FINAL REPORT

for the

City of

Salmon Arm

Energy and Greenhouse Gas Emissions Study

0752.0015.01 / October 2008

URBANSYSTEMS.
Suite 200 - 286 St. Paul Street
Kamloops BC V2C 6G4
Telephone: 250-374-8311
Fax: 250-374-5334

Suite 200 - 286 St. Paul Street, Kamloops, BC V2C 6G4
Telephone: 250-374-8311 Fax: 250-374-5334

URBANSYSTEMS.

October 21, 2008 File: 0752.0015.01

COPY

City of Salmon Arm
P.O. Box 40
500-2nd Avenue N.E.
SALMON ARM, BC V1E 4N2

Attention: Corey Paiement, MCIP, Director of Development Services

RE: CITY OF SALMON ARM CORPORATE ENERGY AND GREENHOUSE GAS EMISSIONS STUDY - FINAL REPORT

Please find enclosed ten (10) copies of the City of Salmon Arm Corporate Energy and Greenhouse Gas Emissions Study. This study examines, at a broad level, energy consumption and subsequent greenhouse gas emissions in the City's facilities and fleet. It also provides a description of initiatives that the City could undertake to reduce its energy consumption and greenhouse gas emissions. This study also provides some direction for the City to achieve its obligations under the Climate Action Charter.

It has been a pleasure to work with you and the technical steering committee on this assignment and we hope to work with you again in the future. If you have any questions or comments regarding this study, please feel free to contact us.

Yours truly,

URBAN SYSTEMS LTD.

Dylan Houlihan,
Planning Consultant

/is/dh

U:\Projects_KAM\0752\0015\01\R-Reports-Studies-Documents\Final\2008-10-21-LET-CvrFinalReport.doc

TABLE OF CONTENTS

APPENDICES

EXECUTIVE SUMMARY

The City of Salmon Arm has undertaken many measures to become a more environmentally conscious community. These include water reclamation at the Water Pollution Control Centre (WPCC), promoting pesticide alternatives, and installing a geothermal heating and cooling system at the new City Hall. In 2008, the City signed the Climate Action Charter, which, among other things, commits the City to being carbon neutral in its operations by 2012. While the details of what carbon emissions need to be inventoried and calculated are evolving, they will most definitely include greenhouse gas (GHG) emissions from energy use as a component.

The purpose of this report was to determine how energy is being used in the City and to identify ways the City could reduce energy costs and GHG emissions. At a broader level, the City is using this study to demonstrate leadership to the broader community on energy and climate change issues.

Currently, the City of Salmon Arm uses electricity and derives energy from sources such as natural gas and petroleum resources. Briefly, the salient points from the analysis include:

- The City spent approximately $1.1 million on energy in 2007;
- The largest expenditure was on electricity, which accounted for approximately 56% of energy costs. Electricity also accounted for the greatest portion of energy use;
- The largest consumers of energy were the City's community facilities. Of these, the Sunwave Centre consumed the most electricity and natural gas, and accounts for almost 500 tonnes of GHG emissions;
- In 2007, the City's total emissions were approximately 2000 tonnes/CO_2E; and
- If the City maintains a "business-as-usual" approach, in order to achieve its obligations for Carbon Neutrality, the City will pay approximately $60,000 for carbon offsets in 2012 and every year thereafter. In addition, the City will be required to pay approximately $50,000 in carbon taxes, which will be rebated to the City due to its participation in the Climate Action Charter.

In reviewing energy usage, the City has to balance its desire to reduce GHG emissions with the desire to reduce energy costs. While the two are not mutually exclusive, the fact remains that electricity consumption results in the greatest expenditures, but results in the lowest GHG emissions, while natural gas usage costs much less but results in the largest amount of GHG emissions.

Moving forward, there are a number of initiatives that the City should implement. These start with broad organizational initiatives which help the City integrate energy conservation into the municipal corporate culture. The organizational initiatives include:

- Identifying goals and objectives for energy and GHG emissions reductions;
- Developing Council policies which support sustained action on energy and GHG emission reduction initiatives;
- Initiating an internal energy management committee to provide direction to Council and staff on implementation of this plan and to provide ongoing review of energy issues for the City's operations;
- Developing a carbon offsetting strategy to help the City achieve carbon neutrality;
- Developing an ongoing monitoring framework for ensuring timely accounting of energy consumption and GHG emissions;
- Providing education opportunities to municipal employees on energy and GHG emissions issues;
- Ensuring buildings, infrastructure, and fleet components are maintained regularly; and
- Exploring accrediting existing and future buildings, infrastructure, and fleet components through programs such as LEED and E3 Fleets.

