Kelowna Community Greenhouse Gas Emissions Inventory and Projections Report

November 2009

Policy & Planning
1435 Water Street
Kelowna, BC V1Y 1J4
TEL 250 469-8610
FAX 250 862-3349

kelowna.ca

TABLE OF CONTENTS

1. Executive Summary

In 2001, Kelowna joined the Partners for Climate Protection Program. Municipal Council then endorsed the Kyoto Protocol in March of 2002 and adopted the Federation of Canadian Municipalities resolution towards the reduction of greenhouse gas emissions (GHG) in September of 2002. On September 21st, 2007 the City signed on to the Climate Action Charter (Appendix 1). In signing the Charter, the City committed to being carbon neutral in respect to City operations by 2012, as well as to measuring and reporting community greenhouse gas emissions and creating a complete, compact, more energy efficient community.

In 2008, the provincial government adopted Bill 27 - Local Government (Green Communities) Statutes Amendment Act. Bill 27 requires municipalities to identify a numeric target for greenhouse gas and to amend their Official Community Plans (OCP) to reflect this target by May 31st, 2010. Eager to show leadership on greenhouse gases, the Province committed to a very ambitious 33% reduction from 2007 levels, by 2020. The target set by the Province (for the Province as a whole) establishes a starting point for communities such as the City of Kelowna in setting municipal community emissions targets. It should be noted that, in addition to targeting a 33% reduction by 2020, the Province is also targeting an 80% reduction by 2050. This report focuses on what would be required to achieve the 2020 reductions. The Provincial targets, although not at this point legally imposed on local jurisdictions, cannot be achieved without the cooperation of communities such as Kelowna.

To achieve a 33% reduction of greenhouse gas emissions by 2020, a significant change will be required of all Kelowna residents and businesses including the corporation of the City of Kelowna. In the simplest terms, by 2020, each Kelowna resident will need to generate less than half the greenhouse gas emissions they generated in 2007. Achieving those reductions will require fairly substantial changes in the way Kelowna residents travel and will require significant investments in heating system replacements/upgrades and weatherization.

This report effectively shows that the Province's target is extremely ambitious and daunting. There is little doubt that difficult decisions are required. Implementation of necessary measures will inevitably be met with resistance. The City's strong leadership will be imperative to meet a target with significant local, national and global implications.

Achieving a 33% reduction from 2007 levels by 2020 is beyond the realm of local government alone. While local government can do much to curb corporate emissions and effect change through policy such as the Official Community Plan, much of the ability to effect the changes necessary remains in the realm of provincial and federal government. Senior governments maintain the bulk of legislative and taxation powers and are better positioned to create consumer incentives (e.g. home renovation incentive) and disincentives (e.g. carbon tax). Without the support and assistance of senior governments, there is little reason to believe that the aggressive targets will be achieved by 2020.

This report provides high level information on Kelowna's current emissions and information on the types of measures that would be required to reach the 33% target. This report does not, however, include recommendations for deployment of specific strategies. More effort will be required to identify which initiatives should be pursued and how selected initiatives can best be delivered.

2. Policy Context

The City is currently working on a number of initiatives to reduce greenhouse gas emissions and meet provincial targets. These initiatives include a 2012 Carbon Neutral Plan (for municipal operations), a Transportation Demand Management Plan, and an Active Transportation Plan. Perhaps of greatest significance, in terms of its overall impact, is the work being completed on the City's new Official Community Plan. Once adopted, the new Official Community Plan will provide detailed policy direction for advancing toward a more sustainable future.

The Province's Bill 27 requires municipalities to identify a numeric target for greenhouse gas reduction and to amend their Official Community Plans to reflect this target by May 31st, 2010. The purpose of this report is to provide information to help City Council and staff in the identification of an appropriate, reasonable, and achievable reduction target. This target will be incorporated in the Official Community Plan, and integrated throughout all related planning strategies and projects, significantly those related to transportation, building form and structure, and waste management. The City is actively working toward the completion of the Official Community Plan, however, the City will not be in a position to adopt the new Official Community Plan by the imposed deadline. As a result, staff will be requesting that Council support a text amendment to the existing Official Community Plan which identifies a reduction target as a stop-gap until the new Official Community Plan is adopted.

3. Greenhouse Gas Inventory and Targets

Since 2008, the City has been identifying and inventorying sources of greenhouse gas emissions. In 2008 the City engaged a consultant to create a baseline community greenhouse gas emissions inventory for 2002. The City also worked with the Province and their consultant in the creation of the Kelowna Community Energy & Greenhouse Gas Emissions Inventory: 2007 (referred to as CEEI Reports) as part of the province-wide Community Energy & Greenhouse Gas Emissions Inventory initiative. This report provides an historic snapshot of Kelowna's emission rates, and gives a baseline for reduction strategies (Appendix 2).

Taking an active role in monitoring greenhouse gas emissions has resulted in the collection of historic data that can now be used to identify trends and future projections of greenhouse gas emissions which will be critical moving forward. As an example, the provincial inventory estimates that Kelowna is responsible for approximately 778,958 CO_2e (Carbon Dioxide Equivalent[1]) tonnes, or 7.2 CO_2e(t) per capita. These emission levels represent the 2007 calendar year and provide an important benchmark for future monitoring and reporting.

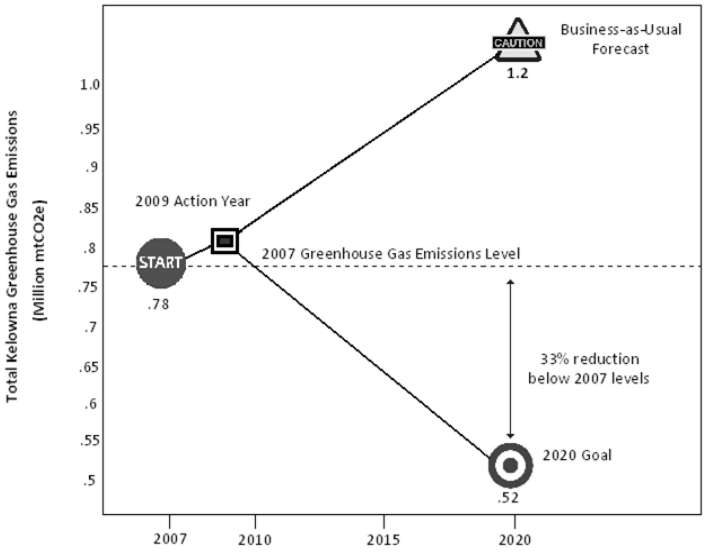
It is important to note that the inventory estimate of 778,958 CO_2e(t) or 7.2 CO_2e(t) per capita is not a comprehensive inventory of greenhouse gases for Kelowna, which is known to be much higher. The Conference Board of Canada estimates that Canadians are responsible for nearly three times this amount, or approximately 22.6 CO_2e(t) per capita[2]. This figure places Canada among the worst ranking per capita GHG emitters -- second only to Australia. The Community Energy & Greenhouse

[1] CO_2e (t) - the unit of measurement that defines the global warming potential of the six greenhouse gases. CO_2e is expressed in terms of the global warming potential of one unit of carbon dioxide.
[2] Retrieved from the Conference Board of Canada - http://www.conferenceboard.ca/hcp/details/environment/greenhouse-gas-emissions.aspx#

Gas Emissions Inventory (in contrast to the Conference Board of Canada figure) accounts for buildings, on-road transportation, and solid waste. These three sectors are at least partially within the domain of municipal government authority and are therefore the focus of this report.

Kelowna has the second highest per capita greenhouse gas emissions of the Province's mid-sized cities. Using a 'business as usual model' and assuming current trend lines, the City is on track to increase annual per capita emissions in excess of one tonne to 8.3 $CO_2e(t)$ by 2020. At this rate, the City of Kelowna would be generating nearly 1,200,000 $CO_2e(t)$ by 2020 (Figure 1).

Figure 1: Illustration Showing the Gap Between a 'Business As Usual' and 33% Reduction Below 2007



The significant gap between the approximately 1,152,000 $CO_2e(t)$ suggested by the business as usual model and the 525,000 $CO_2e(t)$ target indicates the extremely difficult challenge that lies ahead for the City of Kelowna.

It is also important to note that the difficulty in reaching reduction targets is compounded by population growth. The population of Kelowna is expected to increase from approximately 109,500 in 2007 to 141,500 by 2020 (an increase of 32,000). Therefore, reducing total emissions to meet targets will require a substantially larger reduction in per capita emissions when compared with current per capita emissions.

In terms of the current breakdown of emissions by source, well over half (57%) of the community's current greenhouse gas emissions relate to transportation. The next largest source of greenhouse gas emissions is from the building sector (35%) which includes residential, commercial, and industrial buildings. Although considered to be among the cleanest burning fossil fuels, the combustion of natural gas for building operations is responsible for 44% of emissions, with minimal contributions from the consumption of electricity. Solid waste contributes the remaining 8% of community-wide greenhouse gas emissions.

4. Community Energy and Greenhouse Gas Emissions Inventory (CEEI) & Methodology

Hyla Environmental Services recently completed 2007 Community Energy and Emissions Inventory (CEEI) reports for municipalities and regional districts on behalf of the Province (see Appendix 2 for Kelowna Community Energy & Greenhouse Gas Emissions Inventory: 2007). The focus of the CEEI inventories is on activities that directly produce greenhouse gas emissions, or on the direct consumption of energy.

The CEEI reports are meant to provide a high level inventory of greenhouse gas emissions and lack extensive detail. The information available remains quite 'high level' because the consultants preparing the information found it time-consuming and difficult to collect data given data agglomeration challenges and the reality that multiple players (public and private) had to be contacted for information.

Data for these inventories is consolidated into three sectors: transportation, buildings, and solid waste. A fourth sector, deforestation, was calculated for regional districts. Urban municipalities were not assessed for greenhouse gas contributions resulting from deforestation associated with urban development and agriculture. While some deforestation occurs in Kelowna, the amount is much more nominal than in rural areas.

The following excerpts from the CEEI user guide provide detailed information on the methodology and data used in creating these baseline greenhouse gas inventories.[3]

Transportation

The Transportation sector is subcategorized into several passenger and commercial vehicle classes. Each subcategory includes an estimate of the amount of fuel used (total vehicle kilometers traveled) and the resulting CO_2e totals for each vehicle class. Only vehicles registered to be driven on public roads are reported. The CEEI transportation sector has limitations in the reporting of greenhouse gas emissions as it does not include vehicles that are not licensed to be driven on public roads such as bulldozers, forklifts, all-terrain vehicles, etc. Additionally, marine, rail and air transportation emissions are not included as the data is not readily available.

The formula used to calculate fuel consumed and CO_2e emitted for each of the British Columbia communities assessed is:

Number of Vehicles x Kilometers Driven X GHG Emission Factors = GHG Emissions

It is important to note that the Vehicle Kilometers Travelled (VKT) estimates could only be generated for a small grouping of vehicle classes, and only by seven geographical regions. Until more refined VKT estimates, or actual VKT data can be secured, neither differing driving patterns, nor successful local government efforts to reduce vehicle use in individual communities will be accurately reflected in these annual CEEI reports. The Province is presently exploring ways to improve VKT data.

