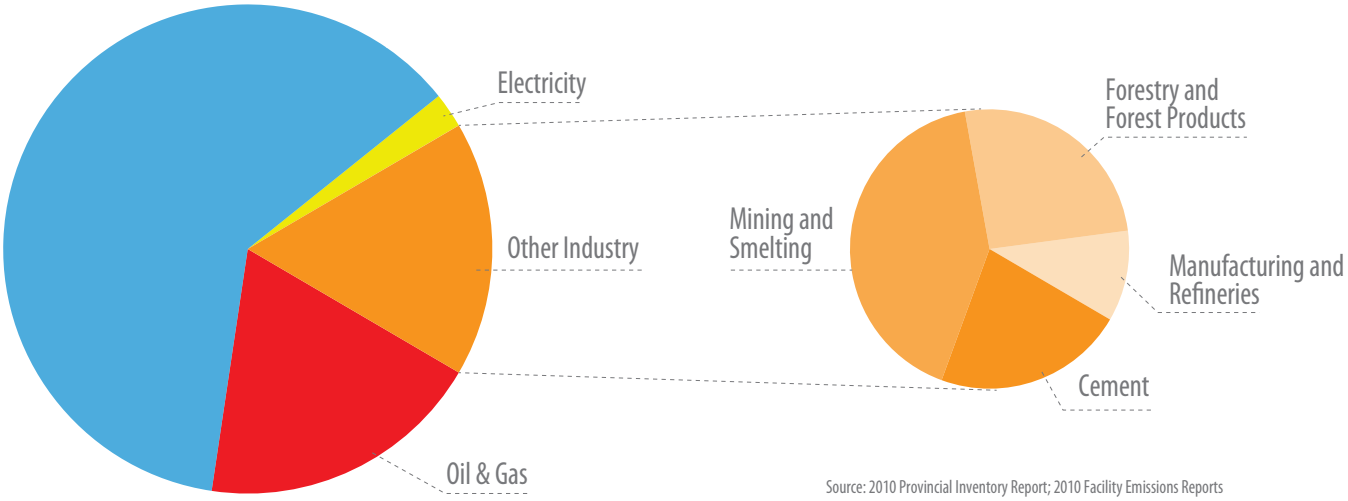
B.C. industries are important economic drivers, providing employment, revenues, products and resources to local and international markets. Industrial production comprises one-third of B.C.'s greenhouse gas emissions.

B.C. is pursuing policies that will help companies save money while driving GHG emissions down, and that provide the cost and regulatory certainty that businesses require in order to plan long term investments.

Industrial emissions come primarily from the oil and gas, electricity, cement, smelting, mining, manufacturing, and forestry and forest products sectors. Emissions have been increasing over time in the oil and gas sector, but emissions from the other industry sectors, taken together, have dropped to roughly their 1990 levels after peaking in 2000.

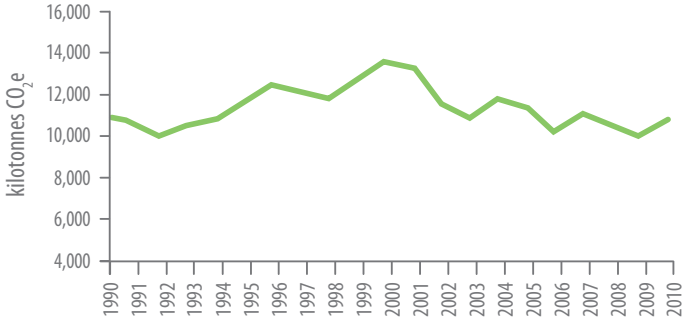
Industrial emission sources are significant. The challenge is to find ways to maintain competitiveness while pursuing greater energy efficiency, technology adoption and innovation. This approach can help prevent shifting industrial production to jurisdictions with fewer climate policies, where higher emissions would continue contributing to climate change. What is needed are policies that will help B.C. industry achieve clean, more efficient production.

B.C. 2012 Emissions by Sector



Source: 2010 Provincial Inventory Report; 2010 Facility Emissions Reports

Total B.C. Industry Emissions Excluding Oil and Gas and Electricity Generation (kilotonnes)



What we're doing across industry

The revenue neutral carbon tax applies to all industry sectors. The carbon tax covers emissions from fossil fuel combustion, providing an incentive to reduce emissions. The carbon tax increases to $30/tonne of GHGs on July 1, 2012. The proceeds from the carbon tax are applied to personal and corporate tax reductions.

The Innovative Clean Energy Fund supports the development of new sources of clean energy and technologies that address environmental priorities. It supports commercialization and showcases clean energy technologies including solar, wind, tidal, geothermal, ocean wave, and bioenergy. Clean energy and clean technologies have application across industrial sectors and will help reduce emissions.

Demand side management programs offered through BC Hydro and Fortis BC encourage conservation and reduce the need to increase supply of electricity from higher greenhouse gas sources. These programs include both industrial and household consumption and together saved over 2,000 gigawatt hours of electricity in 2011/12. Industry as the larger energy consumer produces a large share of these savings.

The proposed *Energy and Water Efficiency Act* would expand the province's ability to set efficiency standards, improve enforcement, and enable industry to compare energy-performance standards that can be used to drive cost savings. As a result of this change, it is anticipated that large energy consumers in B.C. such as pulp-and-paper producers could lower their energy consumption by 10 to 20 per cent over five years.

