City of Chilliwack

Integrated Air Quality, Energy and Greenhouse Gas Community Action Plan

Prepared for
City of Chilliwack

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Executive Summary

The City of Chilliwack has undertaken an integrated air quality, energy and greenhouse gas action plan for both its corporate operations and the community as a whole. This document addresses the community component by:

- Defining actions for the municipality to implement (alone, or in partnership with others) that will reduce energy consumption, air emissions and GHG emissions for both municipal operations and the community as a whole.
- Supporting the overall provincial goal of a 33% reduction in GHG emissions by 2020, and the interim targets of 6% by 2012 and 18% by 2016.
- Determining the GHG emission reduction targets, policies, and actions that should be included in the City's Official Community Plan (OCP) in order to comply with Local Government Act requirements, as set out in the Green Communities Act (Bill 27, 2008).

To complement the actions outlined in this Community Plan, the City of Chilliwack will be incorporating a variety of air quality, energy and greenhouse gas initiatives into its municipal operations. These activities are detailed in a separate Corporate Plan.

Community Air Contaminant Emissions and Ambient Air Quality

Activities undertaken by residents and businesses in the community lead to the emission of air contaminants. The 2005 Lower Fraser Valley Air Emissions Inventory reports the quantities of emissions by source for the valley. For most of the analysed pollutants, activities originating in Chilliwack account for approximately 3 to 6% of all emissions in the Lower Fraser Valley (LFV), which is consistent with population figures.

Ammonia is a significant air emission in the Chilliwack area, and comprises 14% of the ammonia emissions for the Canadian portion of the LFV. When ammonia enters the air, it reacts and becomes secondary particulate matter – a key component of "white haze" which leads to visibility concerns in the Fraser Valley.

In addition to particulate matter, ozone concentrations in Chilliwack can also reach elevated levels during summer months. Ozone is generated when nitrogen oxides react with volatile organic compounds (VOCs) in the presence of sunlight. Nitrogen oxides are produced during fossil fuel combustion, so the connection between air quality, energy consumption and greenhouse gases is relatively direct.

Community Energy and GHG Emissions

Energy use and GHG emissions were quantified by the BC Ministry of Environment for all communities in BC for 2007. The results of this inventory show that Chilliwack consumed 9,850,000 GJ of energy and emitted 536,000 tonnes of greenhouse gas emissions in 2007 (not including industrial electricity or agricultural emissions). Agricultural activities emit an estimated additional 112,000 tonnes, bringing the total GHG emission estimate to 648,000.

Transportation is the largest contributor to the community's energy use and GHG emissions. An estimated 44% of Chilliwack's energy is consumed by transportation, and this segment accounts for approximately 46% of the GHG emissions.

GHG Emission Reduction Target

Chilliwack will aim to reduce community greenhouse gas emissions by 20% per capita from 2007 levels by 2020. Achieving this target will require a joint effort by the federal and provincial governments, City of Chilliwack, and community members. The City of Chilliwack will initiate programs that fall within our legislative jurisdiction by implementing the activities and policies in the City's Air Quality, Energy and Greenhouse Gas Action Plan.

Key Actions for Meeting the Target

In order to reduce emissions to the target level, this plan identifies 36 actions that the City will undertake. These actions are presented in four categories as follows:

- Legacy (High effort, High impact)
- Leverage (Low effort, High impact)
- Traction (Low effort, Low impact)
- Foundation (High effort, Low direct impact)

Implementation Considerations

The plan will be implemented in phases, with activities prioritized by level of impact and ease of implementation. Activities will be funded primarily through Carbon Tax rebates and Gas Tax funds. The energy and greenhouse gas field is evolving, and this plan is intended to be flexible, allowing accommodation of new technologies or programs as they are deemed advantageous.

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Glossary

CO Carbon monoxide is a poisonous gas emitted from vehicle tailpipes that burn fossil fuels. It is also emitted from burning wood. CO can have significant impacts on human health.

CO2e Carbon dioxide equivalents are a measure for how strong a greenhouse gas is relative to the emission of carbon dioxide. For example, emitting 1 tonne of methane gas has the equivalent impact of emitting 25 tonnes of carbon dioxide.

CAC Common air contaminants are a group of pollutants that air quality management traditionally seeks to reduce because their presence, and interactions, result in smog and acid rain. The six contaminants include: particulate matter (PM), nitrogen oxides (NO_x), sulphur oxides (SO_x), volatile organic compounds (VOC), carbon monoxide (CO), and ammonia. Ground-level ozone (O_3) and secondary particulate matter are also referred to with CACs because they are by-products of interactions between CACs.

CWS Canada Wide Standards were developed in 2000 to ensure a national minimal standard of air quality that all Canadians should have a right to for two pollutants: ozone (O_3) and fine particulate matter ($PM_{2.5}$).

GHG Greenhouse gases are gases that trap heat in the earth's atmosphere. The dominant greenhouse gas resulting from human activity is carbon dioxide (from fossil fuel combustion), followed by methane (from solid waste and agriculture).

LFV The Lower Fraser Valley airshed is an area of shared air that encompasses Metro Vancouver, the Fraser Valley Regional District, and parts of Whatcom County in the U.S.

µg/m³ Micrograms per meter cubed is a measure of the concentration of a pollutant (e.g. ozone) in the ambient air.

NH_3 Ammonia is a gas that is emitted from livestock waste management and fertilizer application. It has a strong odour, can irritate eyes, nose and throat, and can interact with other gases to form secondary particulate matter, which has harmful effects on human health and the environment.

NO_x Nitrogen oxides are gases formed from burning fuel, and from air in the combustion process. Nitrogen oxides can have adverse effects on human health and the environment.

O_3 Ground-level ozone is a secondary pollutant that forms from the interaction between NO_x and VOCs in sunlight. It is leads to smog, is highly irritating and can cause significant human health impacts. It also decreases productivity of crops and vegetation.

OCP Official Community Plans are developed by municipalities in BC and provide a longer term vision for the community. It guides decisions about land use, planning, and general purposes of local government. OCPs are usually developed with significant public consultation.

PM Particulate Matter is airborne particles, and are often split into two categories: $PM_{2.5}$ (fine particulate) and PM_{10} (courser particulate). They are also categorized as primary (directly emitted) or secondary (formed in the air by interaction between other compounds). PM is linked to numerous human health and environmental concerns.

ppb Parts per billion is a measurement of relative quantities of a pollutant in the ambient air. This unit is often used to describe the amount of ozone in the air we are breathing, and is used to determine acceptable levels of ozone for meeting the Canada Wide Standards.

SO_x Sulphur oxides are gases emitted from combustion and refining processes of coal, oil and other ores. Sulphur oxides can have adverse effects on human health and the environment.

VOC Volatile Organic Compounds are fumes and vapours from gasoline and solvents. There are also natural sources of VOCs such as coniferous forests. Some VOCs have direct toxic effects on humans. Some VOCs react with nitrogen oxides to form ground-level ozone that leads to smog and formation of secondary particulate matter; both of which have harmful effects on human health and the environment.

1 Introduction

1.1 The Issue of Air Quality

For decades, studies have shown that the level of pollutants in our air can cause serious health and environmental concerns. Health Canada estimates 5,900 deaths per year, in eight of Canada's largest cities, can be attributed to air pollution[1]. The City of Chilliwack appreciates the importance of managing air emissions and, as a result of its location at the end of the Fraser Valley airshed, is faced with the challenge of doing so on a regional scale. Local air quality in Chilliwack is affected by non-point source emissions from Metro Vancouver, the Fraser Valley Regional District and from Whatcom County in Washington State. Emissions from sources such as agriculture, industry and transportation are concerns for public health, and can negatively affect visibility and levels of common air contaminants (CACs) in the Fraser Valley. Although the quality of the air we breathe is influenced by activities within the local or regional context of an airshed, several aspects that serve to guide these activities fall outside the jurisdiction of local governments. For example, the federal government sets vehicle emission standards for all vehicles and the provincial government regulates industrial emissions and agricultural practices.

However, decisions made at the municipal level can have a significant impact on local air quality. In particular, neighbourhood planning that incorporates mixed-use, pedestrian and cycling friendly principles can reduce transportation related emissions. Furthermore, municipalities have authority to regulate residential burning practices which can affect ambient particulate matter levels. There is a strong case for municipalities to consider the issue of air quality in their planning. However, municipalities cannot guarantee clean air for residents without cooperation from other agencies that influence local air quality.

1.2 The Issue of Climate Change

For many years, there has been increasing evidence that global climate change resulting from emissions of carbon dioxide and other greenhouse gases (GHGs) is causing, or will soon cause, significant environmental impact on the ecology of the planet. Conclusions of the 2007 Intergovernmental Panel on Climate Change (IPCC) on the climate change trends observed to date are that human-caused contributions are "more likely than not" and the expectation is that the human-caused impact in the future is "virtually certain."

There is also a growing impetus for action by all energy consumers to reduce emissions of GHGs. In 2005, the UK government commissioned an independent review called the "Stern Review", which assessed the potential economic impacts of climate change and the potential costs of

[1] http://www.ec.gc.ca/cleanair-airpur/Health_Concerns-WSC8A1FE65-1_En.htm

stabilizing atmospheric carbon levels [2]. Among the conclusions were that climate change is expected to have serious negative impacts on global economic growth and development. It states that the "costs of stabilizing the climate are significant but manageable; delay would be dangerous and much more costly". This is a significant conclusion highlighting that deferring action will be more costly than initiating action immediately.

Climate change is a global issue, caused by the daily activities of billions of humans – primarily through the consumption of fossil fuel energy. A solution to the issue will require the activities of billions of humans to conserve energy and reduce GHG emissions. All persons and entities – including local governments – have a role to play in finding these solutions.

Related to climate change, is the issue of peak oil. Peak oil is the point in time when the maximum rate of global oil production has been reached. Once half of our original oil reserves have been used up, production is more likely to stop growing and begin to decline (hence the use of the term "peak"). The issue is not that oil will run out, but rather that the costs of oil production will become so high that continuing our dependency on oil will no longer be economically justifiable. According to the International Energy Agency, oil accounts for 43% of global energy consumption and 39% of global CO2 emissions.[3] Many of the products we use on a daily basis are built using oil as a feedstock, including: plastics, paints, pharmaceuticals, fertilizers, electronic components, tires and many more. Our economy functions on the premise of having an abundance of cheap oil available to us. As this abundance of cheap oil declines, reducing our dependence on it will be a key strategy for ensuring long-term sustainability; reducing our vulnerability to price fluctuations and increasing the security of our energy supply.

Peak oil is often seen as a complimentary issue to climate change – reducing our dependence on fossil fuels, reduces GHG emissions. However, some potential responses to peak oil may actually increase GHG emissions, including switching to certain fuel sources (e.g., coal), developing tar sands (or other non-conventional oil sources) and removing forests for biofuel production. Similarly, some responses to climate change do little to address the issue of peak oil (e.g., emissions trading, forestry-based offsets, carbon capture).[4] A more sustainable approach to climate change planning considers the broader implications of GHG reduction measures in order to ensure that actions reduce both GHG emissions and oil dependence and ideally, result in other environmental, social and economic benefits. Similarly, a strategy to address climate change in Chilliwack, must also consider impacts to air quality and energy sustainability in an integrated manner.

[2] See the Stern review at http://www.hm-treasury.gov.uk/stern_review_final_report.htm

[3] *Key World Energy Statistics* (2008). International Energy Agency. http://www.iea.org/textbase/nppdf/free/2008/key_stats_2008.pdf

[4] Dynamic Cities Project May 2008 presentation at the Metro Vancouver Community Sustainability Breakfast. http://dynamiccities.squarespace.com/dcp-slideshows-publications/

1.3 Why Integrate Air Quality with Energy and Greenhouse Gas Planning?

For most CACs and GHG emissions, a significant component of the emissions are related to combustion of fossil fuels (see Table 1). Therefore, energy management (in particular fossil fuel-based energy) is an important step that impacts both GHG and air emissions simultaneously. However, in some cases carbon reduction options may result in the emission of CACs. An integrated approach will allow the City to better evaluate carbon reduction measures in terms of overall environmental impacts and benefits.

Table 1: Energy related emissions in the Lower Fraser Valley (LFV)

	CO	VOC	NO_x	SO_x	$PM_{2.5}$	GHG
Total Emissions	215,797	69,101	48,264	4,429	6,270	17,069,445
Energy Related Emissions	211,649	25,613	46,076	4,242	3,640	14,382,853
% of Emissions that are energy related	98%	37%	95%	96%	58%	84%

Source: GVRD, Phase 2: Harmonized Measures for Reducing Greenhouse Gases and Air Pollution in the LFV, November 2001

1.4 Benefits of an Integrated Action Plan

There are many benefits to managing energy, greenhouse gases and other air emissions in Chilliwack, including:

- Reduced energy costs – energy costs can be substantially reduced by being more energy efficient;
- Reduced impacts to climate change – managing carbon emissions helps to minimize impacts on the global ecosystem;
- Improved air quality and health benefits – reducing the use of fossil fuels, especially in transportation, also reduces the amount of pollutants being released into the air we breathe;
- Reduced vulnerability to energy markets – reducing the dependence on fossil fuels helps to decrease the vulnerability to fluctuating energy supply and pricing;
- Job creation and business opportunities – promoting a green economy (clean technologies, renewable energies, water services, green transportation, waste management, green buildings and sustainable agriculture and forests) can open up new job and business opportunities;
- More liveable and sustainable communities – the activities that support energy conservation are aligned with other sustainable community objectives such as building compact, complete communities, more efficient infrastructure, walkable neighbourhoods, and protection of farmland and natural areas.

1.5 Objectives of this Integrated Action Plan

The Air and Energy Plan Objectives are to:

- Define actions for the municipality to implement (alone, or in partnership with others) that will reduce energy consumption, air emissions and GHG emissions for both municipal operations and the community as a whole.
- Support the overall provincial goal of a 33% reduction in GHG emissions by 2020, and the interim targets of 6% by 2012 and 18% by 2016.
- Determine the GHG emission reduction targets, policies, and actions that should be included in the City's Official Community Plan (OCP) in order to comply with Local Government Act requirements, as set out in the Green Communities Act (Bill 27, 2008).

2 Current Legislative Context

2.1 Federal Legislation and Initiatives

Federally, the ***Canadian Environmental Protection Act*** **(CEPA)** regulates environmental contaminants and includes specific provisions that control the fuels and engine emissions of vehicles and equipment. In 2009, requirements for reporting Greenhouse Gas emissions were reduced by half to include all facilities emitting 50,000 tonnes or greater. In 2010, the federal government passed **Passenger Automobile and Light Truck Greenhouse Gas Emission Regulations** to create national vehicle efficiency standards that harmonize with the US standards by 2011. Under this legislation, new vehicles sold in 2016 are expected to be 40% more efficient than vehicles sold in 2008.

In January 2010, the Canadian federal government announced a nation-wide GHG emission reduction target of 17% below 2005 levels by 2020. The federal government's existing measures are projected to achieve approximately 20% of these reductions.

Canada Wide Standards (CWS) were developed in 2000 to ensure a national minimal standard of air quality that all Canadians should have a right to for two pollutants: ozone (O_3) and fine particulate matter ($PM_{2.5}$). These standards were to be attained by 2010. The standards are as follows:

> *Ozone* – must not exceed 65 ppb in an 8-hour period, averaged over 3 consecutive years.
>
> *Fine Particulate Matter* – must not exceed 25 µg/m^3 in a 24-hour period, averaged over 3 consecutive years.

In addition to the standards, **National Ambient Air Quality Objectives (NAAQO)** have been formed to establish a national goal that protects health, the environment and aesthetics. Standards have been developed for: Sulphur Dioxide (SO_2), Total Suspended Particulate (TSP), Carbon Monoxide (CO), Nitrogen Dioxide (NO_2), and Ozone (O_3)[5].

The federal government, led by Environment Canada, also participates in the **Georgia Basin / Puget Sound International Airshed Strategy** in coordination with the US Environmental Protection Agency (EPA), coastal First Nations and non-governmental organizations. Because Chilliwack is inside the Georgia Basin airshed, this international cooperative effort to manage air quality has an impact on the air residents of Chilliwack breathe[6].

[5] See www.hc-sc.gc.ca/ewh-semt/air/out-ext/reg-eng.php for detailed listing of NAAQ objectives.

[6] See http://www.pyr.ec.gc.ca/airshed/index_e.htm for more information on the GB-PS IAS.

2.2 Provincial Legislation

The Province has been moving forward with a series of ambitious measures to advance energy efficiency and reduce community consumption. These include:

- **GHG Emissions Reduction Target Act (Bill 44, 2007)**: The Province of BC has set a province-wide GHG emissions reduction target of 33% below 2007 levels by 2020 (6% by 2012 and 18% by 2016). The Act also sets requirements for Public Sector Organizations (PSOs) to be carbon neutral by 2010. Although local governments are encouraged to support the provincial goals, Bill 44 does not apply to local governments.
- **"Greening" the BC Building Code (Bill 10, 2008)**: New Building Code requirements to increase energy and water efficiency are in effect. Bill 10 provides local governments with the authority to apply the "green" Building Code provisions, including higher energy efficiency standards for single family and high rise multi-family units, as well as water efficiency requirements.
- **Green Communities Act (Bill 27, 2008)**: Bill 27 requires local governments include GHG emission targets, policies, and actions in their OCPs. To achieve this objective, the legislation provides a range of *potential* new powers for local governments[7].

