CORPORATE ENERGY AND EMISSIONS PLAN 2010

FOR THE 2008 INVENTORY YEAR

PREPARED FOR:

City of Langley

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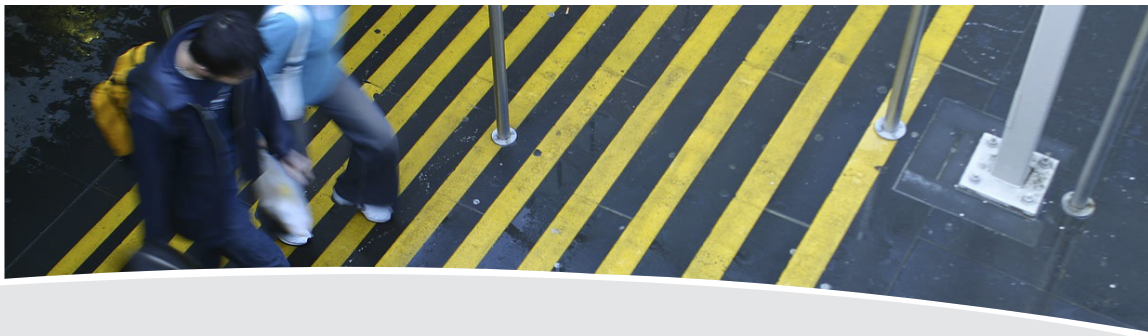

Staff are gratefully acknowledged for their efforts in the development of this plan.

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About Hyla Environmental Services Ltd.

HES Ltd. specializes in developing corporate and community energy and emissions plans for local government and departments within senior levels of government (regional, provincial, and federal). With over 13 years of dedicated experience to emissions management, HES' work extends to corporate and community sustainability plans, including integrated community sustainability plans. HES has developed proprietary software, Energy and Emissions Reporting and Monitoring System™ (EEMRS™), which is used to calculate emissions, develop emissions forecasts, and integrate account-level management to produce accurate, cost effective emissions management strategies. HES is a leader in this field having completed over 105 corporate energy and emissions inventories and 21 emissions management strategies. As well, HES produces community-wide energy and emissions inventories for all local government (189) in British Columbia on behalf of the Province of British Columbia's Ministry of Environment.

HES Ltd. is proud to be a founding reporter of The Climate Registry.

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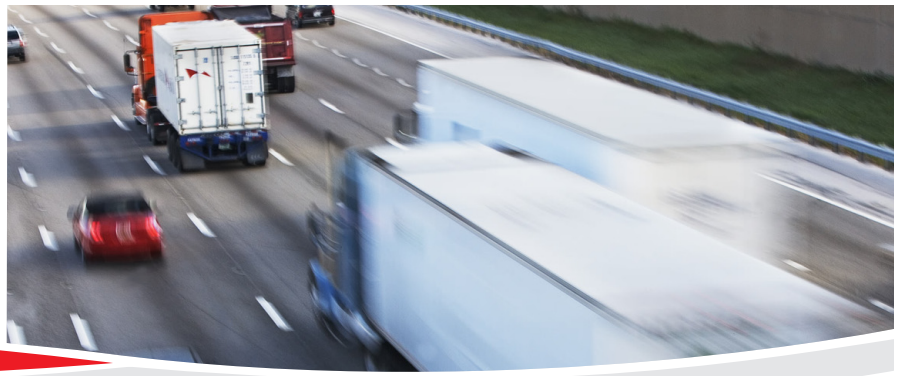

ACRONYMS

CO_2 – Carbon Dioxide
CO_2e– Carbon Dioxide Equivalent
EEMRS™ – Energy and Emissions Monitoring and Reporting System™
GHG – Greenhouse Gas
HES – Hyla Environmental Services Ltd.

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Executive Summary

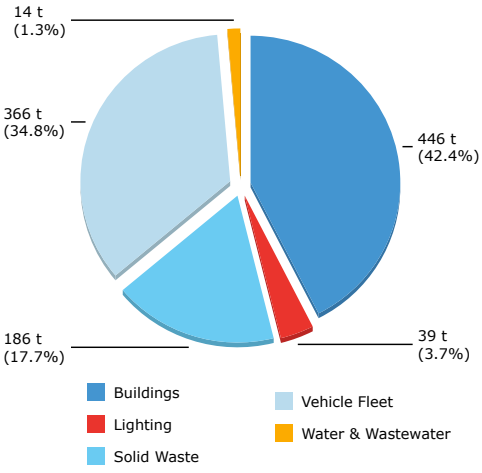
The 2010 Corporate Energy & Emissions Plan outlines the proposed greenhouse gas (GHG) emissions reduction strategy for the City of Langley. Based on the completed inventory of GHG emissions and the implementation of the proposed recommendations, the City can meet the GHG emissions reduction target described below.

We calculated energy use, energy costs and GHG emissions for the base year (2008) and forecast year (2018) to determine the City's total potential GHG emissions reduction.

In the base year, the City of Langley produced 1,051 tonnes CO_2e and consumed 25,324 GJ at a total cost of $504,717, as shown in the following table. The Buildings sector accounted for the majority of GHG emissions (42%) followed by the vehicle fleet (35%) as shown in the following chart.

Inventory Summary

Parameter	2008
Energy Consumption	25,324 GJ
Energy Costs	$504,717
Emissions	1,051 t CO_2e



Reduction Target Statement:

By endorsing this plan, Council is also endorsing the following target:

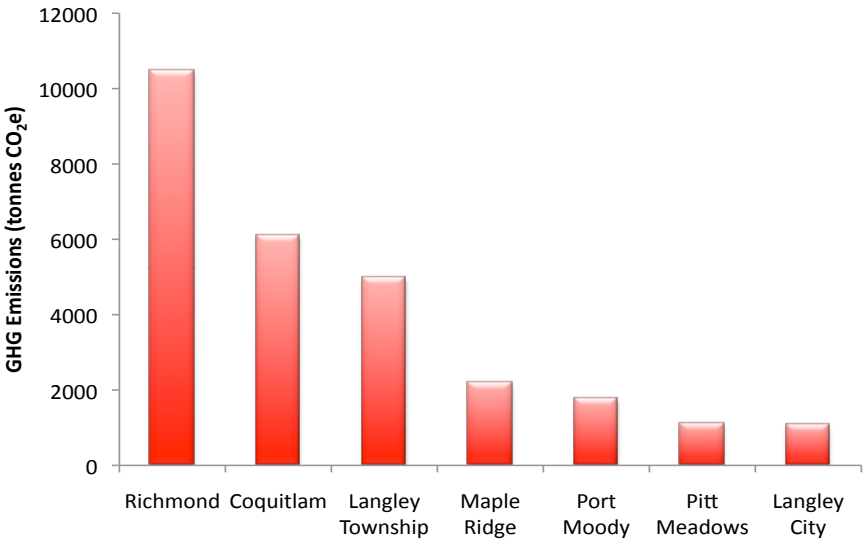
The City of Langley can lower GHG emissions by 12 percent by reducing its 2008 base year emissions by 134 tonnes CO_2e.

How is the City doing so far?

ABSOLUTE EMISSIONS

The City of Langley is in an enviable position in terms of the absolute value of its carbon footprint and in terms of the per capita rate of tonnes of CO_2e per thousand residents. Compared to similarly-sized local governments in the lower mainland for which recent data was available, the City's absolute carbon footprint is very close to those of Pitt Meadows and Port Moody– two very similarly-sized local governments in the near vicinity (Figure E1).

Figure E1 – Corporate GHGs (tonnes CO_2e)

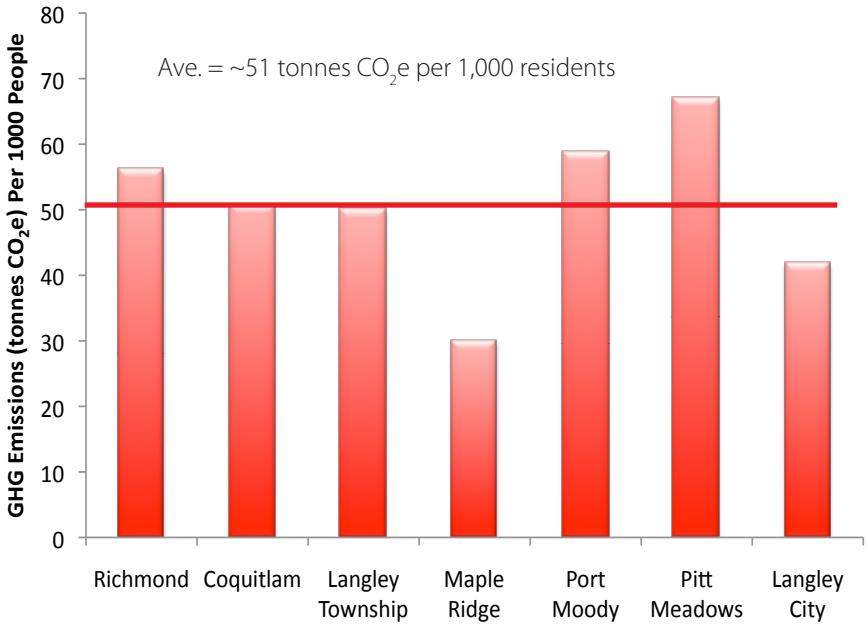


PER CAPITA GHG EMISSIONS

In terms of tonnes per 1,000 residents, the City of Langley is below the average of ~51 tonnes CO_2e per 1,000 residents at approximately 42 tonnes CO_2e per 1000 residents (Figure E2).

The main reason why the City is doing so well is its existing energy efficient buildings and the absence of facilities that consume large quantities of fossil fuels such as natural gas.

Figure E2 – Corporate GHGs Per Thousand People (tonnes CO_2e per 1,000)



Reduction Target Summary

The reduction target for the City of Langley is based on a ten-year period, in accordance with the Federation of Canadian Municipalities' Partners for Climate Protection Program. The ten-year reduction targets for the City are presented in Table E1.