[3] Retrieved from: http://www.env.gov.bc.ca/epd/climate/ceei/pdf/ceei-user-guide.pdf

Buildings

The data collected for the building sector includes all electricity and natural gas delivered by the four major provincial utilities: BC Hydro, Fortis BC, Terasen Gas Inc, and Pacific Northern Gas Ltd. This data is categorized into residential, commercial, and industrial subsectors. Institutional buildings such as schools, hospitals and government buildings are included in the commercial sector.

Although the term "buildings" is used to describe this sector, the energy consumption reported in these subsectors includes electricity and natural gas used for other purposes. For example, in the commercial subsector, the energy consumption figure may include streetlights, water pumping stations, and decorative lighting on street trees. Greenhouse gas emissions caused by non-energy consuming processes such as chemical reactions are not presently included.

Further, the building sector does not include electricity distributed by systems not owned or operated by BC Hydro or Fortis BC. It also does not include heating oil, propane, or wood, due to the difficulty in obtaining province-wide data for these energy types.

Community Solid Waste

2007 CEEI reports include the annual mass of waste tipped by the regional district or municipality at the local landfill(s) and the community's share of estimated CO_2e emissions generated. The waste in place methodology used by the CEEI reports results in a 60,660 $CO_2e(t)$ estimate for Kelowna. City of Kelowna staff[4] have noted that more detailed inventory work undertaken by the City results in greenhouse gas emissions from solid waste being approximately 5,368 $CO_2e(t)$ higher for a total of 66,028 $CO_2e(t)$. In an effort to maintain consistency with the provincially collected benchmark data and an easily identifiable reference, the waste calculated in the CEEI report has been used here.

Waste that is not tipped at a public landfill (e.g. forestry landfills, some industrial waste, compost, green waste) or that are on federal lands, are not included. As well, closed landfills are not included in the 2007 CEEI Reports.

5. Key Findings

Projections

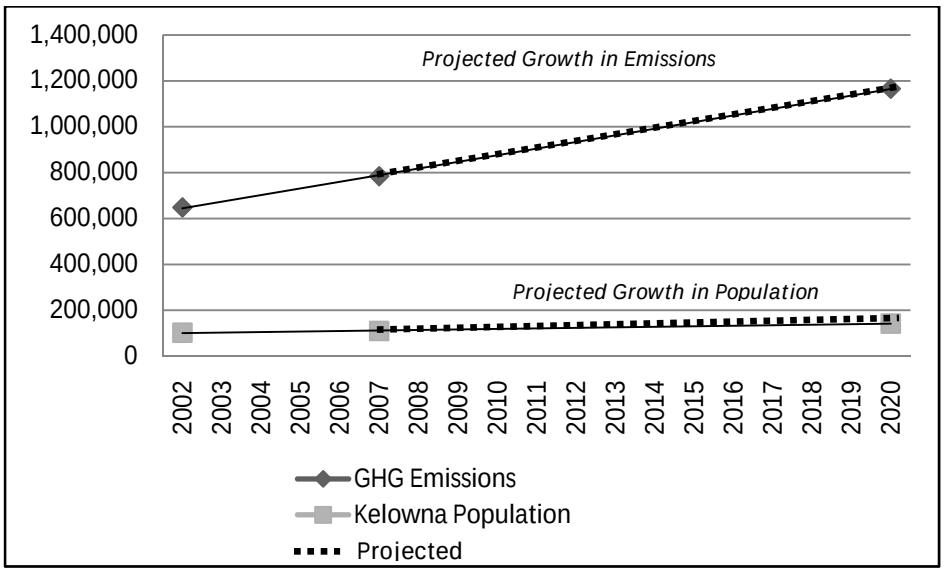
The projections for 2020 were done with a 'business-as usual' scenario, which is to say that levels of consumption are expected to continue along the same trend lines as evident through recent history. Any emissions reduction measures that currently exist, for example the Green Building Code, are already included in the projected Building Sector emissions.

The growth in greenhouse gas emissions between 2002 and 2007 levels was approximately 20%. Based on a 'business as usual' approach, growth of greenhouse gas emissions is projected to increase by approximately 50% between 2007 and 2020. It is important to note that any goal to go below 2007 levels must not only reduce current emissions, but avoid all additional greenhouse gas

[4] Personal communication with Mark Watt, Project Manager / Integrated Systems

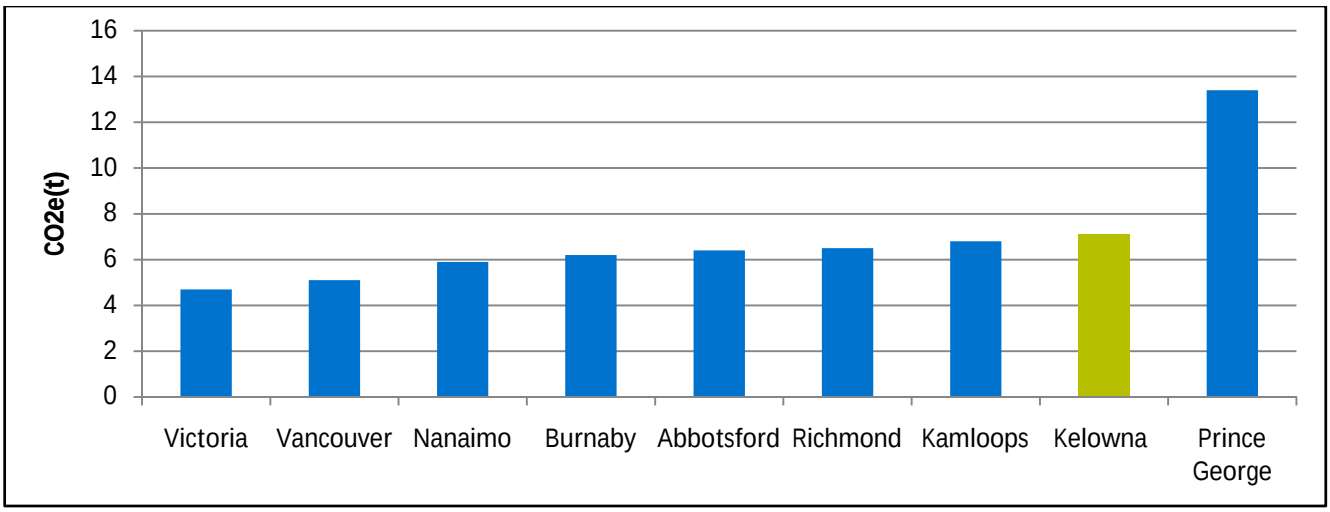
emissions resulting from population growth as well. Figure 2 shows the potential growth in total greenhouse gas emissions if no action is taken.

Figure 2: Kelowna Greenhouse Gas Emissions and Population



The City of Kelowna's population grew at a rate close to seven per cent between 2002 and 2007. Growth translates into increased greenhouse gas production attributable to the City of Kelowna. Any future growth will need to be factored into emissions targets. With all things remaining the same, between 2002 and 2007, Kelowna should have experienced a seven per cent growth in the generation of greenhouse gases. This is not the case however, with the bulk of a 21% increase in emissions not being linked directly to population growth. Between 2002 and 2007, per capita greenhouse gas emissions increased by 13%. The result is that Kelowna produces the second highest amount of greenhouse gases per capita of any urban municipality in British Columbia – behind only Prince George (Figure 3). Prince George's consumption of, and reliance on, natural gas for industrial purposes appears to account for their high per capita emissions. As a result Prince George is not a good comparison to Kelowna.

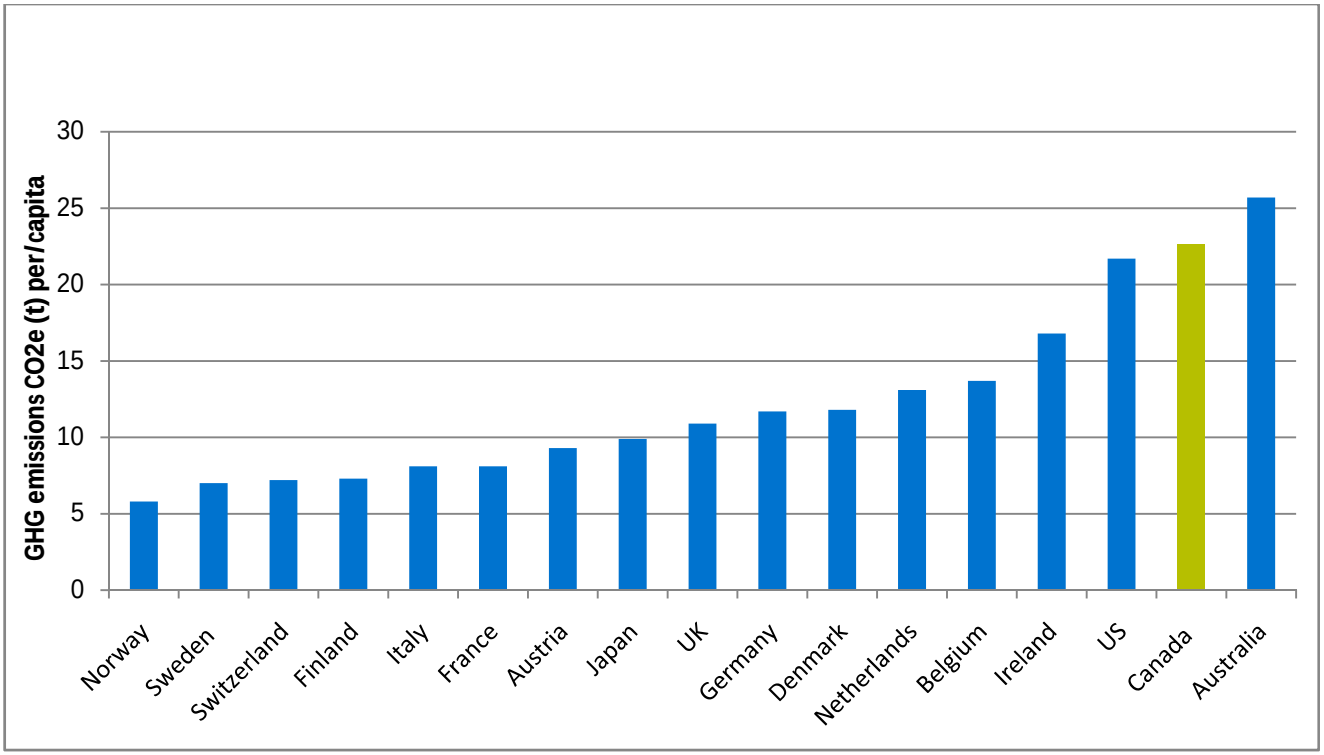
Figure 3: Per Capita Greenhouse Gas Emissions of BC Communities[5]



In addition to Kelowna residents' carbon footprint related to buildings, personal vehicle use, and solid waste, each resident also contributes by consuming goods and services. The carbon footprint associated with manufacturing and inter-regional transportation and other large scale activities is not captured in local data, but is captured in national data. Every Canadian is, in part, responsible for the country's current greenhouse gas signature which has been estimated at approximately 22.6 $CO_2e(t)$ per capita[6]. As a result of our daily activities and high rate of consumption and continued reliance upon fossil fuels, Canada's carbon footprint remains among the highest (second only to Australia) among developed countries, as illustrated in Figure 4. The United States while among the leading overall emitters has a lower per capita emissions rate (estimated at 21.7 $CO_2e(t)$) than Canada.