Buildings in Salmon Arm account for over $500,000 in energy costs and result in over 1200 tonnes of GHG emissions. A number of initiatives should be considered for making buildings more energy efficient. These include:

- Performing individual building audits examining electricity and natural gas usage. Buildings including the Sunwave Centre, SASCU Recreation Centre, RCMP Detachment, and the Water Pollution Control Centre (WPCC) should be audited
- Investigating hot water heating needs in buildings and determining if water temperatures can be altered or if alternate water heating methods can be utilized;
- Improving building envelopes to ensure there is no energy wasted due to poor insulation and windows;
- Reviewing ventilation requirements in building to ensure that appropriate levels of ventilation are being provided to match needs;
- Reviewing air conditioning to ensure that it is properly maintained and determining if newer, more efficient systems, may be appropriate;
- Implementing a turn it down/turn it off campaign in City buildings for lighting, computers, heating, and cooling;
- Replacing office equipment with more efficient equipment, particularly as equipment reaches the end of its useful life;

- Reviewing interior lighting needs to ensure that appropriate light fixtures are being used and appropriate lighting levels are being provided;
- Installing appropriate controls for heating equipment;
- Considering alternate sources of heating such as geothermal systems;
- Considering alternate electricity supply such as solar photovoltaic systems; and
- Installing "green roofs" on existing and future buildings to improve insulation and reduce heating and cooling loads.

The operation of water and sewer infrastructure, as well as outdoor lighting accounts for $400,000 in energy costs and approximately 260 tonnes of GHG emissions. Several initiatives are recommended for improving energy use in infrastructure operations. These initiatives will mainly target electricity use and include:

- Replacing outdoor street lighting with LED lights which use significantly less electricity and typically require less maintenance;
- Enhancing water conservation to reduce the amount of water that needs to be pumped;
- Performing water system audits to determine where in the water system energy is being used the most and determine ways of reducing this energy use;
- Optimizing water pumps to ensure that the most efficient pumps are being used the majority of the time; and
- Replacing old pumps that may be oversized and energy inefficient.

The operation of fleet and equipment accounts for approximately $195,000 in energy costs and approximately 550 tonnes of GHG emissions. Initiatives to reduce energy costs and GHG emissions include the following:

- Adopting an anti-idling policy for all City vehicles;
- Developing a tire pressure monitoring program to ensure properly inflated tires;
- Developing a monitoring program for the fleet which tracks fuel consumption costs, as well as other important vehicle related data (note – much of this is being done as part of the City's participation in the E3 Fleets program);
- Shifting from 2 stroke to 4 stroke engines and/or electrical equipment to reduce GHG and other emissions;
- Using alternative fuelled vehicles such as hybrids, natural gas, and potentially biodiesel compatible vehicles;

- Right-sizing vehicles and optimizing their use to reduce vehicle travel and better match vehicle size with trip needs;
- Implementing a vehicle purchasing policy to ensure that only the appropriate sized vehicles are purchased and to provide guidance for the purchase of alternative fuelled vehicles; and
- Using auxiliary power in vehicles to reduce the need to idle vehicles to operate other functions (i.e. onboard computers, lights, etc.).

While many of the initiatives could be implemented concurrently, it is important that the organizational initiatives be started early in this process as the goal for this program should be to integrate energy conservation into the Salmon Arm corporate culture. The City should also look at implementing many of the lower cost options as soon as possible to build momentum for the implementation of other initiatives that will involve higher capital costs. These include initiatives that encourage employees to use less energy in the workplace where possible. These are low cost, but potentially highly effective initiatives that can result in measurable energy savings and build an energy conservation mindset in the organization. They also build a foundation for more ambitious initiatives in the future.

1.0 INTRODUCTION

1.1 Background

The City of Salmon Arm has undertaken many measures to become a more environmentally conscious community. These include water reclamation at the Water Pollution Control Centre (WPCC), promoting pesticide alternatives, and installing a geothermal heating and cooling system at the new City Hall. The general community also takes an active interest in environmental issues.

The City has also taken steps to facilitate greater energy consciousness in the community. Section 2.5 of the Official Community Plan provides guidance for Community Energy Policies. Building on these voluntary policies, the City wants to demonstrate leadership in the community by looking further at municipal operations to determine where energy efficiency and greenhouse gas (GHG) emissions reductions can be made.