Industry working groups provide a forum for Government to work with representatives from industry to find solutions to reduce energy consumption and greenhouse gas emissions while maintaining competitiveness.

Moving forward

Increased focus on energy efficiency, innovation and clean technology will help increase the productivity and therefore competitiveness in the global market for B.C.'s industrial sectors. At the same time, these sectors can become leaders in preparing for climate change impacts to ensure resiliency in the face of new weather patterns and more extreme weather events.

B.C.'S REPORTING REGULATION FOR LARGE EMITTERS

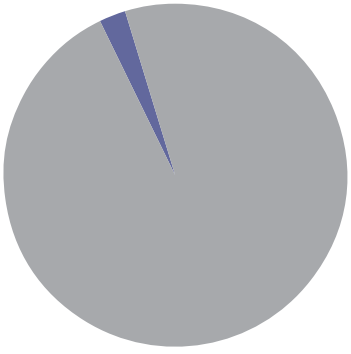
B.C.'s *Reporting Regulation* sets out the requirements for annual reporting of greenhouse gas emissions by B.C. facilities emitting 10,000 tonnes of greenhouses gases per year or greater (includes oil and gas operations). Facilities with obligations under the *Reporting Regulation* are predominately industrial operations. Facilities with emissions of 25,000 tonnes or higher per year are required to have emissions reports verified by a qualified third party.

Accurate emissions data of consistent quality are essential to understanding where our emissions come from and identifying opportunities to reduce them. How much fuel is being used by whom? Which facilities produce relatively more emissions? Where are there leaks? For which activities are emissions going up and which down? Emissions data are an important input into the policy process. They also help emitters to identify inefficiencies, find targeted solutions, and reduce both fuel and other operational costs (e.g. methane leaks), and carbon price costs.

Reporting occurs through a One Window Reporting System housed at Environment Canada that allows emitters to report once to satisfy the requirements of both federal and provincial regulations. This reduces administrative cost for both facilities and government.

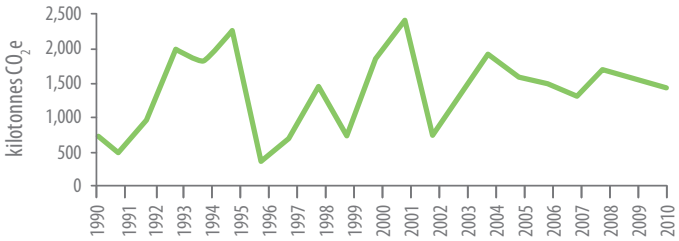
2010 was the first year of reported emissions. 2011 reports have been submitted. Emissions data are published at the facility level on the B.C. Ministry of Environment website. In a few years we will have enough reporting years to track emissions trends and evaluate the effectiveness of policies targeting industrial emissions.

Electricity



Electricity delivers 25 per cent of British Columbia's total energy needs. In 2010, the electricity generation sector emitted two per cent of B.C.'s greenhouse gas (GHG) emissions.

B.C. Electricity and Heat Generation Emissions (kilotonnes)



Because B.C. is rich in heritage hydroelectric resources, which produce few if any greenhouse gases, the emissions from power generation come from rare base load thermal plants, cogeneration plants (combined heat and power), the few remote communities on diesel generators, and thermal power used mainly during periods of high demand and low water years. Reducing demand on the current system will help keep B.C. within its 93 per cent clean or renewable electricity requirement, which limits GHGs. Still, in many sectors increasing use of electricity can reduce GHG emissions from other fuel sources.

In 2010, emissions from electricity imports (not included in B.C.'s GHG inventory) were estimated to be 1.9 million tonnes. Approximately half of this imported electricity was re-exported for market trading purposes.

What's been done

The *Clean Energy Act* was passed in April 2010 and establishes a number of energy objectives including:

- Generating at least 93 per cent of electricity in B.C. from clean or renewable resources.
- Achieving energy self-sufficiency by 2016.
- Ensuring that BC Hydro's rates remain among the most competitive in North America.
- Encouraging switching from one kind of energy source or use to another where it decreases GHG emissions in B.C.
- Limiting reliance on and use of the Burrard Thermal natural gas-fired generating station.

Other policies complementing the *Clean Energy Act* include the requirement for existing fossil fuel fired generation facilities to achieve net zero GHG emissions by 2016.

>93% of electricity from clean and renewable sources in 2010, surpassing the *Clean Energy Act* objective

2,348 gigawatt hours of electricity saved by BC Hydro through demand side management (conservation) measures

20,000 Energy Savings Kits and 1,600 free energy audits to low income British Columbians

BC Hydro has taken steps to address adaptation to climate change impacts. It was a founding partner of the Pacific Climate Impacts Consortium, leading research on hydrological impacts of climate change. BC Hydro also led a 2011 Power Smart Forum focused on adaptation.

FortisBC Generation supplies electricity to the Kootenay and South Okanagan regions of B.C. The company earned a national 2012 Energy Star Market Transformation Award for its PowerSense program that helps customers save electricity and save money.