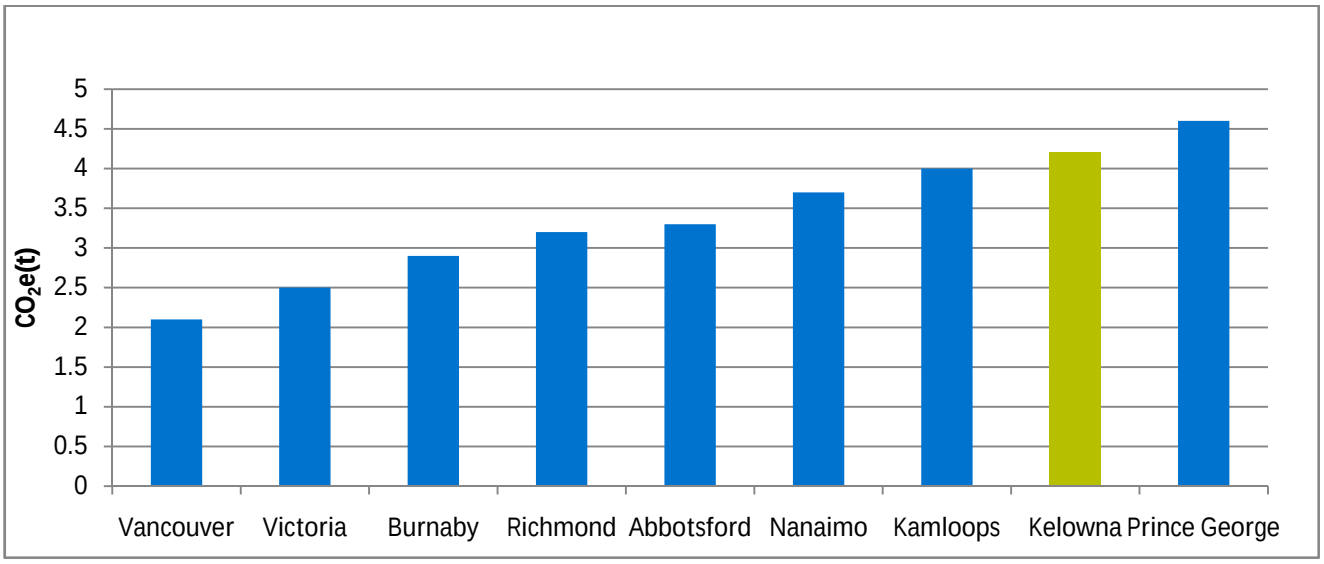
[5] Kelowna Community Energy & Greenhouse Gas Emissions Inventory: 2007
[6] Retrieved from the Conference Board of Canada - http://www.conferenceboard.ca/hcp/details/environment/greenhouse-gas-emissions.aspx#

Figure 4: Per Capita Greenhouse Gas Emissions by Nation[7]



As noted earlier, when compared with its municipal counterparts, Kelowna's per capita greenhouse gas emissions are trumped only by Prince George. In terms of emissions from transportation, Kelowna's vehicular emissions also rank just behind Prince George's.

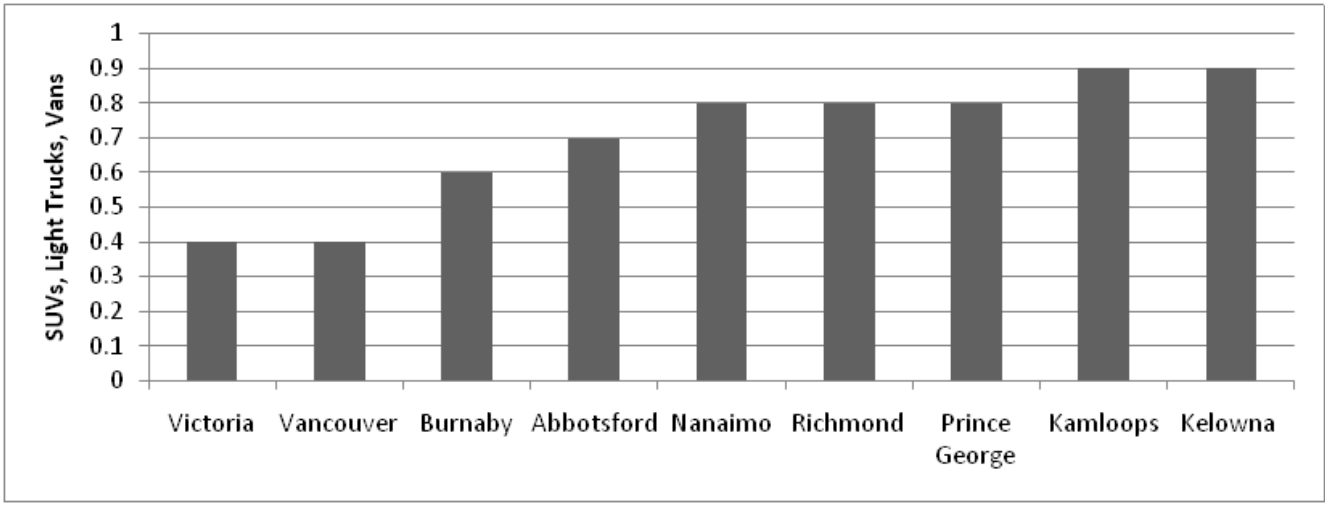
Figure 5: Per Capita Vehicle Emissions for BC Communities[8]



[7] Conference Board of Canada - Retrieved from: http://www.conferenceboard.ca/hcp/details/environment/greenhouse-gas-emissions.aspx
[8] Kelowna Community Energy & Greenhouse Gas Emissions Inventory: 2007

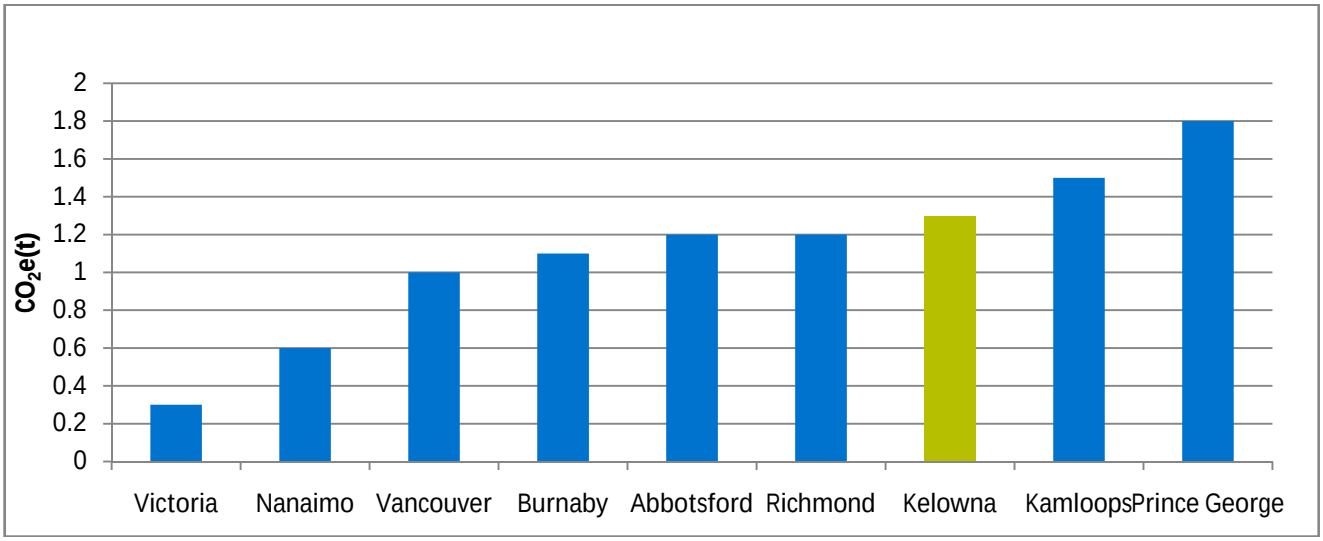
Based on the graph in Figure 6 below it would appear that much of the vehicle emissions result from a higher number of SUV's, light trucks and vans per household than is typical in many other communities including Prince George. According to provincial data, there is nearly one SUV, truck or van per household in Kelowna. In contrast, the average household in more metropolitan cities such as Vancouver and Victoria has less than half as many SUVs, light trucks and vans per capita. While living in a mountainous area accounts for some of this, the demand for large vehicles with higher relative emissions in Kelowna cannot be explained by "need" alone. The type of vehicle owned and operated by individuals is not something that the City has any control over.

Figure 6: SUVs, Light Trucks & Vans per Household for BC Communities



In terms of emissions related to builiding operations, Kelowna has the third highest in British Columbia (Figure 7). Carbon dioxide equivalent emissions pertaining to buildings are largely linked to a community's reliance on natural gas for heating. Electricity from the provincial grid is, relatively speaking, a much cleaner source of energy per unit of heat or power produced.

Figure 7: Building Emissions per Capita, BC Communities[9]



[9] Kelowna Community Energy & Greenhouse Gas Emissions Inventory: 2007

6. Analysis of Inventory Findings

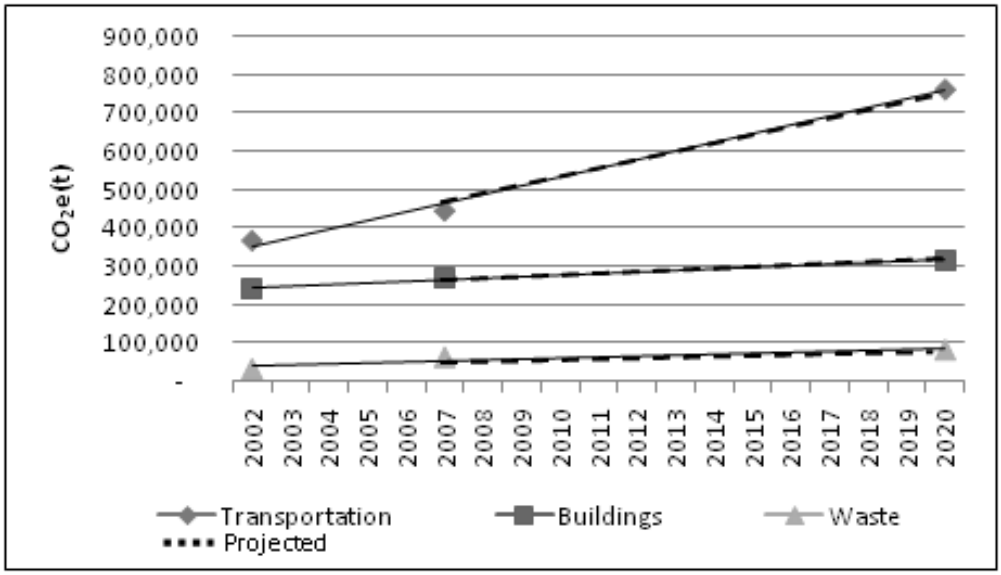
Population growth coupled with marked increases in per capita emissions highlight the challenges facing Kelowna as the community attempts to reduce overall emissions. This is especially true if the target being used is the provincial target of 33% below 2007 levels by 2020. To achieve this goal, significant reductions would be required across the board.