  Potential tools include: using development permits to promote energy and water conservation; allowing parking variances to encourage alternative transportation; providing exemptions from development cost charges for small units, and local government powers to waive or reduce these charges for green developments; and allowing local governments to develop property tax exemption programs based on energy or water efficiency.

  Most of the actions that have been allowed under Bill 27 are directed towards encouraging new development to be energy, climate, and water efficient. There are several tools that could be deployed by the community as it undergoes further development.
- **Clean Energy Act**: In 2010, BC adopted the Clean Energy Act that defines several energy objectives for BC, including achieving electricity self-sufficiency, meeting 66% of the increase in demand by 2020 through conservation and demand management, among others.

In addition to the legislative amendments regarding energy listed above, the province also governs aspects of air quality regulation through the *Environmental Management Act* as follows:

- **Open Burning Smoke Control Regulation**: regulates open burning practices in areas not covered by municipal bylaws (e.g. land clearing, forestry). This regulation is currently under review. Proposed changes support the province-wide approach to reduce

[7] Each of these possible powers still requires that the local government develop an enacting bylaw and to define the conditions and process for it to apply.

or minimize impacts on human health. One change includes establishing "smoke sensitivity zones" (where Chilliwack is proposed to be in a "high" sensitivity zone).

- **Waste Discharge Regulation**: regulates the discharge of substances into the air from industrial sources and requires that permits be obtained to do so.
- **Agricultural Waste Control Regulation** *(also Health Act)*: regulates practices for using, storing and managing agricultural waste in an environmentally sound manner. This is supplemented by the *Code of Agricultural Practice for Waste Management.*
- **Solid Fuel Burning Domestic Appliance Regulation**: regulates new wood-burning appliances to ensure they meet Canadian or US standards for particulate emissions.

2.3 Provincial Action Plans

The provincial government has also undertaken several non-legislative initiatives to help preserve clean air, reduce greenhouse gas emissions, and plan for alternative energy sources. These initiatives include the following:

- **BC Climate Action Plan:** After setting the province-wide GHG emissions reduction target of 33% below 2007 levels by 2020, the province created a plan that outlines strategies and initiatives that will take the province 73% of the way to reaching its target. These initiatives include LiveSmart BC (rebates for energy efficiency upgrades) and a carbon tax on fuels, among others.
- **BC Air Action Plan:** This plan includes 28 actions to reduce air emissions. Actions include eliminating beehive burners, reducing emissions from transit vehicles and school buses, and implementing a province-wide smoke control strategy.
- **BC Air Quality Objectives**: The province has set objectives and guidelines for several air pollutants, including large particulate matter and formaldehyde. These objectives are not enforced as a regulatory standard, but rather establish desired maximum levels of ambient emissions for all communities in BC. When ambient monitoring indicates a community is not meeting the objectives, the province will initiate an air quality management planning process in that region. Objectives are currently being set for $PM_{2.5}$.

2.4 Fraser Valley Regional District and Metro Vancouver Initiatives

Both the Fraser Valley Regional District and Metro Vancouver have developed **Air Quality Management Plans** for their regions. The FVRD AQMP was originally developed in 1998 and is currently being reviewed and updated. The Metro Vancouver AQMP was first developed in 1994 and the emission reduction targets were met earlier than expected. A new AQMP was developed in 2005, and the 33 actions are currently being implemented.

Ambient air quality monitoring in the Lower Fraser Valley is conducted through Metro Vancouver, with contributions from FVRD. There is currently one station in Chilliwack, and four in the FVRD. The FVRD intends to double the existing network to better understand local air quality conditions throughout the region.

Metro Vancouver is currently the only local government that regulates its own waste permits for industrial air emissions. Furthermore, Metro Vancouver sets its own **ambient air quality objectives** for $PM_{2.5}$, PM_{10}, Carbon monoxide, Nitrogen dioxide, Sulphur dioxide, and Ozone.

The FVRD and Ministry of Transportation have cooperated to complete a **study of regional transit** solutions for the Fraser Valley[8]. The study determines the need for regional transit and provides a range of possible solutions to introduce these services to the Fraser Valley.

2.5 City of Chilliwack Bylaws and Initiatives

The City's OCP is expected to be updated in the next one to two years as the population reaches the current OCP threshold of 85,000. The existing OCP highlights several policies related to air quality and energy in the following policy areas:

- Neighbourhood Development
- Affordable Housing
- Economic Viability
- Stewardship
- Waste Management
- Air Quality
- Growth Management
- Densification
- Mobility
- Housing

These OCP policies define the direction of the City towards:

- Promoting densification of neighbourhoods and working close to home.
- Promoting energy conservation.
- Creating a multi-modal transportation system.
- Identifying opportunities for industrial densification.

[8] http://www.th.gov.bc.ca/FraserValleyTransit/publications.htm

The City also has the following bylaws, policies and initiatives that relate to this plan:

- **Climate Action Charter**: As a signatory to the Climate Action Charter, the City is committed to take voluntary action to reduce its energy consumption and GHG emissions, and to achieve 'carbon neutrality' by 2012 in its municipal operations.
- **Open Air Burning (Bylaw 3511)**: Effective March 3, 2008, open air burning is reduced to two seasons – March/April and October/November. Furthermore, burning is only permitted when the Environment Canada ventilation index is good or fair. The bylaw does not permit any outdoor burning on residential, institutional, commercial or industrial properties, and also prohibits the burning of land clearing debris.
- **Solar Ready Hot Water Ready Regulation**: In 2010, council resolved for Chilliwack to be included in the provincial Solar Hot Water Ready Regulation, once it is enacted. This regulation will require roof design and conduit specifications that will allow homes to easily incorporate solar hot water heating.
- **Idle-Free Policy for Municipal Fleet**: In September 2004 council adopted an idle-free policy for the municipal fleet to eliminate unnecessary idling.
- **Idle-Free Outreach**: The City has conducted targeted outreach regarding idling reduction to schools, taxi companies and trucking stops to increase awareness.
- **City Building Energy Retrofits**: The City has been working with Honeywell since 2006 to carry out retrofits to City-owned buildings to improve energy efficiency. This includes installation of some programmable thermostats, upgrades to lighting, and upgrades to certain HVAC systems.
- **Fleet Right-Sizing**: In 2008, the City started a fleet right-sizing initiative to ensure the most fuel efficient and cost-effective vehicle is selected for a given application.
- **Tree Planting**: Recognizing the carbon sequestration benefit of trees, the City has a tree planting program, which involves in-house activities plus coordination with outside volunteer groups to plant trees in the community.
- **Lighting**: The City replaced all green and red traffic lights and ornamental Christmas lights with LED bulbs. Most fleet beacon lights have also been replaced with LED.

Additional City initiatives to reduce air emissions and energy consumption have been identified in the Corporate Air Quality, Energy and Greenhouse Gas Action Plan, which complements this Community Plan.

2.6 Implications for Plan Development

There are a number of jurisdictions and several regulatory and voluntary initiatives that are focussed on reducing air emissions. At the municipal level, the City has a range of influences:

- Direct control: The City has direct control over its own operations and can implement policies and initiatives to reduce its air emissions and energy consumption.
- Indirect control: The City also has indirect control over many practices that contribute to the community's air emissions and energy consumption through planning, development policies, and education programs for its citizens.
- No control, but potential for influence: Outside of the City's control there are several factors that have an impact on the resulting emissions from the community and an impact on the quality of air in the City. These include emissions from the neighbouring communities in the Georgia Basin airshed, activities on First Nation lands, provincial legislation that dictates agricultural operations, energy requirements for buildings and industrial air emissions, and federal legislation that dictates motor vehicle emissions and controls.

This plan highlights both the opportunities where the City can act directly and where the City should collaborate with partners to achieve the goals of maintaining clean air, conserving energy, and reducing GHG emissions.

3 Community Profile

The City of Chilliwack is located in the Fraser Valley Regional District, on the south bank of the Fraser River. The City encompasses a total land area of 260 square kilometres[9]. The City centre lies in the flat valley basin surrounded by agricultural land that is protected by the Agricultural Land Commission (ALC) and First Nations lands that belong to bands in the Stó:lo Nation and Stó:lo Tribal Council. Approximately 64% of land is dedicated to agriculture[10]. Bordering the flat valley are hillsides that contain rural and urban developments.

Highway 1 divides the urban centre of the City into two segments – the downtown core ("Chilliwack Proper") is north of the highway, and the Sardis-Vedder corridor is south of the highway (see Figure 1 for a map of the City). Approximately 80% of households are located in urban and suburban areas[11].

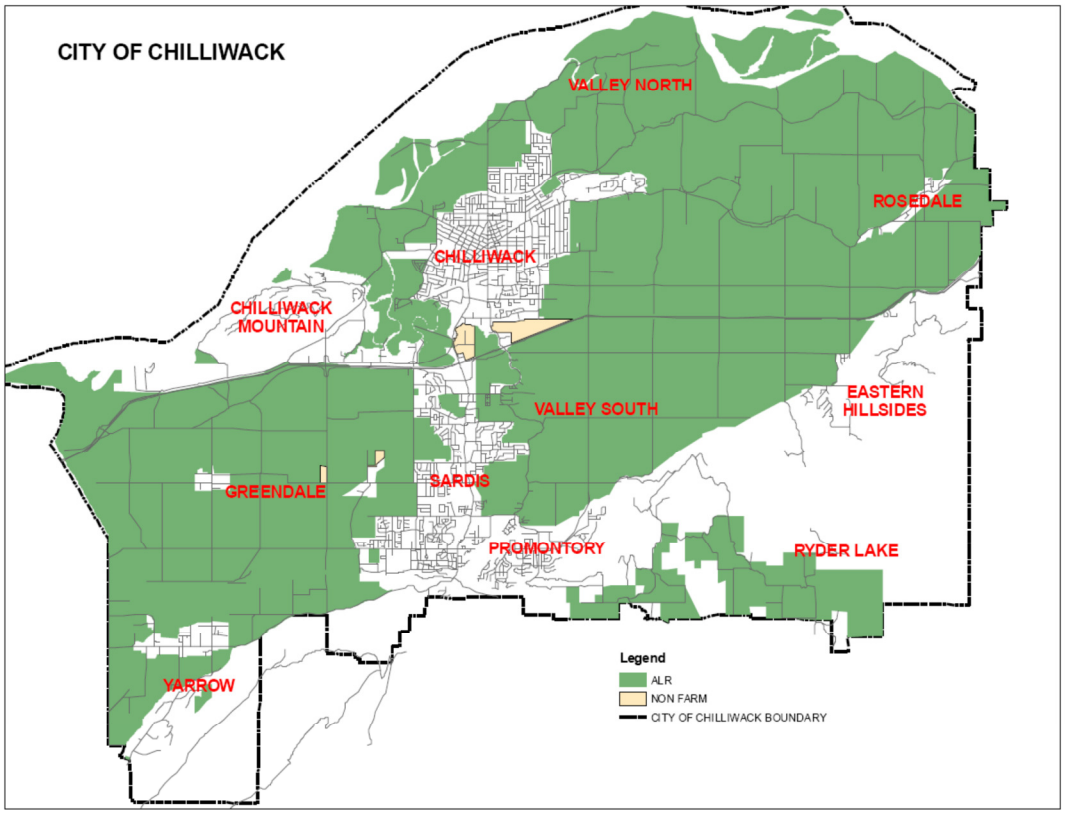


Figure 1: City of Chilliwack Map

Source: City of Chilliwack

[9] BC Stats Community Facts; www.bcstats.gov.bc.ca

[10] Chilliwack Community Profile, Chilliwack Economic Partners Corporation, 2009

[11] Chilliwack Community Profile, Chilliwack Economic Partners Corporation, 2009

3.1 Geography and Meteorology

The Lower Fraser Valley Airshed is often described as being shaped like a funnel. The wide mouth of the funnel extends from Horseshoe Bay, across Vancouver, and through Whatcom County in the USA. The funnel is bordered by the Coast Mountains on the north and the Cascade Mountains on the southeast (see Figure 2). Chilliwack is located in the narrow end of the funnel, which extends east to Hope. In the summer, prevailing winds tend to move the air from west to east during the day, reversing at night. There are also frequent episodes of stagnant air in the summer and winter, where the mountains trap air for days causing an accumulation of pollutants such as ozone and fine particulate matter.

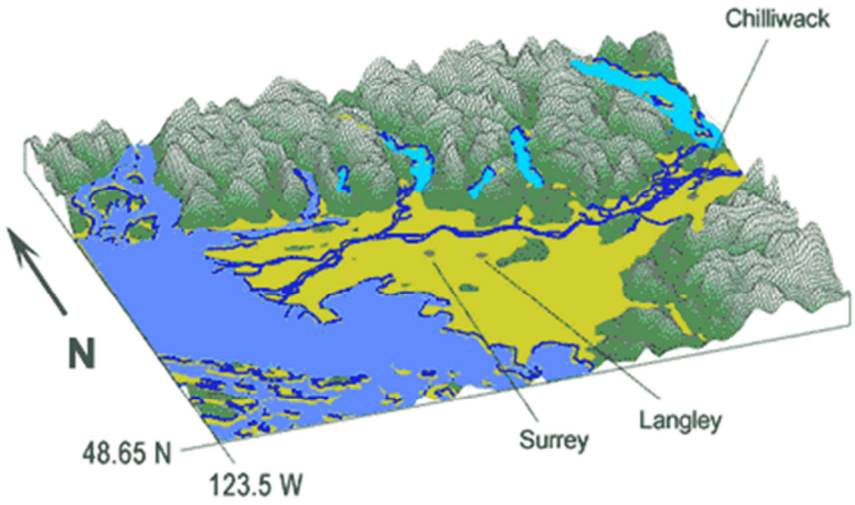


Figure 2: The "Funnel"-Shaped Lower Fraser Valley Airshed

Source: http://www.ecoinfo.ec.gc.ca/env_ind/region/smog/smog_data_e.cfm

3.2 Lower Fraser Valley Ambient Air Quality

There are 27 air quality monitoring stations located throughout the Lower Fraser Valley, four of these are in the Fraser Valley Regional District, and one station is located in Chilliwack. Refer to the side box for a list of the air contaminants that are monitored at this station. Ambient monitoring provides a measure of the level of pollutants in the air that residents are breathing; however, monitoring data do not explain the sources of the pollutants.

Air Contaminants Monitored in Chilliwack

- SO_2 – Sulphur dioxide
- NO_2 – Nitrogen dioxide
- CO – Carbon monoxide
- O_3 – Ozone
- NH_3 – Ammonia
- PM_{10} – Particulate matter < 10 micrometres
- $PM_{2.5}$ – Particulate matter < 2.5 micrometres

Results of ambient monitoring are reported annually through Metro Vancouver. Monitoring shows that ozone and fine particulate matter are pollutants of concern in Chilliwack. Both of these pollutants pose potentially serious health concerns, and contribute to the formation of white haze that impairs visibility. Section 4 of this report identifies the main sources of air contaminants in Chilliwack.

Figure 3 shows that the maximum 8-hour average ozone concentration exceeded the Metro Vancouver 8-hour Objective. The Canada-Wide Standard (CWS) for ozone is not exceeded; however, it is close enough to be of concern[12].

Fine particulate matter ($PM_{2.5}$) has also reached levels of concern historically. As illustrated in Figure 4, in 2002, 2006 and 2007, $PM_{2.5}$ levels *exceeded the Metro Vancouver 24-hour Objective*. $PM_{2.5}$ levels were slightly lower in 2008 and 2009, but were close enough to the 24-hour Objective to be of concern.

[12] The CWS for ozone is 65 ppb, 8-hour averaging time, by 2010. It is based on the 4th highest measurement annually, averaged over 3 consecutive years.