Table E1 – Emission Reduction Target Summaries

Sector	2008 Base Year Quantity (tonnes CO_2e)	2018 Emissions Projection (tonnes CO_2e)	Potential Reductions (2010-2018 implementation)	Emissions after Reductions (2018)	Overall % Reduction (2018)
Buildings	446	448	78	370	-17%
Outdoor Lighting[1]	39	39.2	13	26	-33%
Water and Wastewater	14	14.3	2	12	-12%
Vehicle Fleet	366	369	34	335	-8%
Corporate Solid Waste[2]	186	186	7	179	-4%
Totals	**1,051**	**1,057**	**134**	**923**	**-12%**

[1] Lighting includes all outdoor streetlights owned by the City of Langley, sportsfield lighting, parking lots, etc.

[2] Solid waste from all City of Langley facilities

Breakdown of the values in Table E1

- The *2008 Base Year Quantity* of 1,051 tonnes CO_2e represents GHG emissions from the consumption of energy in all buildings and engineering assets (outdoor lighting, water and wastewater, vehicle fleet), as well as solid waste generated at corporate facilities.
- The *2018 Emissions Projection* of 1,057 tonnes CO_2e shows the forecast of GHG emissions following changes to the inventory of buildings and engineering assets. This forecast includes modifications to the Al Anderson Memorial Pool and the Timms Community Centre.
- The *Potential Reduction (2010-2018 Implementation)* of 134 tonnes CO_2e contains potential GHG emissions reductions for each sector if proposed initiatives are implemented. These estimates were calculated by reviewing all buildings and engineering assets, and assigning reduction initiatives to individual accounts. The estimates are summed to establish Total Potential GHG emissions.
- The *Emissions after Reductions (2018)* quantity of 920 tonnes CO_2e represents Potential Reductions deducted from the 2018 Projection.
- The *Overall % Reduction* is the percent difference between *Emissions after Reductions* and the *2008 Base Year Quantity.*

Recommendations

1 Administrative

Monitoring of corporate GHG emissions should be carried out by a qualified consultant that can employ the same methods as articulted herein. Hyla Environmental Services Ltd. has made a commmitment to the City to provide monitoring data for 2010 and 2011. During that period, we will have built sufficient capacity with City staff to enable the City of monitor it's own GHG emissions. Regardless of who conducts the monitoring, the City should monitor on an annual basis and may wish to consider continuous energy monitoring for City Hall and Al Anderson Pool.

As much as practical, the City should build a systems approach to monitoring energy consumption and link that approach to other accounting of GHG emissions such as those required for Provincial Climate Action Revenue Incentive Program (CARIP) Grant.

2 Buildings and Miscellaneous Facilities

Explore, refine and incorporate energy and emissions reductions measures into existing capital projects, as described in Table E2 and Section 4.

Table E2 ranks GHG reduction measures throughout the City's building stock. Council would consider implementation for each building annually.

All projects combined will cost the City ~ $50,000, save approximately ~ $13,000 annually, with a combined simple payback of 4 years. The reduction total is an estimated 76 tonnes CO_2e.

Table E2 – Prioritized Implementation in the Buildings Sector by CO_2e Reduced

Rank	Account	Account Address	Capital Cost to Implement	Energy Costs Reduced	Simple Payback (years)	CO_2e (tonnes) Reduced
1	Al Anderson Pool[1]	4949 - 207th Street	$34,264	$4,767	7	55.0
2	Douglas Recreation Centre	20550 Douglas Crs	$8,000	$2,433	3	8.0
3	Operations Centre	5713 - 198th Street	$5,250	$3,529	2	7.0
4	City Hall and Library	20399 Douglas Crs	$4,260	$2,200	2	6.0
5	Fire Hall	5785 - 203rd Street	$1,000	$465	2	0.2
	Timms Community Centre[2]	20355 Douglas Crs	$20,450	$1,604	13	3.3
TOTALS			$52,774	$13,394	4	76

[1] Options are presented for Al Anderson Pool– option 2 does not form part of the calculation

[2] Although the Timms Community Centre will be replaced, the recommendations are listed but not counted in the final target

3 Outdoor Lighting

Implementing reduction initiatives for the outdoor lighting sector, as described in the *Technical Compendium of Reduction Initiatives,* could reduce energy consumption by ~ 1,700 GJ, energy costs by ~ $37,000, and GHG emissions by 13 tonnes CO_2e. An advanced management system for streetlighting is proposed. Another option, LED streetlights, is not yet economically feasible but staff will keep apprised of this technology.

4 Water and Wastewater

The *Technical Compendium of Reduction Initiatives* describes reduction initiatives for the water and wastewater sector which, if invoked, could reduce energy consumption by ~ 292 GJ, energy costs by ~ $6,000, and GHG emissions by 2 tonnes CO_2e. Initiatives in this sector include replacing motors over time.

5 Vehicle Fleet

Implement the reduction initiatives for the vehicle fleet sector, as outlined in the *Technical Compendium of Reduction Initiatives,* to reduce energy consumption by ~ 500 GJ, energy costs by ~ $16,000, and GHG emissions by 34 tonnes CO_2e. This sector's initiatives include adjustments to operating medium and heavy duty trucks, idle free operation of vehicles, and technological changes to vehicles.

Other reductions in the vehicle fleet will be achieved with the forthcoming tailpipe standard, although we have not incorporated any reductions relative to the standard as we cannot predict the fuel consumption rates of the type of vehicles mainly used by the City (e.g., light, medium, and heavy duty trucks) after the standard is in force (e.g., 2016).

6 Recycling and Corporate Solid Waste

Initiatives in this sector include reducing paper usage, eliminating food waste from the waste stream, and diverting recyclables from waste streams to landfills. These initiatives could reduce GHG emissions by approximately 9 tonnes CO_2e.

7 Community Energy Planning

Develop a Community Energy and Emissions Plan to explore energy efficient construction standards for new and existing buildings, and initiatives to reduce GHG emissions from transportation and solid waste. Also, prepare community targets to meet the requirements of Bill 27.

Provincial Carbon Neutral Voluntary Commitment:

Table E3 summarizes the emissions inventory for the City becoming carbon neutral by 2012 and endorsing the purchase of carbon credits.

Table E3 – Carbon Neutral Government Accounting

Sector	2008 Base Year Emissions (tonnes CO_2e)	Included / Excluded in Carbon Neutral Accounting	Cost for Offsets with no Implementation ($25/tonne)	Emissions after Reductions (2018)	Cost for Offsets with Implementation ($25/tonne)
Buildings	446	included	$11,150	372	$9,300
Outdoor Lighting	39	included	$975	26	$650
Water and Wastewater	14	included	$350	12	$300
Vehicle Fleet	366	included	$9,150	335	$8,375
Corporate Solid Waste [3]	186	excluded			
Totals	1,051		$21,625	745	$18,625

[3] Solid waste from all City facilities counts in FCM PCP reports, but not in Provincial carbon neutral accounting

Meeting Provincial requirements for carbon neutrality relies on an expenditure of $21,625 for carbon offsets at a price of $25/tonne.

If reduction initiatives were implemented and the 2018 GHG emissions forecast remained intact, by 2018 it would cost $18,625 to become carbon neutral based on carbon offsets at $25/tonne.

Benefits to Local Governments

While the CAC is not legally binding, signatories who meet their commitments under the charter are eligible to receive an annual Climate Action Revenue Incentive Program (CARIP) grant. The value of the CARIP grant matches the carbon tax paid by the local government in the previous year. The grant is intended to support local governments implement reduction initiatives. Table E4 shows carbon neutral accounting if the City did not implement the measures proposed herein. This scenario is described as 'DO NOTHING' and results in a net annual loss of ~$13,000 (e.g., the difference between the costs for GHG offsets and the CARIP Grant). This calculation assumes that the Province will remit the CARIP Grant to CAC signatories as long they report their corporate GHG emissions.

Table E4 – Carbon Neutral Government Accounting - DO NOTHING

	Emissions (tonnes CO_2e)	Cost for Offsets with no Implementation ($25/tonne)	Annual CARIP[3] Grant	Net Gains/Losses
Totals	1,051	$21,625	$8,305	~ ($13,000)

[3] Climate Action Revenue Incentive Program

Table E5 shows carbon neutral accounting in year one if the City implemented the measures proposed herein. This scenario is described as 'IMPLEMENT MEASURES YEAR ONE' and results in a net annual loss of ~ $50,000. Note that the capital costs for implementation are included in this scenario, the capital costs are paid only once, but the one-time expenditure results in energy cost savings year after year.

Table E5 – Carbon Neutral Government Accounting - IMPLEMENT MEASURES YEAR ONE

	Capital Costs to Implement Measures (one time)	Energy Cost Savings after Implementation (annual)	Cost for Offsets after Implementation (annual)	CARIP[3] Grant (annual sliding downward)	Net Gains/Losses
Totals	– $53,000	$13,394	– $18,625	8,305	~ ($50,000)

[3] Climate Action Revenue Incentive Program

Table E6 shows the carbon neutral accounting in year two once the initial, one-time expenditure to implement reduction initiatives is expended in year one. This scenario is described as 'IMPLEMENT MEASURES YEAR TWO' and results in a net gain of ~$2,800. Note that the CARIP Grant has been reduced accordingly since the amount of fuel purchased will be lower in year two after implementation of measures.

Table E6 – Carbon Neutral Government Accounting - IMPLEMENT MEASURES YEAR TWO

	Capital Costs to Implement Measures	Energy Cost Savings after Implementation (annual)	Cost for Offsets after Implementation (annual)	CARIP[3] Grant (annual sliding downward)	Net Gains/Losses
Totals	none	$13,394	– $18,625	$8,000	~ $2,800

[3] Climate Action Revenue Incentive Program

Reduction Target Statement:

The City of Langley can lower GHG emissions by 12 percent by reducing its 2008 base year emissions 134 tonnes CO_2e by 2018

Federation of Canadian Municipalities' Partners for Climate Protection Milestones

Milestone One:
Complete GHG and energy use inventories and forecasts for both operations and the community as a whole (depending upon which plan(s) is being developed).

Milestone Two:
Set Reduction Targets. PCP targets vary for each local government, but must be presented in a 10 year project period.

Milestone Three:
Develop a Management Plan. Develop a plan that sets out how emissions and energy use in local government operations and the community will be reduced.

Milestone Four:
Implement the Plan. Create strong collaborations between departments and maximize benefits from greenhouse gas reductions.

Milestone Five:
Monitor and Report Progress. Maintain support by monitoring, verifying, and reporting greenhouse gas reductions.