The following analysis examines each sector in greater detail to identify activities generating the most greenhouse gas emissions and to determine where the greatest reductions can be achieved.

6.1. Results by Sector

As a result of population growth and increased levels of consumption, each sector is projected to experience an increase in greenhouse gas emissions if reduction and conservation measures are not implemented (Figure 8). It is expected that emissions associated with transportation will experience the largest increases in both absolute and relative terms.

Figure 8: Kelowna Community Greenhouse Gas Emissions by Sector



Transportation

The transportation sector represents the largest component of Kelowna's greenhouse gas emissions at present.

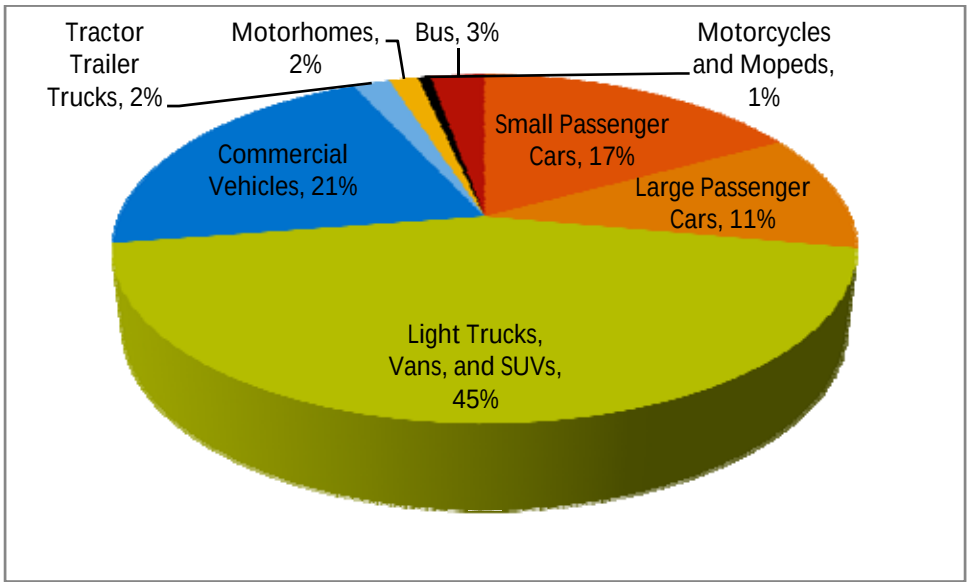
For the last forty years, the Canadian average annual vehicle kilometers travelled per person has continually risen from 7,934 km in 1966 to 16,616 km in 2006. Following the current trend[10] (~1.8 % increase annually), the average annual vehicle kilometers travelled per person could increase to approximately 21,500 by 2020. Assuming this trend of residential, commercial and industrial vehicle use, and attributing that increased use to a growing population, Kelowna can expect transportation emissions alone to account for over 760,000 $CO_2e(t)$ by 2020 (Figure 8). Failure to

[10] Between 1966 and 2006 VKT increased from 7,934 to 16,616, a 1.86% average annual increase.

achieve reductions in the transportation related greenhouse gases would result in failure to meet even modest reduction targets.

The leading greenhouse gas emitters can be identified by examining the composition of our community's vehicle fleet and transportation choices made by individuals. At nearly 200,000 $CO_2e(t)$, Kelowna's approximately 39,000 light trucks, vans, and SUVs contribute just under half (45%) of the total transportation greenhouse gas emissions as illustrated in Figure 9 below. The next largest sector is the combined small and large passenger cars category comprised of nearly 49,000 automobiles with a combined emission total of 124,698 $CO_2e(t)$ or 28%. The disparity between the emissions produced by light trucks, vans, and SUVs versus small and large passenger cars is a primary contributor to Kelowna's high emissions per capita relative to comparable mid-sized cities. Consumer decisions on vehicle purchase (e.g. compact versus SUV) are largely beyond the realm of influence of local government. The provincial and federal governments through incentive/disincentive programs (e.g. ecoAUTO rebate program, emissions standards for manufacturers and carbon taxing) have much greater opportunity to influence these decisions. This reality demonstrates one of the reasons why the support of senior governments will be critical to achieving any greenhouse gas reduction target set by municipalities.

Figure 9: Transportation Sector: Emissions Produced By Vehicle Type[11]

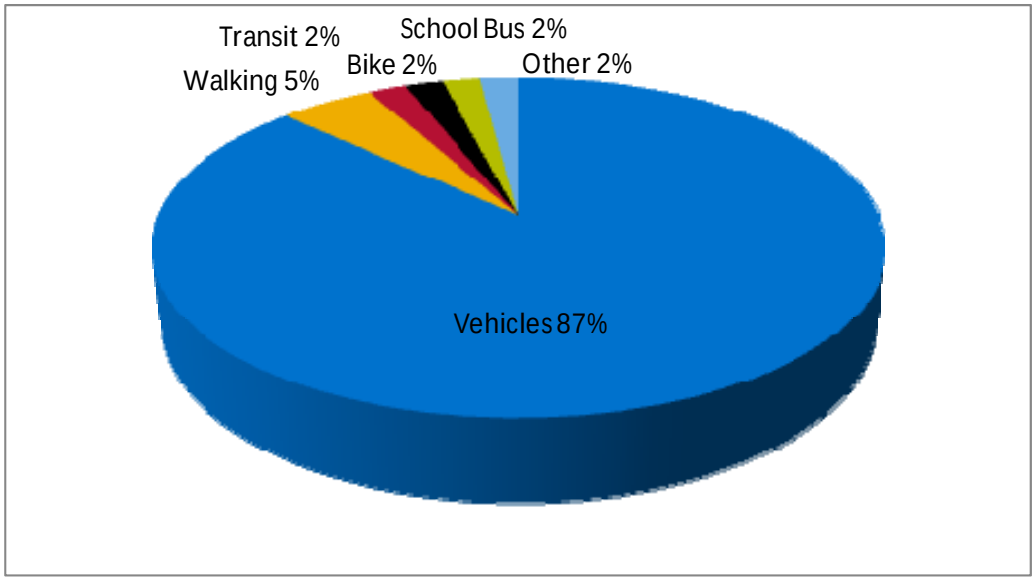


The number of light trucks, vans, and SUVs on Kelowna's roads is compounded by a high number of residents who favour driving as their primary mode of transportation. A survey of commuter patterns shows that a large majority of trips (87%) are made by car, truck or van (either driver or passenger), a figure which is backed up by 2006 Statistics Canada census data[12]. In contrast, the percentage of Victoria residents who choose to commute via car, truck or van is 52%, while 33% make the choice to walk or bike[13].

[11] Kelowna Community Energy & Greenhouse Gas Emissions Inventory: 2007
[12] 2007 North and Central Okanagan Household Travel Survey
[13] Statistics Canada 2006 City of Victoria Community Profile

Creating a community of active residents who embrace active modes of transportation (walking and cycling) and car pooling and transit would likely be a key strategy to reducing emissions. City efforts are well underway to help residents transition to active transportation modes through significant increases of multi-use corridors scheduled for completion in 2010.

Figure 10: Modal Split for the Central Okanagan Regional District[14]



The 2007 North and Central Okanagan Household Travel Survey identifies that one quarter of vehicle trips generated in Kelowna are to and from work while trips to and from school account for 13%. At 62%, the largest category of trips is more discretionary in nature. Reasons for such trips include for example: dining out, recreational activities, social outings, shopping, personal business, and to pick up and drop off items. The discretionary trips category represents a huge opportunity and will be discussed in greater detail in Section 8.

Buildings

The building sector is responsible for the second largest production of greenhouse gas emissions in Kelowna (behind transportation). This is true despite Kelowna being in a fortunate position in terms of energy sources relative to many Canadian cities. In Kelowna, hydroelectricity and natural gas are primarily responsible for heating and power generation. Relative to coal or fuel oil, natural gas is a much cleaner burning fossil fuel, while hydroelectricity is among the cleanest sources of electricity. Future changes to electrical supply capacity, including increased imports of "dirtier" energy from Alberta, could have a significant impact on Kelowna's greenhouse gas emissions. Where power is obtained is largely out of the control of the City and energy consumers. What can be controlled is the consumption of energy and lessening demand for imported energy and increased internal generating capacity (e.g. incorporating waste heat and co-generation).

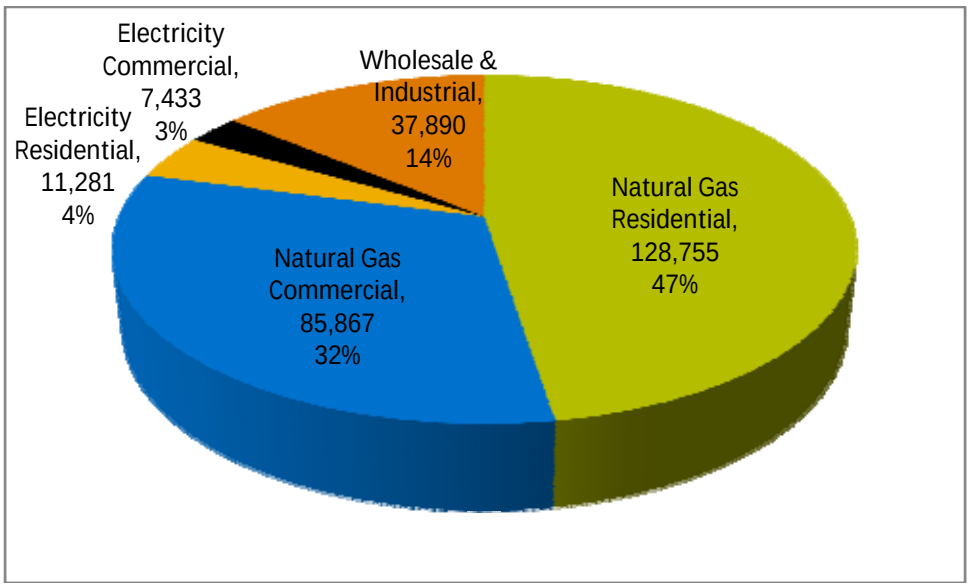
In both the residential and commercial building sectors, 58% of the total energy consumed is from the combustion of natural gas, while the remaining 42% is from electricity. While natural gas is responsible for 58% of the total energy consumed it is responsible for a disproportionate

[14] 2007 North and Central Okanagan Household Travel Survey

percentage of greenhouse gas emissions. For residential purposes, natural gas accounts for 91% of greenhouse gas emissions with the number growing by 6% between 2002 and 2007. This increase correlates closely with population growth.