What we are doing

The majority of BC Hydro's future incremental power demand will be met via conservation and efficiency improvements by 2020.

New clean sources of electricity through independent power projects will be brought on line by 2016.

Smart meters will reduce both waste and theft of electricity, and provide electricity users with information that will help them conserve energy and save money. By enabling more efficient use of existing electricity infrastructure, they can defer the need for new generation capacity. Smart meter installations will reach all customers by December 2012.

The Remote Community Implementation (RCI) Program assists B.C.'s remote communities in reducing their dependence on diesel generation through community energy efficiency projects and new clean energy systems, such as hydro, wind and solar energy.

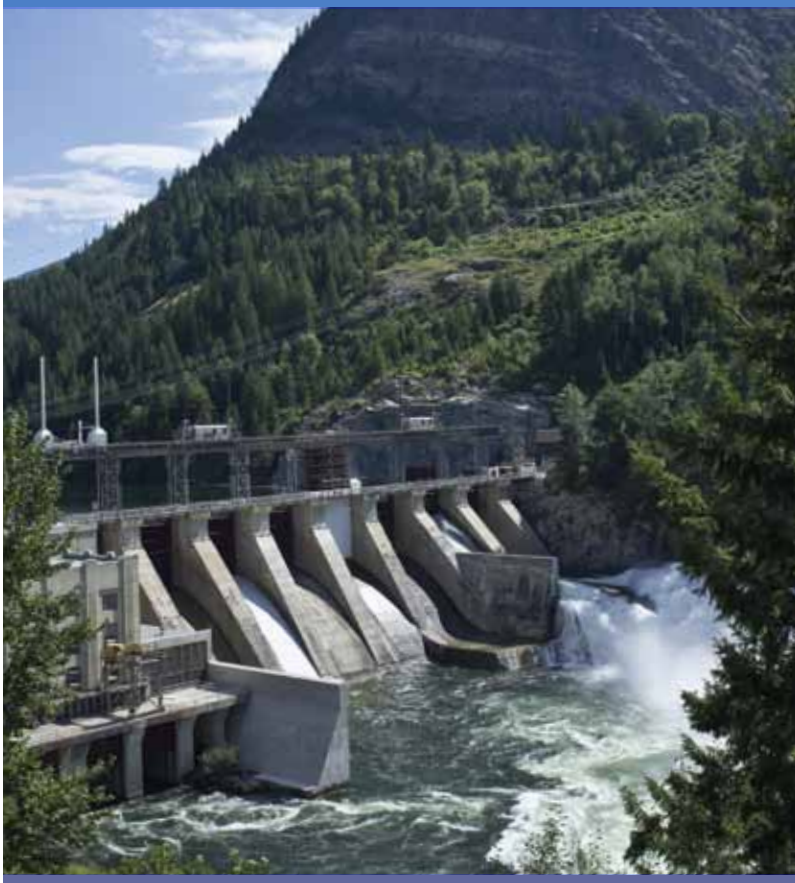
BC Hydro is ensuring that the electrical infrastructure in B.C. will be ready for the anticipated growth in **electric vehicles** through a charging infrastructure demonstration project, a grid impact study, and work to predict where clusters of electric vehicles are likely to occur.

BC Hydro is incorporating consideration of risks posed by climate change into its long range planning.

Moving Forward

B.C. has an electricity supply that is both low cost and low carbon, making electricity a climate solution for B.C. As demand for electricity continues to grow, B.C. will need to continue to develop an electricity system that conserves its resources, promotes the development of clean power, and invests in a way that is resilient to the impacts of climate change.

Conserving energy, while using British Columbia's unique mix of clean and renewable energy sources to supply customers with reliable, low-carbon, electricity, keeps rates competitive and emissions low.



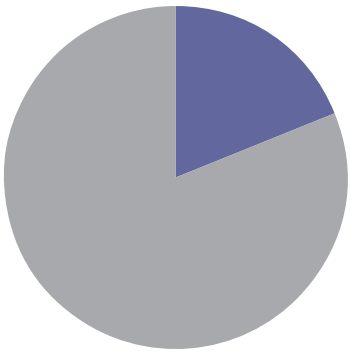
Brilliant Dam near Castlegar

CASE STUDY: ATLIN HYDRO PROJECT

In September 2009 the Taku River Tlingit First Nation community celebrated the official grand opening of Atlin's 2.1 megawatt hydroelectric project. The project replaces diesel generation and is expected to prevent the emission of over 100,000 tonnes of greenhouse gases over the next 25 years.

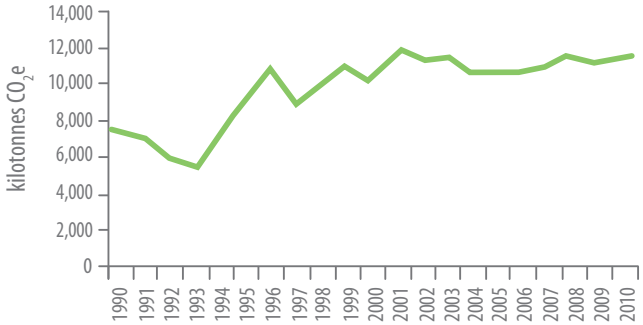
Until recently, the community of Atlin's electricity was provided using more than 1 million litres of diesel fuel per year. The pollution and cost associated with this was becoming a cause for concern and, consequently, hydro power became a focal issue for the community.