1 Introduction

The City of Langley is committed to addressing issues of climate change by implementing policies and programs on sustainable community development, energy efficiency and conservation, and reducing greenhouse gas (GHG) emissions.

This report will be accompanied by two other key documents related to sustainability in the City of Langley, a Community Greenhouse Gas Emissions Plan and a Sustainability Framework. Together the three documents respond to the recommendations of the City's Corporate Strategic Plan. This report outlines a GHG emissions reduction strategy for the City of Langley. It establishes a current inventory and baseline of energy consumption and GHG emissions and proposes reduction initiatives that will enable the City of Langley to reduce its energy consumption and GHG emissions over a ten-year period.

In 2002, the City of Langley announced its participation in the Federation of Canadian Municipalities' (FCM) Partners for Climate Protection (PCP) program. This umbrella initiative encourages municipal participation in GHG emission reduction initiatives and overall sustainability. By participating in the PCP initiative, municipalities receive up-to-date information on global climate change and strategies to reduce GHG emissions, including innovative financing strategies and sample action plans. Participating municipalities also make a commitment to complete five milestones that guide them in reducing GHG emissions (see inset).

Although this report complies with PCP inventory requirements, new international protocols are being introduced and the City of Langley will need to update the inventory process accordingly. These emerging protocols are more comprehensive than existing PCP protocol, adding lower priority GHG emission sources, such as emissions from employee travel and contracted services such as solid waste collection and road building, and upstream and downstream emissions from the purchase of supplies and materials. Although it will not be mandatory to report these emissions, local governments will be encouraged to establish internal tracking systems to develop comprehensive, data-rich GHG emissions inventories.

The City of Langley has also signed the BC Climate Action Charter, which, in part, is a voluntary commitment to work towards carbon neutral operations by 2012. Through this provincial initiative, local governments pledge to

measure and report their community's GHG emissions profile and work to create compact, more energy-efficient communities. A Corporate Energy and GHG Emissions Plan with detailed reduction targets and reduction measures is the next step in fulfilling the requirements of both the PCP and Climate Action Charter programs.

1.1 Energy and Emissions Plan Development

Hyla Environmental Services Ltd. (HES) was hired to develop an energy and emissions management plan for the City of Langley. Municipal staff helped identify energy consumption accounts (that is, an asset that consumes energy, such as a building or pumping facility) and gathered all other energy consumption and direct emissions data. This baseline inventory provides an essential starting point from which to develop relevant GHG emission reduction measures. HES then conducted walk-through audits of buildings and engineering assets to identify opportunities to reduce GHG emissions and to develop forecasted estimates of GHG emissions over the next ten years. City staff assisted HES in the identification of energy consumption accounts and assisted HES gather other energy consumption and direct emissions data. Forecasts of GHG emissions were estimated through discussions with staff and reduction initiatives were assigned to corporate assets after walkthrough audits of buildings and engineering assets were undertaken. See the inset on page 3 for an outline of the plan development process and section 1.3 for a more detalied overview.

1.2 Regional and Local Context

The City of Langley is located in the Fraser Valley directly east of the City of Surrey and south of the Fraser River. As of the 2006 Census, the City had a population of 23,606 residents with a density of 2,309 residents per square kilometre[1]. See figure 1.2.1 for an aerial map of the city.

Figure 1.2.1 – Aerial photo of the City of Langley, British Columbia

[1] Statisticss Canada 2006 (www.statcan.gc.ca)

CORPORATE ENERGY AND EMISSIONS PLAN DEVELOPMENT PROCESS:

1 Acquire energy consumption data and direct GHG emissions data

2 Identify accounts

3 Develop draft energy and GHG emissions inventory

4 Conduct interviews and walkthrough audits of buildings and engineering assets

5 Develop the GHG emissions forecast

6 Develop the GHG emissions reduction initiatives

7 Develop the capital costs for implementation

8 Develop the overall GHG emissions reduction quantity

1.3 Preparing the Inventory and GHG Emissions Reduction Plan

By joining the PCP initiative, municipalities make a voluntary commitment to complete five milestones (see inset on page 1). To create an effective strategy to reduce GHG emissions, municipalities must first develop an inventory of current emissions. This baseline offers a starting point from which progress can be measured and allows municipalities to forecast future emissions and assess the benefits of proposed reduction measures.

This report describes the corporate GHG emissions for the base year 2008, forecasts energy use and emissions to 2018, and outlines related reduction initiatives for a project period of 2010 to 2018. We review emissions from each of the following sectors: buildings, fleet vehicles and other motorized equipment, outdoor lighting, potable water, storm and sanitary sewers, and solid waste generated at city owned and operated facilities.

A review of emissions by source allows us to analyze the origin of various emissions and the type of fuel burned while carrying out the activity or operation. Major sources of GHG emissions include electricity, natural gas, propane, diesel fuel and gasoline. Methane from the decomposition of waste in landfills is also a significant source of GHG emissions, but it is a direct emission, as opposed to the emissions that result from burning fossil fuels.

We used data on the energy consumed by various local government operations to calculate the mass of GHG emissions. This information forms the data from which the overall program goal is derived, and upon which progress can be measured in the future.

Local government staff helped us collect energy consumption data. BC Hydro provided consumption data for accounts owned by the City of Langley and Terasen Gas Inc. provided natural gas consumption data and costs. We compiled vehicle fleet data from internal records, and calculated solid waste generated from operations by estimating the volume of bins at corporate facilities and the frequency of bin pick-up.

Data was imported into the Energy and Emissions module of Hyla Environmental Services' Energy & Emissions Monitoring and Reporting System™. The emissions calculator within this software conforms to the methods described in the International Panel on Climate Change Greenhouse Gas Inventory Reference Manual, the principles provided in the International Standards Organization (ISO) Draft International Standard for Greenhouse Gases, and the general guidance within the FCM's guidance document for preparing PCP inventories.[2, 3, 4] Emissions coefficients are found in the IPCC document for liquid and gaseous fuels.

The emissions factor for BC Hydro-supplied electricity for 2008 was used to calculate GHG emissions (0.022 kg CO_2e/kWh)[5].

Energy and emissions were calculated at the account level, and a detailed summary of the energy and emissions inventory is provided in Appendix I. The emissions forecast used growth estimates in each sector provided by

[2] 2006 IPCC Guidelines for National Greenhouse Gas Inventories
[3] ISO 14064 Standard on Greenhouse Gas Accounting and Verification
[4] FCM – Developing Inventories for GHG Emissions and Energy Consumption: Partners for climate change
[5] BC Hydro – EN16 Greenhouse Gas Intensities

REPORT ORGANIZATION

staff and discussed among the project team. Fossil fuel costs were estimated using price projections from Nesbitt Burns (www.bmonesbittburns.com) and the US Energy Agency's Fuel Economy website (www.fueleconomy.gov).

Forecasting Energy Consumption and Emissions

In order for this report to be recognized by the PCP Secretariat as fulfilling Milestone One of the PCP program, we needed to develop a 10-year forecast of energy consumption, costs and GHG emissions. We prepared a forecast based on anticipated changes to individual accounts and new accounts that will be added during the ten-year forecast period. The forecast was derived from HES' interviews with staff. The emissions forecast is presented in the sections for each sector.

Forecasts and their Contribution to Reduction Targets

The forecasts of energy consumption, costs and GHG emissions are based on the projected growth in these parameters from the base year through to the end of the forecast period. Forecasts allow us to understand future energy consumption, costs of consumption and emissions. As stated earlier, the forecast is an essential component of the reduction targets. However, forecasts should be considered a work in progress as new information can change the forecasts and, consequently, the reduction targets. Since all the parameters used to calculate the reduction targets are subject to change, targets will change as new information is gathered.

The reduction target is equal to the percent difference between the base year inventory and the forecast year inventory. Because reduction targets are absolute and not based on per capita emissions, to achieve an actual reduction, the total reductions achieved during the project period must be greater than the growth in emissions.

Regardless of any overall increase in emissions during the project period, implementing reduction initiatives will, at a minimum, decrease the amount of growth in emissions relative to if the business as usual scenario is allowed to continue. The reduction initiatives that the city selected are summarized in the sections for each sector.

Calculating Energy and GHG Emission Reductions

To calculate the overall reductions outlined in this report, we selected reduction initiatives that reduce energy consumption and GHG emissions from the existing infrastructure (i.e., base year energy and emissions).

Although reduction amounts are considered estimates, we have carefully considered the effect each reduction initiative will have on energy consumption. We estimated the GHG emissions reductions for each proposed initiative in each sector.

Estimates of reduction quantities are provided for energy consumption, cost for consumption and GHG emissions from best practices well-established from similar reduction initiatives.

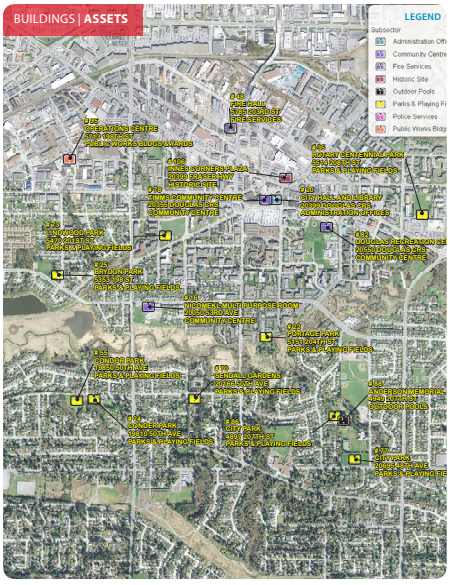
Reduction measures are not appropriate for some very small accounts (e.g., pumps that consume <3,000 kWh/year). For other accounts, no reduction initiatives are possible (e.g., flat rate accounts for irrigation systems with existing rain sensors and timers). Within this document, accounts are grouped as they appear in the detailed energy and emissions inventory presented in Appendix I. Estimates of energy, costs for energy and GHG emission reductions are provided for each reduction initiative for each account, and capital costs, simple payback, costs per kilotonne reduced and an implementation schedule are also provided.