In contrast with the slower growth in residential emissions, commercial emissions have risen by 30% from 2002 levels and are explained by a 26% increase in commercial space between 2002 and 2007. Similar to the residential sector, there is a nearly even split between electricity and natural gas consumption, while 92% of emissions result from the combustion of natural gas.

Figure 11: Building Sector Emissions CO2e(t)/ Consumption[15]



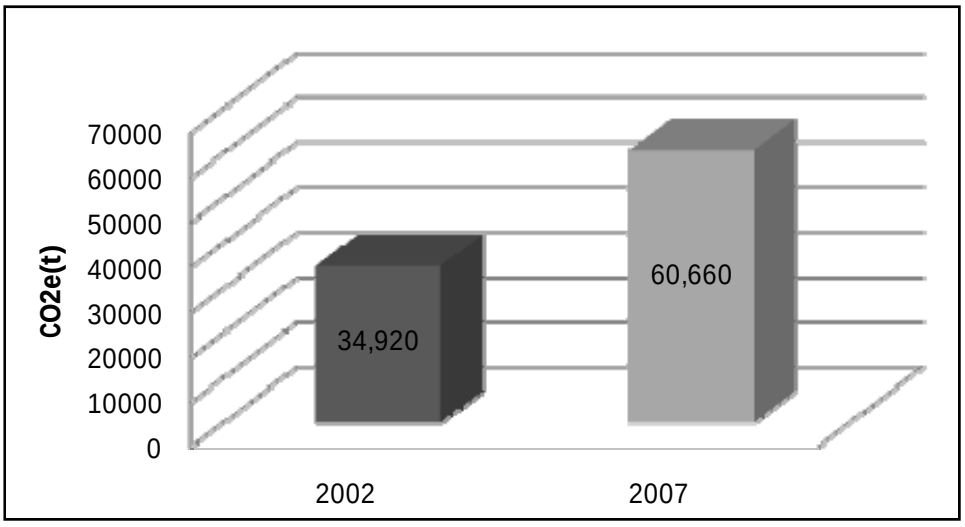
Emissions in the industrial building sector cannot be compared as the data collection methods and groupings differ between the 2002 and 2007 inventories. However, within the 2007 inventory, natural gas consumption is responsible for 94% of industrial greenhouse gas emissions. The proportion of energy consumption in industrial buildings differs from the residential and commercial sectors in that 67% of the total energy consumed in the industrial sector is from natural gas.

Solid Waste

Of the three sectors considered by the greenhouse gas emission inventory, solid waste contributes the least. Of concern, however, is the rate at which the share of the total has been growing. Solid waste emissions rose 89% between 2002 and 2007 as illustrated in Figure 12. In 2002, solid waste accounted for only 5% of overall emissions. By 2007 this number has grown to 8% (Figure 12).

[15] Kelowna Community Energy & Greenhouse Gas Emissions Inventory: 2007

Figure 12: Solid Waste $CO_2e(t)$ Emissions for the Years 2002 & 2007



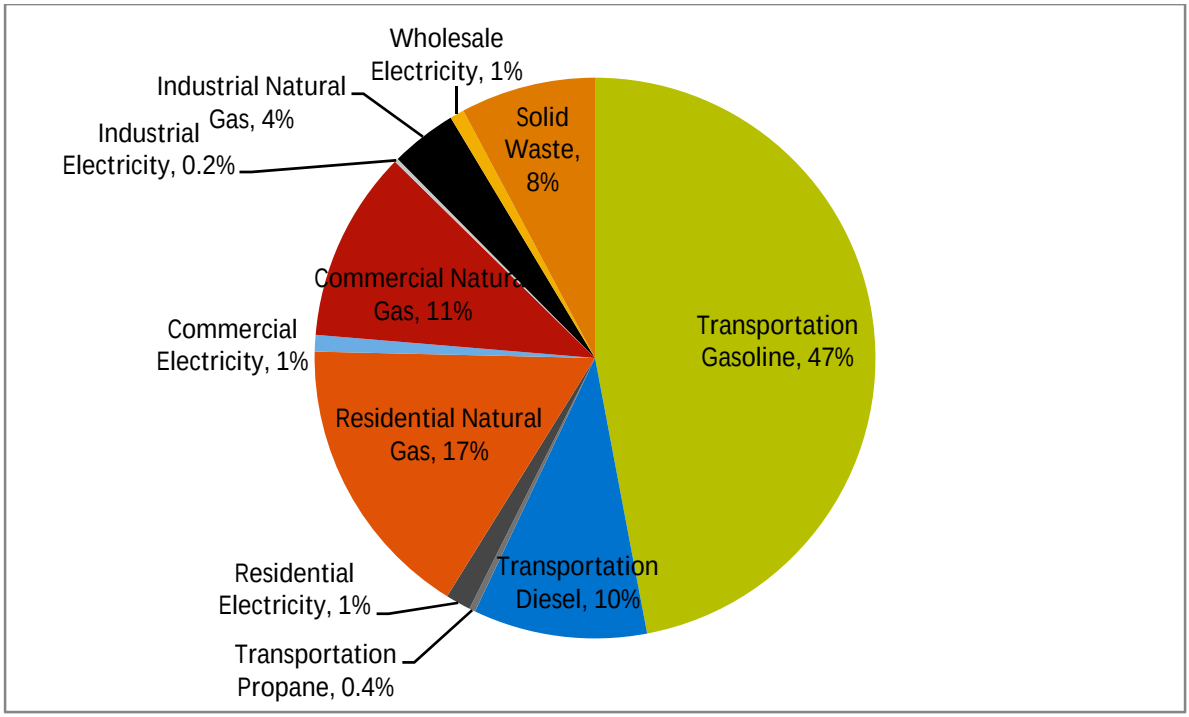
It should be noted that Kelowna is not unique, with similar trends being experienced globally. The increase can largely be attributed to the robust economy of the mid-2000's which resulted in record-breaking construction and construction waste. Locally, in some years, debris from unusual spring floods and violent summer storms added to the volume of waste entering the landfill. The 2003 Firestorm contributed significant volumes of ash and demolition waste. Unusual weather events have contributed somewhat to higher waste volumes, but the primary reason for the increase has been growth in consumption and construction/demolition waste.

In the future, it is likely that Solid Waste CO2e emission measuring protocols will change such that the emissions are measured NET of methane capture and destruction (which the City has been actively pursuing, but which have not been reflected in the 2007 data). It is also possible that the city may in the future be able to benefit from carbon credits resulting from landfill gas utilization.

7. Putting it All Together

Kelowna's greenhouse gas emissions have been identified and compared by activity sector and energy source in Figure 13.

Figure 13: Emissions by Sector and Fuel Source



The use of gasoline and diesel fuels for transportation dominates Kelowna's current emissions allocation, accounting for 57% of transportation related emissions. Residential, commercial and industrial natural gas consumption creates the next highest contribution at 32%. Together these components represent nearly 90% of the greenhouse gases emitted. As a result, to achieve success, they will need to be the central focus of Kelowna's greenhouse gas reduction strategy.

Any goal to reduce greenhouse gas emissions below 2007 levels must not only reduce current emissions, but address all additional greenhouse gas emissions resulting from population growth. Due to the cumulative impact of population growth on the total emissions, reducing total emissions from current levels will require a larger future change in per capita emissions. Population growth is expected to be in the range of 1.8% per annum or approximately 32,000 additional residents by 2020[16] (from 2007). The impacts of these new residents will need to be accounted for in emission reduction calculations. Based on the current per capita emission allocation of 7.2 $CO_2e(t)$, the increased population would add approximately 230,000 $CO_2e(t)$ of emissions.

To achieve a 33% reduction of greenhouse gas emissions by 2020, a significant change will be required of all Kelowna residents and businesses including the corporation of the City of Kelowna. In the simplest terms, by 2020, each Kelowna resident will need to generate less than half the greenhouse gas emissions they were responsible for in 2007. Achieving those reductions will require fairly substantial changes in the way Kelowna residents travel and will require significant investments in heating and cooling system replacements/upgrades and weatherization.

[16] City of Kelowna 20 Year Growth Strategy (2008).

The greenhouse gas profile (Table 1) indicates four scenarios including: future emissions given current trends (business as usual); status quo emissions (i.e. reduce emissions per capita, while increasing population); a less aggressive alternative approach to the provincial target (22% reduction by 2020); and target emissions as defined by the Province (33% reduction by 2020).

Table 1: Greenhouse Gas Profile

Target	Total Kelowna $CO_2e(t)$/yr	Per Capita $CO_2e(t)$/yr	% Change in Total CO_2e
2007 GHG emissions	778,958	7.2	0%
Business as Usual 2020	1,179,720	8.2	50% increase
Alternative 2020 emissions	614,632	4.3	22% decrease
Provincial Target for 2020	525,498	3.7	33% decrease

It should be noted that, in addition to targeting a 33% reduction by 2020, the Province is also targeting an 80% reduction by 2050. This report focuses on what would be required to achieve the 2020 reductions.

8. Reduction Strategies

Given that the 'business as usual' approach to greenhouse gas emissions would result in a significant per capita and overall increase, a coordinated and inspired reduction and implementation strategies will be essential to achieving all but the 'business as usual' target.

The effects of a variety of potential reduction strategies is detailed below. The reduction potential of each strategy will vary depending on the extent to which the various initiatives are embraced[17].
The potential reduction strategies have been provided to give the reader a sense of the number, type, and significance of the change required to meet the target. The strategies noted are provided only as a sample. Further work is necessary to identify which measures would deliver the greatest 'multiple bottom line' benefits and which would be most palatable to the community. A much more detailed study of strategies would be required as part of a follow-up Action Plan.

What is clear from the data presented in this Section is that a silver bullet solution (i.e. electric cars) does not exist at this time (and likely never will). Instead, the solution will lie in significant changes in how individuals value energy and the environment. Such changes must be pervasive and sustained for a 33% reduction target to be achieved. Many of the measures that will be necessary

[17] The reduction projects, policies and reduction levels have been based primarily upon the Climate and Air Pollution Planning Assistant tool (CAPPA).

are beyond the legislative or jurisdictional mandates granted to local governments. To achieve a 33% reduction, both provincial and federal policy and program support are essential.

Transportation

Annual household vehicle travel has increased steadily since the 1960's, and there is little evidence to suggest that this trend is coming to an end. However, holding the line on the annual growth in per household vehicle travel and ideally reducing household vehicle travel provides the greatest potential to reduce vehicle emissions from what is otherwise projected for 2020.

As noted earlier, 87% of residents commute to work by automobile. This reality also represents a significant opportunity to increase the modal split in favour of other modes. The City of Kelowna is actively pursuing these opportunities through initiatives such as the Active Transportation Master Plan, construction of a number of multi-use corridors, and land use planning/urban design supportive of walking, cycling and transit use. These are long-term initiatives which will only start yielding results by 2020. The opportunity to curb the number of trips through better trip planning offers hope. This initiative relies heavily on public education and uptake by residents rather than capital-intensive construction projects. In fact, road building projects tend to increase household vehicle travel through the uptake of "latent demand" which may have been deterred through congestion. Simply decreasing the level of service on Kelowna's roads could have a positive impact on vehicle kilometers traveled, though additional study would be needed to identify the net gain, given increased idling during congested periods.