Oil & Gas



B.C.'s oil and gas sector is dominated by its rapidly growing natural gas production. Basins in north-eastern B.C. have large reserves and industry forecasts significant growth in production to 2020, ensuring that natural gas remains an important part of B.C.'s economy. B.C. is now working with industry to develop liquefied natural gas (LNG) export facilities on the coast that will benefit from higher natural gas prices in Asia while potentially displacing more emissions-intensive forms of energy such as coal-fired electricity in that continent.

B.C. Oil and Gas Sector Emissions (kilotonnes)



Natural gas is a climate solution. B.C.'s natural gas is a bridging fuel that will contribute to global reductions in greenhouse gas emissions as we move into the future of clean, greener energy alternatives. As the cleanest burning fossil fuel, natural gas can reduce emissions through fuel switching in vehicles, and internationally as efforts to reduce use of coal-fired electricity increases use of natural gas. B.C.'s challenge is to deliver natural gas to these markets, while taking efforts to reduce greenhouse gas emissions in B.C. associated with natural gas production.

What's been done

Electrification: B.C.'s Montney natural gas basin is being electrified where cost-effective and could reduce GHG emissions by 2 million tonnes/year. Options to electrify parts of the Horn basin are also being explored.

Carbon capture and sequestration: B.C. partnered with Spectra Energy to complete a feasibility study of a CCS project at Spectra's Fort Nelson plant, a project that could reduce emissions by 2 million tonnes/year. B.C. already uses a form of CCS at six sour gas injection sites in the province including the largest North American acid-gas reinjection site at Spectra's Kwoen Facility.

B.C.'s Flaring and Venting Reduction Guideline: The final goal is elimination of all routine flaring by 2016. Routine flaring of formation gas has already been discontinued at B.C. natural gas facilities, lowering annual emissions by 140,000 tonnes.

What we are doing

Clean energy LNG facilities: B.C.'s first two LNG plants are anticipated to use clean electricity which will result in lower emissions than plants elsewhere in the world. Moving forward, additional LNG facility developments will use local clean energy with support from B.C.'s natural gas as necessary. This LNG will be exported to Asia, benefitting from higher Asian natural gas prices.

26% reduction in total flared volumes since 2006 through flaring, incinerating and venting guidelines

Photo credit: Arc Resources

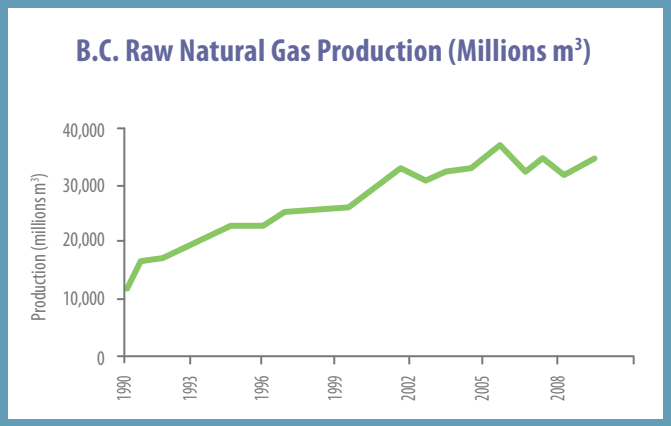
Moving Forward

B.C. has the potential to benefit from Asian decisions to increase the use of natural gas in response to energy security and climate change concerns. Here at home, B.C. is working with industry to find solutions to make B.C.'s production of natural gas a true climate solution through the use of clean energy, new technologies, and carbon capture and storage.

CASE STUDY: ENCANA'S SATURN FACILITY ELECTRIFICATION

EnCana worked with B.C. Hydro to identify design improvements that would make both its compressor site and gas gathering system more energy-efficient. The energy-efficient features include a larger diameter pipeline, compressor cylinder upgrades, high-efficiency motors and variable speed drives. Although these measures increased the up-front cost of the electrification project, the Saturn facility now has a 5 megawatt load reduction, greater reliability, lower maintenance costs and significantly lower noise levels. As a result, 15 gigawatt hours of electricity are saved annually, enough to power a community the size of Bowen Island for a year. The electrification of the facility has also significantly lowered GHG emissions.

Emission reduction strategies at oil and gas facilities, such as electrification and energy efficiencies, can lead to reduced carbon costs for B.C. facilities. Such measures can have payback periods of less than five years. Emission reductions contribute to improved local air quality.



Source: CAPP

Emissions Pathway: Natural Gas Production

Natural gas production and related emissions have grown steadily in B.C. since 1990, by roughly 300% and 60% respectively. Sector emissions depend on production levels, the gas basin involved, production and transmission fuel efficiency, the energy source, and the level of fugitive emissions.

Natural gas production is forecast to continue to grow until at least 2020 with the level of growth dependent on natural gas price and LNG export levels. With increased production, upstream and midstream emissions will depend on the level of mitigation actions taken, which in turn largely depends on policy stringency.