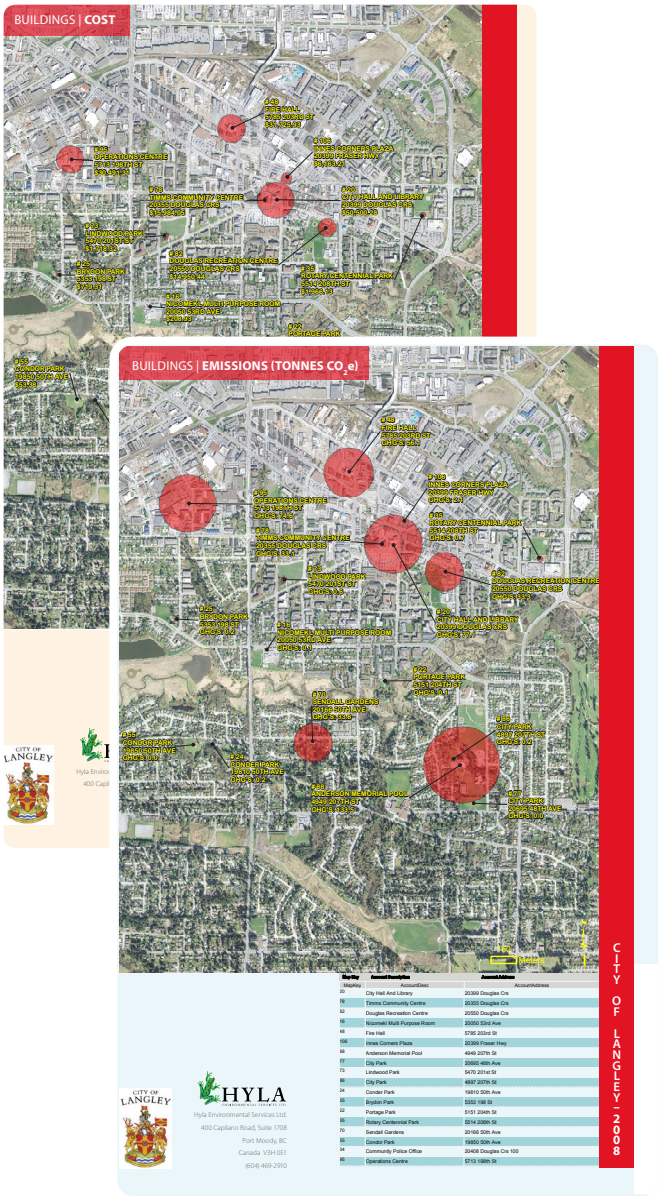
1.4 How this Report is Organized

The remainder of this report is organized into eight sections. Section two presents the energy consumption, costs and GHG emissions inventory for each sector. Section three presents information on the costs associated with the Carbon Tax and carbon neutral governance. Sections four through eight present an inventory breakdown by subsector, forecasts of predicted consumption and emissions and a summary of proposed reduction initiatives for the buildings, lighting, water and wastewater, vehicle fleet, and solid waste sectors. Section nine summarizes the emissions and reduction targets.

Appendix I presents the GHG Energy and Emissions Inventory for 2008, Appendix II presents a series of maps illustrating energy consumption, cost and GHG emissions for the buildings and water and wastewater sectors. Illustrative maps for outdoor lighting and the corporate vehicle fleet are not provided. Examples of the illustrative maps provided in Appendix II are shown in the series of figures on the following page.

Note: the thumbnails of the maps below were not meant to be read, rather, they provide a quick illustrative view of the asset maps and energy consumption, costs, and GHG emissions maps that are provided in the buildings and water and wastewater sections (Sections 4 & 6) and the appendices.





2 Corporate Inventory

2.1 Corporate Inventory Summary

The City owns and operates 146 assets, which include: 18 buildings, 68 outdoor lighting accounts, 51 vehicles and 9 water and wastewater facilities (Table 2.1.1). Table 2.1.2 provides an overview of the City of Langley's 2008 corporate GHG emissions. The buildings and vehicle fleet sectors produced the majority of the City's emissions (42 and 35 percent respectively). Emissions from solid waste contributed 18 percent of emissions, while lighting, water & wastewater sectors combined made up 5 percent of total GHG emissions .

The City of Langley consumed approximately 25,000 GJ of energy at a total cost of ~$505,000 in the 2008 inventory year, for a total of 1,051 tonnes CO_2e.

See Appendix 1 for a complete inventory summary for 2008.

Table 2.1.1 – Asset Count Summary

Sector	Number of Assets
Buildings	18
Outdoor Lighting[1]	68
Vehicle Fleet	51
Water & Wastewater	9
TOTAL	**146**

Table 2.1.2 – Energy, Costs, and Greenhouse Gas Emissions by Sector (2008)

Sector	Total Energy (GJ)	Total Cost	Total Emissions (CO_2e tonnes)	Percent Energy	Percent Costs	Percent Emissions
Buildings	13,343	$186,598	446	53%	37%	42%
Lighting	5,046	$108,797	39	20%	22%	4%
Water & Wastewater	1,835	$36,948	14	7%	7%	1%
Vehicle Fleet	5,100	$172,373	366	20%	34%	35%
Solid Waste			186			18%
Total	**25,324**	**$504,717**	**1,051**	**100%**	**100%**	**100%**

2.2 Inventory by Sector

The buildings sector was the largest energy consumer, using ~13,000 GJ (53 percent) in 2008. The City's outdoor lighting sector and vehicle fleet accounted for ~5,100 GJ (20 percent) each., while the water and wastewater sector used 1,835 GJ (7 percent; Figure 2.2.1).

The buildings sector had the highest associated energy costs at ~$187,000 (37 percent), closely followed by the vehicle fleet at ~$172,000 (34 percent). The outdoor lighting sector had an associated ~$109,000 (22 percent) in energy costs, while the water & wastewater sector was lowest at ~$37,000 (7 percent; Figure 2.2.2).

Together, the buildings and fleet sectors were responsible for approximately 77 percent of the City's emissions, each generating 446 tonnes CO_2e (42 percent) and 366 tonnes CO_2e (35 percent) respectively. City generated solid waste produced 186 tonnes CO_2e (18 percent). Together, outdoor lighting and water & wastewater facilities accounted for 5 percent of the City's GHG emissions (53 tonnes; Figure 2.2.3).

Figure 2.2.1 – Energy Use by Sector

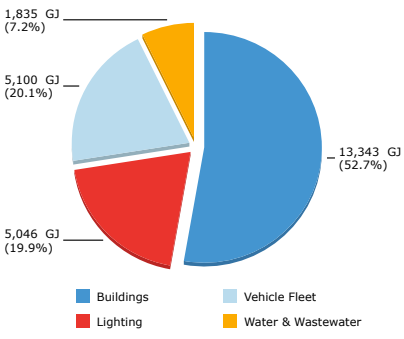


Figure 2.2.2 – Energy Costs by Sector

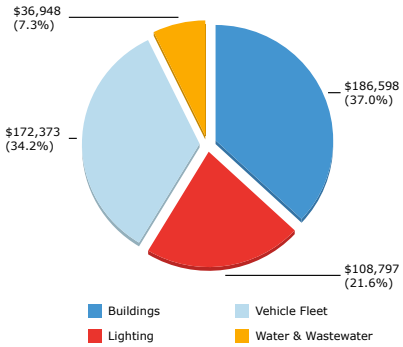
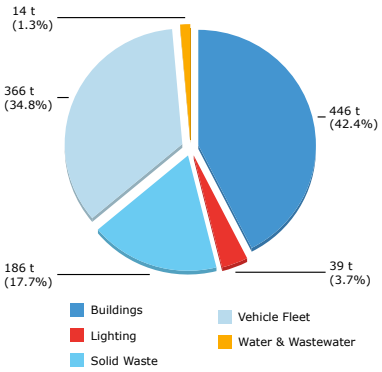


Figure 2.2.3 – GHG Emissions by Sector



2.3 Inventory by Energy Type

As Table 2.3.1 shows, the City of Langley utilizes five types of energy sources: Electricity, natural gas, propane, gasoline and diesel fuel (please note: propane is listed as propane for buildings and mobile propane for the vehicle fleet).

Table 2.3.1 – Sources of Corporate Energy & Costs (2008)

Energy Type	Units	Total Use	Total Energy (GJ)	Total Cost	Percent Total Energy by Source	Percent Total Costs by Source
Electricity	kWh	3,427,415	12,339	$255,193	49%	51%
Natural Gas	GJ	7,884	7,884	$77,151	31%	15%
Propane	litres	2,489	63	$2,489	0%	0%
Gasoline	litres	47,367	1,642	$56,055	6%	11%
Diesel Fuel	litres	87,747	3,394	$113,763	13%	23%
Mbl Propane	litres	66	2	$66	0%	0%
Total			**25,324**	**$504,717**	**100%**	**100%**

Electricity was the City's largest source of energy (GJ), accounting for 49 percent of total energy consumed, followed by natural gas (31 percent), diesel fuel (13 percent), and gasoline (6 percent). Stationary and mobile propane together made up less than 1 percent of energy use (Figure 2.3.1).

Electricity also had the greatest total energy costs at 51 percent, followed by diesel fuel (23 percent), natural gas (15 percent), and gasoline (11 percent). Stationary propane and mobile propane accounted for less than 1 percent of costs (Figure 2.3.2).

The combustion of natural gas was the greatest source of GHG emissions in the City (38 percent of total emissions), followed by diesel fuel (23 percent), gasoline (11 percent), and electricity (9 percent). Stationary propane and mobile propane accounted for less than 1 percent of the City's total emissions. (Table 2.3.2 and the accompanying illustration in Figure 2.3.3 show the contribution of each energy source to total emissions.)