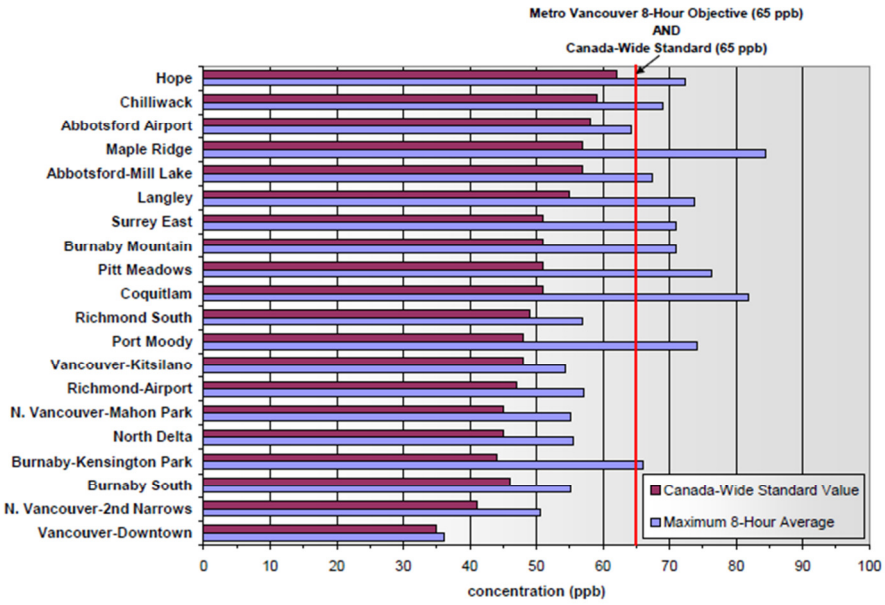


Figure 3: Ozone levels from ambient air quality monitoring, 2009

Source: 2009 Lower Fraser Valley Air Quality Report, December 2010

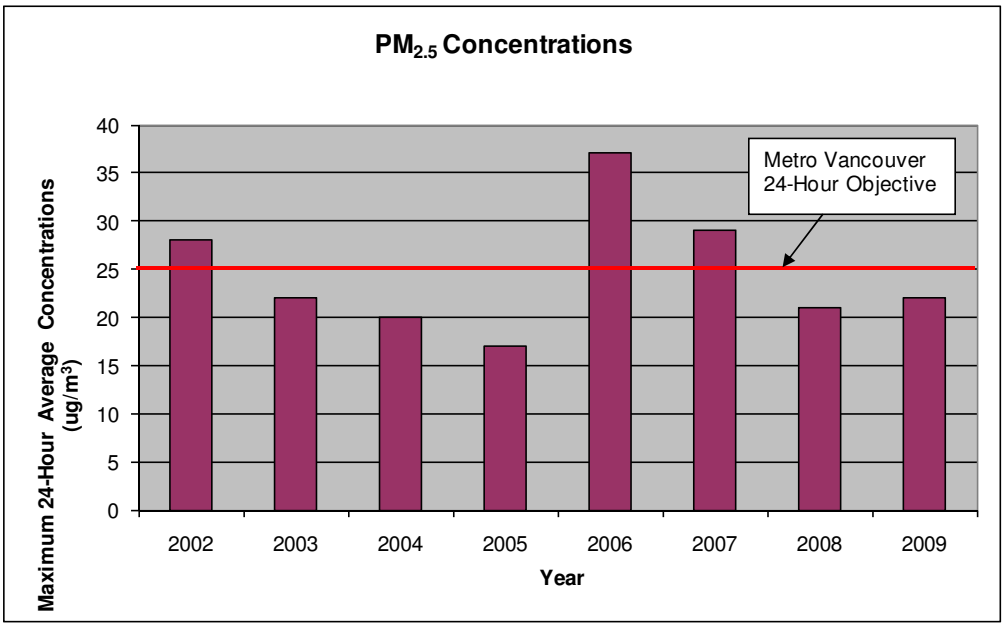


Figure 4: $PM_{2.5}$ levels in Chilliwack from ambient air quality monitoring, 2002-2009

Source: 2002 to 2009 Lower Fraser Valley Air Quality Reports

3.3 Climate

The climate in Chilliwack is moderate, with average daily high temperatures of 5.2 degrees Celsius in January and 24.4 degrees Celsius in July[13]. This leads to moderate heating requirements for approximately two-thirds of the year, and some cooling requirements in the summer. Table 2 shows a comparison of the heating and cooling requirements (expressed as degree days)[14]. The space conditioning is primarily heating demand; however, cooling demand is significantly higher than Vancouver indicating there may be more use of air conditioners in Chilliwack during the summer. The heating and cooling degree days provide an indication of the amount of space heating energy required. Other energy consumption such as water heating, and electricity consumption are driven by many factors unrelated to the climate.

Table 2: Heating and Cooling Requirements in Chilliwack and Selected Canadian Cities

Location	Heating Degree Days (Annual)	Cooling Degree Days (Annual)
Chilliwack	**2,833**	**106**
Vancouver	2,926	44
Prince George	4,728	40
Whitehorse, YK	6,811	8
Edmonton, AB	5,708	28
Toronto, ON	4,066	252

Source: Climate Normals 1971-2000; http://climate.weatheroffice.ec.gc.ca/

3.4 Population and Dwellings

The City of Chilliwack's population in 2007 was 78,115 residents[15]. Chilliwack has seen substantial growth over recent years, with a population increase of 10.6% between 2001 and 2006[16]. A population breakdown (see Figure 5) indicates that Chilliwack's population contains a higher proportion of residents under 15 and over 65 compared to the BC average, whereas there is a lower proportion of residents in the 25 to 65 age range.

[13] Environment Canada, 2008.

[14] A heating degree day is the number of days that the temperature is below 18°C, multiplied by the temperature below 18. For example two days at 10°C is 2*(18-10) = 16 degree days. Similarly cooling degree days are the days and temperature above 18°C. The use of 18 deg C as the defining temperature for HDDs is a common benchmark in heating and air conditioning analysis.

[15] City of Chilliwack

[16] Statistics Canada 2006 Census

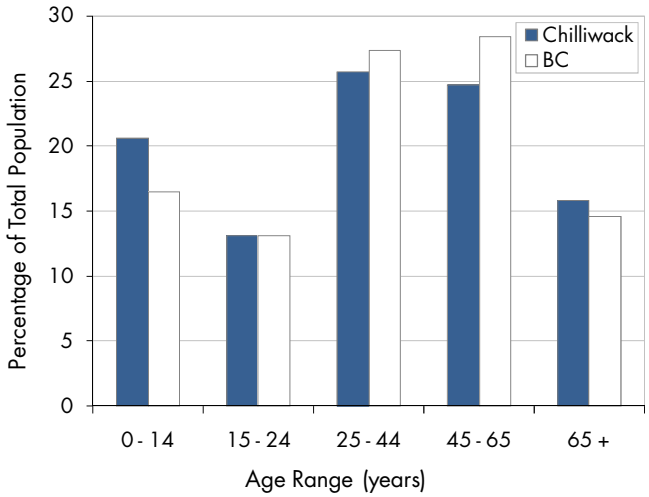


Figure 5: Population by Age Group

Source: BC Stats Community Profile 2007

The 2006 Census recorded 26,869 occupied dwellings in the community and projections expect this to rise to over 40,000 by 2021[17]. The predominant housing type is detached dwellings (Figure 6) comprising approximately 62% of existing buildings. The next most prevalent dwelling types are low-rise apartment buildings and row houses, representing 19% and 11% of housing, respectively.

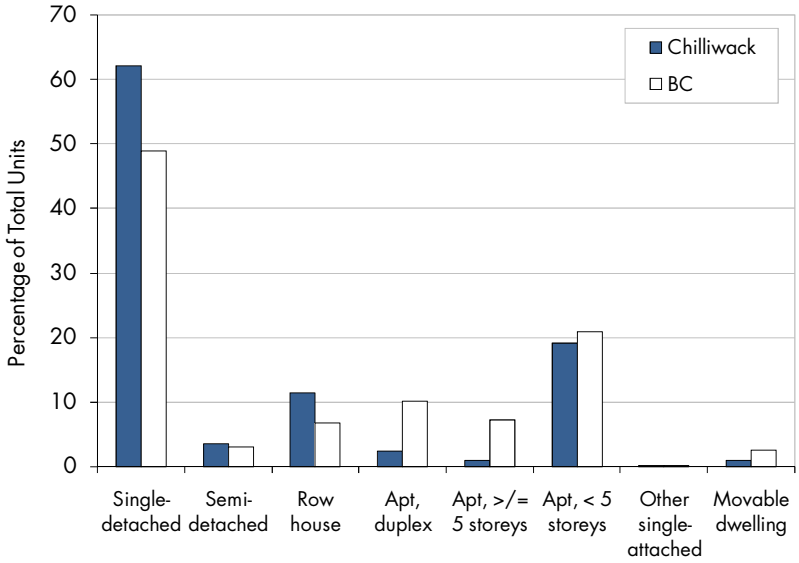


Figure 6: Housing Stock by Type

Source: BC Stats Community Profile 2007

[17] City of Chilliwack, 2006

Approximately 75% are occupant owned, and 25% are rented. This is high compared to the BC average of 70% of dwellings are occupant owned.

About half (47%) of the houses were built before 1980, with over 27% of those built before the 1970s. Approximately 17% of all housing is almost 50 years or older. These older homes would have been built to less stringent energy requirements, may have deterioration of air sealing, and likely include older furnaces and water heating appliances. Frequently there is an opportunity for improvements in energy efficiency in older buildings.

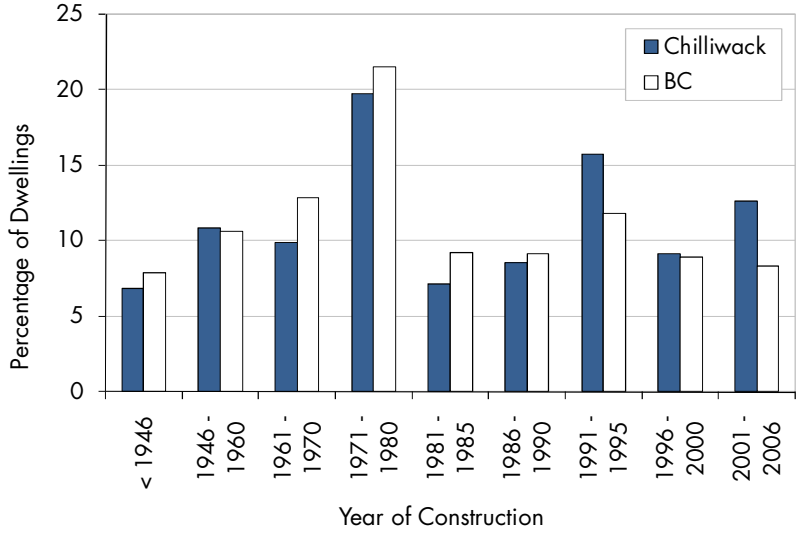


Figure 7: Housing Stock by Age of Building

Source: BC Stats Community Profile 2007

New buildings constructed since 1990 represent 37% of the total stock. There is a clear trend toward multi-family residential housing starts instead of the once dominant single-family residences, as shown in Figure 8.

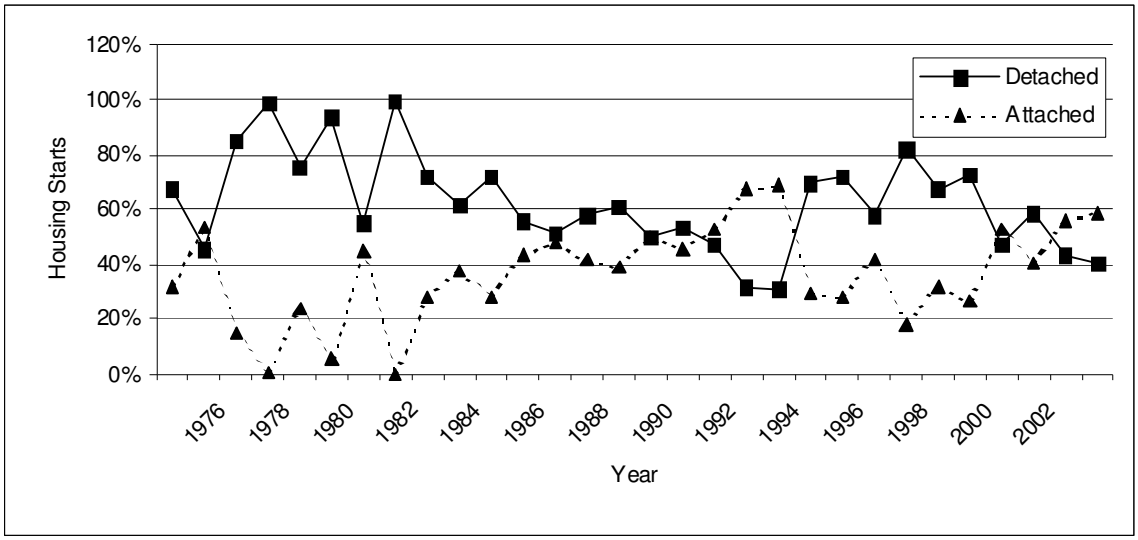


Figure 8: Trend in Housing Starts in Chilliwack (1975-2004)

3.5 Transportation

Transportation options in the City include automobiles, public transportation, cycling and walking. The community includes a more densely populated centre (up to densities of 40 to 80 units per acre), a very sparsely populated agricultural zone, and some rural low density hillside communities (densities of 7.25 units per acre). Because the population is spread across a wide area, there is a high reliance on automobiles. The OCP and Downtown Development Plan priorities of higher density in the City centre can lead to reduced energy use for transportation if appropriate amenities and services are provided along with increased density.

Residents of Chilliwack currently overwhelmingly use single-occupancy vehicles to commute to work (see Table 3). Approximately 83% of residents commute to work as the driver of an automobile, 9% of residents commute as a passenger in an automobile, 6% walk or cycle, and 1% take public transit.

The majority of daily trips are within the community (approximately 87%), 10% are within the Fraser Valley and the remaining 3% are outside the regional district[18]. This indicates residents are able to fulfill most of their needs for work, recreation, and amenities within the City, providing a strong opportunity for a shift to a more sustainable local transportation system.

Of the trips made for commuting to workplaces in Chilliwack, approximately 14% are by people coming into Chilliwack from other communities in the Fraser Valley and beyond[19].

[18] Strategic Review of Transit in the Fraser Valley: Foundation Paper #1 – Draft; April, 2009, p35.

[19] Strategic Review of Transit in the Fraser Valley: Foundation Paper #1 – Draft; April, 2009, p37.

Table 3: Transportation Modal Split for Commuters

Mode of transportation to work	Chilliwack		BC	
	number	% of total	number	% of total
Car, truck, van, as driver	24,725	83%	1,353,790	72%
Car, truck, van, as passenger	2,820	9%	145,840	8%
Public transit	335	1%	195,145	10%
Walked or bicycled	1,695	6%	167,650	9%
All other modes	340	1%	27,620	2%
Total employed labour force 15 years and over with a usual place of work or no fixed workplace address	29,925	100.0 %	1,890,055	100.0 %

Source: Statistics Canada 2006 census community profiles
Note: Values may not sum precisely due to rounding

Public transportation is operated by BC Transit on a year-round basis, with some schedules that are only seasonal. Average ridership is increasing annually, as shown in Figure 9, and in 2008 ridership exceeded 450,000. In 2011, BC Transit, the City of Chilliwack and other local governments in the Fraser Valley will be developing a Transit Future Plan for the region, which builds on the Strategic Transit Review completed in 2010. The Transit Future Plan will evaluate transit service upgrade options and identify recommended solutions to encourage increased transit ridership.

In addition to transportation within the community by community members, the air quality in Chilliwack may be impacted by emissions from significant volumes of traffic that flow through the City on the trans-Canada highway.

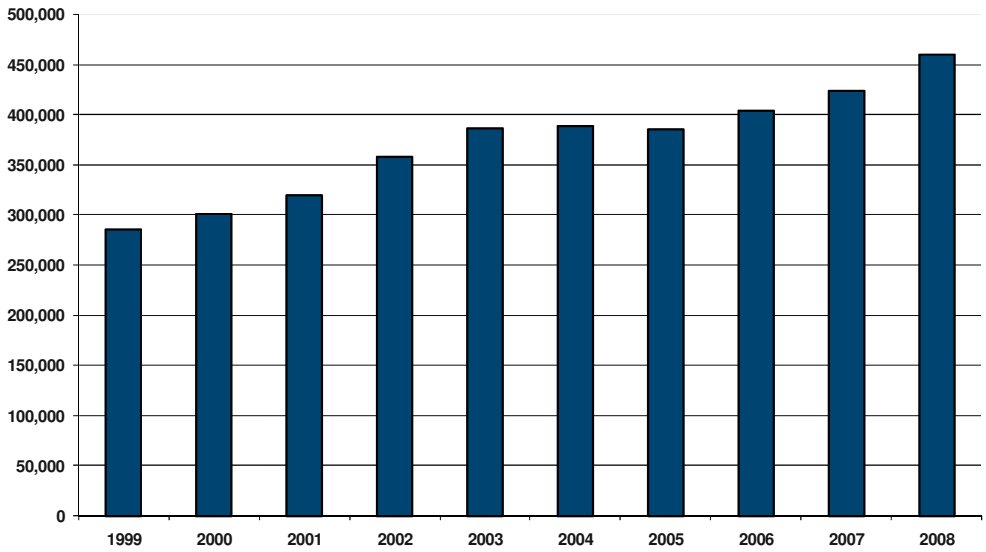


Figure 9: Annual Transit Ridership in Chilliwack

Source: City of Chilliwack

3.6 Economy

The community of Chilliwack was built primarily on the agricultural and forestry industries. Over time this economic base has diversified and it now supports significant services and manufacturing sectors. However, agriculture still holds an important place in the City's economy, as shown in Figure 10. With protection of agricultural land through the ALR, agriculture will likely continue to be a significant part of Chilliwack's economy in the future. Agricultural activities can have impacts on air quality, greenhouse gas emissions and energy use. Institution of best practices can significantly reduce these impacts. Food processing and other manufacturing industries are growing in significance in the local economy. These activities may also have impacts on air quality, greenhouse gas emissions, and energy use in the community.