This forecast increase could be mitigated through further electrification of facilities where cost-effective, low carbon energy sources (e.g. compressor electrification), energy efficiency measures (e.g. waste heat recovery and compressor driver fuel efficiency), greater implementation of venting emission reduction technologies (e.g. no-bleed pneumatic devices, plunger lift systems, dry seal compressors), and the elimination of fugitive emission sources (leaks for valves, connectors, pump flanges). Although these individual emission reductions are small, they lead to a cumulatively large effect.

Detail on cost effective natural gas emission reduction opportunities can be found in the U.S. Environmental Protection Agency's Final New Source Performance Standards.

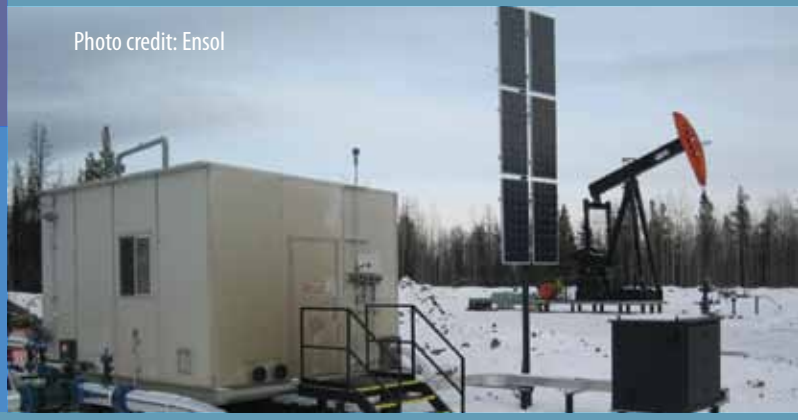


Photo credit: Ensol

Vented and Fugitive Emissions

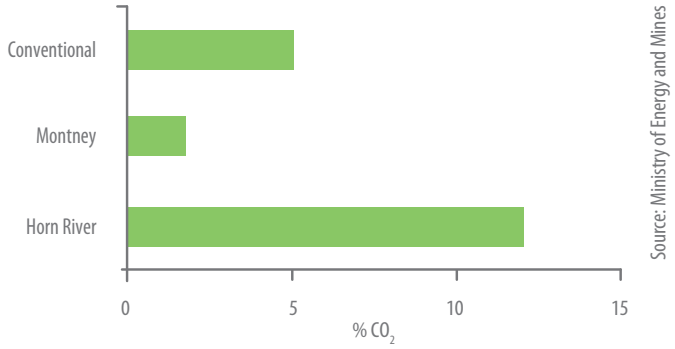
Vented emissions are the controlled and intentional release of uncombusted gas during processing. Venting is not an acceptable alternative for flaring and is only allowed where it may be conducted safely and flaring or incineration is not practical. Fugitive emissions are unintentional releases during production, processing and transmission.

Many technologies and practices create cost-effective fugitive emission reductions, while increasing the amount of sales gas for industry and royalty revenue for the Crown.

Vented emissions occur at different intensities within each category of current B.C. natural gas production. Conventional and unconventional gas are both found in the Montney and Horn River basins. Each basin has its own emissions levels and economic outlook.

Conventional natural gas can contain approximately 5 per cent CO_2 (see graph), some of which is vented upon processing. Conventional production and associated emissions are declining due to reserve depletion.

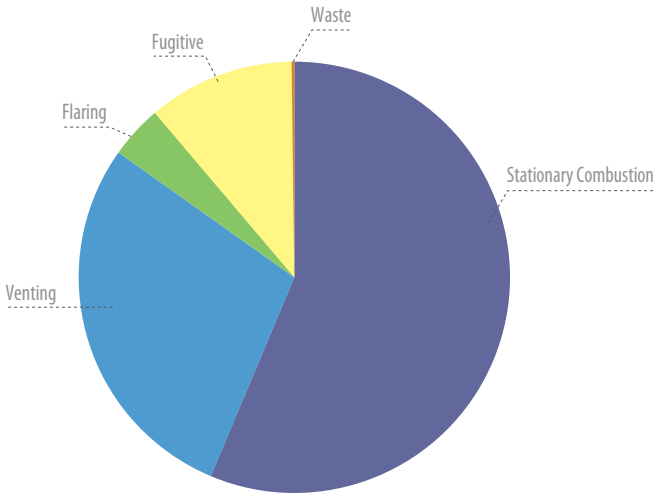
Per cent CO_2 Content by Gas Basin



Production in the Montney basin is increasing due to its profitable high natural gas liquids content. This shift in B.C. production will decrease projected emissions because of Montney's low CO_2 content and reduced combustion emissions from planned electrification.

Horn River production is currently low due to its distance to markets, lack of infrastructure, and higher costs of production. As prices increase, Horn River gas production will likely increase significantly. The Horn River reservoir has a relatively high CO_2 content, which currently is vented during processing. B.C. is working with industries to encourage the development of the Horn River, while also exploring how use of clean energy and carbon capture and storage to significantly decrease GHG emissions as production shifts to this region.