1.2 Scope of Report

This report examines the City of Salmon Arm's energy use for its various infrastructure components including buildings, sewer and water, and lighting, as well as for their fleet and equipment. For each component, a summary of the energy use, cost, and greenhouse gas emissions is provided. Data was compiled from BC Hydro account histories, Terasen Gas and other natural gas account histories, and from the City of Salmon Arm's Public Works department, who provided information on fuel usage for fleet and equipment. While there may be small gaps in the information presented, it is sufficient for the analysis being undertaken acknowledging that it will be important to update this information and broaden the scope of the information collected to achieve the commitments the City has made to become carbon neutral.

One important component of this overall assignment is the development of a spreadsheet that can be used in the future to track energy usage. This spreadsheet lists all the important energy use components in the City, including buildings and fleet vehicles, and allows the City to track energy used, costs, and greenhouse gas emissions. This report also makes broad recommendations on how energy could be used more efficiently, or, in some cases, where an alternate supply could be provided.

It is important to note that this report does not contain information regarding employee travel in their own vehicles or for flights, nor does it include data on emissions from landfills and other such activities. Further, it does not include energy used or GHG emissions for contract work, such as municipal construction projects that are awarded to private sector firms. As the City

takes steps to become carbon neutral, it should begin to require contractors account for fuel usage and corresponding GHG emissions.

1.3 Methodology

A building and fleet inventory was established through a general review of the City energy records. Each building and each fleet account was assigned to a relevant category based on type of municipal operation. The categories include:

Civic

- City Hall
- Vehicles (3)

Protective Services

- Fire halls (4)
- RCMP Building
- Fire Training Centre
- Vehicles (15)
- Booster Station

Lighting

- Canoe Overhead Lighting
- Ornamental Street Lighting
- Crosswalk signal
- Ross Street Parking Lot

Community Facilities

- Little Mountain Clubhouse
- SASCU
- Sunwave Centre
- Curling Rink
- Indoor Sports Complex

Parks

- Raven Park
- Walkway Lighting
- Wharf
- Cemetery
- Blackburn Park
- Canoe Beach
- Vehicles (5)
- Equipment (3)

Public Works

- Airport buildings
- Airport Hazard Beacons
- Public Works Buildings
- Vehicles (16)
- Equipment (10)

Water

- Reservoirs (10)
- Pump Stations (6)
- Metford Dam
- PVR Station (2)
- Booster Stations

Sewer

- Water Pollution Control Centre
- Lift Stations (6)

Records of the City's energy use were collected from the relevant sources. These include:

- Electrical use – BC Hydro billings;
- Natural Gas use – Terasen Gas billings, Absolute Energy Billings; and
- Petroleum use – Public Works summaries.

For each of these sources of energy, the amount of energy used as well as the energy costs was established. GHG emissions were based on emission factors developed as part of the Province of BC's Greenhouse Gas Emission Guide. These factors include:

- Electricity – 22 grams CO_2E/kwh;

- Natural Gas – 0.051 tonnes CO_2E/GJ;
- Gasoline – 0.00276 tonnes CO_2E/litre;
- Diesel – 0.00241 tonnes CO_2E/litre.

These factors were applied to energy consumption to determine the total GHG emissions.

2.0 UNDERSTANDING ENERGY

There are three principal sources of energy that the City consumes in an active manner. These include electricity provided by BC Hydro, natural gas provided by Terasen Gas and other supply marketers, which is burned to create heat, and gasoline and diesel fuel provided by various sources, which is used to create mechanical energy. In a passive manner, the City also utilizes energy from the sun for lighting and heat. These sources of energy have different costs and GHG emissions associated with them. Before analyzing energy use, it is important to review the types of energy and their associated costs and impacts on GHG emissions in the BC context. Carbon tax implications are discussed in greater detail in later sections of the report.

2.1 Electricity

Currently, the City of Salmon Arm's electrical needs are met through BC Hydro. The majority of electricity that BC Hydro provides comes from hydro-electric dams which are generally considered "clean" sources, excluding the initial environmental damage of constructing new dams and reservoirs. This also excludes the potential methane emissions that result from decomposing organic material in reservoirs, which has been found to be quite significant in some instances. Despite BC's plentiful supply of electricity, the province is still a net importer of electricity with supplementary power provided by Alberta and Washington which rely to varying degrees on coal and natural gas electrical generating plants.

2.1.1 Cost of Electricity

BC Hydro separates its electricity rates by commercial and residential use. According to the BC Hydro website, rates for commercial use of electricity are based on the following:

1. **The demand for electricity.** Customers who have an electricity demand of 35 kilowatts (kW) and over are billed on a rate schedule that includes a basic charge, a charge for electricity consumption and a charge for demand. Customers who have a demand less than 35 kW are billed on a rate schedule that includes a basic charge and a charge for electricity consumption. A commercial customer that utilizes less than 35 kW is assessed a basic charge of $0.1548 per day and $0.0796 per kWh.
2. **The supply voltage.** Hydro supplies its general service customers with electricity either at primary voltage (750 volts or more) or secondary voltage (less than 750 volts).
3. **The area of the province in which the customer is located.** Customers in Zone II remote locations not connected to Hydro's grid are charged under different rate schedules. Customers in Zone II with demand greater than 45 kVA (kilovolt amperes) may be required to be served under a special contract.