Figure 2.3.1 – Energy Consumption by Energy Type

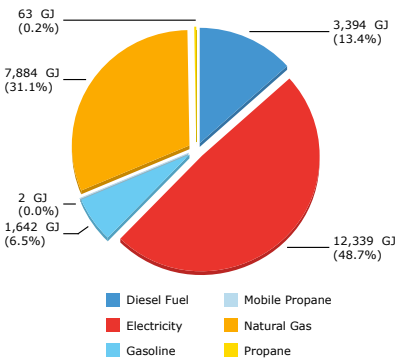


Figure 2.3.2 – Energy Costs by Energy Type

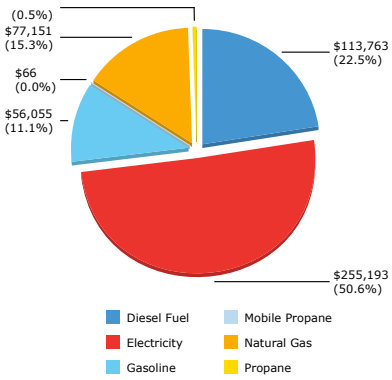


Figure 2.3.3 – GHG Emissions by Source

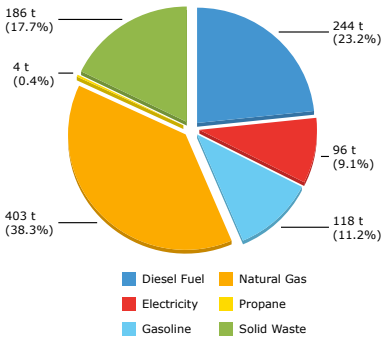


Table 2.3.2 – Sources of Corporate Emissions (2008)

Energy Type	Units	Total Use	Total Emissions (CO2e tonnes)	Percent by Source
Electricity	kWh	3,427,415	96.0	9%
Natural Gas	GJ	7,884	403.3	38%
Propane	litres	2,489	3.8	0%
Gasoline	litres	47,367	118.3	11%
Diesel Fuel	litres	87,747	243.9	23%
Mbl Propane	litres	66	0.1	0%
Solid Waste			186.0	18%
Total			**1,051.4**	**100%**

2.4 Synopsis

In the 2008 inventory year, the City of Langley consumed approximately 25,000 GJ of energy, which cost ~$500,000 and generated ~1,000 tonnes of GHG emissions. The building sector consumed the most energy and produced the highest percentage of GHG emissions. Electricity was the City's largest source of energy costs and consumption, but of all energy types, natural gas was the highest producer of GHG emissions.

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3 Carbon Neutral Governance

3.1 Carbon Neutral Governance and the Climate Action Charter

What is it?

In 2007 the BC Provincial Government, the Union of British Columbia Municipalities (UBCM) and over a hundred communities across the province signed the BC Climate Action Charter (CAC). The CAC is a voluntary commitment made by local governments to become carbon neutral in their corporate operations by 2012.[1] Other functions of the Charter are to foster cooperative inter-government relationships, remove legislative and regulatory barriers to climate change actions, and encourage the development of compact, socially responsible communities.

In order to help local governments meet these objectives the CAC established a joint Provincial-UBCM Green Communities Committee (GCC) and Green Communities Working Group (GCW). As of September 2009, 176 local governments signed on to the CAC.

What is the commitment?

Local governments that sign the CAC - a non-legally binding agreement - commit to achieving carbon neutral operations by 2012. "Carbon neutrality" means reducing emissions from corporate operations and mitigating the remaining emissions through qualified GHG offsets. Every year CAC signatories must publicize their plans for achieving carbon neutrality as well as their progress towards meeting their climate action goals. While GHG emissions resulting from corporate solid waste have been included in this report in order to meet the requirements of the FCM PCP Program, these emissions are not counted under the CAC agreement.

The Pacific Carbon Trust (PCT) is the provincial crown corporation mandated to provide quality BC-based GHG offsets for the public sector. The PCT offers carbon offsets at the cost of $25 per tonne of CO_2e. It will cost the City of Langley $21,625 to offset 865, excluding the 186 tonnes from the total GHG emissions do to solid waste, tonnes CO_2e produced in 2008 to meet CAC requirements this year.

Table 3.1.1 summarizes the emissions inventory to be included in carbon neutral accounting if the City becomes carbon neutral by 2012, and endorses the purchase of carbon credits.

[1] Solid waste facilities regulated under The Environmental Management Act are not included

Table 3.1.1 – Carbon Tax Costs Summary

Sector	2008 Base Year Emissions (tonnes CO_2e)	Included / Excluded in Carbon Neutral Accounting	Cost for Offsets with no Implementation ($25/tonne)	Emissions after Reductions (2018)	Cost for Offsets with Implementation ($25/tonne)
Buildings	446	included	$11,150	372	$9,300
Outdoor Lighting	39	included	$975	26	$650
Water and Wastewater	14	included	$350	12	$300
Vehicle Fleet	366	included	$9,150	335	$8,375
Corporate Solid Waste [3]	186	excluded			
Totals	1,051		$21,625	745	$18,625

[3] Solid waste from all City facilities counts in FCM PCP reports, but not in Provincial carbon neutral accounting

Provincial requirements on carbon neutrality include a $21,625 expenditure for carbon offsets at a price of $25/tonne.

If the reduction initiatives in this report were implemented successfully, and the GHG emissions forecast is accurate, it would cost the City $18,625 to become carbon neutral by 2018.

Benefits to Local Governments

While the CAC is not legally binding, signatories who meet their commitments under the charter are eligible to receive an annual Climate Action Revenue Incentive Program (CARIP) grant. The value of the CARIP grant matches the carbon tax paid by the local government in the previous year. The grant is intended to support local governments implement reduction initiatives. Table 3.1.2 shows carbon neutral accounting if the City did not implement the measures proposed herein. This scenario is described as 'DO NOTHING' and results in a net annual loss of ~$13,000 (i.e. the difference between the costs for GHG offsets and the CARIP Grant). This calculation assumes that the Province will remit the CARIP Grant to CAC signatories as long they report their corporate GHG emissions.

Table 3.1.2 – Carbon Neutral Government Accounting - DO NOTHING

	2008 Base Year Emissions (tonnes CO_2e)	Cost for Offsets with no Implementation ($25/tonne)	Annual CARIP[3] Grant	Net Annual Loss 2008
Totals	1,051	$21,625	$8,305	$13,320

[3] Climate Action Revenue Incentive Program

Table 3.1.3 shows carbon neutral accounting in year one if the City implemented the measures proposed herein. This scenario is described as 'IMPLEMENT MEASURES YEAR ONE' and results in a net annual loss of ~$50,000. Note that the capital costs for implementation are included in this scenario, the capital costs are paid only once, but the one-time expenditure results in energy cost savings year after year.

Table 3.1.3 – Carbon Neutral Government Accounting - IMPLEMENT MEASURES YEAR ONE

	Capital Costs to Implement Measures (one time)	Energy Cost Savings after Implementation (annual)	Cost for Offsets after Implementation (annual)	CARIP[3] Grant (annual sliding downward)	Net Gains/Losses
Totals	– $53,000	+ $13,394	– $18,625	+$8,305	~ ($50,000)

[3] Climate Action Revenue Incentive Program

Table 3.1.4 shows the carbon neutral accounting in year two once the initial, one-time expenditure to implement reduction initiatives is expended in year one. This scenario is described as 'IMPLEMENT MEASURES YEAR TWO' and results in a net gain of ~$2,800. Note that the CARIP Grant has been reduced accordingly since the amount of fuel purchased will be lower in year two after implementation of measures.

Table 3.1.4 – Carbon Neutral Government Accounting - IMPLEMENT MEASURES YEAR TWO

	Capital Costs to Implement Measures	Energy Cost Savings after Implementation (annual)	Cost for Offsets after Implementation (annual)	CARIP[3] Grant (annual sliding downward)	Net Gains/Losses
Totals	none	+ $13,394	– $18,625	+ $8,000	+ $2,800

[3] Climate Action Revenue Incentive Program

Provincial Guidance

The GCC and GCW produced a guidance workbook to help local governments develop plans. The document provides local governments with guidance on data collection and program scope. The GCC advises local governments to report their energy and emissions data in the following 6 service areas:

i. Administration and Governance
ii. Drinking, Storm and Wastewater
iii. Solid Waste Collection, Transportation and Diversion
iv. Roads and Traffic Operations
v. Arts, Recreation Parks and Cultural Services
vi. Fire Protection

Note that while these service areas can be easily integrated into current reporting, the City is obligated to follow the FCM–PCP protocol since the FCM is a major funding partner.

4 Buildings

4.1 Buildings Overview

The City of Langley owns and maintains 18 buildings, including administrative offices, fire, recreation, and parks facilities (see Figure 4.1.1). In 2008 City-owned buildings consumed ~13,000 GJ of energy, cost ~$187,000, and generated 450 tonnes CO_2e. Buildings utilized 2 energy types: electricity (~5,500 GJ) and natural gas (~7,900 GJ; Table 4.1.1).

Outdoor pools were the largest source of GHGs in the buildings sector, accounting for 30 percent of the sector's emissions. Administration buildings and public works buildings were also significant sources of emissions, both accounting for 17 percent of the building sector's GHGs (Figure 4.1.2).

Note that although the City owns the Twin Rinks Ice Arena, a private company leases the building. Therefore, the ice arena is not counted in the City's inventory.

Table 4.1.1 – Summary of Buildings Sector Emissions (2008)

Sector	Energy Type & Units		Total Use	Total Energy (GJ)	Total Costs	Total CO_2e (t)
Buildings	Electricity	kWh	1,516,114	5,458	$109,448	42.5
	Natural Gas	GJ	7,884	7,884	$77,151	403.3
Totals				**13,343**	**$186,598**	**446**