B.C. 2012 Oil and Gas Emissions by Type



Proportions will change as different basins are developed.
Source: B.C. 2010 Reported Emissions

Cement

In 2010, this sector emitted approximately 3 per cent of provincial emissions. Cement production has twenty times the GHG emissions intensity per dollar of GDP compared to the industrial average. More than half of cement sector emissions result from the calcination of raw materials and are difficult to avoid. Cement manufacturing also requires sustained high temperatures in excess of 1,450 degrees Celsius, usually provided by burning fossil fuels like coal and petroleum coke. B.C. has three cement production facilities.

Although cement is an emissions intense industry, B.C.'s cement producers are more energy efficient than the North American and world averages.

Highlights

- **Building code amendments:** B.C.'s Building Code was amended in 2010 to allow use of Portland Limestone Cement (Contempra), the manufacture of which reduces GHG emissions 10 per cent per tonne of cement produced.
- **Fuel switching**: Currently 10 per cent of the B.C. cement sector's fuel comes from alternative sources like construction waste and scrap tires. Mixed fuels such as these can be 20-25 per cent less carbon intensive than the conventionally used primary fuel, coal. The use of scrap tires has been shown to reduce emissions of nitrous oxides. Lafarge has, in partnership with Urban Wood Waste Recyclers, created an engineered fuel that includes waste wood from construction and demolition.
- **Energy efficiency:** Since 2008 the cement industry has participated in several Power Smart Partner Industrial programs and implemented energy efficiency measures. By 2011, savings of up to 15.6 gigawatt hours in energy use were achieved, with the possibility of an additional 21 gigawatt hours of identified energy savings.
- **GHG reduction opportunities:** B.C.'s cement industry is working with the B.C. government and stakeholders to improve energy efficiency, increase the use of zero- and low-carbon renewable and alternative energy sources, increase the use of supplementary cementing materials, continue to develop innovative products and processes, and promote concrete as a sustainable construction material for major developments.

CASE STUDY: CONTEMPRA CEMENT

Contempra branded cement is a blend which employs less greenhouse gas intensive clinker thereby reducing total GHG emissions by up to ten per cent. Each tonne of clinker replaced with supplementary cementing materials will reduce CO_2 emissions by 900 kilograms.

Contempra is included under Portland-limestone cement in the 2010 National Building Code of Canada and is approved for use in British Columbia. Several of B.C.'s largest buildings have used Contempra cement.

A number of low-carbon or carbon-negative cements are currently being developed or are in demonstration and testing.

Use of blended cements and supplementary cementing materials to produce concrete typically replaces 20 per cent of the energy-intensive clinker that would otherwise be required. This improves air quality, reduces energy consumption, and uses materials otherwise destined for landfill. It also increases production capacity without installing new kilns.

2 of B.C.'s three cement plants are in the top quartile internationally for energy efficiency

10% of the fuel used by B.C. cement sector comes from alternative sources like construction waste

Forestry and Forest Products Manufacturing

The forestry and forest products sector in British Columbia includes pulp and paper, wood products manufacturing, logging and silviculture. In 2010, emissions from the largest pulp and paper and wood manufacturing facilities accounted for 2% of the province's emissions. Emissions from logging vehicles are accounted for in the transport section and deforestation is accounted for in the carbon sinks section. Pulp and paper mills do not anticipate significant emissions growth to 2020.

The forestry sector has opportunities to further reduce emissions through fuel-switching to biomass and energy efficiency measures. Standing forests store significant amounts of carbon and are discussed further in the sinks section.

Highlights

- **The B.C. Bioenergy Network,** of which the B.C. government is the founding partner, fosters the development and deployment of bioenergy technologies. B.C. bio-energy projects have generated renewable power for sale to the B.C. grid. New global markets for bio-products are forecast to reach an estimated $200 billion value by 2015.
- **Industry investments** in upgraded boilers, fuel-switching to biomass and the implementation of energy efficiency projects have delivered significant GHG reductions. Cogeneration of steam and electricity has been an integral part of pulp and paper and wood products manufacturing operations for decades.
- **Demand for bio-energy and wood products** has increased because the revenue neutral carbon tax incents switching away from fossil fuels. This leads to emission reductions in other sectors of the economy as use of higher emission materials like fossil fuel and cement or steel is displaced.
- **The Forest Carbon Offset Protocol (FCOP)** was developed by the B.C. government in collaboration with industry to develop B.C. forest carbon offsets from a broad range of forest activities.
- **Adaptation** is being incorporated into the Ministry of Forests, Lands and Natural Resource Operations' business. The Ministry has undertaken work to increase knowledge, develop tools and update its management framework to address climate change impacts. The impacts of climate change on the forest industry have been, and likely will be, significant due to extensive mountain pine beetle infestations in B.C.'s interior forests and projected changes in growing conditions for trees.

65% emission reduction in pulp and paper mills since 1990

46% emission reduction in wood products manufacturing facilities since 1990

237,514 tonnes of emissions reduced by carbon offsets projects produced by the forestry sector in B.C. since 2009

$350 Million invested in pulp and paper sector energy efficiency projects in B.C.

UBC Nexterra combined heat and power. Photo Credit: McFarland Marceau Architects Ltd.