It is important to understand the role that demand charges can play in determining potential energy costs. Commercial customers who use more than 35 kW are charged a basic charge of $4.42 per month, $0.0691 per kWh for the first 14,800 kWh, and $0.0354 for all additional kWh. In addition a demand charge of $3.77 per kW is charged for demand usage between 35 kW and 115 kW while a charge of $7.23 per kW is applied for additional demand usage. Demand charges are applied to the peak usage over the course of a billing period. For instance, if a facility has a pronounced peak demand of 120 kW at a particular time during the billing period, the account would be billed approximately $337.75 ((115 kW – 35 kW) * $3.77 + (120 kW – 115 kW) * $7.23)). While not necessarily decreasing energy consumption, addressing peak demands through use of tools such as capacitors, and changing how motors are operated, particularly in how they start and stop, can result in significant cost savings due to reduced peak demand.

In 2007, the BC government released its Energy Plan which indicated that the province is to be electricity self-sufficient by 2016 with 50% of BC Hydro's incremental need for electricity coming through conservation by 2020. Further, all electricity will be required to come from carbon neutral sources such as hydro-electric dams and renewable energy sources such as wind, solar, and tidal energy.

To support the conservation efforts, it is inevitable that there will be increases in prices for electricity to encourage demand management. Already BC Hydro has announced new tiered electricity pricing initiatives to encourage conservation as well as rate increases for residential customers. The rates provided incorporate a 6.56% increase from 2007. BC Hydro will be increasing rates again in 2009 by 8.21%. As the government commits itself to electricity conservation and electrical self-sufficiency, it is likely there will be more pressure to use price as a means to regulate demand.

2.1.2 Relationship to Greenhouse Gas Emissions

As mentioned previously, while most of BC's electricity is considered clean, from a GHG emission perspective, it is notable that the province still imports electricity from Alberta and Washington which are more reliant on coal and natural gas which does produce GHG emissions. It is also important to note, that while not well studied yet, there is reason to believe that hydro-electric dams contribute to GHG emissions through the decomposition of organic matter in reservoirs. The extent of this contribution varies greatly depending on the manner in which the reservoir was constructed and its location. However, the important point is that hydro-electricity, which forms the vast majority of BC's electrical resources, cannot be relied upon to be completely GHG emission free.

Based on the BC Greenhouse Gas Emission Assessment Guide, the greenhouse gas emissions from electricity generated in BC was 22 grams CO_2E/kwh. This does not include electricity

imported from other jurisdictions, such as Alberta, so the actual amount is presumed to be higher.

2.2 Natural Gas

Currently the City of Salmon Arm obtains most of its natural gas from Terasen Gas, though some of the recreation facilities receive service from fixed price marketers. Natural gas in Salmon Arm is predominantly used for space and water heating purposes. It is marketed as a generally clean source of energy though, unlike hydro-electric power, does not come from renewable sources and there are acknowledged emissions.

2.2.1 Cost of Natural Gas

Terasen Gas has a variety of rate classes based on level of use. For each rate class there are fixed monthly basic and administration charges as well as variable prices per gigajoule used. While classes are decided by level of use, it is advantageous to review level of use to see if the facility can be moved to a different rate class for cost savings. This also highlights how strategic conservation can result in being placed in a different rate class which may result in significant savings. The three rate structures, for commercial consumption, are based on annual consumption of under 2000 GJ, 2000 – 5000 GJ, and greater than 5000 GJ of natural gas. Often times there is some advantage to ensuring that buildings are in the proper rate structure as there can be minor cost savings.

Natural gas prices have fluctuated. Recently, Terasen Gas announced that commodity prices for natural gas would decrease by 15%, resulting in savings of $2.24/GJ.

Fixed price marketing companies have provided some City recreation facilities with natural gas. In general, the cost of this natural gas has been lower than that sourced from Terasen Gas.

2.2.2 Relationship to Greenhouse Gas Emissions

Buildings in BC are a significant contributor to greenhouse gas emissions. According to the BC Greenhouse Gas Assessment Guide, emissions from buildings account for 11% of BC's greenhouse gas emissions with the majority of this attributed to natural gas use. The emission factor for natural gas is 0.051 tonnes of CO_2E/GJ of natural gas.