Figure 4.1.1 – Aerial photo of City-owned buildings that consume energy

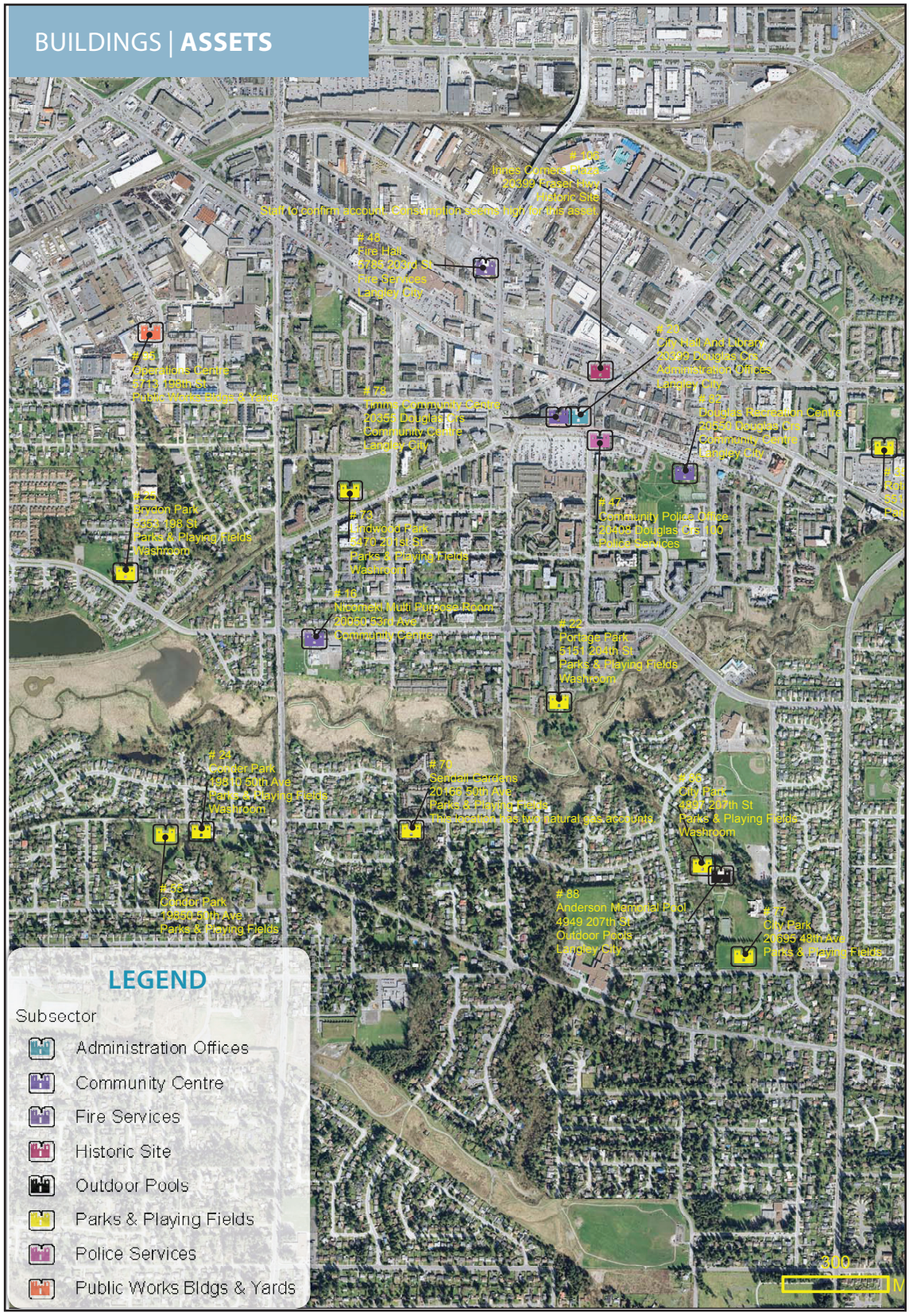
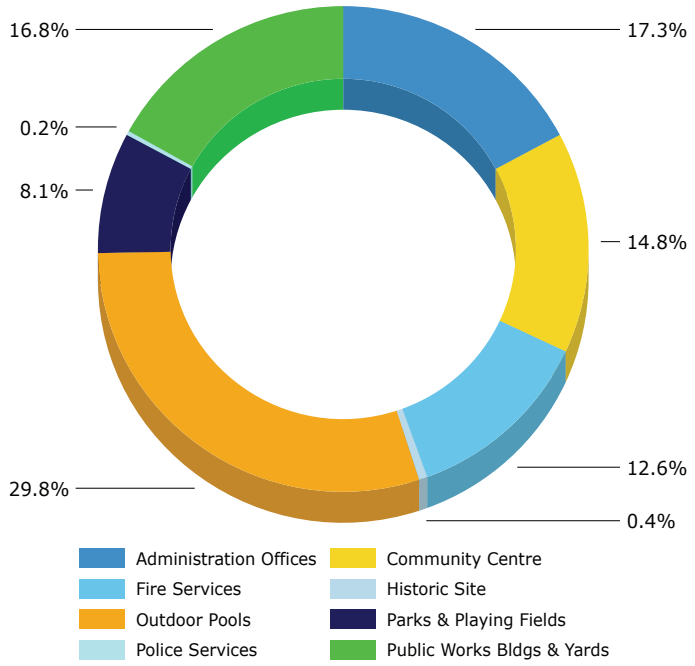


Figure 4.1.2 – GHG Emissions in the Building Subsectors (2008)



The Anderson Memorial Pool was the City's single largest source of GHG emissions, producing ~134 tonnes CO_2e in 2008, followed by City Hall and the Library (77 tonnes CO_2e), and Operations Centre (75 tonnes CO_2e; Table 4.1.2). For a geographical representation of energy consumption, costs and GHG emissions see Appendix III.

Table 4.1.2 – Buildings Ranked by GHG Emissions (2008)

2008 Rank	Account	Energy	Costs	CO_2e
1	**Anderson Memorial Pool** - 4949 207th St	3,039 GJ	$19,908	133.5 t
2	**City Hall And Library** - 20399 Douglas Crs	3,337 GJ	$50,500	77.1 t
3	**Operations Centre** - 5713 198th St	1,890 GJ	$30,491	74.6 t
4	**Fire Hall** - 5785 203rd St	1,921 GJ	$31,726	56.1 t
5	**Sendall Gardens** - 20166 50th Ave	757 GJ	$10,412	33.8 t

4.2 Buildings Forecast

This section outlines anticipated changes in the buildings sector, forming the base of the overall energy and emissions forecast. The estimated forecast percentage is based on expected changes to individual accounts or new accounts added during the ten-year period.

At present, plans include replacing the Timms Community Centre and expanding the Anderson Memorial Pool. The forecast for the Timms Centre was based on estimated square footage of the new building and typical consumption of similar buildings in HES' database. The forecast for the Anderson Memorial Pool is minimal.

Table 4.2.1 provides a summary of expected growth in the buildings sector. A nominal growth in GHG emissions (0.5 percent per year) has been included for energy consumption to account for extended hours of operation in buildings over time. Although a small incremental increase has been included for energy consumption and resulting GHG emissions, costs for energy will increase over time. Therefore the resulting forecast of energy costs

is included. In 2009, the City spent $.07/kWh on electricity and $13/GJ on natural gas (note: including delivery charges). In the forecast year, the City will pay an estimated ~$0.15/kWh for electricity and ~$15 for natural gas.

To better prepare future budgets, local governments are paying special attention to energy cost forecasts. Conservative estimates for cost increases are provided in Table 4.2.2, along with a forecast of projected energy consumption, and GHG emissions to 2018.

Based on predicted increases from 2008 to 2018, electricity consumption may grow from 1,516,114 kWh per year to 1,519,916 kWh per year. Natural gas consumption may also rise slightly. With growing costs for electricity and natural gas incorporated, energy prices could increase from $186,598 to $345,685, while GHG emissions should grow less than 1 percent, from 446 tonnes CO_2e to 448 tonnes CO_2e.

Table 4.2.2 – Forecast of Buildings Consumption

Sector	2008 (Base Year)			Change		2018 (Forecast Year)		
	Consumption	Cost	Emissions (t CO_2e)	%	Increment	Consumption	Cost	Emissions (t CO_2e)
Buildings								
Electricity	1,516,114 kWh	$109,448	42.5	5%	87,819	1,603,929 kWh	$227,417	44.9
Natural	7,884 GJ	$77,151	403.3	0%		7,886 GJ	$118,267	403.4
	13,343 GJ	**$186,598**	**445.7**				**$345,685**	**448.3**

3.3 Reduction Initiatives

There are several ways the City can reduce energy consumption and related GHG emissions in buildings. Beyond proposed reduction initiatives, implement awareness programs such as 'turn it off'.

The following subsections summarize potential energy reduction initiatives for the City's highest energy-consuming buildings.

Initiatives Completed and/or Underway

In most buildings, T12 fluorescent fixtures were replaced with T8 fixtures, and magnetic ballasts were upgraded to electronic ballasts. As expected, smaller, older buildings have not been retrofitted.

Proposed Reduction Initiatives

Table 3.3.1 shows estimated reductions in energy use, energy costs and GHG emissions for the proposed initiatives (as approved by the Council on an annual basis).

Table 4.3.1 – Proposed Reduction Initiatives in the Buildings Sector

Buildings		Reductions		
		Consumption	Costs	CO_2e (t)
Subtotals	Electricity	52,972 kWh	$4,226	0 t
	Natural Gas	1,508 GJ	$10,773	77 t
Total this Sector:		**1,699 GJ**	**$14,999**	**78 t**

Implementing building retrofits can save an estimated 1,700 GJ of energy, or approximately $15,000. These initiatives would also reduce emissions by about 79 tonnes CO_2e (note that there is a rounding error in Table 4.3.1). The combined simple payback for all projects is approximately 5 years.

Technology

Technology will play an important role in actual reductions achieved during the project period. New technologies that increase energy efficiency -- and the potential for alternative energy sources and new technologies for energy production -- are key to significant reductions in the future.

Generally, reduction initiatives do not include technologies that are not currently cost effective or commercially viable.

The rest of this section covers the results of the walk-through building audits. Each subsection summarizes the annual energy consumption, energy costs and CO_2e savings possible through implementing the reduction measures. Capital costs and simple payback are also provided. This information is also summarized in Table 3.5. ranked by quantity of CO_2e reduction. See the Technical Compendium of Reduction Initiatives for a detailed listing of reduction initiatives.

City Hall and Library

The City Hall and Library are approximately 35,000 square feet, with an annual natural gas usage of ~1,180 GJ and electricity consumption of ~600,000 kWh. For it's size, the City Hall and Library consume less energy per square foot than similar buildings in the region and are therefore 'energy efficient' [Editor: provide stats or remove].

Several zone-controlled rooftop units provide air conditioning and space heating. Upon walkthrough of the building, several under-the-desk space heaters were observed. Although these types of heaters are strongly discouraged, low wattage heaters preserve more natural gas. Based on observations of monthly natural gas usage and energy end use breakdown for this building type, an estimated 110 GJ of natural gas could be saved with a temperature setback of 0.5-1 degrees.

Several areas of the building are inefficiently lit, including the underground parking lot (e.g., T12 electronic), foyer lighting (e.g., HID) and the library's track lighting and wall/sconce lighting (e.g., halogen). Replace the underground parking lot lights with T8 fixtures or high output CFL clusters. In lieu of replacing the foyer and library lights, staff can simply turn them off in brighter seasons, or install photocells that activate when natural light is low. Other minor changes include occupancy sensors in service rooms.