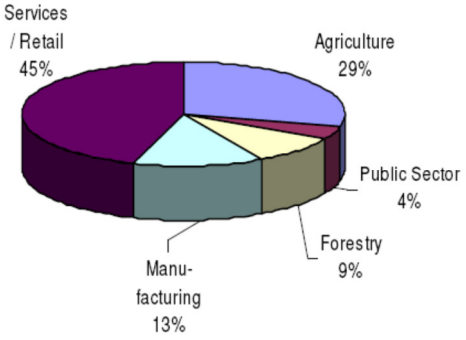


Figure 10: Economic Diversity in Chilliwack

Source: Chilliwack Community Profile, Chilliwack Economic Partners Corporation, 2009

Given the large quantities of waste produced through agricultural and food processing activities, there may be significant opportunities to convert that waste into an alternative energy source using technologies such as anaerobic digesters.

3.7 Future Growth

The City's current OCP was developed over a decade ago and is intended for a population of up to 85,000, which Chilliwack is quickly approaching. The City has completed a study of growth projections from 2007 to 2031. These projections focus on changes in population and dwellings for each of the neighbourhoods in the City, though there are some projections for changes in industrial, commercial and institutional activities as well. Key findings of this study indicate that:

- City's population is expected to grow from 78,000 in 2007 to 124,000 by 2031, an average of 2.0% per year (this is considered a relatively conservative estimate).
- Urban population could account for 95% of the City's population in 25 years.
- Future growth will be concentrated in the urban realm; rural growth will be minimal. The urban growth will primarily occur in the corridor along key community "nodes" of Chilliwack proper, Sardis and Vedder.

- There is sufficient capacity within the existing urban containment boundary to accommodate the growth. Growth will need to incorporate diverse housing needs, and will need to be positioned to provide socially and economically viable neighbourhoods where residents can work close to home.
- Promontory, a hillside development, is approximately 85% developed and is expected to reach capacity by 2016. It does not have sufficient flat areas to include any significant commercial or industrial development.
- Chilliwack Mountain, also a hillside development, is approximately half developed given the target/vision of the current OCP; however development targets for this area will be reviewed as part of the upcoming OCP update.
- The Eastern Hillsides may grow from a 2007 population of approximately 820 to a population of 6,000 to 7,400 by 2031, depending on the outcome of the Eastern Hillsides planning process currently underway.
- Industrial sites need to be identified on the valley floor close to major transportation (Trans-Canada Highway and CN Rail lines) to support local economic development and ensure local employment for the long-term.

The City has developed a Downtown Land Use and Development Plan, which focuses on increasing density, while drawing in new business interest, and revitalizing the core.

3.8 Implications for Plan Development

There are a number of features of the community that are unique to Chilliwack that will affect the actions in this plan. Some of the challenges and opportunities include:

Challenges:

- City covers a large geographic area and supports geographically dispersed developments with low population densities. This causes a higher reliance on automobiles due to the distributed nature of amenities, services, and employment locations.
- Nature of ALR has caused development on hillsides. These are more energy intensive developments that require automobile transportation, have limited amenities close to living, and require more energy to provide municipal services.
- Steep topography on hillsides makes alternative modes of transportation challenging.
- Air quality is impacted by neighbouring communities in the Lower Fraser Valley Airshed, including Metro Vancouver and parts of Whatcom County in the USA. The City has relatively low influence over activities in these areas, but the activities have significant impact on Chilliwack's air.
- Some lower income homeowners will face financial barriers in becoming more energy efficient.

- Taking steps to reduce energy consumption and greenhouse gas emissions can require capital investments at the outset, leading to shorter-term cost increases to residents and businesses; though many initiatives have longer-term cost and other benefits.
- During periods of slow growth and development, there is limited opportunity for significant change in the energy state of the housing stock.

Opportunities:

- Current Downtown land use planning focuses on compact development, with amenities in close proximity to residents. More compact development generally creates lower energy demands for buildings and for transportation.
- The older housing stock provides opportunities for conducting retrofits that are simple and inexpensive to execute, while providing visible benefits.
- Relatively high owner-occupancy of houses which makes investments in the buildings more promising than in rental stock.
- Existing transportation data indicates residents tend to stay within Chilliwack to fulfill the vast majority of their needs for work, recreation and amenities. The City can build on this existing pattern to encourage a shift to more sustainable transportation choices for accessing key workplaces and amenities in Chilliwack.
- Preservation of ALR forces more compact development in non-ALR areas.
- Potential for new developments that can be encouraged to include and showcase energy efficiency.

4 Air Quality, Energy and GHG Emissions Inventory and Forecast

Air emissions, energy consumption and GHG emissions in the community derive from:

- **Buildings** – The energy to heat and cool residential, commercial and industrial buildings, as well as the activities that occur within these residences and facilities. This data is obtained through the Community Energy and Emissions Inventory (CEEI) initiative from utility records and includes electricity and natural gas consumption (see section 4.1 below for further information on CEEI). Other sources such as wood, fuel oil, or propane tank heat have not been quantified in the inventory[20].
- **Transportation** – Vehicular consumption and emissions, is based on a count of the vehicles in the community, an estimate of fuel consumption based on type of vehicle, and an estimate of the number of kilometres driven. This data is obtained through the CEEI initiative and includes data sources from ICBC and Natural Resources Canada.
- **Waste** – Waste does not directly consume energy but when deposited into landfills, it decomposes and releases methane gas which is a greenhouse gas stronger than carbon dioxide. Solid waste emission estimates are based on the Scholl-Canyon waste-in-place methodology[21].
- **Agriculture** – Fertilizer application and manure management practices both impact local air quality by releasing particulate matter and ammonia that contributes to secondary particulate matter formation and visibility concerns known as white haze. This data is obtained from detailed modeling performed by Metro Vancouver and reported every 5 years in the Lower Fraser Valley Emissions Inventory.
- **Indoor and outdoor burning** – Wood smoke from interior fireplaces/woodstoves, and open burning all contribute to the release of fine particulate matter that may impact human health. This data is obtained from modeling performed by Metro Vancouver and reported every 5 years in the Lower Fraser Valley Emissions Inventory.
- **Industrial activity** – This data is obtained from modeling performed by Metro Vancouver and reported every 5 years in the Lower Fraser Valley Emissions Inventory.
- **Rail and Off-Road sources** – This data is obtained from modeling performed by Metro Vancouver and reported every 5 years in the Lower Fraser Valley Emissions Inventory.

[20] Industrial energy consumption is available only for natural gas as confidentiality concerns prevent the release of the electricity data at present. The industrial natural gas consumption amounts to about 11% of the building energy consumption.

[21] http://www.env.gov.bc.ca/epd/codes/landfill_gas/pdf/inventory_ggg_landfills.pdf; a report prepared by Golder Associates for the BC Ministry of Environment.

4.1 Energy Consumption and Greenhouse Gas Emissions

Two sources of data have been compiled to provide the community's energy consumption and greenhouse gas emissions.

1. The Provincial Ministry of Environment, as part of the Community Energy and Emissions Inventory (CEEI) initiative has provided an inventory of community energy consumption and greenhouse gas (GHG) emissions [22]. This initiative has provided each community in the province with standardized greenhouse gas inventories for 2007. The CEEI initiative does not include certain contributors to greenhouse gases, such as agricultural activities and, in many cases, industrial activities.
2. The Lower Fraser Valley 2005 Emission Inventory is prepared by Metro Vancouver with detailed modeling of emissions. This emissions inventory includes estimates of greenhouse gas emissions from all sources, including agricultural activity.

The community of Chilliwack has total GHG emissions of 536,000 tonnes of CO_2 equivalents, or 6.8 tonnes per capita based on the 2007 CEEI data source (which excludes industrial electricity use and agriculture). Including agriculture, the community's GHG emissions are approximately 648,000 tonnes of CO_2 equivalents, or 8.3 tonnes per capita. See Table 4 for the community's energy consumption and associated GHG emissions. An estimated 44% of Chilliwack's energy is consumed by transportation, and this segment accounts for approximately 46% of the GHG emissions.

Table 4: Community Energy Consumption and GHG Emissions in Chilliwack in 2007

Use	Energy (as GJs)	GHG Emission (tonnes of CO_2e)	Approximate Retail Value ($)[4]
Residential	3,030,000	100,000	$ 43,900,000
Commercial	2,120,000	66,000	$ 31,200,000
Industrial[1]	380,000	19,300	$ 4,500,000
Transportation (estimated)[2]	4,320,000	295,000	$ 168,700,000
Agriculture[3]	-	112,000	-
Solid Waste	-	55,000	-
Total	9,850,000	648,000	$ 248,400,000
Total (per capita)	**126**	**8.3**	**$ 3,300**

Source: CEEI Report, June 30, 2010 Report; http://www.toolkit.bc.ca/ceei

[22] The CEEI inventories use actual utility data for electricity and natural gas consumption. For vehicles fuels, the consumption is estimated from vehicles counts, published fuel efficiency, and assumed annual driving distances. This inventory does not include privately supplied energy such as propane or heating oil, and does not include wood or other biomass derived energy.

Table notes:

1) Industrial electricity consumption data was withheld to protect account holder privacy. The industrial consumption and emissions includes only natural gas data.

2) Transportation emissions are estimated from vehicle counts and assumed annual average travel distances. These may not match with fuel sales within the City.

3) GHG emissions from agricultural sources are derived from the 2005 Lower Fraser Valley Emissions Inventory in the Technical Appendix for the FVRD. The inventory estimates 17% of FVRD GHG emissions derive from agricultural sources (does not include off-road vehicles such as tractors or emissions from burning practices). To estimate agricultural GHG emissions for Chilliwack, 17% of the community's total GHG emissions were used.

4) Retail value is provided for information only and is based on typical retail prices and is not derived from billing data. Actual billings will differ from this value due to different rate schedules, fixed charges, and price variability through the year. Unit prices used here are electricity 6.5 cents per kWh, natural gas $12 per GJ, vehicle fuels $1.40 per litre - representative of 2007 prices.

Energy consumption in Chilliwack is illustrated in Figure 11, broken down by fuel type (e.g. electricity, natural gas, gasoline, diesel) and by end use (e.g. residential buildings, commercial buildings, industrial buildings, personal vehicles, commercial vehicles). Figure 12 illustrates the GHG emissions associated with this energy consumption, also broken down by fuel type and end use. A detailed breakdown is provided in Appendix A.

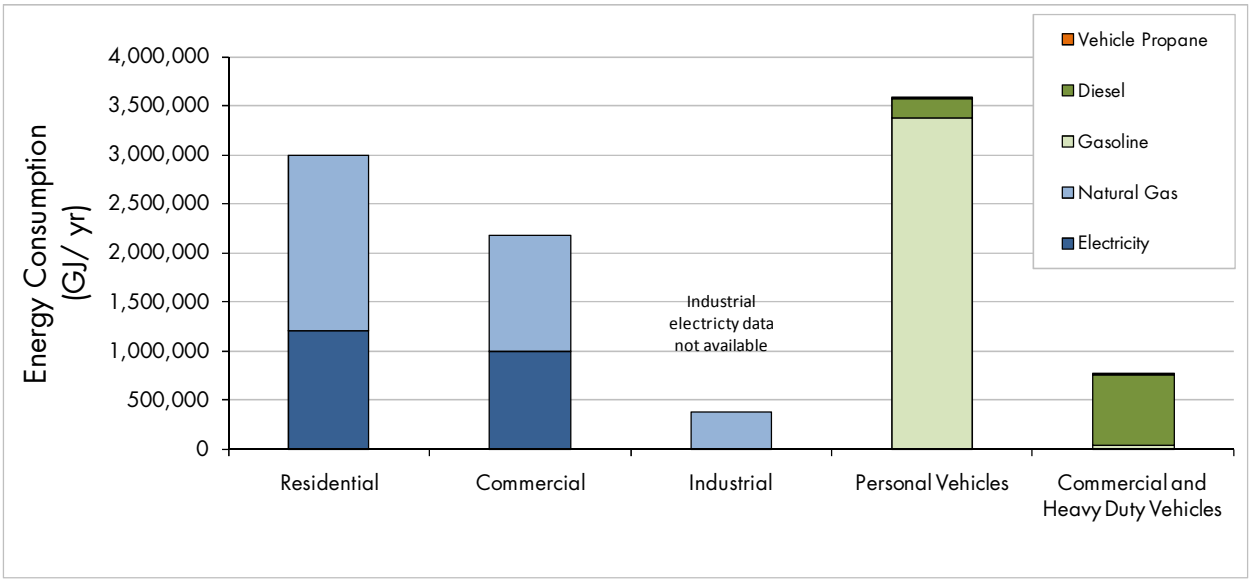


Figure 11: Community Energy Consumption by End Use and Fuel Type (2007)

Source: Ministry of Environment Community Energy and Emissions Inventory (CEEI) Initiative

Figure notes:

1) Only utility-provided energy is available. Other energy sources such as propane, fuel oil, and wood may be substantial but are not yet estimable.

2) Industrial electricity consumption has been withheld to protect confidentiality of account holders.

3) Transportation numbers are based on vehicle registrations and assumed average travel distances and have not been checked against actual consumption data.

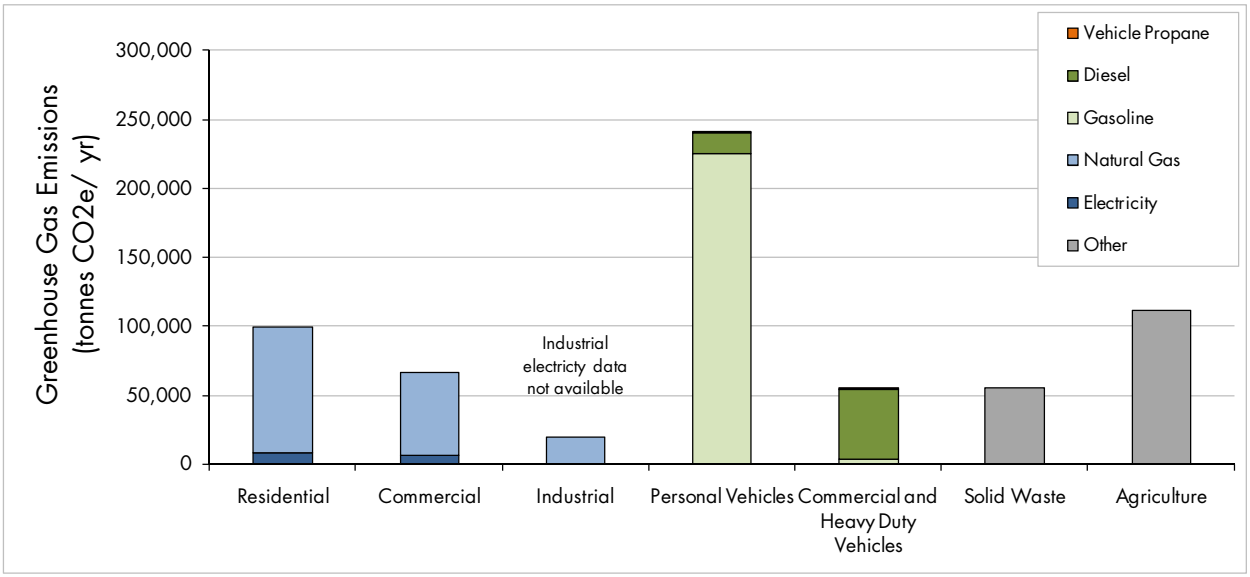


Figure 12: Community GHG Emissions by End Use and Fuel Type (2007)

Source: Ministry of Environment Community Energy and Emissions Inventory (CEEI) Initiative.

Figure notes:
1) Only utility-provided energy is available. Other energy sources such as propane, fuel oil, and wood may be substantial but are not yet estimable.

2) Industrial electricity consumption has been withheld to protect confidentiality of account holders.

3) Transportation numbers are based on vehicle registrations and assumed average travel distances and have not been checked against actual fuel sales data.

4.2 Common Air Contaminant Emission Inventory

The emissions inventory of Common Air Contaminants (CACs) for Chilliwack, FVRD and LFV are presented in Table 5 from the Lower Fraser Valley 2005 Emission Inventory. Note that the CO_2 equivalent emissions are higher than those estimated by the CEEI initiative (presented above). This inventory accounts for emissions from off-road vehicles (such as farm equipment) and rail, neither of which is included in the CEEI data.