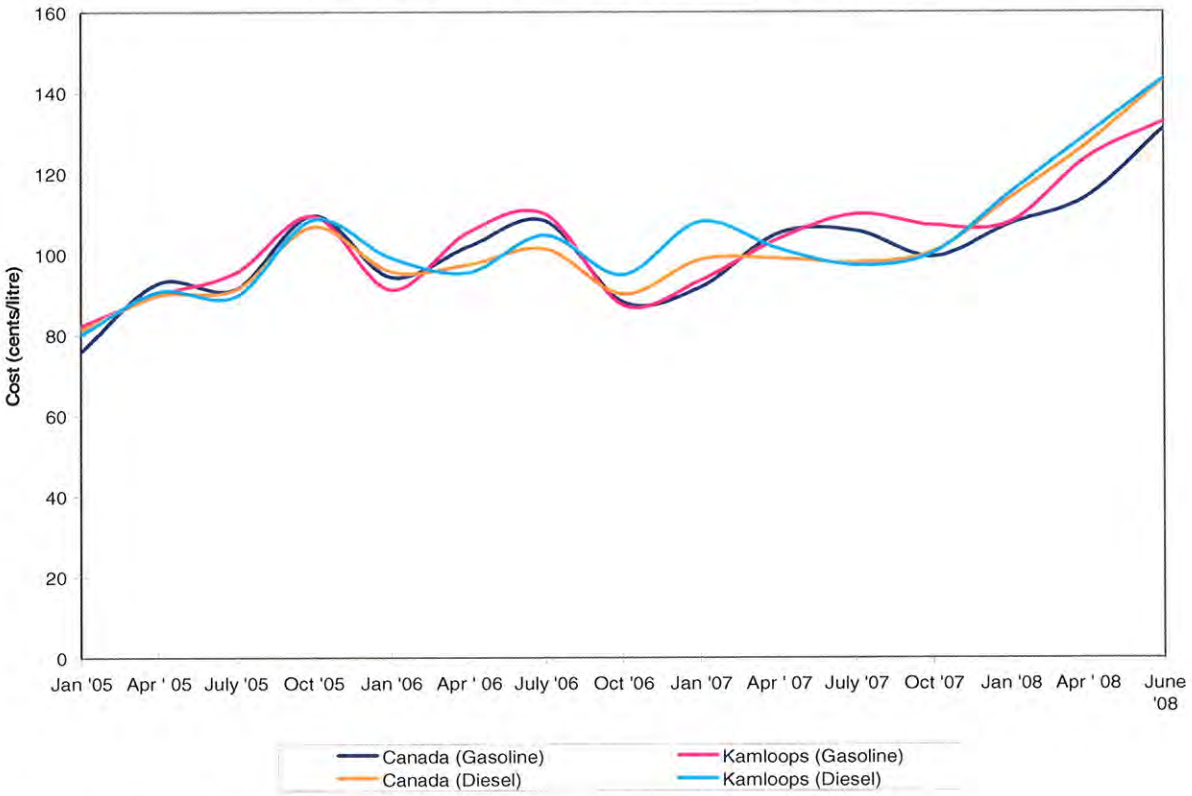
2.3 Petroleum Products

Petroleum products are used as an energy source principally for transportation needs and equipment through gasoline and diesel.

2.3.1 Cost of Fuel

Fuel costs have continued to rise due to volatility and political instability in key oil markets, increased demand from developing countries such as China and India, as well as concerns that world supplies of oil have reached their peak and that the remaining supply for the next few decades will come from areas where the oil is typically less cost effective to access, such as the Alberta oilsands. Recently, gasoline and diesel prices have fluctuated between $1.15 and $1.40 per litre with the price expected to increase with the introduction of the carbon tax (described in more detail in Sections 3 and 4) and continued supply constraints, though there has been a dramatic decrease in the cost of oil due to the current economic slowdown. **Figure 2.1** summarizes average petroleum costs since 2005 for both Canada and for the Kamloops market, which likely best reflects the Salmon Arm market.

Figure 2.1 – Petroleum Costs (2005 – 2008)



Source: Natural Resources Canada – Fuel Focus Report

2.3.2 Relationship to Greenhouse Gas Emissions

There have been numerous advances in the fuelling of automobiles to reduce greenhouse gas emissions. These include such technology as hybrid vehicles, use of biodiesel, and limited roll-out of natural gas and electric vehicles. Further, the range of automobiles that are available

continues to evolve with a number of smaller automobiles available, such as SMART cars, which can serve urban needs. Looking forward, plug-in hybrid vehicles and hydrogen vehicles may become marketable soon. These will be dependent on advances in battery technology and fuel cells.