The replacement of cars with fuel efficient vehicles, hybrids, electric cars and the reduction of SUV's, light trucks, & vans will have the next largest impact on reducing emissions. Unfortunately the ability for municipal government to impact consumer purchases is limited to parking incentives for fuel efficient vehicles and disincentives for inefficient vehicles. There is evidence that the market is reacting to higher fuel prices and climate change concerns, and that manufacturers are producing more fuel efficient models as a result. It is highly unlikely that the market response will, on its own, be enough to achieve significant emission reductions.

Buildings

The majority of the housing stock (~85%) and most of the commercial, industrial and institutional buildings that will exist in 2020 are already constructed. As such, influencing how new structures are built (e.g. LEED or Built Green certified) will have only limited overall impact. Instead, significant improvements will need to occur through the retrofit of existing structures. Retrofits should focus on the reduction of energy consumption, especially natural gas, but also electricity within existing stock through various measures.

Implementation of District Energy Systems using renewable energy sources or waste heat from industrial/institutional sources would have a significant impact on lowering building greenhouse gas emissions. Such systems are significantly complex and the City would likely need to take a lead role in providing the infrastructure similar to other utilities such as water and sewer.

Much simpler, and available to all individual home and building owners, is weatherization (e.g. sealing cracks around windows and doors and adding insulation to ceilings and walls). Renovations

are well known to be a simple and effective approach that could yield significant positive results if implemented on a sufficiently broad basis.

To some extent, local residents can also take advantage of solar power opportunities. Orienting structures to capture heat in the cold months and avoid heat capture in the warm months (passive solar); adding solar hot water collectors to replace natural gas and electric water heaters; and photovoltaic panels to generate electricity are all options that the City and residents can pursue.

Solid Waste

Solid waste emission reductions will, quite simply, require the generation of less solid waste. Reductions can be achieved with expanded use of recycling programs and with reduced consumption.

Opportunities also exist for capturing landfill gas. Best practices see over 70% efficiency for landfill gas capture. Today, the City captures close to 50%. For 2009, it is estimated that the annual destruction of C02e is at 26,000 tonnes (up from 10,000 in 2008). The City is moving towards more landfill gas utilization. This move holds promise for net carbon credits by further reducing the City's need for electricity to support landfill operations. This also holds promise for potential further use to heat nearby greenhouses, or institutional and residential buildings.

Potential Reduction Strategies

Table 2 lists a number of emission reduction strategies for each of the above-noted sectors and provides estimates of potential emission reductions.

It should be noted that all the reductions are from the *projected* 2020 emissions, not current emissions.

Table 2: Emission Reduction Strategies – Transportation

Vehicle Emissions Reduction Strategies	Degree of Implementation	Total Est. Reduction $CO_2e(t)$
Maintain average annual vehicle km travelled/household at 2007 levels (approximately 17,000 km/household, or 8,500 km/vehicle)	Would require participation by most residents to succeed.	170,000
Replace older, more polluting models with hybrids/electric vehicles	Assumes that hybrid/electric vehicle sales will gradually increase from 10% of new vehicles to 35% by 2020. Over a ten year period, it is assumed that 23% of new vehicles will be either hybrids or electric. The reduction rate assumes that of that 23%, 80% will be hybrid and 20% electric.	82,000
Reduce the % of SUV/Vans/Trucks	Assuming that SUVs, vans and trucks go from being 44% of the total passenger fleet (2007 figure) to making up 24% of new vehicles purchased over the ten years	62,000
Replace older, more polluting models with more fuel-efficient cars	Assumes that 53% of 100,000 new vehicles purchased over the next ten years will be at least 25% more fuel efficient than the vehicles being replaced.	70,000
Reduce and eliminate trips	Assumes that every household will eliminate six vehicle trips a week, based on an 8.5 km average trip length. This could be achieved by telecommuting (working from home) or through an awareness of driving habits and making more efficient trips.	40,000
Shorten Trips	Assuming each new household living centrally makes eight, four kilometer trips per day, five days per week, 52 weeks per year (8,320 km/year) versus the same number of 8.5 km length trips (17,680 km). The number of units within urban centres & inner suburbs are based on the 2006 total Household Structure by Urban Centre data and projected 2030 core & inner suburb numbers from the OCP Review. This value, 12,000, was divided by two to represent the 2020 build out scenario rather than 2030.	28,000

Vehicle Emissions Reduction Strategies	Degree of Implementation	Total Est. Reduction $CO_2e(t)$
Increase bike trips	Annual $CO_2e(t)$ reduction calculations are based on an average three km trip, ten trips per week 48 weeks per year. This equates to 15% of the total population biking as their primary mode of transportation. (Rate was 2.6% in 2007).	7500
Increase bus ridership	Assumes that transit ridership (modal split) increases from 3.6% (2007) to 15%. Estimates are based on for annual reduction in $CO_2e(t)$ are based on an average six km trip, ten trips per week 48 weeks per year.	15,000
Increase pedestrian trips	Assumes that the modal split for walking increases from 5% (2007) to 15%. Estimates are based on an average one km trip, ten trips per week 48 weeks per year.	2500
Increase carpooling & vanpooling	Estimate assumes all households will participate. Estimates for annual reduction are based on four car pool trips per month at an average distance of ten km.	7200
Implement car share program	Estimate assumes that two per cent of households participate and that car share participants will drive 40% less on average.	3000
Improve vehicle maintenance -- tuning, tire pressure	Estimate assumes 60% of cars have tire pressure checked monthly and owners keep automobiles tuned as per manufacturer recommendations.	7000
Reduce idling	Estimate assumes 60% of vehicle owners reduce idling by ten minutes per day.	4000
Total potential transportation emissions reduction		**498,200**

Table 2: Emission Reduction Strategies - Buildings

Building Emissions Reduction Strategies	Degree of Implementation	Total Est. Reduction $CO_2e(t)$
Install high efficiency water heaters	42% of all water heaters are electric. It is assumed that water heaters are replaced every 12 years. Of these homes it is assumed that 8% will be replaced annually.	7500
Install Solar Hot Water heaters	250 units annually	1500
Install low flow shower heads & faucets	2000 households annually (old home upgraded)	750
Replace old appliances (includes F, DW & W&D) with energy star appliances	3600 households annually. This is based on an assumption that appliances are replaced every 15 years and that 100% replace with energy star appliances.	3000
Weatherize homes	800 existing homes retrofitted annually. In addition, all anticipated new single-family homes (4783) built between 2010 and 2020 will be constructed at a standard equivalent to weatherization.	15,000
Install geothermal heat pump	Assuming 200 new or existing homes convert to geothermal each year and that each home that is on geothermal saves 3 tonnes of CO_2	6000
Replace old A/C and chillers with more efficient models	200 homes purchase more efficient air conditioners annually	100
Lower the temperature of buildings at night	50% of households	6000
Shorten showers	30% of households. Calculations are assuming a five minute shower rather than a bath.	500
Use cold water to wash clothes	30% of households	3000
Use energy-saving setting to dry dishes	30% of households	1500
Turn off lights when not in use	30% of households	400
Turn off TV, computer and equipment when not in use	30% of households	400
Get rid of second fridge	Assume that 15% of single-family homes have second fridges, of that 15% we expect 50% to get rid of them	300
Limit use of gas lawn mowers, leaf blowers and snow blowers	Assumes 15% of single family homes use push-power instead of gas for lawn mowing.	25
Implement downtown district energy by 2020		35000
	Total potential building emissions reduction	**81,225**

Table 2: Emission Reduction Strategies - Community Solid Waste

Waste Emissions Reduction Strategies	Degree of Implementation	Total Est. Reduction CO2e(t)
Reduce consumption/generate less waste	Assuming half of households reduce consumption by 10%	4000
Compost kitchen waste	This assumes that 25% of total single family dwellings occupied by usual residents would participate.	600
Commercial food waste collection	Assuming 75% of waste is collected.	15,750
Methane re-use (instead of destruction)	This assumes 75% collection efficiency and escalating gas concentration as gas field matures. It is further assumed that 25% of buried garbage is sourced.	26,250
Total potential solid waste emissions reduction		**46,600**

Table 2: Emission Reduction Strategies - Carbon Sequestration

Tree Sequestration of CO_2e	Degree of Implementation	Total Reduction $CO_2e(t)$
2020 Tree Canopy $CO_2e(t)$ sequestered	Current tree canopy	6500
Plant mature trees	If specific varieties of trees are planted in 2009/10 it is possible to have additional "Healthy Trees" in the 2020 tree canopy.	N/A
Plant young trees	Assumes that for the next three years we plant 10,000 trees annually and that they are of a variety that has a rapid growth rate.	200
Plant trees to shade buildings	Assumes that of 30,000 new trees planted, 10,000 will be strategically placed to ensure wind and sun protection to buildings	50
Total potential emissions being sequestered		**6,750**

Table 3 summarizes the information provided in Table 2, by sector. As noted in the table, the Transportation Sector represents the largest potential source of reductions.

Table 3: Emission Reduction Strategies - Summary

Source Of Reduction or Sequestration	Total Est. Reduction $CO_2e(t)$
Transportation	498,200
Buildings	81,225
Waste	46,600
Tree Sequestration	6750
Total Potential Emissions Reduction or Sequestered	**632,775**

The reduction strategies noted in Table 2 are intended only as a sample. It is acknowledged that many other strategies exist now and new strategies will continue to present themselves.

Further, it should be noted that the reduction strategies included in Table 2 are theoretical only and will require much greater consideration to confirm that:

- they are viable in the local context,
- they are within the City's realm of influence either through lobbying, education, or direct actions; and,
- the potential reduction capability (# of tones) is accurate and feasible.

Many of the initiatives listed in Table 2 could be made more viable with supportive actions/policies from the provincial and federal levels. Examples of supportive programs, policies and regulations include:

- Incentives for landfill gas capture and utilization;
- Hospital and school district asset planning – aligned with municipal planning objectives and providing funding for long-time asset planning/replacement;
- Greater flexibility in the ability to levy Development Cost Charges so that local governments can, under appropriate circumstances, charge for bus, pedestrian and cycling infrastructure instead of arterial roads alone;
- Regulatory changes to the Motor Vehicle Act to create better conditions for active transportation users;
- More stringent Building Code requirements;
- Distance based insurance premiums;
- More supportive taxi cab regulations;
- New funding sources for alternative transportation;
- Greater provincial contributions to public transit; and,
- Seller responsibility for waste.

Achieving any of the above may require lobbying by the City either independently and through UBCM and FCM.

This report suggests that achieving a 33% reduction is, in theory, possible. Table 4 shows that if all the measures noted in Table 2 were implemented, the City would be able to achieve a 33% reduction in emissions (from 2007 levels) by 2020. It is, however, also clear that achieving a 33% reduction will not be easy. The changes required are significant and would require considerable commitment by local residents and businesses.