Table 5: 2005 Common Air Contaminant Emissions for Chilliwack, FVRD and LFV

Location	Population	CO	NO_x	PM	PM_{10}	$PM_{2.5}$	SO_x	VOC	NH_3	CO_2e
Chilliwack	69,000	14,551	1,686	1,002	499	289	35	3,178	1,653	656,400
% of LFV	*3%*	*4%*	*3%*	*6%*	*5%*	*5%*	*1%*	*4%*	*14%*	*4%*
FVRD		53,783	6,686	3,465	1,657	899	162	19,594	6,459	2,298,613
% of LFV		*14%*	*13%*	*19%*	*18%*	*16%*	*3%*	*27%*	*55%*	*13%*
LFV (Cdn portion)	2,418,000	375,309	50,842	18,150	9,414	5,599	5,544	73,918	11,790	17,905,748

Source: 2005 Lower Fraser Valley Air Emissions Inventory & Forecast and Backcast, Metro Vancouver (2007).

Ammonia is a significant air emission in the Chilliwack area, and comprises 14% of the ammonia emissions for the entire Canadian portion of the LFV. When ammonia enters the air, it reacts and

becomes secondary particulate matter – a key component of "white haze" which leads to visibility concerns in the Fraser Valley. 76% of ammonia emissions and 11% of "smog-forming pollutants" (NH_3, VOC, $PM_{2.5}$, NO_x, SO_x) result from agricultural activity in the Lower Fraser Valley.

The City of Chilliwack also emits approximately 16% of the methane gas from the Canadian portion of the LFV.

4.3 Forecast

The concentrations of several air contaminants in the City of Chilliwack's air are expected to decrease by 2030, and several are expected to increase. In particular, NH_3 and PM are expected to increase by 40% and 24%, respectively. NO_x and SO_x are expected to decrease significantly due to technological improvements and heightened vehicle emission standards.

Table 6: Forecast air emissions for City of Chilliwack to 2030

	CO	NO_x	PM	PM_{10}	$PM_{2.5}$	SO_x	VOC	NH_3
2005	14,551	1,686	1,002	499	289	35	3,178	1,653
2030	14,696	922	1,244	569	301	21	2,948	2,314
% change	1%	-45%	24%	14%	4%	-40%	-7%	40%

Source: 2005 Lower Fraser Valley Air Emissions Inventory & Forecast and Backcast, Metro Vancouver (2007).

Energy and greenhouse gas emission forecasts were developed as part of this project. These indicate an expected 20-25% increase in energy consumption and 15-20% increase in GHG emissions under a "Business As Usual" scenario. This scenario takes into account expected growth and technological improvements in vehicles and building efficiency as follows:

- Residential building energy demand is reduced by 20% between 2008 and 2020 (e.g. building code improvements, appliance / equipment improvements, etc.)
- Commercial building energy demand is reduced by 9% between 2008 and 2020[23] (e.g. building code improvements, appliance / equipment improvements, etc.)
- Passenger vehicle fleet average fuel economy improves by 40% between 2016 and 2031 (e.g., general fleet turnover and improved efficiencies in vehicle design)
- Commercial vehicle fleet average fuel economy improves by 15% between 2020 and 2035 (e.g., general fleet turnover and improved efficiencies in vehicle design)[24]

[23] Residential and commercial building energy performance targets from the BC Energy Efficient Buildings strategy.

[24] Passenger and commercial vehicle efficiency improvements expected based on the federal government announcements to increase fuel efficiency requirements by 2016 (light duty) and 2018 (heavy duty).

See Figure 13 for the expected increases in GHG emissions, split by sector. A dotted line indicates the level of reduction that would be necessary to obtain a 33% reduction in emissions by 2020 (the provincial target).

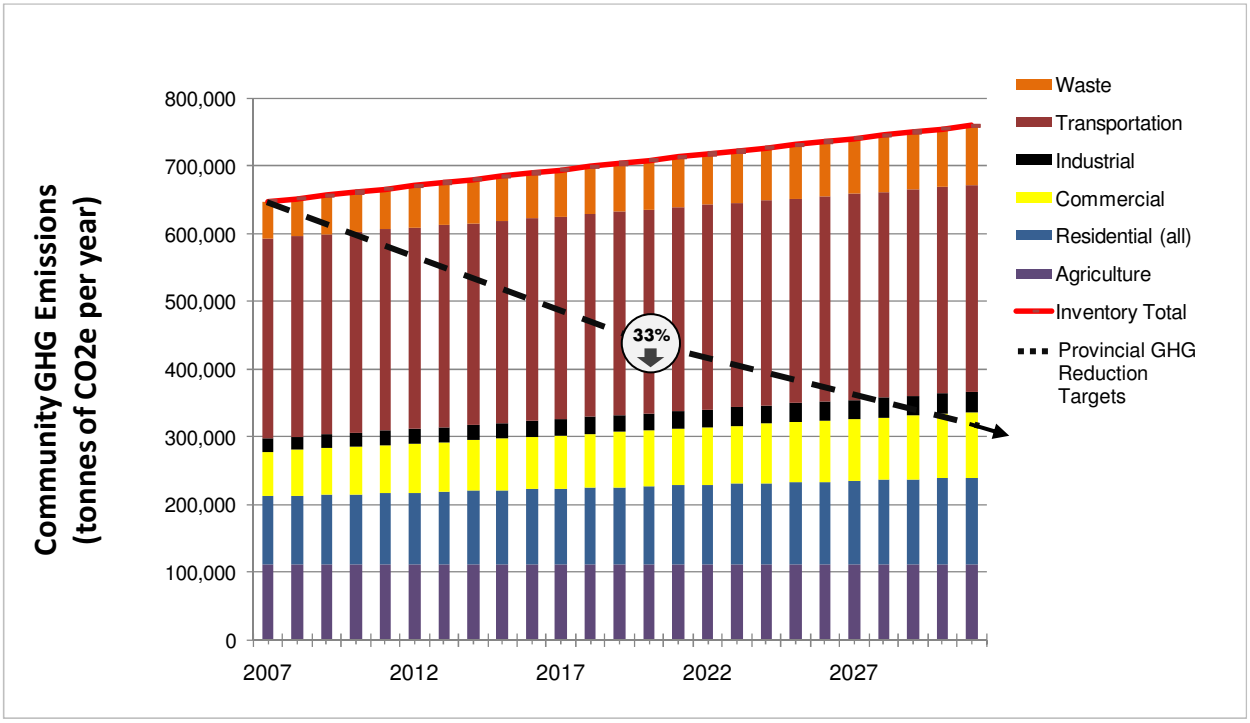


Figure 13: Estimated Community GHG Emissions Forecast, 2007 to 2031 (Tonnes)

4.4 Implications for Plan Development

The emissions inventories for Chilliwack provide insight into the primary sources of air emissions, energy consumption, and GHG emissions in the community at large. The most significant areas of energy consumption and air emissions are:

- Personal vehicles make the largest contribution to GHG emissions in the community. Because the City is quite distributed, it is car-dependent and this leads to significant vehicle emissions. Focusing future growth around urban nodes may help reduce these emissions, but more significant reductions will result from changes to federal vehicle emission standards, which are expected to improve the overall fuel efficiency of the fleet of vehicles sold in 2016 by 40% relative to the fleet of vehicles sold in 2008.
- Residential and commercial space and water heating are also significant components of the community's total GHG emissions. There are likely opportunities here to increase energy efficiency through renovations and the greening of the BC Building Code.

- Ammonia and particulate matter are the pollutants from Chilliwack that contribute the most to the total emissions in the LFV (Canadian portion). These are largely related to the agricultural activity in the City's ALR.

The forecasts show a 22% increase in energy consumption and a 17% increase in GHG emissions. This plan will identify actions that can reduce the most significant sources of emissions for both corporate and community activities.

5 Plan Framework

5.1 Adaptive Management Approach

The air quality in Chilliwack is occasionally reaching levels of concern for certain pollutants that can impact human health. Over time it is expected that both the City and surrounding regions will continue to experience population growth and development that is likely to place added pressure on this sensitive airshed. Simultaneously, energy consumption and GHG emissions are likely to rise, particularly with the population expected to grow to 124,000 by 2031 (a 60% increase). These changing conditions require the City and its partners to adapt policies and programs over time to ensure the community grows in a healthy, sustainable manner.

In this plan, a **Vision** is defined that depicts *"Where we want to be"* in the long term.

Five **Goals** are defined that provide more specific descriptions of what the community would like to achieve, and are useful tools to ensure future decision-making aligns with this plan.

A series of **Targets** are also identified that measure progress towards the stated vision and goals and answer the question *"How are we doing?"*.

Finally, a list of **Actions** are outlined to provide an initial list of activities the City should undertake to achieve the vision and goals, or *"How to get there"*.

Figure 14: Framework for Community Air Quality and Energy Planning

In order to **Implement** the action plan, the City will need to commit to longer-term funding for staff time and expenditures. Provincial Carbon Tax rebates are available to fund the activities. The City will also need to monitor progress to ensure the activities are leading them in the desired direction.

Collectively, these steps form an adaptive management framework for air quality and energy planning. In order to adapt to changing conditions, the Actions and Implementation plan may change, however, the Vision and Goals will continue to provide the desired direction for the long term.

5.2 Air and Energy Vision

A working vision was developed from a review of City of Chilliwack documents and plans and conversations with staff at the outset of the development of this plan. A formalized community visioning process will be undertaken by the City of Chilliwack when it updates its OCP in the near future. As a part of the OCP visioning process, the City may wish to re-evaluate this vision to ensure it aligns with the updated OCP.

Draft Vision for Energy, Climate Change and Air Quality

Chilliwack is a vibrant community with a mix of rural and urban neighbourhoods. We are striving towards an energy efficient economy, a low carbon lifestyle, and healthy, clear air as these are essential for the long term viability of our community.

We share our air with our neighbours, and we work actively with all the communities of the Fraser Valley to protect it. Our senior governments work to protect our air and support energy efficiency through legislation and programs. We also take action independently where needed. We cannot achieve everything ourselves, but we cannot expect others to act without us.

With foresight and consideration of all our residents, stakeholders, and partners, we are advancing the goals of energy efficiency, climate change mitigation, and clean air. We are part of the solution.

5.3 Air and Energy Goals

In addition to defining a future vision for the community, a series of end-state goals provide more specific guidance that defines "Where we want to be". These goals provide a tool for future decision making, to ensure decisions continue to align with the community energy plan. An initial list of actions is described below, but these actions may change over time as appropriate to meet the following goals:

Goals:

1. We have clean air that minimizes human health impacts.
2. We have clear views in our community.
3. Our residents and businesses make informed energy choices that minimize emissions.
4. We minimize greenhouse gas emissions through conservation and alternatives to fossil fuels.
5. We have constructive relationships with our neighbours, partners and other levels of government.

5.4 Theme Areas

Seven theme areas were selected as a framework for presenting the actions in the community plan. These are:

Sharing Air In Our Region	❖ Partnerships for clean air
Planning Our City	❖ Strategic policies to define air quality and climate change action ❖ Engagement of citizens in energy and air quality issues ❖ Measuring, tracking and reporting progress
Developing Our Neighbourhoods	❖ Growth through infill / densification ❖ Energy strategies for new development
Living In Our Homes	❖ Energy conservation practices ❖ Energy efficient construction and renovation
Facilitating Our Mobility	❖ Alternative transportation options
Supplying Our Energy	❖ Renewable energy sources ❖ Community energy systems
Building Our Economy	❖ Enhancing local employment opportunities ❖ Preserving diversity (agriculture, manufacturing, services)

6 Action Plan

A series of 36 actions are identified to help the City understand how to reach the Vision and Goals defined in Section 5. Actions range from one-time activities to longer-term program development activities or planning requirements which require bylaws to be enacted. The actions were analyzed for level of effort to implement and expected level of impact on air quality, energy consumption and greenhouse gas emissions.

The results of this analysis are shown in Figure 15, a quadrant which organizes actions into four categories:

- **Legacy**: These actions require a longer-term commitment (e.g. staff time for 5 years) but are expected to result in higher benefits or larger reductions in emissions if implemented effectively.

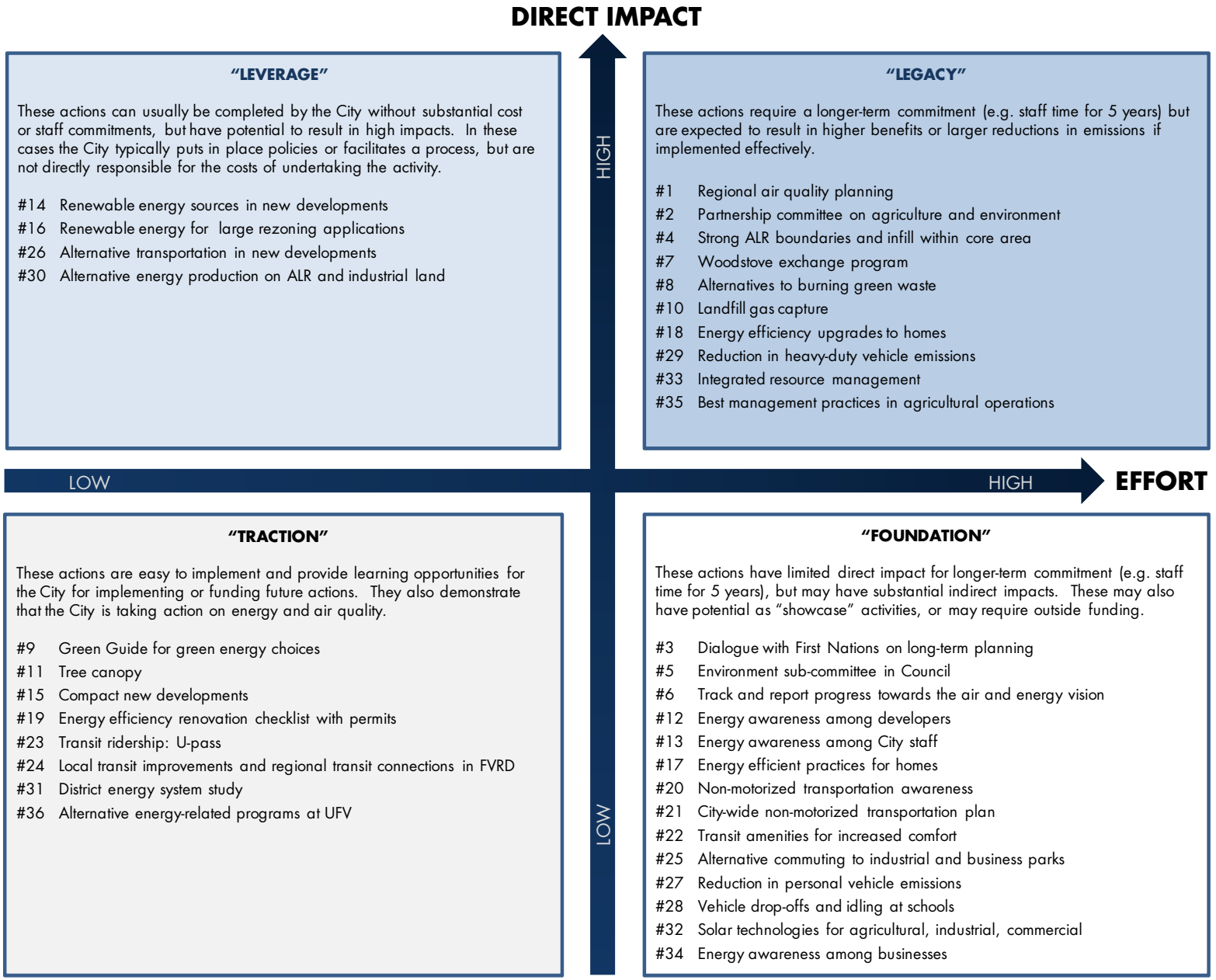
- **Leverage**: These actions can usually be completed by the City without substantial cost or staff commitments, but have potential to result in high impacts. In these cases the City typically puts in place policies or facilitates a process, but are not directly responsible for the costs of undertaking the activity.

- **Traction**: These actions are easy to implement and provide learning opportunities for the City for implementing or funding future actions. They also demonstrate that the City is taking action on energy and air quality.

- **Foundation**: These actions have limited direct impact for longer-term commitment (e.g. staff time for 5 years), but may have substantial indirect impacts. These may also have potential as "showcase" activities, or may require outside funding.

Refer to Appendix C for a description of the criteria used to determine the level of effort and impact for each action.

Figure 15: Summary of Actions



Each of the actions is described in the following table. Where applicable, one or more tools or examples are included as a reference for the City of Chilliwack to aid in implementation of the action.