Advances to improve petroleum use and GHG emissions have occurred but there are still significant concerns with the roll-out of technology and its overall level of impact. For example, biofuels can contribute to reduced greenhouse gas emissions from the tailpipe of vehicles. However, recent analyses have suggested that some biofuels can even result in greater life-cycle GHG emissions than traditional petroleum products due to the amount of energy used to produce the fuel. Market trends have also shown that producing biofuels is displacing food crops to a large extent contributing to higher food prices. Next generation biofuels, which are being derived from non-food crops, offer more promise in reducing social costs, but the impact on life-cycle GHG emissions is still questionable.

There are also issues with hybrid vehicles in that fuel efficiency is largely a determinant of the driver habits, the terrain being travelled in, and whether driving is predominantly on urban roads, where there is greater efficiency as auxiliary power is used, or on highways, where there is less efficiency as primarily gasoline is used for power.

In general, diesel engines provide more power than gasoline engines. Four-stroke engines are generally more efficient than two-stroke engines as there is a more complete burning of fuel and no need to burn oil as part of the process. Two-stroke engines are popular due to their simple design and their power-to-weight ratio which explains their popularity for chainsaws, lawnmowers, etc.

Based on the BC Greenhouse Gas Emission Assessment Guide, diesel fuel produces 0.00276 tonnes of CO_2E /litre while gasoline fuel produces 0.00241 tonnes of CO_2E /litre. For context, a vehicle with a 40 litre tank that starts full and is fully used will produce the equivalent weight of emissions of fully grown, large man (approximately 210 lbs).

2.4 Summary

As can be seen in the analysis of the various energy sources, energy prices have increased significantly in the recent past. It is not expected, over the long-term, that these increasing prices will abate, particularly for petroleum products.

An interesting component of energy that is explored further in this report is the fact that reducing energy use is not necessarily linked to reducing GHG emissions. As evident in the preceding

sections, energy supplied through electricity results in substantially less GHG emissions than natural gas or petroleum products. Therefore, it is important to understand what the priorities are in terms of addressing energy use – reducing cost, reducing GHG emissions, or striking a balance between the two. This will guide future investments into reducing energy use.

3.0 PROVINCIAL CONSIDERATIONS

Along with understanding the various sources of energy, it is also important to understand the emerging provincial considerations as they relate to energy and GHG emissions. The Province, in the last two years, has identified significant goals to improve energy use and reduce carbon emissions. These goals have emanated largely from the *BC Energy Plan,* the *BC Climate Action Plan,* and the *Climate Action Team Report.* Specifically, these goals and initiatives include:

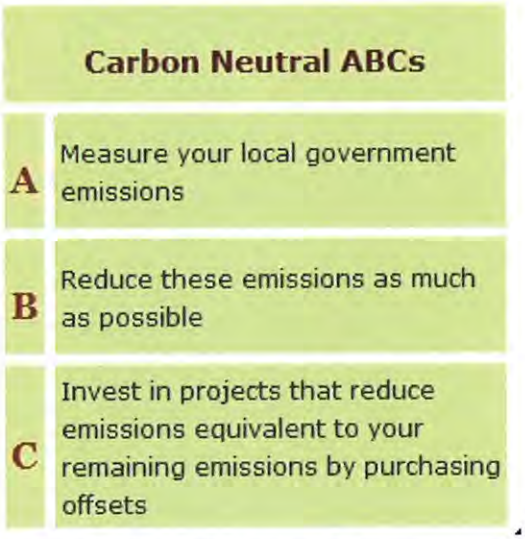
- Introducing carbon taxation – BC is one of the first jurisdictions in North America to implement carbon pricing. Starting in July 2008, all fossil fuels were taxed based on the amount of carbon they produce, starting at a base rate of $10 per tonne and escalating to $30 per tonne over the next four years. The Climate Action Team has suggested that the province review whether further increases would be needed beyond 2012. At the 2008 Union of BC Municipalities (UBCM) convention, the province announced that municipalities who have signed the Climate Action Charter would receive a rebate on carbon taxes paid.
- Mandating provincial government carbon neutrality for government operations by 2010 – the provincial government has committed to becoming carbon neutral in its operations by 2010 and is actively engaged in looking at ways to reduce their carbon footprint.
- Establishing the Climate Action Charter in 2007 – at the UBCM conference in 2007, municipalities from across the province signed the Climate Action Charter which committed signatories to becoming carbon neutral in their operations by 2012. The City of Salmon Arm has since signed the Climate Action Charter.
- Mandating Provincial electricity self-sufficiency by 2016 and corresponding commitment that electricity will come from carbon neutral sources.
- Acquiring 50% of BC Hydro's incremental resource needs through conservation by 2020.
- Legislating municipalities to include targets, policies, and actions in their OCPs that pertain to greenhouse gas emissions by May 31, 2010.
- Reducing the energy demand at work by 9% per square metre by 2020 for commercial and institutional buildings.
- Reference to the fact that BC Hydro will be installing smart meters for commercial customers by 2012. Smart meters will take accurate electricity usage readings at regular intervals and provide feedback to the customer.
- Introducing legislation giving municipalities the opportunity to incorporate energy and water efficiency considerations into development permit area guidelines.
- Allowing flexibility in Development Cost Charges (DCC) to encourage energy efficiency and low impact development.