This building is a good candidate for solar photovoltaics to reduce electrical loads, but only if future technologies are cost effective and bring the simple payback to <10 years. This building could also benefit from solar walls, but since roof top units are new and efficient, the rate of return, which must include the initial cost of the new roof top units, would be low. This building is not suitable for solar hot water heating due to the small energy consumption for domestic hot water.

Total energy savings are estimated at 156 GJ, cost savings estimated at $2,200, and GHG emissions reductions estimated at 2 tonnes CO_2e. (The following Table and Table 4.5).

City Hall And Library -20399 Douglas Crs

2008 Natural Gas Consumption and Estimates of Reductions

2008 Inventory			Reductions						
Consumption	Costs	CO_2e (t)	Consumption	Costs	CO_2e (t)	Capital Cost	Simple Payback (yrs)	Cost per Kt reduced	Affect on 2ndary Energy Type
1,179 GJ	$15,153	60	110 GJ	$1,451	5.6 t				
1. SPACE TEMPERATURE DRIFT			110 GJ	$1,451	5.6 t	$0	0.0	$0.0	○ Yes
NATURAL GAS SUBTOTAL			110 GJ	$1,451	5.6 t	**$0**	**0.0**		
			110 GJ	**$1,451**	**5.6 t**				

2008 Electricity Consumption and Estimates of Reductions

2008 Inventory			Reductions						
Consumption	Costs	CO_2e (t)	Consumption	Costs	CO_2e (t)	Capital Cost	Simple Payback (yrs)	Cost per Kt reduced	Affect on 2ndary Energy Type
599,385 kWh	$35,347	17	12,710 kWh	$749	0.4 t				
2. 'TURN IT OFF 'PROGRAM			2,398 kWh	$141	0.1 t	$0		$0.0	○ Yes
3. CONVERT TO T8 OR T5 HO			8,991 kWh	$530	0.3 t	$3,000	5.7	$11.9	○ Yes
4. CONVERT TO LEDS			465 kWh	$27	0.0 t	$160	5.8	$12.3	○ Yes
5. OCCUPANCY SENSORS – INDOOR LIGHTING			857 kWh	$50	0.0 t	$1,100	21.8	$45.8	○ Yes
ELECTRICITY SUBTOTAL			12,710 kWh	$749	0.4 t	**$4,260**	**5.7**		
			46 GJ	**$749**	**0.4 t**				
ACCOUNT SUBTOTAL	Electricity		12,710 kWh	$749	0.4 t	**$4,260**	**1.9**		
	Natural Gas		110 GJ	$1,451	5.6 t				
			156 GJ	**$2,200**	**6.0 t**				

Douglas Recreation Centre

The Douglas Recreation Centre consumes ~85,000 kWh of electricity and ~600 GJ of natural gas annually. The facility includes a gymnasium/hall, daycare, offices, games room, meeting room, and multipurpose room. The adjacent outdoor stage, which draws power for halogen lights and presumably musical and acoustic electronics, may be a parasitic connection (e.g., HES staff or city staff were not able to locate the service connection for the outdoor stage). Regardless, this facility consumes very little energy for its size, though this may reflect a low level of use, not energy efficiency.

A packaged rooftop unit and a furnace provide air conditioning and space heating. The rooftop unit services the hi-bay gymnasiums/halls, and requires a CO2 sensor. A low volume tank-type water heater provides domestic hot water. A timer should be installed for the multipurpose rooms fireplace, to ensure the appliance is not left on for extended periods during the day or overnight.

Inside the building are T8s, which light all but the hallways and mulitpurpose room. Replace halogen lights in the hallways with CFL bulbs, and incandescent bulbs in the multipurpose room with CFLs. City maintenance staff should retrofit these lights in the near future. The gymnasium/hall is lit by pulse type metal halide lights, which remain on all day.

Total energy savings are estimated at 160 GJ, cost savings at ~$2,400, and GHG emissions reductions at ~8 tonnes CO_2e. (Table 4.5 and the following Table).

Douglas Recreation Centre

Douglas Recreation Centre -20550 Douglas Crs

2008 Natural Gas Consumption and Estimates of Reductions

2008 Inventory			Reductions						
Consumption	Costs	CO_2e (t)	Consumption	Costs	CO_2e (t)	Capital Cost	Simple Payback (yrs)	Cost per Kt reduced	Affect on 2ndary Energy Type
605 GJ	$8,002	31	151 GJ	$2,225	7.7 t				
12. CO2 SENSORS			151 GJ	$2,225	7.7 t	$7,500	3.4	$1.0	O Yes
NATURAL GAS SUBTOTAL			151 GJ	$2,225	7.7 t	**$7,500**	**3.4**		
			151 GJ	**$2,225**	**7.7 t**				

2008 Electricity Consumption and Estimates of Reductions

2008 Inventory			Reductions						
Consumption	Costs	CO_2e (t)	Consumption	Costs	CO_2e (t)	Capital Cost	Simple Payback (yrs)	Cost per Kt reduced	Affect on 2ndary Energy Type
84,867 kWh	$6,948	2	2,546 kWh	$208	0.1 t				
13. UPGRADE LIGHTING SYSTEM			2,546 kWh	$208	0.1 t	$500	2.4	$7.0	O Yes
ELECTRICITY SUBTOTAL			2,546 kWh	$208	0.1 t	**$500**	**2.4**		
			9 GJ	**$208**	**0.1 t**				
ACCOUNT SUBTOTAL	Electricity		2,546 kWh	$208	0.1 t	**$8,000**	**3.3**		
	Natural Gas		151 GJ	$2,225	7.7 t				
			160 GJ	**$2,433**	**7.8 t**				

Timms Community Centre

Timms Community Centre, adjacent to City Hall, is a small facility with exercise rooms, community meeting room, kitchen, and recreation/games room. This is an older building that was constructed in 1966 and renovated in 2001. The facility consumes ~100,000 kWh of electricity and ~600 GJ of natural gas annually.

In the original footprint, the Communtity Centre will be replaced with a new, slightly larger building, which will not likely consume more energy. However, since an energy model was not commissioned by the City, no forecast for this building was provided.

The walkthrough for the Timms Community Centre was completed prior to Council's decision to replace this building. Regardless, should plans change, the reduction initiatives are listed, although potential reductions in the final target calculation are not included since they will not likely be implemented.

The Furnaces, roof top units and hot water tanks consume natural gas while typical indoor and outdoor lighting, mechanical fans, electric baseboard heaters, and kitchen/building appliances consume electricity. The furnace and the split duct air conditioning unit are old and should be replaced with more efficient units to conserve natural gas and electricity. Throughout the building, indoor lighting is provided by T8 fixtures with 32 Watt tubes. The 32 Watt tubes could be replaced with 28 Watt tubes as required. Other minor retrofits include replacing the exit signs lights with LEDs, weatherstripping the exterior doors, upgrading the air handling unit controls, adding programmable thermostats, and replacing kitchen appliances with EnergyStar units.

Total energy savings are estimated at 94 GJ, cost savings at ~$1,600, and GHG emissions reductions at ~3 tonnes CO_2e. (Table that follows and Table 4.5). (Note: these estimates are not in the final target calculation).

Timms Community Centre -20355 Douglas Crs

2008 Natural Gas Consumption and Estimates of Reductions

2008 Inventory			Reductions						
Consumption	Costs	CO_2e (t)	Consumption	Costs	CO_2e (t)	Capital Cost	Simple Payback (yrs)	Cost per Kt reduced	Affect on 2ndary Energy Type
592 GJ	$7,762	30	59 GJ	$814	3.0 t				
6. UPGRADE TO HIGH EFFICIENCY WARM AIR			59 GJ	$814	3.0 t	$3,500	4.3	$1.2	○ Yes
NATURAL GAS SUBTOTAL			59 GJ	$814	3.0 t	**$3,500**	**4.3**		
			59 GJ	**$814**	**3.0 t**				

2008 Electricity Consumption and Estimates of Reductions

2008 Inventory			Reductions						
Consumption	Costs	CO_2e (t)	Consumption	Costs	CO_2e (t)	Capital Cost	Simple Payback (yrs)	Cost per Kt reduced	Affect on 2ndary Energy Type
99,815 kWh	$8,222	3	9,595 kWh	$790	0.3 t				
7. REPAIR DRAFTS AND LEAKS			898 kWh	$74	0.0 t	$250	3.4	$9.9	○ Yes
8. CONVERT TO LEDS			452 kWh	$37	0.0 t	$200	5.4	$15.8	○ Yes
9. UPGRADE AHU CONTROLS			1,397 kWh	$115	0.0 t	$750	6.5	$19.2	○ Yes
10. ENERGYSTAR			859 kWh	$71	0.0 t	$750	10.6	$31.2	○ Yes
11. UPGRADE AC AND REFRIGERANT			5,989 kWh	$493	0.2 t	$15,000	30.4	$89.5	○ Yes
ELECTRICITY SUBTOTAL			9,595 kWh	$790	0.3 t	**$16,950**	**21.5**		
			35 GJ	**$790**	**0.3 t**				
ACCOUNT SUBTOTAL	Electricity		9,595 kWh	$790	0.3 t	**$20,450**	**12.8**		
	Natural Gas		59 GJ	$814	3.0 t				
			94 GJ	**$1,604**	**3.3 t**				

Timms Community Centre will be replaced in the near future

Fire Hall

The Fire Hall consumes ~ 270,000 kWh of electricity and ~950 GJ of natural gas annually. This facility is a new building, and is energy efficient relative to typical fire halls. The facilty's average electrical consumption could be attributed to the electric dryers for safety clothing, and the many second floor offices.

All the lighting in this building is T8 with electronic ballasts. The bay areas are lit by metal halide lights. There are no recommendations for indoor lighting.

The bays are heated by natural gas-fired infrared tube heaters, which account for most of the natural gas consumption beyond space heating in winter months, domestic hot water, and natural gas for the stove. No energy end-use breakdowns were calculated for this building and none were required for the purposes of this review.

The outdoor lights (e.g., mainly halogen) are currently on a timer that does not adjust to seasonal light levels. A photocell should be installed.

Total energy savings are estimated at 23 GJ, cost savings at ~$465, and GHG emissions reductions at <1 tonne CO_2e. (Table that follows and Table 4.5).