#	Action	Details
OUR REGION		
1	Participate in regional Air Quality Management Planning	Implement actions from the AQMP in cooperation with FVRD and neighbouring communities. Work towards: a. Region-wide consistent bylaw for open burning. b. Requirement for tarps on rail cars to eliminate coal dust. c. Reduction in diesel particulate emissions (e.g. through use of biodiesel for locomotives going through the City). d. Increased number of monitoring stations in Chilliwack (mobile or permanent). e. Best practices for manure management, in particular liquid fertilizer application. f. Continuous dialogue with Metro Vancouver and provincial government to review air emission standards for air quality improvement. Opportunities & Tools: Regional Air Quality Management Plan and process already in place. These actions require cooperation from provincial and federal agencies.
2	Participate in the multi-agency Partnership Committee on Agriculture and the Environment	Promote agricultural best management practices that reduce air emissions. Encourage funding from Federal and Provincial governments to implement BMPs. Opportunities & Tools: Partnership Committee is already in place, but tends to focus more on water. A shift to include more air quality considerations is underway. The agriculture commission approached City to create an Agricultural Plan.
3	Engage in dialogue with First Nations regarding long-term community planning	Share visions, goals and initiatives regarding long-term community planning.
OUR CITY		
4	Maintain strong support for ALR boundaries and encourage infill development within the core area	Create more compact development in the downtown core and the Sardis-Vedder corridor. Continue to allow zoning changes for secondary suites to encourage higher densities in existing neighbourhoods, particularly in the downtown and Sardis-Vedder corridor. Consider changing zoning to allow secondary suites for rental throughout the City (subject to other City policies & bylaws). Opportunities & Tools: The downtown land use plan supports this approach. Furthermore, the City already has reduced DCCs for single family if it meets multi-family density (typically stratas).

#	Action	Details
5	Form an environment sub-committee in Council	Committee may consist of various community representatives. Opportunities & Tools: Other BC municipalities have undertaken this. Examples include City of Richmond (over 10 years) and Town of Ladysmith (just 1 year).
6	Monitor and report on progress towards the air and energy vision	Monitor and report on progress towards the air and energy vision defined in this plan. Display results on a public website for community members.
7	Reduce emissions from woodstoves	a. Continue supporting the FVRD/MoE woodstove exchange program. Encourage FVRD to provide "Burn it smart" education workshops simultaneously. b. Develop an education program to limit the use of wood stoves on "Poor" or "Fair/Poor" air quality days in Chilliwack. Opportunities & Tools: BC MoE provides resources to run this program.
8	Reduce burning of green waste	a. Develop an education campaign in conjunction with enforcement of Open Air Burning Bylaw on alternatives to burning. Increase awareness of concerns over burning prohibited materials. b. Provide a workshop to fire fighters and other City staff on alternatives to burning. c. Consider amending the Open Air Burning Bylaw to further reduce emissions (e.g. only allow burning on "Good" days, shortening the burning window). Opportunities & Tools: Education campaigns have already been developed around this topic by several jurisdictions. For example, the Cowichan Valley Regional District developed a series of three Open Burning Fact sheets as part of their education campaign.
9	Create a Green Guide to advance green energy choices to residents	Work with CEPCO and possibly UFV to advance green energy choices to residents through a published guide. This may extend to encouraging individuals or organizations to take on activities in the community to advance green choices. Opportunities & Tools: The City of Richmond produced an environmental project guide for its residents, which could serve as a model.
10	Accelerate landfill gas capture regulation requirement	Currently required to have an action plan by 2012, and a capture system built by 2016. Also consider implementing an organics diversion program for compostable waste. Opportunities & Tools: If implemented early, City may be eligible for offset credits prior to regulation coming into force.
11	Encourage increased tree canopy	Develop neighbourhood tree planting programs. Evaluate outcomes of recently adopted "Tree Management (Land Development) Bylaw" and Hillside Development Guidelines.

#	Action	Details
OUR NEIGHBOURHOODS (DEVELOPMENT)		
12	Encourage energy efficient design and building among developers and realtors	a. Work with Canadian Home Builders Association (CHBA) to increase energy awareness amongst developers. Support awareness workshops for developers on site at a green development (e.g. Garrison Crossing LEED ND project, a Built Green project). Possibly include building inspectors in these workshops. b. Create a municipal "Guidelines to Development" based on best practices guidance provided by the province[25]. Chilliwack guidelines could include air emission and GHG reduction objectives. Distribute to developers. c. Work with Realty Board to deliver workshops and distribute handouts about green developments features and energy efficient renovations. Opportunities & Tools: The CHBA has several Built Green certified builders in the Chilliwack region. Realtors are a potential access point to many home owners.
13	Increase energy awareness among City staff	Provide learning sessions for staff to bring understanding and awareness about available technologies and opportunities for energy conservation, alternative energy, and GHG emission reductions in buildings.
14	Strongly encourage use of renewable energy sources in new developments	Implement DPGs that encourage renewable energy be incorporated into new developments under the privileges extended in the Green Communities amendment (Bill 27) to the LGA. This may include passive solar and natural ventilation guidelines. Opportunities & Tools: The nature of DPGs provides flexibility to council, as approvals occur on a case-by-case basis.
15	Continue encouraging compact new developments	Evaluate all rezoning applications for level of compact development with respect to energy and greenhouse gas implications.
16	Require evaluation of renewable energy sources for large rezoning applications	Require rezoning applications for large developments to evaluate the feasibility of meeting 20% of energy needs with renewable energy sources and/or higher green building standards. Opportunities & Tools: Bowen Island developed a rezoning policy in 2007 that stipulates green building standards. The City of Vancouver recently strengthened an existing policy to require all rezoning applications to meet LEED Gold equivalency standards.
OUR HOMES		
17	Encourage the provincial government to promote energy efficient practices for homes. Promote programs developed by	a. Work with BC Hydro to promote energy efficient practices for homes, including compact fluorescent lights, laundry lines, timers on lights, etc. (Home Show booth, Community events, web presence) b. Work with CHBA to develop an educational booth at the annual Chilliwack Home Show about green building and energy efficient home

[25] Available at: http://www.cscd.gov.bc.ca/lgd/planning/greenchoices.htm

#	Action	Details
	the provincial government and other agencies.	retrofits. Promote provincial and federal incentive programs for energy efficient renovations. c. Update City website to provide links to grants and programs that support energy efficiency renovations or technology upgrades. d. Work with Realty Board to educate realtors on green features / upgrades in homes. Also distribute information about available incentive programs through realtors and builders. Opportunities & Tools: BC Hydro has energy efficiency coordinators throughout the province that work with communities to promote energy efficiency practices. Several grant and incentive programs exist, but are not always known to home owners – the City can help make this connection.
18	Promote energy efficiency in homes	Encourage the provincial government to continue an energy efficiency program for homes. Also, consider implementing one or more of the following: a. Air source heat pumps have been identified as a good option in Chilliwack - create a program to raise awareness of this technology. b. Use Local Improvement Charges (LICs) to fund energy efficient upgrades. OR c. Implement a Revitalization Tax Exemption bylaw that reduces property taxes for homeowners and/or businesses that retrofit buildings and show specified improvements in ER (Energy Rating) as determined by a certified energy audit. (This could also be used for new homes that meet specified energy standards). Opportunities & Tools: District of Saanich has a green building rebate program to encourage higher energy efficient building standards. The District of Central Saanich obtained a legal opinion that indicates Local Improvement Charges can be used to finance energy efficiency improvements in BC, however, no municipalities have implemented this to date.
19	Provide an energy efficiency renovation checklist with permits	Distribute an energy efficiency renovation checklist with permit applications. Consider requiring the checklist be completed prior to approving the permit. Opportunities & Tools: Several BC municipalities have developed a checklist that can be used as models.
OUR MOBILITY		
20	Promote non-motorized transportation options	a. Promote neighbourhood 'walk to school' programs (International walk to school month/ Way to Go! School Program) b. Conduct assessment for bicycle friendliness. c. Update the cycling map to show rack locations, rec centres, schools, libraries, parks. Produce hardcopies to distribute around the City. Opportunities & Tools: School programs such as Way to Go! and international walk to school month are already developed and in use in other jurisdictions. Parent Advisory Committees may coordinate or lead these activities.

#	Action	Details
21	Develop a City-wide non-motorized transportation plan	Take an integrated approach to increasing mobility opportunities for pedestrians, cyclists, scooters, wheelchairs, etc. This may include: a. Continue to expand cycling and sidewalk network. b. Improve North-South bike corridor. c. Create off-road bike paths to schools and recreation centres, where possible. d. Plan for and build wider sidewalks / cycling lanes: increase to 2m rather than 1.5m.
22	Improve transit amenities for increased comfort	Identify opportunities to improve bus stops, curbside pullouts, etc to increase comfort of passengers.
23	Promote programs that increase transit ridership, including the U-pass program	Promote the U-pass system and adjust transit schedules to align with class schedules. Identify opportunity to expand program to large employers.
24	Improve local transit service and support regional transit connections between nodes in FVRD	Evaluate route and schedule options to increase service levels. The regional transit initiative is currently being explored by the FVRD and member municipalities.
25	Encourage alternative commuting methods to industrial and business parks	Ensure industrial and business park areas are accessible and well-serviced for alternative commuting methods. Investigate opportunities to work with large employers to co-fund shuttles for employees. Opportunities & Tools: Stream, the largest employer in Chilliwack is interested in promoting alternative commuting methods.
26	Provide opportunities for alternative transportation in lieu of required parking in new developments	a. Developers may provide car coop spaces and memberships in lieu of some parking spaces. b. Allow developers to build cycling amenities for residential and commercial developments (e.g. large entryways, covered lock-up areas, button-activated doors) in lieu of parking requirements. Many of these may have co-benefits for increasing mobility for scooters, wheelchairs, etc. Ensure adequate measures are taken to avoid parking issues. Opportunities & Tools: The Oliva development in Tswawwassen had reduced parking requirements by providing space for a co-operative car and memberships to the Car Co-op to each resident in building.
27	Promote reduction in personal vehicle emissions	a. Expand the idle-free campaign: place signage at key locations (e.g. schools, truck stops, rail crossings). b. Promote Scrap-it program to residents. c. Develop and implement a bylaw allowing electric vehicles on roads up to 50km/hr. d. Encourage 1 car families; identify opportunities for coop cars to replace need for 2nd car. e. Encourage car pooling or other alternatives, particularly to community events, recreational activities & schools.

#	Action	Details
		Opportunities & Tools: Natural Resources Canada provides idle free program guidance and document/sign templates. Several BC municipalities have implemented electric vehicle bylaws, including Vancouver, Whistler and Oak Bay.
28	Work with the School District to reduce vehicle drop-offs and idling	a. Work with School District 33 to encourage activities that will reduce the number of vehicle drop offs (e.g. walk to school, carpool, etc.). b. Provide idle-free program materials to Parent Advisory Committees and encourage action. Have schools develop idle-free signage for drop-off zones.
29	Encourage the reduction in heavy duty vehicle emissions	a. Arrange for more ACOR (AirCare On-Road program) inspections of heavy-duty vehicles going through the community. b. Encourage business community to get tested by ACOR voluntarily (can be arranged by calling ACOR number). c. Share fleet management policies developed for the City to encourage uptake among businesses. d. Encourage federal government to implement emission reduction requirements for vehicles
OUR ENERGY SUPPLY		
30	Develop a business case to identify potential for alternative energy production on agricultural and Industrial land	Work with the Ministry of Agriculture and Lands, FVRD, the agricultural community and possibly the Chamber of Commerce to develop a business case for on-farm organic material digesters for energy production. Implement a demonstration project based on outcome. Opportunities & Tools: The Ministry of Agriculture and Lands is currently studying several alternative options for energy production from agricultural waste. The BC BioEnergy Strategy supports IRM for alternative energy production.
31	Investigate opportunity for a district energy system	Investigate opportunity for a district energy system. This could provide space and water heat for a defined service area such as a new development or a specific core area of the City. A first step will be to conduct a pre-feasibility study which can define the most promising opportunities for district energy – both from the perspective of potential load (energy users) and of the potential energy sources. The pre-feasibility study would need to consider AQ impacts.
32	Encourage solar technologies for agricultural, commercial and industrial activities	Opportunities for crop drying, food processing and agricultural applications.
OUR ECONOMY		

#	Action	Details
33	Facilitate Integrated Resource Management activities	Integrated Resource Management (IRM) activities may include anaerobic digesters, municipal organics, etc. a. Review zoning bylaw to ensure there are no prohibitions against allowing these activities. Amend to allow for digesters. b. Facilitate applications to ALC for IRM activities. Help interpret bylaws and provincial regulations (e.g. help mediate with Province). c. Approve building permits and business licenses for digesters. d. Coordinate learning sessions with MAL to get better understanding of risks and benefits. e. City may purchase energy from local farms (e.g. "cow power program" for natural gas). Opportunities & Tools: The Ministry of Agriculture and Lands is currently studying several alternative options for energy production from agricultural waste. The BC BioEnergy Strategy supports IRM for alternative energy production.
34	Work with the Chamber of Commerce to increase energy awareness among businesses	Encourage green energy topics for monthly member luncheons (green driving, energy evaluations, E3 fleet principles, ride-sharing programs). Opportunities & Tools: Natural Resources Canada has developed a Guide to Implementing an Energy Efficiency Awareness Program, a useful resource for commercial and institutional organizations.
35	Promote best management and energy efficient practices in agricultural operations	a. Best management practices for air quality. b. Work with BC Hydro and the Chilliwack Agricultural Commission to promote energy efficient practices, lighting and other technology in agricultural operations. Opportunities & Tools: The province's BioEnergy Strategy supports diversion of agricultural biomass for anaerobic digestion as a potential source of alternative energy production.
36	Identify opportunities for alternative energy-related programs at UFV	Approach UFV Chilliwack campus Deans to discuss Integrated Resource Management (IRM) education and program opportunities at University to build local knowledge / capacity. Also need for more trade training in green building.

7 Implementation

7.1 Air and Energy Considerations in the City's Strategic Direction

This integrated plan identifies a Vision, Goals and a series of Actions to guide the community towards a lower carbon future with decreased air emissions. In order to implement this plan, a commitment will be required from Council to fund staff and disbursement expenses that are dedicated to air quality, energy and greenhouse gas reduction activities. This will create a strong foundation for future initiatives, some of which may be substantial – such as a community district energy system that services residents living in a core area.

Decisions and planning relating to the City's strategic direction will need to incorporate the goals identified in this plan to ensure decisions align with the community's long-term vision for air quality, energy use and greenhouse gas emissions. One staff member will be designated as the plan's sponsor, and this staff will be responsible for ensuring the plan is represented at the management and council levels.

The activities identified in this plan can be implemented opportunistically. Activities should be prioritized according to opportunities such as funding programs, key partnerships and increased public interest that present themselves over the course of plan implementation.

7.2 Funding Commitment

Plan implementation requires a commitment of sufficient funds for disbursements, such as planning studies, legal services, and consultant fees, in addition to dedicated staff time discussed below. Required funds for these services are estimated to be $490,000, with activities to be implemented in phases over the next five to ten years, depending on funding availability. This estimate does not include the activities with larger capital fund requirements (action 10 – building a landfill gas capture system). Table 7 provides a summary of the estimated disbursement and staff costs for the 36 actions.

For example, Action 31 "Investigate opportunity for district energy system" has an estimated disbursement cost of $50,000 to hire consultants to complete the pre-feasibility study. There is an additional cost for staff time for this activity to work with the consultants to carry out the study.

Several external funding sources exist that the City may pursue to share some of these costs. Appendix D provides a list of selected funding opportunities for implementing community energy plans. For example, activities can be funded using the Carbon Tax rebates offered through the provincial Climate Action Revenue Incentive Program, which is a conditional grant for communities that have signed the Climate Action Charter and report on carbon reduction activities.

Table 7: Summary of Actions with Expected Level of Impact and Effort

#	Action	Department Responsible	Level of Impact[26]			Staff Resources ($)	Disbursements ($) (e.g. studies, consultant fees)	Considerations (Lifecycle, Triple Bottom Line)
			Air quality	Energy use	GHGs			
OUR REGION								
1	Participate in regional Air Quality Management Planning	Engineering	High	-	-	$ 5,000/yr	$ -	Demonstrates partnerships in the community
2	Participate in the multi-agency Partnership Committee on Agriculture and the Environment	Engineering	High	-	-	$ 10,000/yr	$ -	Supports stewardship of air, water and land resources
3	Engage in dialogue with First Nations regarding long-term community planning	Municipal Development	Low	Low	Low	$ 3,000/yr	$ -	Demonstrates partnerships in the community
OUR CITY								
4	Maintain strong support for ALR boundaries and encourage infill development within the core area	Municipal Development	High	High	High	$ -	$ -	Supports local agricultural economy, rural lifestyle
5	Form an environment sub-committee (or advisory committee) to Council	Council	Mod	Mod	Mod	$ 15,000/yr	$ 4,000/yr	Addresses a spectrum of environmental issues
6	Monitor and report on progress towards the air and energy vision	Engineering	Low	Low	Low	$ 5,000/yr	$ 5,000/yr	Creates public knowledge and support for these actions
7	Continue to support FVRD woodstove exchange program	Engineering	High	-	-	$ 5,000/yr	$ -	Improves safety of wood burning appliances
8	Reduce burning of green waste	Engineering	High	-	-	$ 5,000/yr	$ -	Improves health and visibility
9	Create a Green Guide to advance green energy choices to residents	Engineering	Low	Low	Low	$ 7,500	$ 25,000	Demonstrates partnerships in the community
10	Accelerate landfill gas capture regulation requirement [A]	Engineering	-	-	High	$ 5,000	$ -	Manages odour; eligible for sale of carbon credits (until 2016)
11	Increase Tree Canopy	Engineering	-	-	Low	$ -	$ -	Improves community aesthetics

[26] The criteria used to categorize the expected level of impact are defined in Appendix C.