- Developing the new Green Building Code which requires new homes to achieve an EnerGuide rating of 77 and makes low water use fixtures mandatory. It has been suggested that the Building Code be updated every three years.
- Requiring all provincially funded buildings to be LEED certified and requiring by 2016 that all new publicly-funded buildings in the province have net-zero GHG emissions. It is unclear whether this would extend to buildings that the province provides funds for construction through capital infrastructure grants. It is also unclear what the definition of publicly-funded would be.
- Requiring a reduction of electricity use in existing provincial buildings by 20%.
- Requiring all new provincial government buildings to be LEED Gold or better.
- Reducing provincial greenhouse gas emissions by 33% by 2020.

Appendix C contains a list of all relevant provincial reports and links to websites for these reports. The initiatives listed are manifested in how the provincial government deals with municipal governments. For example, the application forms for the new BC Building Canada Fund required municipalities to include comments on how their given project would impact GHG emissions and energy use. In the future, it is expected that this criteria will become much more stringent and that funding may be predicated on how the municipality has addressed GHG emissions, and energy consumption.

3.1 Carbon Neutrality

There has been much discussion surrounding the topic of carbon neutrality, particularly as the province has committed itself to being carbon neutral in its operations by 2010 and a number of municipalities, such as Salmon Arm, have voluntarily committed to being carbon neutral by 2012. Carbon neutrality means reducing greenhouse gas emissions to achieve a net of zero emissions. There are three steps to becoming carbon neutral: 1) calculating carbon emissions from corporate operations and ancillary activities; 2) reducing carbon emissions through conservation measures such as changing transportation habits and evolving to cleaner supply (i.e. solar hot water heating); and 3) buying carbon offsets to contribute to projects that replace fossil fuels with renewable energy sources or remove carbon dioxide from the air.



Source: Climate Action Toolkit Website

3.1.1 Carbon Inventory

The City, as a signatory to the Climate Action Charter, will need to inventory all its carbon emissions and purchase offsets for these emissions to bring them to a net of zero. The Green Communities Committee, a joint partnership between the province and UBCM, has undertaken some work to detail the boundaries of what would need to be included in the carbon inventory. While there is still much clarification required, it is known that all GHG emissions for energy used for traditional municipal services (i.e. parks, recreation, protective services, community facilities, infrastructure, lighting, etc.) will need to be included though services that are offered, but are typically outside of the realm of a municipality, such as social housing, will not be included. In addition, any typical municipal services that the municipality contracts out, such as solid waste collection and potentially construction services, will need to be included, though this is to be phased in as part of future contracts. Further, municipalities will need to track solid waste from operations and apply emissions factors to this due to methane generation. In order to be carbon neutral by 2012, the City will have to calculate its GHG emission inventory based on 2011 data.

3.1.2 Carbon Reduction

There are many initiatives a municipality such as Salmon Arm can undertake to reduce carbon emissions. These are outlined in more detail for Salmon Arm later in this report, but a broad level, replacing fossil fuels with renewable resources and reducing the use of fossil fuels is the most effective means of reducing carbon emissions. This will result in an absolute carbon reduction, and in many cases, over the long-term, which is required. For instance, if the City were to replace natural gas hot water heating in a building with solar hot water heating, they could reduce their GHG emissions significantly for that building and this would be a long-lasting absolute reduction in GHG emissions. Conservation techniques also have significant benefits to carbon reduction. However, due to BC's reliance largely on clean energy sources, there is less benefit to carbon reduction to reducing electricity usage. Thus, while installing solar panels on buildings is applaudable, unless they are used to replace natural gas heating with electric heating, they will not result in appreciable reductions in GHG emissions compared to other initiatives.