Table 4: Emission Scenarios – Summary

Emission Scenarios	$CO_2e(t)$
Annual emissions (2007)	784,327
Projected emissions (2020) if no reduction measures implemented	1,152,072
2020 target emissions if 33% reduction from 2007 endorsed	525,498
Reductions from transportation, building, solid waste, and sequestration initiatives listed in Table 2	632,775
2020 emissions after reductions identified in Table 3	519,297

9. Carbon Credits and Offsets Purchase Option

Carbon credits and offsets have garnered much attention in recent years as individuals, communities, corporations and governments grapple with greenhouse gases and human-induced climate change. Carbon trading is an emissions trading approach which allows emitters to offset their emissions through the purchase of carbon credits[18]. One Carbon Credit is equal to one ton of carbon. The idea is to allow market mechanisms to drive processes in the direction of lower emissions or less "carbon intensive" approaches. With a price attached to the cost of a carbon credit, the purchase of carbon credits can be used to finance carbon reduction schemes (e.g. reforestation) between trading partners and around the world.

The Province has recently forced its ministries, agencies, as well as schools and hospitals, to pay for the amount of carbon they emit through the Pacific Carbon Trust, a new Crown Corporation[19]. The price that has been established through the Pacific Carbon Trust is $25 per tonne of carbon or equivalent emitted. This number is not fixed and there is no consensus on what the rate should be with the federal government suggesting the credits will be worth approximately $50 per tonne in 2020 and environmental groups urging government to price them at $200 per tonne[20]. Whatever the rate, it is clear from Table 5 that not making a concerted effort to reduce carbon emissions

[18] Source: http://en.wikipedia.org/wiki/Carbon_credit
[19] Sources: http://www.pacificcarbontrust.ca/ & http://communities.canada.com/vancouversun/blogs/communityofinterest/archive/2009/10/26/cashing-in-on-climate-change-the-carbon-offset-scam.aspx
[20] Source: http://pubs.pembina.org/reports/climate-leadership-report-en.pdf

could be a very costly move should senior governments require local governments to purchase carbon credits to offset emissions.

Table 5: Cost to Purchase Carbon Offset Credits (in millions) Under Three Pricing Schemes

Target	$25 per tonne	$50 per tonne	$200 per tonne
Business as Usual 2020	$16.4	$32.7	$130.8
2007 GHG emissions	$6.3	$12.7	$50.7
Alternative 2020 emissions	$2.2	$4.5	$17.8
Provincial Target for 2020	$0	$0	$0

In the world-wide context, offset credits are currently around $0.06 per tonne with projections to $3 per tonne being discussed. Suggestions that pricing could increase to $25-200 per tonne are still speculative. In the City of Kelowna's experience, the one-time cost/tonne of carbon reduction in buildings has ranged from $500-$3200, depending on the intervention. The payback, however, has averaged 3.3 years simply on the basis of energy cost savings. So the short-term business case for carbon reduction is related to energy savings, not avoided carbon offset purchases. Due to long pay-back periods, carbon offset purchases alone provide little incentive to reducing carbon emissions. In fact, if this cost avoidance becomes the argument, then it would be much cheaper to offload the City's carbon problems to others. Pursuing that avenue would, however, raise questions relating to social justice.

Thus, while there is no certainty around carbon offsetting, should the future bring mandated carbon offsetting, and should the price be higher than currently, then betting against that possibility could be a costly exercise. As a municipality, the question would need to be "what can be accomplished in terms of carbon emission reduction and sequestration for the cost of $16 million annually" (i.e. the costs if the price was set at $25/tonne and with emissions as projected under the 'business as usual' scenario)?

10. Strategic Implications

This report has endeavored to be realistic about greenhouse gas targets which are much easier to set than to meet. Simply put, reducing emissions will be difficult. Overall, conservation remains the most direct and cost-effective method to reduce greenhouse gas emissions. To be successful, substantial change will be needed both in how government delivers services and in how residents and businesses operate their buildings and vehicles. Such changes demand increased vigilance and awareness of individual and collective impacts.

Resistance to the types of changes required would seem inevitable on some levels. Certain industries have developed around a fossil fuel economy (e.g. heavy industrial) and there will be a reluctance to change. The statistics provided in Section 5 which show that Kelowna residents have chosen to drive larger, less efficient vehicles, also suggests there may be challenges bringing the community on-side. Such habits and personal decisions will not be easily overcome.

As the transportation sector accounts for a majority of Kelowna's greenhouse gas emissions, significant efforts will need to be devoted to this area. When it comes to buildings, extensive efforts will need to be directed at reducing natural gas consumption in existing buildings and to a lesser extent in future stock.

To reach the provincial reduction target of 33% below 2007 levels, the City of Kelowna and local governments in general will need to be supported by appropriate senior government actions. Senior governments will need to take action on regulatory fronts falling within their jurisdictions so as to set an 'equal playing field' and a supportive environment for the actions of local governments.

11. Recommended Next Steps

This report provides information on Kelowna's current and potential greenhouse gas emissions profile. This report also lists potential strategies for reductions and identifies the potential impact of each of these strategies. This report does not identify the financial costs of any of the strategies, nor the potential benefits (e.g. green economy) that might accrue from taking action. It is suggested that these matters be further explored and that the information be broadly discussed by community stakeholders as part of developing an Action Plan. It is recommended that the Action Plan be comprehensive in nature with the mandate to consider all related activities that could not feasibly be considered as part of this report. The approach suggested would be multi-disciplinary in nature, taking on a multiple bottom line (people, planet, and profit) accounting mandate and a systems approach. The objective of gathering and discussing the information would be to identify a package of implementable strategies appropriate for Kelowna.

In terms of next steps, the following actions are recommended:

- Incorporate Council-directed greenhouse gas reduction target into existing Official Community Plan (by May 31, 2010);
- Adopt the new Official Community Plan as a road map for overall sustainability (end of 2010);

- Establish a multi-disciplinary Kelowna 2020 Action Plan task force comprised of community champions to identify financial costs and community benefits associated with potential reduction strategies; and
- Identify and commit financial and staff resources to implement reduction strategies identified by Kelowna 2020 Action Plan.

12. References for Further Information

Live Smart BC- GHG Emissions
http://www.livesmartbc.ca/learn/emissions.html

BC Climate Action Toolkit
http://www.toolkit.bc.ca/

GHG Action Guide
http://www.ghgactionguide.ca/

Solar BC
http://www.solarbc.ca/

Community Energy Association
http://www.communityenergy.bc.ca/

13. Appendix 1: British Columbia Climate Action Charter

THE BRITISH COLUMBIA CLIMATE ACTION CHARTER

BETWEEN

THE PROVINCE OF BRITISH COLUMBIA (THE PROVINCE)

AND

THE UNION OF BRITISH COLUMBIA MUNICIPALITIES (UBCM)

AND

SIGNATORY LOCAL GOVERNMENTS

(THE PARTIES)

(1) The Parties share the common understanding that:

(a) Scientific consensus has developed that increasing emissions of human caused greenhouse gases (GHG), including carbon dioxide, methane and other GHG emissions, that are released into the atmosphere are affecting the Earth's climate;

(b) the evidence of global warming is unequivocal and the effects of climate change are evident across British Columbia;

(c) reducing GHG emissions will generate environmental and health benefits for individuals, families, and communities;

(d) climate change and reducing GHG emissions are issues of importance to British Columbians;

(e) governments urgently need to implement effective measures to reduce GHG emissions and anticipate and prepare for climate change impacts;

(f) protecting the environment can be done in ways that promote economic prosperity; and

(g) it is important to take action and to work together to share best practices, to reduce GHG emissions and address the impacts of climate change.

(2) The Parties acknowledge that each has an important role in addressing climate change and that:

(a) The Province has taken action on climate change, including commitments made in the 2007 Speech from the Throne, the BC Energy Plan, and the Western Climate Initiative on climate change;

(b) Local Governments have taken action on climate change, including planning livable, sustainable communities, encouraging green developments and transit oriented developments, and implementing innovative infrastructure technologies including landfill gas recapture and production of clean energy; and

(c) these actions create the foundation for the Parties to be leaders in affecting climate change.

(3) This Charter acknowledges that:

(a) The interrelationship between each Order of Government's respective jurisdictions and accountabilities with respect to communities, and activities related to and within communities, creates both a need and an opportunity to work collaboratively on climate change initiatives;

(b) both Orders of Government have recognized a need for action, both see that the circumstances represent a Climate for Change in British Columbia, and both are responding; and

(c) the actions of each of the Parties towards climate change will be more successful if undertaken jointly with other Parties.

(4) The Parties share the common goals of:

(a) Fostering co-operative inter-governmental relations;

(b) aiming to reduce GHG emissions, including both their own and those created by others;

(c) removing legislative, regulatory, policy, or other barriers to taking action on climate change;

(d) implementing programs, policies, or legislative actions, within their respective jurisdictions, that facilitate reduced GHG emissions, where appropriate;

(e) encouraging communities that are complete and compact and socially responsive; and

(f) encouraging infrastructure and a built environment that supports the economic and social needs of the community while minimizing its environmental impact.

(5) In order to contribute to reducing GHG emissions:

(a) Signatory Local Governments agree to develop strategies and take actions to achieve the following goals:

(i) being carbon neutral in respect of their operations by 2012, recognizing that solid waste facilities regulated under *the Environmental Management Act* are not included in operations for the purposes of this Charter.

(ii) measuring and reporting on their community's GHG emissions profile; and

(iii) creating complete, compact, more energy efficient rural and urban communities (e.g. foster a built environment that supports a reduction in car dependency and

energy use, establish policies and processes that support fast tracking of green development projects, adopt zoning practices that encourage land use patterns that increase density and reduce sprawl.)

(b) The Province and the UBCM will support local governments in pursuing these goals, including developing options and actions for local governments to be carbon neutral in respect of their operations by 2012.

(6) **The Parties agree that this commitment to working together towards reducing GHG emissions will be implemented through establishing a Joint Provincial-UBCM Green Communities Committee and Green Communities Working Groups that support that Committee, with the following purposes:**

(a) To develop a range of actions that can affect climate change, including initiatives such as: assessment, taxation, zoning or other regulatory reforms or incentives to encourage land use patterns that promote increased density, smaller lot sizes, encourage mixed uses and reduced GHG emissions; development of GHG reduction targets and strategies, alternative transportation opportunities, policies and processes that support fast-tracking of green development projects, community gardens and urban forestry; and integrated transportation and land use planning;

(b) to build local government capacity to plan and implement climate change initiatives;

(c) to support local government in taking actions on becoming carbon neutral in respect of their operations by 2012, including developing a common approach to determine carbon neutrality for the purposes of this Charter, identifying carbon neutral strategies and actions appropriate for the range of communities in British Columbia and becoming reporting entities under the Climate Registry; and,

(d) to share information and explore additional opportunities to support climate change activities, through enhanced collaboration amongst the Parties, and through encouraging and promoting climate change initiatives of individuals and businesses within communities.

(7) Once a common approach to carbon neutrality is developed under section (6)(c), Signatory Local Governments will implement their commitment in 5 (a) (i).