#	Action	Department Responsible	Level of Impact[26]			Staff Resources ($)	Disbursements ($) (e.g. studies, consultant fees)	Considerations (Lifecycle, Triple Bottom Line)
			Air quality	Energy use	GHGs			
OUR NEIGHBOURHOODS (DEVELOPMENT)								
12	Encourage energy efficient design and building among developers	Municipal Development	-	Low	Low	$ 2,500/yr	$ 10,000	Supports development of local green industry; supports local employment
13	Increase energy awareness among City staff	Engineering	-	Low	Low	$ 1,000/yr	$ -	Demonstrates leadership on energy; opportunities for transfer of knowledge to residents
14	Strongly encourage use of renewable energy sources in new developments	Municipal Development	-	-	Mod to High	$ 2,500	$ 25,000	Supports development of local green industry; supports local employment
15	Encourage compact new developments	Municipal Development	Low	Low	Low	$ -	$ -	Supports livable communities
16	Require evaluation of renewable energy sources for large rezoning applications	Municipal Development	-	-	High	$ 5,000/yr	$ -	Supports development of local green industry; supports local employment
OUR HOMES								
17	Partner with other agencies to promote energy efficient practices for homes	Municipal Development	-	Mod	Mod	$ 6,000/yr	$ -	Creates public knowledge
18	Create a program to encourage energy efficiency upgrades to homes	Municipal Development	-	High	High	$ 10,000	$ 10,000	Supports local employment; Improves affordability of home ownership
19	Provide an energy efficiency renovation checklist with permits	Municipal Development	-	Low	Low	$ 2,500	$ 10,000	Supports local employment; Improves affordability of home ownership
OUR MOBILITY								
20	Promote non-motorized transportation options	Engineering	Low	Low	Low	$ 5,000/yr	$ 25,000	Improves health and reduces traffic congestion
21	Develop a City-wide non-motorized transportation plan	Engineering	Low	Low	Low	$ 15,000	$ 50,000	Improves health and reduces traffic congestion
22	Improve transit amenities for increased comfort	Engineering	Low	Low	Low	$ -	$ 20,000/yr	Supports accessibility for ageing population
23	Promote programs that increase transit ridership, including the U-pass program	Engineering	Low	Low	Low	$ 1,000/yr	$ -	Improves health and reduces traffic congestion
24	Improve local transit service and support regional transit connections between nodes in FVRD [B]	Engineering	Mod	Mod	Mod	$ 15,000	$ -	Improves health and reduces traffic congestion

#	Action	Department Responsible	Level of Impact[26]			Staff Resources ($)	Disbursements ($) (e.g. studies, consultant fees)	Considerations (Lifecycle, Triple Bottom Line)
			Air quality	Energy use	GHGs			
25	Encourage alternative commuting methods to industrial and business parks	Municipal Development	Low	Low	Low	$ 2,000/yr	$ -	Improves health and reduces traffic congestion
26	Provide opportunities for alternative transportation in lieu of required parking in new developments	Engineering	Mod	Mod	Mod	$ 5,000	$ 25,000	Improves health and reduces traffic congestion; Supports accessibility for ageing population
27	Promote reduction in personal vehicle emissions	Engineering	High	Mod	Mod	$ 5,000/yr	$ 5,000/yr	Improves health and reduces traffic congestion
28	Work with the School District to reduce vehicle drop-offs and idling	Engineering	Low	Low	Low	$ 2,000/yr	$ -	Improves health and reduces traffic congestion
29	Encourage the reduction in heavy-duty vehicle emissions	Engineering	High	Mod	Mod	$ 5,000/yr	$ 5,000/yr	Reduces noise levels
OUR ENERGY SUPPLY								
30	Develop a business case to identify potential for alternative energy production on ALR and Industrial land	Municipal Devt / Engineering	High (if reduces open burning)	High	High	$ 2,500	$ 50,000	Contributes to local energy security
31	Investigate opportunity for district energy system	Engineering	Negative (may increase CACs)	High	High	$ 5,000	$ 50,000	Demonstrates leadership in alternative energy
32	Encourage solar technologies for agricultural, commercial and industrial activities	Municipal Development	Low	Low	Low	$ 5,000/yr	$ -	Demonstrates leadership in use of solar technologies
OUR ECONOMY								
33	Facilitate Integrated Resource Management activities	Municipal Development	High	High	High	$ 2,500/yr	$ -	Strong business case for IRM to reduce waste and water use; Positive financial benefits promised – still uncertain
34	Work with the Chamber of Commerce to increase energy awareness among businesses	Engineering	-	Low	Low	$ 2,000/yr	$ -	Demonstrates partnerships in the community
35	Promote best management and energy efficient practices in agricultural operations	Engineering	High	High	High	$ 5,000/yr	$ -	Improves health; manages odour
36	Identify opportunities for alternative energy-related programs at UFV	Engineering	-	Low	Low	$ 10,000	$ 15,000	Builds local capacity

Table Notes: [A]: No capital cost is included for installation of the landfill gas capture system because it is required by provincial regulations (by 2016) and will happen outside energy planning budgets. Acceleration of the installation may add additional costs; however, the City would also be able to sell carbon offsets for the period up to 2016.
[B]: Transit disbursements not included, as planning is currently underway.

7.3 Personnel Requirements

Dedicated staff time and funding will be required to prioritize, initiate, carry out and monitor the plan's activities. Table 7 details the estimated staff cost by activity and is based on a rate of $500 per day. This is based on an assumption that new staff will undertake each action, and does not consider the potential for overlap with existing initiatives. Some efficiency may be found with existing staff responsibilities or between activities.

It is recommended that a staff member be designated as the "Air Quality and Energy Program Coordinator". This person is responsible for working with staff from each department to initiate activities and ensure that the annual work plan is progressing. The program coordinator may also seek out funding and key partnerships for larger, longer-term activities. A sample break-down of responsibilities for the program coordinator and other staff are listed in Table 8. Funding assistance for this staff member may be available; BC Hydro currently offers a program to fund 50% of the cost of an Energy Manager.

Table 8: Examples of Program Coordinator and Staff Responsibilities for Implementation

Typical Responsibilities of Program Coordinator	Typical Responsibilities of Other Department Staff
Establish annual work plan (in consultation with Environmental sub-committee)	Implement transit, cycling, planning and other programs that are consistent with this plan
Develop internal awareness programs	Budget to participate and implement identified improvements
Publicize activities to staff through internal communications	Monitor and report on activities
Define data collection requirements and frequency; Collect, store and report on data	Act as ambassadors in the community regarding air quality, energy and GHG emission reductions
Make contact with other partners to promote the plan and find areas for municipal involvement	
Apply for funding through various provincial and federal programs to meet the plan objectives	
Promote clean air and energy efficiency awareness in the community	
Act as a resource to the community on air quality and energy efficiency	

7.4 Monitor, Report, Re-evaluate

By applying an adaptive management approach to plan implementation, it is important to monitor changes in air quality, energy use and greenhouse gas emissions over time to gauge the

effectiveness of activities being undertaken. To accomplish this, a monitoring program will be developed that tracks specific indicators of progress. Proposed indicators for this plan are outlined in Table 9.

As implementation progresses, the list of actions will be re-evaluated and modified to ensure the community is moving towards the Vision and Goals. Corrective action will be taken if indicators show the community is not aligning with the Vision and Goals.

Table 9: Indicators and "activity" results for measuring plan progress

Theme Area	Indicator	Possible Activity Results
Our Region	➢ Healthy air ➢ Visibility	➢ Zero exceedences of Canada Wide Standards for $PM_{2.5}$ and Ozone ➢ Air Quality Health Index (AQHI) does not exceed 6 (moderate) ➢ *Visibility Index (VI) is poor less than x days per year (to be determined once this index is established provincially)*
Our City	➢ Energy consumption ➢ Greenhouse gas emissions	➢ Energy use (and GHG emissions) per capita compared to 2007 ➢ Per capita GHG emissions are 20% below 2007 levels by 2020
Our Neighbourhoods	➢ Urban containment ➢ Alternative energy in new developments	➢ 100% of growth occurs within UCB
Our Homes	➢ Energy use in existing building stock	➢ 10% of existing detached dwellings have had Energuide audits by 2020 ➢ 10% penetration of energy innovators program in commercial sector by 2015
Our Mobility	➢ Transit use ➢ Non-motorized transportation	➢ Morning peak mode share is 2% transit by 2020 ➢ Road network will increase pedestrian / cycle lanes by 1km per year (currently have 190km of lanes)
Our Energy Supply	➢ Alternative (non-fossil fuel) energy	➢ 10 % of community energy is from locally produced alternative sources by 2020.
Our Economy	➢ Agricultural practices	➢ 100% of farms use Best Management Practices

8 GHG Emissions Reduction Targets

The *Local Government (Green Communities) Statutes Amendment* Act (Bill 27 – 2077) requires that every community establishes a target in its OCP for GHG emission reduction, and identify the "plans and policies" to achieve these. This section provides a scoping-level review of the types of reductions that may be expected from the actions defined in the plan.

8.1 Challenges for Municipal GHG Management

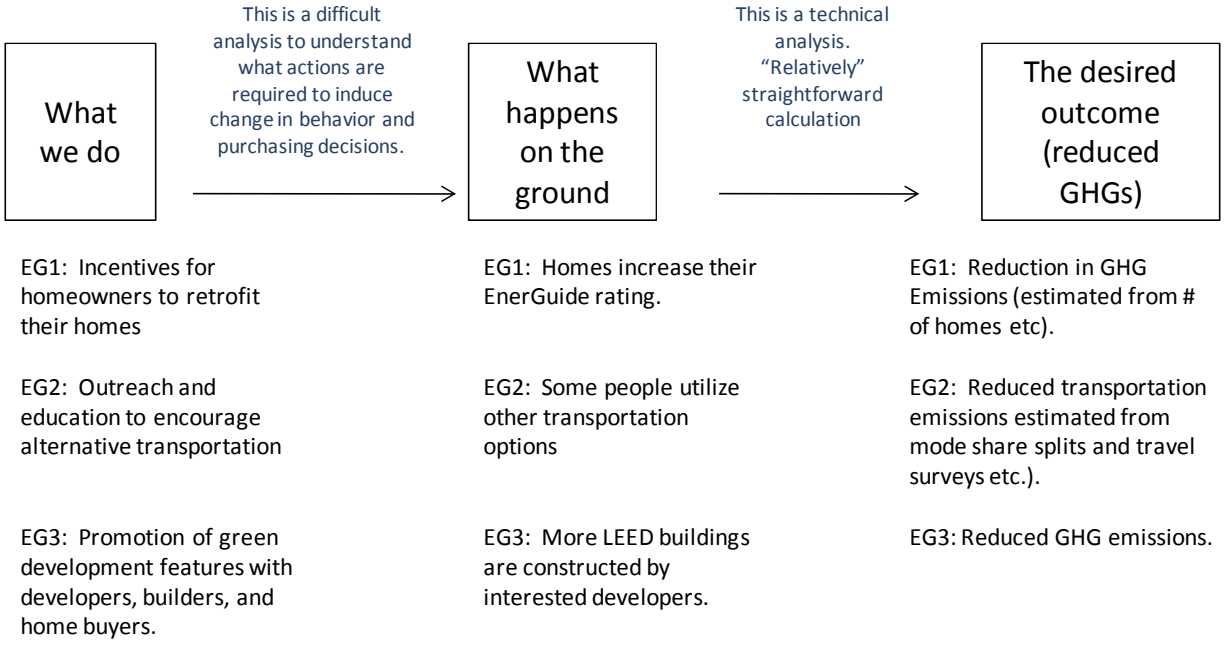
The area of municipal management of community GHG emissions is a new activity. Traditional municipal service areas (water, sewers, infrastructure, planning and land use) are generally within the municipality's authority to address. In contrast, GHG management is only under the general 'influence' of local governments. For example, many standards, including building codes and vehicle fuel economy are set by other levels of government. Local governments are only able to require these be exceeded in unique circumstances[27].

Aside from the jurisdictional challenges, a new area of learning for many municipalities is to understand exactly what causes the required behavioural changes (in developers, homebuyers, residents etc.). This is demonstrated schematically in Figure 16. The figure shows the actions that the municipality executes (i.e. the actions in this plan), the on-the-ground result, and the final desired outcome. The challenge BC municipalities are working through is to understand the impact that their actions will have. Which combination of education, incentive, and regulation will affect change in the community, and obtain the desired GHG reduction outcomes?

The actions defined in this plan represent a solid starting point. To help define some targets, the analysis assumes that the desired results are achieved. This helps to scope the expected reductions that are possible.

[27] Typically this can occur when a development is to occur on municipally owned land and the municipality can require additional features in a development agreement. (e.g. Dockside Green, or the South East False Creek lands).

Figure 16: Actions – Results – Outcomes Schematic



8.2 Target Reductions Methodology

This section describes a scoping-level analysis of the possible results and GHG reductions from the actions defined in the plan. The actions are grouped according to the key result intended and are described in Table 10. Also indicated is either a known or assumed maximum possible saving.

Table 10: Illustrative Activity Areas and Potential Results

Theme	No.	Key Activity	Description of the Estimated Result and Possible Outcome
Our Region	1	Planning and Agency Involvement	This action is primarily driven towards air quality improvements. However, the potential exists to define and implement regional activities that also reduce GHG emissions. Assumed that these activities might reduce emissions by 5% for new growth.
Our City	2	LFG Capture	Assumed that LFG capture would reduce GHG emissions from solid waste disposal at the landfill by 50%.
Our Neighbourhoods	3	LEED Gold (40% below Code)	Buildings built to LEED gold standard would use 40% less energy than standard buildings. This applies to new commercial and multi-unit buildings.
	4	District Heating Node	A district heating node is assumed to cover a specific geographic area that would save the equivalent of 5% of building emissions (e.g. meaning that 2,500 dwelling units or their equivalent in commercial emissions would be heated from the node).
	5	Planning / LEED ND / DPA Guidelines	Assumed that encouraging LEED for neighbourhoods, including GHG emissions text into Development Permit Areas, and other planning measures reduce GHG emissions 20% in new development.

Theme	No.	Key Activity	Description of the Estimated Result and Possible Outcome
Our Homes	6	Residential Retrofits	Energy retrofits for typical homes yield energy and GHG savings on the order of 30% for existing housing stock.
	7	Energuide 85 for New Homes	New detached dwellings built to an energy efficiency rating of EGH85 consume 35% less energy and create associated emissions than a new home built to code (currently EGH77)
Our Mobility	8	Transportation Reduction	Assumed that personal vehicle emissions are reduced through resident behavioral change, transportation demand management options. Federal vehicle emission standard improvements result in a 40% decrease in GHG emissions from new vehicles starting in 2016 relative to new vehicles sold in 2008.
	9	Alternative Transportation	Alternative transportation infrastructure (bike paths, walking, local amenities, transit infrastructure) enable a reduction in passenger vehicle emissions.
Our Energy Supply	10	Agricultural Biomass Energy (Anaerobic Digestion)	Anaerobic digestion of agricultural waste results in a decrease in GHG emissions from 10% of buildings by 10% (by displacing the use of natural gas).
	11	Solar	Solar thermal system can be used for hot water heating and to a lesser extent for space heating. Assumed that an installation on a home or building would displace 10% of emissions in 10% of buildings.
Our economy	12	Commercial Building Retrofits	Retrofits to commercial buildings (including MF residential buildings) would reduce energy consumption related emissions by 30%.

In practice, the full level of savings will not be achieved. The amount of reduction achieved depends upon the strength of the measure used to implement it. Based on experiences with program activities three general levels of effort and the corresponding uptake are described in Table 11.

Table 11: Level of Effort Descriptors

Level	Example / Possible Activities	Estimated Outcomes
Low	➢ Outreach and education ➢ Promotions ➢ Awards	10% of potential reductions are achieved (i.e. 10% uptake)
Medium	Non-financial Incentives: ➢ Infrastructure services(e.g. bus stops to encourage transit) ➢ Permit Processing ➢ In-kind Assistance Financial Incentives: ➢ Building permit discounts and rebates ➢ Revitalization tax exemptions	50% of potential reductions are achieved
High	➢ Regulatory Requirements: ➢ DPA guidelines ➢ District Energy connection	90% of potential reductions are achieved

8.3 Anticipated Action Plan Results

The key results, the level of effort assumed based on the plan actions, and the expected annual reductions are shown in Table 12 and plotted in Figure 17. Key observations and comments include that:

- Continued community growth (anticipated to average about 2.0 % annually) will result in substantial increases in GHG emissions. These increases make it challenging to reduce the total GHG emissions. The challenge for Chilliwack is substantial, and this is one faced by many growing communities.