Fire Hall -5785 203rd St

2008 Electricity Consumption and Estimates of Reductions

		2008 Inventory			Reductions						
		Consumption	Costs	CO_2e (t)	Consumption	Costs	CO_2e (t)	Capital Cost	Simple Payback (yrs)	Cost per Kt reduced	Affect on 2ndary Energy Type
		269,967 kWh	$19,369	8	6,325 kWh	$465	0.2 t				
14.	PHOTOCELLS ON OUTDOOR LIGHTS				6,325 kWh	$465	0.2 t	$1,000	2.1	$5.6	○ Yes
	ELECTRICITY SUBTOTAL				6,325 kWh	$465	0.2 t	**$1,000**	**2.1**		
					23 GJ	**$465**	**0.2 t**				
	ACCOUNT SUBTOTAL Electricity				6,325 kWh	$465	0.2 t	**$1,000**	**2.1**		
					23 GJ	**$465**	**0.2 t**				

Langley's Fire Hall

Anderson Memorial Pool

Anderson Memorial Pool is an older outdoor pool that consumes ~ 2,500 GJ natural gas and ~ 140,000 kWh of electricity annually. Space heating requirements are minimal since the building is unoccupied during the off-season. The washroom portables near the pool are responsible for some consumption (e.g., the electrical account associated with the pool). Although a consumption breakdown was not in the scope of this report, HES estimates these portables consume no more than 7,000 kWh/year.

The make up air unit employed in the Summer is not appropriate for off-season use. A winter-use-only furnace is recommended to maintain off-season indoor temperatures without drawing and heating outside air. Also, revised air handling unit controls are highly recommended, to ensure the fan on the make-up air unit only operates in winter.

This building is not a good candidate for solar photovoltaics due to low electrical load requirements. In the summer, solar hot water heating for the pool is recommended, contingent on Langley's plans for the buildings' future. Since solar hot water heating costs ~$25,000 to install, it is not recommended if the buildings life is less than 10 years.

Total energy savings are estimated at 1,067 GJ, cost savings at ~$4,800, and GHG emissions reductions at ~55 tonnes CO_2e. (Table that follows and Table 4.5).

Anderson Memorial Pool -4949 207th St

2008 Natural Gas Consumption and Estimates of Reductions

2008 Inventory			Reductions						
Consumption	Costs	CO_2e (t)	Consumption	Costs	CO_2e (t)	Capital Cost	Simple Payback (yrs)	Cost per Kt reduced	Affect on 2ndary Energy Type
2,533 GJ	$7,844	130	1,064 GJ	$4,640	54.4 t				
15. UPGRADE AHU CONTROLS			431 GJ	$1,878	22.0 t	$750	0.4	$0.0	O Yes
16. SOLAR HEATING - HOT WATER			633 GJ	$2,762	32.4 t	$25,000	9.1	$0.8	O Yes
17. WINTER-USE FURNACE			0 GJ	$0	0.0 t	$7,414	?	?	O Yes
NATURAL GAS SUBTOTAL			1,064 GJ	$4,640	54.4 t	**$33,164**	**7.1**		
			1,064 GJ	**$4,640**	**54.4 t**				

2008 Electricity Consumption and Estimates of Reductions

2008 Inventory			Reductions						
Consumption	Costs	CO_2e (t)	Consumption	Costs	CO_2e (t)	Capital Cost	Simple Payback (yrs)	Cost per Kt reduced	Affect on 2ndary Energy Type
140,443 kWh	$12,064	4	855 kWh	$127	0.0 t				
18. OCCUPANCY SENSORS – INDOOR LIGHTING			855 kWh	$127	0.0 t	$1,100	8.7	$45.9	O Yes
ELECTRICITY SUBTOTAL			855 kWh	$127	0.0 t	**$1,100**	**8.7**		
			3 GJ	**$127**	**0.0 t**				
ACCOUNT SUBTOTAL	Electricity		855 kWh	$127	0.0 t	**$34,264**	**7.2**		
	Natural Gas		1,064 GJ	$4,640	54.4 t				
			1,067 GJ	**$4,767**	**54.5 t**				

Park Buildings

Although walkthrough audits were not completed for any park buildings, City maintenance staff should retrofit T12 lighting to T8 in the near future. Where lights are seldom used and not retrofitted, replace broken lenses and/or egg crate lenses.

In park buildings with baseboard heaters, install programmable thermostats to setback temperatures to the minimum required during unoccupied periods. Estimates of energy and GHG emissions reductions were not provided for park buildings.

Sendall Gardens Greenhouse

Sendall Gardens is a park consisting of a caretaker's house and walkthrough, glass greenhouse. The greenhouse is closed during winter months and otherwise open to the public during the summer and warmer portions of spring and fall (e.g., April 1 to October 1). There are public washrooms on site and hot water is available in the lavatories. The greenhouse is single pane glass, which is normal for greenhouses, but the greenhouse is heated by two gas-fired ceiling hangers during winter and the cooler portions of spring and fall in order to maintain the plants inside. Beyond minor upkeep to the greenhouse and replacement of fans, there are no reduction opportunities available at this facility.

Sendall Gardens

Public Works Buildings

The Public Works Building is an 11,000 square foot building with a series of open-to-the-air work bays at the periphery of the property. The building consumes approximately 1,400 GJ of natural gas annually and ~ 140,000 kWh of electricity. Domestic hot water is supplied by an instantaneous water heater.

Given its age and condition, the Public Works Building is not a good candidate for energy retrofits with long paybacks (e.g., > 7 years). Regardless, the City must continue to retrofit mechanical systems to maintain comfortable indoor temperatures for occupants and electronic equipment.

The roof top units serving this building were replaced in 2005 and do not heat the office area. Roof access was not granted to HES and subconsultants due to safety issues, although access to the roof did not affect the outcome of HES' walkthrough and final assessment of the building.

The lighting in this building was upgraded to T8, including overhead lighting (pulse start) for workbenches in the garage. Induction lighting is not recommended.

Door interlocks and infrared tube heaters are not suitable for this building since the slab heating is operational in the garage bay area. However, weather striping the exterior doors is recommended.

Outdated lighting (i.e., T12 lighting, HIDs, and halogen lighting) is scattered throughout the yard and open air garages. This lighting could be retrofitted, although the space requires analysis; a new public works yard would influence the type of lighting retrofit. At minimum, these lights (e.g., outdoor HIDs, overhead lamps, and fluorescent lights in open air garages) must be turned off during the day to conserve energy. A photocell is recommended. To avoid the costs for photocells, at minimum staff should manually control these lights as part of their daily routine.

Note that a space needs assessment for City public works, and operations has been commissioned.

Total energy savings are estimated at ~200 GJ, cost savings estimated at ~$3,500, and GHG emissions reductions estimated at ~7 tonnes CO_2e. (Table that follows and Table 4.5).

Operations Centre -5713 198th St

2008 Natural Gas Consumption and Estimates of Reductions

	2008 Inventory			Reductions						
	Consumption	Costs	CO_2e (t)	Consumption	Costs	CO_2e (t)	Capital Cost	Simple Payback (yrs)	Cost per Kt reduced	Affect on 2ndary Energy Type
	1,382 GJ	$17,831	71	124 GJ	$1,643	6.3 t				
19.	REPAIR DRAFTS AND LEAKS			12 GJ	$159	0.6 t	$250	1.6	$0.4	○ Yes
20.	UPGRADE CONTROLS FOR SPACE HEATING			112 GJ	$1,484	5.7 t	$2,500	1.7	$0.4	○ Yes
	NATURAL GAS SUBTOTAL			124 GJ	$1,643	6.3 t	**$2,750**	**1.7**		
				124 GJ	**$1,643**	**6.3 t**				

2008 Electricity Consumption and Estimates of Reductions

	2008 Inventory			Reductions						
	Consumption	Costs	CO_2e (t)	Consumption	Costs	CO_2e (t)	Capital Cost	Simple Payback (yrs)	Cost per Kt reduced	Affect on 2ndary Energy Type
	141,222 kWh	$12,660	4	20,940 kWh	$1,886	0.6 t				
21.	REPAIR DRAFTS AND LEAKS			250 kWh	$23	0.0 t			$0.0	◉ Yes
22.	PHOTOCELLS ON OUTDOOR LIGHTS			8,452 kWh	$761	0.2 t	$1,000	1.3	$4.2	○ Yes
23.	INSTALL THERMOSTAT			12,238 kWh	$1,102	0.3 t	$1,500	1.4	$4.4	○ Yes
	ELECTRICITY SUBTOTAL			20,940 kWh	$1,886	0.6 t	**$2,500**	**1.3**		
				75 GJ	**$1,886**	**0.6 t**				
	ACCOUNT SUBTOTAL	Electricity		20,940 kWh	$1,886	0.6 t	**$5,250**	**1.5**		
		Natural Gas		124 GJ	$1,643	6.3 t				
				199 GJ	**$3,529**	**6.9 t**				

Operations Centre

4.5 Summary

Table 4.5 ranks reduction measures throughout the City's building stock based on tonnes of GHGs reduced. Values for capital costs are estimated, and for costs reduced and simple payback are calculated at 2008 unit energy prices. As the unit price for energy increases over time, the simple payback associated with the project decreases accordingly. The values for CO_2e saved, including electricity, are calculated using the 2007 emissions factor for electricity. All projects combined will cost the City ~ $73,000, lead to approximately ~15,000 in savings with a combined simple payback of 5 years. The total tonnes reduced is an estimated 79 tonnes CO_2e.

Table 4.5 – Prioritized Implementation in the Buildings Sector by CO_2e Reduced

Rank	Account	Account Address	Capital Costs	Energy Reduced	Simple Payback (years)	CO_2e (t) Reduced
1	Al Anderson Pool[1]	4949 - 207th Street	$34,264	$4,767	7	55.0
2	Douglas Recreation Centre	20550 Douglas Crs	$8,000	$2,433	3	8.0
3	Operations Centre	5713 - 198th Street	$5,250	$3,529	2	7.0
4	City Hall and Library	20399 Douglas Crs	$4,260	$2,200	2	6.0
5	Fire Hall	5785 - 203rd Street	$1,000	$465	2	0.2
	Timms Community Centre[2]	20355 Douglas Crs	$20,450	$1,604	13	3.3
TOTALS			$52,774	$13,394	4	76

[1] Options are presented for Al Anderson Pool– option 2 does not form part of the calculation

[2] Although the Timms Community Centre will be replaced, the recommendations are listed but not counted in the final target