CASE STUDY: UBC BIOMASS COMBINED HEAT AND POWER

The Campus as a Living Laboratory initiative at the University of British Columbia brings together UBC operations, researchers, students and residents with industry partners to co-develop and demonstrate the solutions and products of the future. The Bioenergy Research and Demonstration Facility, a signature project, partners UBC with Nexterra Systems and GE Energy to demonstrate a uniquely-scaled combined heat and power (CHP) system. The system uses locally sourced woody biomass to produce 2 megawatts of electricity and 9,600 pounds per hour of steam. This application displaces 12 per cent of UBC campus natural gas consumption, reduces 4,500 tonnes of greenhouse gas emissions per year and significantly advances UBC's goal to become carbon neutral by 2050.

Climate action in the forestry sector reduces costs and develops revenue streams for producers, fostering greater sector employment. Emissions reduction programs also improve air quality with corresponding health benefits for forestry employees and nearby communities.

Mining and Smelting

The B.C. mining and smelting sector emits 5 per cent of provincial emissions, with approximately 1 million tonnes from mining vehicles and mobile equipment (also accounted for in the transport section). Forecasted growth to 2020 will lead to increased sectoral emissions, despite the sector's energy efficiency and emissions reduction practices.

Highlights

- **Electrification:** Government, via BC Hydro, is constructing the Northwest Transmission Line (NTL) to support the low-emission growth of the mining and clean energy sectors. The 344 kilometre, 287 kilovolt NTL will also help some northwest B.C. mining facilities to replace diesel usage with electricity, reducing their emissions.
- **Sustainability practices:** B.C.'s mining sector has incorporated diverse practices into its operations such as utilizing natural gas and renewable alternatives to power operations and sequestering carbon dioxide into tailings to reduce emissions.
- **B.C.'s revenue neutral carbon tax:** The carbon tax has incentivized fuel switching at some facilities from coal to cleaner-burning natural gas.
- **Adaptation:** The B.C. mining sector has begun to consider risks from a changing climate to mine site design, operations and closure.

Sequestration opportunities:

Hard Creek Nickel, in partnership with UBC, studied the feasibility of sequestering carbon in mine tailings at the Turnagain Mine. The sequestration potential is close to 2 million tonnes of CO_2 per year.

The Cassiar Tailings Sequestration Project also evaluates mine tailings as a candidate for commercial CO_2 sequestration. Full use of the Cassiar tailings pile could sequester over 8 million tonnes of CO_2 over the life of the project.

Rio Tinto Alcan in Kitimat plans to invest approximately $3.3 billion to modernize its primary Kitimat aluminum smelter which will reduce greenhouse gas emissions intensity by **40%** below current levels

Manufacturing

Emissions from pulp, paper, wood product, cement, and primary metal manufacturing are addressed in other sections of this report. B.C.'s larger manufacturing facilities (those with 10,000 tonnes of GHG emissions or greater) emitted 0.3% of B.C.'s emissions. Since many manufacturing facilities emit fewer than 10,000 tonnes of greenhouse gases, this is an underestimate of the sector's total emissions. In addition, petroleum refineries emit 0.5 million tonnes annually.

Highlights

- **Energy Advisors:** BC Hydro and the Canadian Manufacturers & Exporters provide energy experts for B.C. manufacturers. These experts deliver site inspections and energy assessments to recommend energy efficiency improvements.
- **Power Smart Partner Program:** BC Hydro provides up to 100% project funding for industrial and commercial energy efficiency projects.
- **Product Incentive Program:** BC Hydro provides incentives on more than 10,000 energy efficient products. BC Hydro partnered with the B.C. Food Manufacturers Association with over 45% of its members participating in the program.
- **Climate Smart:** This social enterprise based in Vancouver helps small and medium sized firms to reduce GHG emissions with a focus on cost savings and brand enhancement. Over 100 companies and organizations have been trained so far, representing almost 500,000 tonnes of inventoried greenhouse gases, with an average first-year reduction of almost 10 per cent.

$210,000 annually saved by companies through LiveSmart For Small Business energy efficiency programs

100 companies trained through Climate Smart, representing 500,000 tonnes of inventoried greenhouse gases

Moving forward on Climate Action

With participation from individuals, local governments, businesses, and others, B.C.'s GHG emissions have declined 4.5 per cent since the Climate Action Plan was implemented in 2007. This puts B.C. within reach of its interim target of 6 per cent below 2007 levels by the 2012 calendar year. At the same time, there are risks to continued progress towards B.C.'s targets, including emissions growth from natural gas and other industry sectors, if measures are not taken to mitigate emissions.

Many factors affect GHG emissions, including the global economy and global oil prices, but there are positive signs that B.C. is moving towards greener options in the economy. Greenhouse gas emissions and demand for fossil fuels have declined since 2007 while B.C.'s GDP and population growth were above the Canadian average. B.C.'s climate policies – including those that have yet to take full effect – will help to continue overall progress, but more will need to be done.

A key component of B.C.'s leadership position on climate action is B.C.'s revenue neutral carbon tax. A review of all aspects of the carbon tax was announced in Budget 2012 and will include an assessment of competitiveness of all sectors and revenue neutrality. Government looks forward to engaging with British Columbians on the future of the carbon tax, and other measures that will continue our progress towards our targets and continue to prepare British Columbians for climate change impacts.