- Reduction measures currently defined in this Plan could lead to community wide reductions of over 85,000 tonnes per year by 2020. This reduction, combined with efficiency improvements due to Senior Government regulations, would result in a reduction of over 5% from the 2007 levels, and approximately 25% from the BAU scenario.

- Key reductions are achieved through reducing landfill emissions, and reducing transportation.

- The actions defined in the plan would be implemented between 2010 and 2020. After that, their effectiveness is assumed to be maintained, though not increase. As a result growth between 2020 and 2030 results in increasing emissions to 2030. Additional reduction measures will be required by 2020 in order to maintain or further decrease emissions[28].

- The actions of the City do not occur in isolation. Higher levels of government, other stakeholders, and individuals will all contribute to achieving these reductions. The plan is structured to provide encouragement and support in a pragmatic fashion that highlights the multiple benefits of taking action. Implementation review will define whether success has been achieved, and whether stronger actions are justified.

It is important to note that climate action should not be perceived as a regressive step. Reducing carbon emissions is an activity that has features of:

- Reducing waste: Being more energy efficient and using fossil fuels more efficiently.

- Being thoughtful consumers: Thinking about our energy purchases.

- Exploring and innovating: Using other energy sources: solar, heat pumps, etc.

- Building the economy: Creating new industries and opportunities in an "energy conscious economy".

[28] It should be noted that in this area 10 years is a "long time". Factors such as peak oil, economy changes, demographics, building code improvements, etc. may have very drastic impacts on energy consumption before 2020 arrives.

This plan is designed to be opportunity and incentive-based as these are the municipal tools most readily available. In this theme it is noted that reducing carbon emissions is not intended to:

- Penalize inaction: to be successful, GHG reduction efforts will focus on 'carrots, not sticks'.
- Forego opportunities for economic growth: the plan should help foster economic development centered on high efficiency and renewable energy sources.

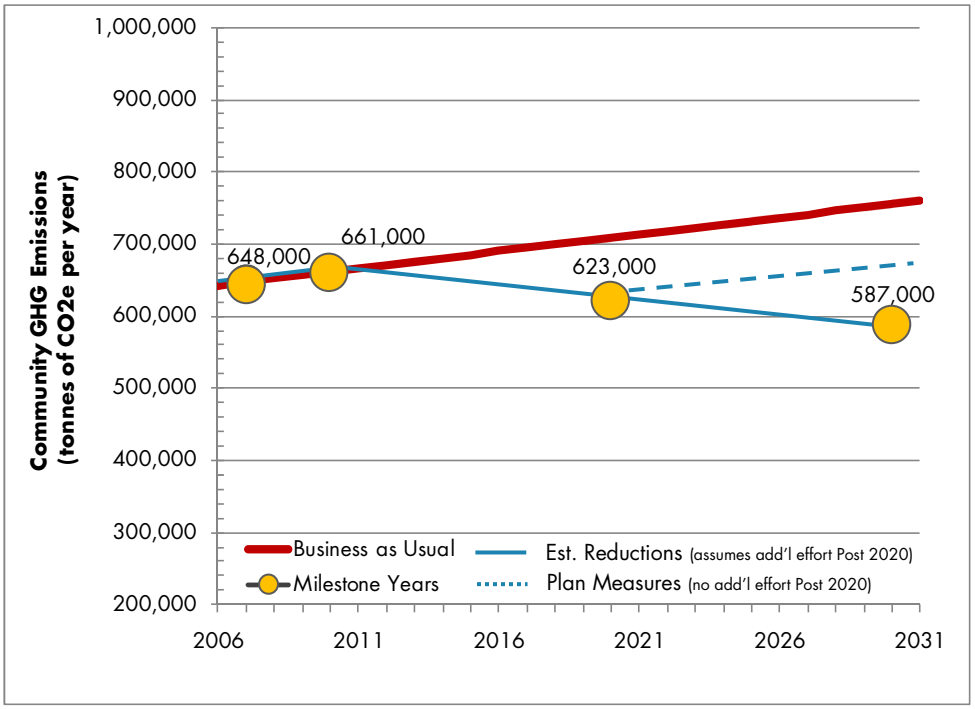
To help evaluate the activities that would have to occur to achieve reductions, a scenario was developed using 'scoping level' estimates of possible outcomes of an action plan. These are highlighted in Table 12 and show potential reductions relative to the BAU scenario. Some points to note are that:

- The scenario describes one possible path forward. In practice, many other factors might come into play which would affect the reductions that are possible (e.g. fuel price changes, new technologies, changes to the forecasted growth rate, etc.)
- None of the actions shown in Table 12 is revolutionary, or would require technology that is not available today. For example: (1) There are new developments in Chilliwack using ground source heat pumps that reduce emissions more than 50%. (2) Many homes have been affordably retrofitted and saved over 30% in energy use and GHG emissions. The challenge of the plan is to make the "occasional" into the commonplace.

Table 12: Estimated Reductions Resulting from Plan Implementation (tonnes of CO2e)

Area	Level of Activity to Achieve in the next decade. By 2020…	GHG Savings by 2020 (tonnes/year)
New Development	…½ of the new development will be generating 25% less emissions than the standard. ….an additional ¼ of new development will create 50% less emissions than today's standards. ….½ of the new commercial buildings create 50% less emissions than current commercial buildings.	10,000
Existing Buildings	…¼ of residents will make an upgrade or improvement with a reduction of 25% of emissions per home. …½ of other residents will on average improve their efficiency by 10%. …10% of commercial buildings reduce emissions by 30%.	10,000
Passenger vehicles	…our residents have reduced their emissions from passenger vehicles by 10% through use of alternative transportation or reducing travel.	25,000
Energy Supply	…alternative sources of energy (including solar, anaerobic digestion, and a district heating node) have displaced an additional 5% of building related emissions, and potentially reduced GHG agricultural emissions through anaerobic digestion.	10,000
Solid Waste	…landfill gas capture and organics diversion achieve a 50% reduction in emissions from waste decomposition.	30,000
	Total Reductions from Plan Implementation (estimated)	**85,000**

Figure 17: Potential Action Plan Reductions



8.4 Target Recommendation

Chilliwack will aim to reduce community greenhouse gas emissions by **20% per capita from 2007 levels by 2020.** This is an overall reduction of approximately 5% from 2007 levels based on current population projections. Achieving this target will require a joint effort by the federal and provincial governments, City of Chilliwack, and community members. The City of Chilliwack will initiate programs that fall within our legislative jurisdiction by implementing the activities and policies in the City's Air Quality, Energy and Greenhouse Gas Action Plan.

APPENDICES

Appendix A: Detailed Energy and GHG Inventories

Appendix B: Criteria for Level of Effort and Impact

Appendix C: Example Programs and Policies

Appendix D: Example External Funding Sources

Appendix A: Detailed Energy and GHG Inventories

The inventoried energy and associated GHG emissions are tabulated in Table A-2 for buildings and solid waste, and Table A-3 for transportation. Province-wide it is expected that waste-generated methane adds another several percent to the total GHG inventory[29].

Key features to note from this information are that:

- Total (inventoried and estimated) energy consumption is about 5,500,000 GJ for buildings, and 4,300,000 GJ for transportation.
- The overall energy consumption is about 31% residential buildings, 25% commercial and industrial buildings, and 44% transportation.
- The community disposes of about 34,000 tonnes of solid waste per year.
- GHG emissions originate about 29% from buildings, 46% from transportation, 17% from agriculture and 8% from solid waste.
- Electricity is approximately 22% of the community's energy consumption, but only results in about 2% of the community's GHG emissions. This is because of the largely hydro powered electricity which is mostly carbon-free.

Table A - 1: Community Energy and GHG Emissions for Buildings and Solid Waste (2007)

Use	Energy Source	Units of Energy Purchase	Energy (as purchased)	Energy (as GJs)	GHG Emission (tonnes of CO_2e)	Approximate Retail Value ($)
Residential	Electricity	kWh	345,559,155	1,244,012	8,524	$ 22,461,345
	Natural Gas	GJ	1,790,094	1,790,094	91,295	$ 21,481,128
Commercial	Electricity	kWh	264,527,150	952,297	6,525	$ 17,194,265
	Natural Gas	GJ	1,170,603	1,170,603	59,701	$ 14,047,236
Industrial	Electricity	kWh	-	-	-	-
	Natural Gas	GJ	378,067	378,067	19,281	$ 4,536,804
Solid Waste	-	tonnes	34,117	-	54,920	-
Total				5,535,073	240,246	$ 79,720,778
Total (per capita)				70.9	3.1	$ 1,021

Source: Ministry of Environment Community Energy and Emissions Inventory (CEEI) Initiative

Notes:
1) Only utility-provided energy is available. Other energy sources such as propane, fuel oil, and wood may be substantial but are not yet estimable.
2) Industrial electricity consumption has been withheld for reasons of confidentiality.
3) The GHG emissions associated with electricity consumption are estimated from BC Hydro production averages. This does not include the effects of power imports or exports.

[29] The Province is addressing landfill methane generation through a new set of landfill regulations which will require the capture and utilization of landfill gas at most landfills in the province.

Table A - 2: Estimated Community Transportation Energy Consumption and GHG Emissions (2007)

Use	Energy Source	Units of Energy Purchase	Energy (as purchased)	Energy (as GJs)	GHG Emission (tonnes of CO2e)	Approximate Retail Value ($)
Small Passenger	Gasoline	L	21,136,023	739,761	50,337	$ 29,590,432
	Diesel Fuel	L	734,515	28,132	2,006	$ 1,028,321
	Other	L	2,960	113	5	$ 4,144
Large Passenger	Gasoline	L	17,189,155	601,620	40,791	$ 24,064,817
	Diesel Fuel	L	287,670	11,018	785	$ 402,738
	Other	L	49,549	1,898	76	$ 69,369
Light Trucks, Vans and SUVs	Gasoline	L	56,004,860	1,960,170	133,843	$ 78,406,804
	Diesel Fuel	L	4,195,962	160,705	11,463	$ 5,874,347
	Other	L	306,573	11,742	470	$ 337,230
Commercial Vehicles	Gasoline	L	549,210	19,222	1,283	$ 768,894
	Diesel Fuel	L	1,819,731	69,696	4,897	$ 2,547,623
	Other	L	75,404	2,888	116	$ 82,944
	Gasoline		26,409	924	62	$ 36,973
Tractor	Diesel Fuel	L	16,485,339	631,388	44,362	$ 23,079,475
	Other		2,380	91	4	$ 3,332
Motorhomes	Gasoline	L	565,340	19,787	1,323	$ 791,476
	Diesel Fuel	L	78,586	3,010	211	$ 110,020
	Other	L	7,199	276	11	$ 7,919
Motorcycles	Gasoline	L	341,991	11,970	798	$ 1,642
Bus	Gasoline	L	385,543	13,494	907	$ 539,760
	Diesel Fuel	L	600,829	23,012	1,617	$ 841,161
	Other	L	86,318	3,306	132	$ 94,950
Total				4,314,223	295,499	$ 168,684,371
Total (per capita)				55.2	3.8	$ 2,159

Source: Ministry of Environment Community Energy and Emissions Inventory (CEEI) Initiative

Note: Transportation numbers are estimated based on vehicle registrations, estimated fuel consumption by vehicle type and assumed average travel distances and have not been checked against actual consumption data.

Appendix B: Criteria for Level of Effort and Impact

The actions were analyzed as follows:

- First, evaluate in general terms both the level of effort required to execute the activity, and the potential impact. This is done using simple criteria – 'high' and 'low' effort and impact. A high impact was evaluated as having a high potential benefit or in other words, a positive impact. This part of the analysis is shown as a matrix in the table below. Impacts were determined for three categories: Air Quality, Energy Consumption and GHG emissions.
- Second, assess the City's ability to affect changes to this item. This is defined as either 'Direct' in which the City would perform an activity, or 'Indirect' in which the City would provide encouragement or assistance to execute an activity (e.g. encourage others to act). Actions that were felt to be under the direct or indirect influence of the City were carried through to the next stage of the analysis.
- Third, identify which air and energy goals each of the actions support. This analysis ensures that the action is integral to the path towards the City's vision and goals.
- Fourth, identify additional considerations that demonstrate less direct impacts of implementing each action. These include triple-bottom line, socio-economic and lifecycle considerations.

		Level of Impact	
		Low	**High**
Level of Effort	**High**	**Quadrant D** Large effort for a limited return. Generally would want to avoid these actions, however some may have co-benefits, or intangible benefits (public awareness, etc).	**Quadrant A** Large effort but benefits can be substantial and typically would be permanent. This would include capital projects which require greater funding than program and incentive actions.
	Low	**Quadrant C** Relatively small return (or too difficult to measure the return), but potential co-benefits or "plus" features such as public awareness and education could make them desirable.	**Quadrant B** Relatively small effort - or easy to implement initiative - by the City but with long term potential benefits. Many of these actions may have already been executed.

Defining the effort of the activities is challenging as the nature of these activities is very different and program or capital costs vary. Similarly, defining the benefit is a challenge since the outcome may not be easily measured. The approach used here has been to split the activities into low/high categories of effort and high/low categories of impact. This categorization is subjective and it is true that any action could be implemented with a little or a lot of vigor (requiring low or high effort) and resulting in low or high impacts on emissions.

For "effort" the general criteria are:

Item	Low Effort	High Effort
Staff Effort (time)	Staff time is time limited (not ongoing). Does not require a new FTE or a major commitment of an existing FTE.	Full time (or majority of an FTE) funded by City is required - possibly for more than one budget year. Ongoing funding in the city budgets.
City Resources ($)	City can fund activity from internal budgets. Typically these cost less than an average staff salary.	Requires major capital funding, some of which might be required from other agencies or stakeholders. These frequently require extensive work to compile a business case and seek funding and may be multi-year projects.

For impacts, the impact could be either an increase or decrease in air emissions, energy use and GHG emissions. Ideally, an action would decrease all three attributes. If any one of the three was considered high, then it was screened as a potentially high impact. Note that impacts can be either positive or negative, and some actions might reduce one or two areas, but cause an increase in the third.

For "impacts" the general criteria are:

Item	Low	High
Energy, GHG or Air Emissions	Consumption/emissions changes are small part of the total inventory - however they may be a reasonable portion of a sub-sector (e.g. residential). Consumption/emissions changes may be uncertain or difficult to quantify and are not expected to be substantial. Consumption/emissions changes may depend on personal behaviour and may not be certain to last. Activity may not be directly tied to a reduction activity but are part of a coordinated program. For example, educational and outreach activities are supportive of all reductions, but usually cannot be linked to any specific reduction.	Consumption/emissions changes are large and represent a substantial portion of either the total emissions or a sub-sector. Consumption/emissions changes are based on a major facility, equipment or policy change and cannot be easily reversed. Consumption/emissions changes represent a major policy change which will have long term effects as the community grows. For example a relocation of some activities to different areas.

Appendix C: Example Programs and Policies

1. Open Burning Fact Sheets: Cowichan Valley Regional District

   http://www.cvrd.bc.ca/documents/Engineering%20Services/Solid%20Waste/Pollution%20Prevention/Air%20Quality/BurningFactSheet.PDF

2. Green Guide: City of Richmond's Community Guide of Environmentally Oriented Projects

   http://www.richmond.ca/__shared/assets/complete_document6670.pdf

3. Guide to Implementing an Energy Efficiency Awareness Program: Natural Resources Canada

   http://oee.nrcan.gc.ca/publications/commercial/m144-22-2003e.cfm

4. Sustainability checklists for permits: Several municipalities in BC

   http://www.toolkit.bc.ca/tool/sustainability-checklist

5. Renewable energy policy for rezoning applications: Bowen Island

   http://www.bimbc.ca/files/policies/Green%20Building%20Standards2.pdf

   City of Vancouver:

   http://vancouver.ca/ctyclerk/cclerk/20100204/documents/penv3.pdf

6. Rebate program for green building: District of Saanich

   http://www.gov.saanich.bc.ca/business/development/greenbuilding/GreenBuilding.html

7. Legal opinion regarding the use of Local Improvement Charges to finance energy efficiency improvements in BC municipalities:

   http://www.communityenergy.bc.ca/sites/default/files/LIC%20Legal%20Opinion.pdf

Appendix D: Example External Funding Sources

1. LiveSmart BC

   Rebates and incentives to help British Columbians reduce their carbon footprint at home, on the road, and at work.

2. BC Hydro: Energy Manager Funding

   BC Hydro has provided partial funding to some municipalities for an energy Manager position. In some cases, municipalities may partner with School Districts or Health Authorities to share a BC Hydro sponsored Energy Manager.

3. BC Hydro Power Smart

   Rebates and incentives to encourage energy efficiency in new construction and the installation of energy efficient products and appliances in existing facilities.

4. FCM Green Municipal Fund

   Grants available to support sustainability and climate action planning efforts. Low-interest loans available to support capital projects that reduce energy and GHG emissions. Competitive process with RFPs launched annually to fund projects related to brownfield redevelopment, energy, planning, transportation, waste and water.

5. Climate Action Revenue Incentive Program (CARIP) grant

   The City may elect to use its annual CARIP grant to support both community and corporate (operational) climate action initiatives.