(8) To recognize and support the GHG emission reduction initiatives and the climate change goals outlined in this Charter, Signatory Local Governments are invited by the other Parties to include a statement of their initiatives and commitments as an appendix to this Charter.

(9) This Charter is not intended to be legally binding or impose legal obligations on any Party and will have no legal effect.

SIGNED on behalf of the PROVINCE OF BRITISH COLUMBIA by:

The Honourable Gordon Campbell
Premier of British Columbia

Date: September 26, 2007

The Honourable Ida Chong Minister
of Community Service and Minster
Responsible for Senior's and
Women's Issues

Date: September 26, 2007

SIGNED on behalf of the UNION OF BRITISH COLUMBIA MUNICIPALITIES by:

Councillor Brenda Binnie and
President of the Union of British
Columbia Municipalities

Date: September 26, 2007

SIGNED on behalf of the SIGNATORY LOCAL GOVERNMENT:

City of Kelowna
(NAME OF LOCAL GOVERNMENT)

by:

Sharon Shepherd
Mayor/Chair

Date September 21, 2007

SHARON SHEPHERD, MAYOR

14. Appendix 2: Kelowna Community Energy & Greenhouse Gas Emissions Inventory: 2007

Kelowna

Community Energy & Greenhouse Gas Emissions Inventory: 2007

This is your local government's draft 2007 Community Energy and Greenhouse Gas Emissions Inventory (CEEI). From March 10th to April 15th 2009, the Province and partners are asking for your review and feedback - http://www.toolkit.bc.ca/ceei - on the content, clarity and usefulness of your community's draft 2007 CEEI Report.

What is a CEEI Report?

CEEI Reports are a result of a multi-agency effort to provide a province-wide solution to assist local governments in BC to track and report annual community-wide energy consumption and greenhouse gas (GHG) emissions. For 2007, the CEEI Reports provide high-level energy and GHG emission estimates in three primary sectors – on-road transportation, buildings and solid waste. As additional information, estimates on land-use change emissions from deforestation are provided at the regional district level. CEEI Reports are one of the many resources available through the Climate Action Toolkit (http://www.toolkit.bc.ca), a web-based service provided through the ongoing collaboration between UBCM and the Province.

Why does my local government need a CEEI Report?

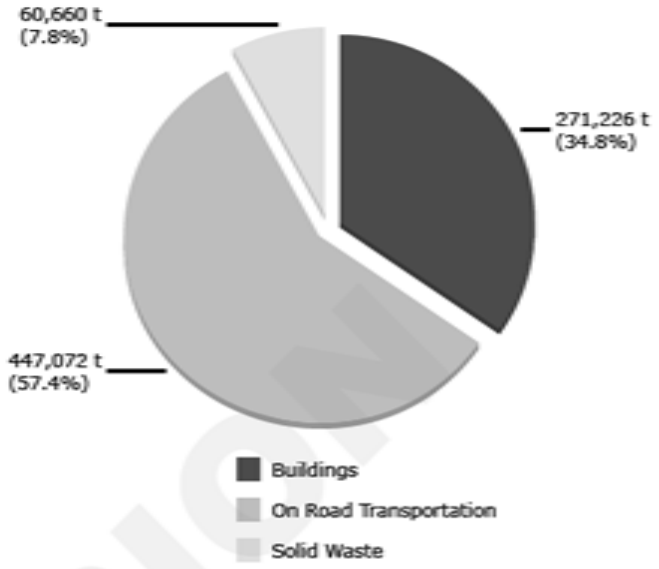
An energy and GHG emissions inventory can be a valuable tool that helps local governments plan and implement GHG and energy management strategies, while at the same time strengthening broader sustainability planning at the local level. CEEI reports have two primary purposes – to fulfill local governments' Climate Action Charter commitment to measure and report their community's GHG emissions profile, and to establish a base year inventory for local governments to consider as they develop targets, policies, and actions related to the Province's new Green Communities Legislation (Bill 27). As an additional benefit, CEEI Reports support BC local government members of the Federation of Canadian Municipalities' Partners for Climate Protection program to achieve Milestone One of the community stream – a community GHG emissions inventory.

A first in North America!

CEEI is a first in North America, and a first step for BC communities. The 2007 CEEI Reports are based on best available province-wide data. The accuracy and detail of CEEI reports will continue to improve to meet increasing local and provincial government information needs. For example, the CEEI working group is presently pursuing ways to refine community boundary accuracy for a number of BC's smaller communities. Also, local governments may wish to provide additional information to the CEEI and/or enhance their CEEI report (in sectors and/or detail) where interest, capacity and local information sources permit (e.g., provide the CEEI with accurate community-specific solid waste data). For future reports, the CEEI working group will be considering the inclusion of additional components to GHG inventories as advised by emerging international protocols, the information needs of local governments, and the Province's forthcoming Green Communities Incentive Program.

Hyla Environmental Services Ltd. (HES) is providing 2007 CEEI Reports using its Energy and Emissions Monitoring and Reporting System™. HES is also developing a 2007 CEEI Technical Methods and Guidance document, presently scheduled to be available in late March 2009.

CO_2e (tonnes) by Sector *



* In some CEEI Reports, inaccuracy in solid waste data and/or where electricity and natural gas consumption data for buildings has been withheld for confidentiality purposes, the relative percentages of GHGs in each sector as illustrated above may appear disproportionate. For this reason, care should be taken in interpreting these reports, particularly where comparisons with other local government may be of interest.

Please refer to the CEEI User Guide for overviews of each sector (http://www.env.gov.bc.ca/epd/climate/ceei/pdf/ceei-user-guide.pdf). For answers to Frequently Asked Questions go to http://www.env.gov.bc.ca/epd/climate/ceei/pdf/ceei-faq.pdf. To explore 'taking action community wide', go to http://www.toolkit.bc.ca/taking-action/community-wide. For more information, please contact the Ministry of Environment at CEEIRPT@gov.bc.ca.

Notice to the Reader: This CEEI Report uses information from a variety of sources to estimate GHG emissions. While the methodologies, assumptions and data used are intended to provide reasonable estimates of greenhouse gas emissions, the information presented in this report may not be appropriate for all purposes. The Province of BC, data providers and HES Ltd. do not provide any warranty to the user or guarantee the accuracy or reliability of the data contained in this report. The user accepts responsibility for the ultimate use of such data.

Kelowna
Community Energy & Greenhouse Gas Emissions Inventory: 2007

Buildings	Consumption By Type					Energy & Emissions Total	
	Type	Connections	Consumption	Energy/Connection	Energy (GJ)	CO_2e (t)	Energy (GJ)	CO_2e (t)
Residential Buildings	Electricity	49,306	512,785,174 kWh	10,400 kWh/C	1,846,027	11,281	**4,363,261**	**140,036**
	Natural Gas	31,160	2,517,235 GJ	81 GJ/C	2,517,235	128,755		
Commercial Buildings	Electricity	4,084	337,867,647 kWh	82,730 kWh/C	1,216,324	7,433	**2,896,072**	**93,300**
	Natural Gas	3,735	1,678,749 GJ	449 GJ/C	1,678,749	85,867		
Industrial Buildings	Electricity	43	78,825,294 kWh	1,833,146 kWh/C	283,771	1,734	**865,100**	**31,469**
	Natural Gas	21	581,329 GJ	27,682 GJ/C	581,329	29,735		
Wholesale Amount	Electricity	1	291,854,400 kWh	291,854,400 kWh/C	1,050,676	6,421	**1,050,676**	**6,421**
Subtotal	Electricity	53,434	1,221,332,515 kWh		4,396,797	26,869	**9,174,109**	**271,226**
	Natural Gas	34,916	4,777,312 GJ		4,777,312	244,357		

On Road Transportation	Consumption By Type					Energy & Emissions Total	
	Type	Units	Consumption	Litres/Unit	Energy (GJ)	CO_2e (t)	Energy (GJ)	CO_2e (t)
Small Passenger Cars	Gasoline	32,476	30,139,158 litres	928 L/U	1,044,623	75,269	**1,059,707**	**76,353**
	Diesel Fuel	609	389,971 litres	640 L/U	15,084	1,084		
Large Passenger Cars	Gasoline	15,662	19,130,844 litres	1,221 L/U	663,075	47,777	**671,058**	**48,345**
	Diesel Fuel	199	194,978 litres	980 L/U	7,542	542		
	Mobile Propane	18	17,435 litres	969 L/U	441	27		
Light Trucks, Vans, And Suvs	Gasoline	38,174	78,796,242 litres	2,064 L/U	2,731,078	196,783	**2,773,080**	**199,606**
	Diesel Fuel	386	657,294 litres	1,703 L/U	25,424	1,827		
	Mobile Propane	349	654,992 litres	1,877 L/U	16,578	996		
Commercial Vehicles	Gasoline	7,767	14,287,227 litres	1,839 L/U	495,195	35,680	**1,281,439**	**91,945**

On Road Transportation continued

	Diesel Fuel	4,483	19,816,417 litres	4,420 L/U	766,499	55,078		
	Mobile Propane	248	780,128 litres	3,146 L/U	19,745	1,186		
Tractor Trailer Trucks	Diesel Fuel	222	3,109,993 litres	14,009 L/U	120,295	8,644	**120,295**	**8,644**
Motorhomes	Gasoline	1,332	2,345,526 litres	1,761 L/U	81,296	5,858	**93,569**	**6,721**
	Diesel Fuel	145	276,322 litres	1,906 L/U	10,688	768		
	Mobile Propane	47	62,612 litres	1,332 L/U	1,585	95		
Motorcycles And Mopeds	Gasoline	3,185	1,184,820 litres	372 L/U	41,066	2,959	**41,066**	**2,959**
Bus	Gasoline	94	785,840 litres	8,360 L/U	27,237	1,963	**175,053**	**12,500**
	Diesel Fuel	202	3,636,000 litres	18,000 L/U	140,640	10,106		
	Mobile Propane	15	283,500 litres	18,900 L/U	7,175	431		
Subtotal	Gasoline	98,690	146,669,656 litres		5,083,570	366,288	**6,215,267**	**447,072**
	Diesel Fuel	6,246	28,080,975 litres		1,086,172	78,049		
	Mbl Propane	677	1,798,667 litres		45,524	2,734		

Solid Waste	Direct Emissions				Emissions Total
	Type	Estimation Method	Mass (t)	CO_2e (t)	CO_2e (t)
Community Solid Waste	Solid Waste	Waste-in-Place	94,348	60,660	**60,660**
Subtotal			94,348	60,660	**60,660**

Grand Total	Activity	Consumption	Energy	CO_2e	Energy & Emissions Total	
					Energy (GJ)	CO_2e (t)
	Electricity	1,221,332,515 kWh	4,396,797 GJ	26,869 t		
	Natural Gas	4,777,312 GJ	4,777,312 GJ	244,357 t		
	Gasoline	146,669,656 litres	5,083,570 GJ	366,288 t	**15,389,376**	**778,958**
	Diesel Fuel	28,080,975 litres	1,086,172 GJ	78,049 t		
	Mbl Propane	1,798,667 litres	45,524 GJ	2,734 t		
	Solid Waste			60,660 t		