For further information:

DATA SOURCES

B.C.'s Provincial Greenhouse Gas Inventory Report, 2010
http://www.env.gov.bc.ca/cas/mitigation/ghg_inventory/index.html

B.C. Reporting Regulation 2010 GHG Emission Report Summaries
http://www.env.gov.bc.ca/cas/mitigation/ggrcta/reporting-regulation/2010-emissions-reports.html

Supply and demand of primary and secondary energy in natural units
http://www5.statcan.gc.ca/cansim/pick-choisir?lang=eng&p2=33&id=1280017

Supply and disposition of refined petroleum products
http://www5.statcan.gc.ca/cansim/pick-choisir?lang=eng&p2=33&id=1340004

Gross domestic product (GDP) at basic prices, by North American Industry Classification System (NAICS) and province
http://www5.statcan.gc.ca/cansim/pick-choisir?lang=eng&p2=33&id=3790025

Canadian vehicle survey, vehicle-kilometres, by type of vehicle, province and territory
http://www5.statcan.gc.ca/cansim/pick-choisir?lang=eng&p2=33&id=4050058

B.C. Community Energy and Emissions Inventory, 2010
http://www.env.gov.bc.ca/cas/mitigation/ceei/index.html

Natural Resources Canada, Canadian Forest Service: National forest carbon monitoring, accounting and reporting system
http://cfs.nrcan.gc.ca/pages/93?lang=en_CA

Natural Resources Canada Energy Use Data Handbook
http://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/handbook_res_ca.cfm?attr=0

GENERAL

B.C. Climate Action Plan, 2008
http://www.gov.bc.ca/premier/attachments/climate_action_plan.pdf

LiveSmart BC
http://www.livesmartbc.ca/

Pacific Institute for Climate Solutions
http://pics.uvic.ca/

Climate Action Charter
http://www.livesmartbc.ca/community/charter.html

B.C. Climate Action Toolkit
http://www.toolkit.bc.ca/

Climate Insights 101
http://pics.uvic.ca/insights

CLIMATE CHANGE IMPACTS AND ADAPTATION

B.C. Climate Change Adaptation Strategy, 2010
http://www.livesmartbc.ca/attachments/Adaptation_Strategy.pdf

National Round Table on the Environment and the Economy, 2011
http://nrtee-trnee.ca/climate/climate-prosperity/the-economic-impacts-of-climate-change-for-canada

Munich RE, 2012.
http://www.munichre.com/en/reinsurance/business/non-life/georisks/natcatservice/default.aspx

Insurance Bureau of Canada, 2012
http://www.ibc.ca/en/Natural_Disasters/Weather_Story.asp

Intergovernmental Panel on Climate Change, 2012
http://www.ipcc-wg2.gov/SREX/images/uploads/SREX-All_FINAL.pdf

Pacific Climate Impacts Consortium
http://pacificclimate.org/

Regional Adaptation Collaborative
*http://www.env.gov.bc.ca/cas/adaptation/rac.html*ReTooling for Climate Change

CLIMATE CHANGE IMPACTS AND ADAPTATION CONTINUED

Future Forest Ecosystems Scientific Council
http://www.for.gov.bc.ca/hfp/future_forests/council/

Plan2Adapt
http://pacificclimate.org/tools-and-data/plan2adapt

Forest Stewardship Action Plan for Climate Change Adaptation, 2012
http://www.for.gov.bc.ca/ftp/HFP/external/!publish/ClimateChange/Adaptation/MFLNR_CCAdaptation_Action_Plan_2012_final.pdf

Water Act Modernization
http://www.livingwatersmart.ca/water-act/

Climate Change Adaptation Risk and Opportunity Assessment for Agriculture
http://www.bcagclimateaction.ca/wp/wp-content/media/AdaptROseries-ExecSummary.pdf

EMISSION REDUCTION INITIATIVES

B.C. Climate Action Legislation and Regulations
http://www.env.gov.bc.ca/cas//legislation/index.html

B.C.'s Revenue Neutral Carbon Tax
http://www.fin.gov.bc.ca/tbs/tp/climate/carbon_tax.htm

B.C. Green Energy Plan, 2009
http://www.energyplan.gov.bc.ca/

Pacific Carbon Trust
http://www.pacificcarbontrust.com/

Forest Carbon Offset Protocol
http://www.env.gov.bc.ca/cas/mitigation/fcop.html

B.C. Carbon Neutral Government Report
http://www.livesmartbc.ca/government/carbon_neutral/index.html

US EPA. Oil and Natural Gas Sector: New Source Performance Standards and National Emission Standards for Hazardous Air Pollutants
http://yosemite.epa.gov/opei/RuleGate.nsf/byRIN/2060-AP76

JOBS AND INNOVATION

B.C. Bioenergy Network
http://www.bcbioenergy.ca/

Legislative Committee on the Bio-Economy report, 2012
http://www.gov.bc.ca/jti/down/bio_economy_report_final.pdf

B.C.'s Green Economy Strategy, 2012
http://www.bcge.ca/

B.C. Jobs Plan, 2011
http://www.bcjobsplan.ca/

Canadian Clean Technology Industry Report, Analytica Advisors, 2011
http://analytica-advisors.com/

KPMG BC Technology Report Card, 2012
http://www.kpmg.com/ca/en/issuesandinsights/articlespublications/pages/british-columbia-technology-report-card-2012.aspx

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