3.1.3 Carbon Offsetting

Carbon offsetting is compensating for greenhouse gas emissions by funding external programs aimed at reducing greenhouse gas emissions or increasing carbon dioxide absorption. Important concepts to offsetting are additionality, and verifiability. Carbon offsets that are purchased must result in an investment that would typically be outside the current capacity of the organization. For example, without significant investment, there would be little potential for some remote communities to switch from diesel power generation to a cleaner energy source such as solar photovoltaic. Thus, if an offsetting initiative invested in this upgrade, it would be considered in

addition to the typical scenario. Verifiability requires that there be documented evidence that the offset will, and is, resulting in reductions of GHG emissions. Third party audits are often mandated to assure that the offsets are working.

Carbon offsets are typically purchased through a carbon offsetting organization which charges a certain amount of money per unit of carbon produced and subsequently reinvests this money into initiatives elsewhere that reduce carbon. These reinvestments often are made in tree planting, or in clean energy production. Carbon offsetting has been criticized because it does not necessarily result in changes in the behaviour of the emitter and is merely a way to make people and organizations feel less guilty about their emissions. There are also questions about the value of some reinvestments. For example, while planting trees is generally good for the environment, trees merely act as a store of carbon. Once they die, this carbon is subsequently released into the atmosphere, albeit at a slow pace if decomposition occurs naturally, unless the wood is processed into another product such as furniture. Therefore, over the long-term the value of planting more trees to act solely as carbon storage is questionable. Further, a tree generally only absorbs 2.5 kg to 2.8 kg of carbon dioxide every year and generally can do this for 80 years. To offset one tonne of carbon in a year would require the planting of approximately 400 trees on a yearly basis to have an immediate reduction of carbon, though 5 trees could be planted and over the course of their lifetime, could offset the one tonne of carbon barring any premature death due to fire or disease.

The provincial Pacific Carbon Trust is an initiative of the BC government to provide a fund that can collect carbon offsets from provincial government operations and reinvest them into projects that will reduce CO_2E emissions. The program will be available to municipalities participating in the Climate Action Charter agreement to be carbon neutral by 2012. Funds that are collected will be reinvested in projects throughout BC. One disadvantage of purchasing offsets from external organizations is that there is no guarantee that the funds collected will be reinvested in initiatives local to Salmon Arm.

Due to the amount of offsets that may be required to become carbon neutral, municipalities such as Salmon Arm should consider developing a local offset program. Politically, this may be more palatable as the money paid for offsets would be invested locally. If such a scheme is advanced, it is likely that the City would have to pay more for offsets to achieve the GHG emissions required to become carbon neutral due to smaller economies of scale.

4.0 ENERGY USE

This section summarizes energy use for each type of energy source by the type of municipal operation. For each type of energy, there is a summary of costs, consumption, and GHG emissions for 2005, 2006, and 2007 as well as a short forecast of what future expenditures might be based on planned price increases and associated costs for carbon taxation and carbon offsetting.

4.1 Electrical Use Summary

The City of Salmon Arm sources all electricity from BC Hydro. During the last two years, the City has spent almost $600,000 per year on electricity, over 66 different accounts, accounting for approximately 60% of the City's energy budget. The electricity expenditure increase from 2005 to the last two years has been almost $100,000 and is attributable, in large part, to the construction of the new City Hall, as well as increases in lighting costs. It is important to note that the electricity costs for City Hall also includes usage at the Provincial Court House. The Court House comprises approximately 50% of the floorspace of the entire City Hall, not including the parkade/basement. This has not been separated in the following analysis. **Table 4.1** summarizes electricity use for the last 3 years.

Table 4.1 – Electricity Consumption Summary

	Cost			Consumption (kWh)			GHG Emissions (tonnes CO_2E)		
	2005	2006	2007	2005	2006	2007	2005	2006	2007
Civic	$3,692	$33,427	$34,312	57,712	642,224	684,504	1.3	14.1	15.1
Lighting	$66,520	$101,371	$105,237	360,533	584,952	629,242	7.9	12.9	13.8
Protective Services	$20,650	$22,178	$23,052	302,757	325,644	352,947	6.7	7.2	7.8
Public Works	$15,334	$17,743	$18,663	193,653	248,736	260,998	4.3	5.5	5.7
Sewer	$117,110	$120,989	$115,641	2,607,076	2,628,646	2,292,734	57.4	57.8	50.4
Water	$118,624	$145,841	$144,298	1,411,478	1,974,601	1,935,088	31.1	43.4	42.6
Community Facilities	$161,455	$167,772	$173,352	3,247,338	3,253,126	3,331,018	71.4	71.6	73.3
Parks	$2,327	$4,694	$3,617	21,898	54,804	41,473	0.5	1.2	0.9
Total	$505,712	$614,013	$618,172	8,202,445	9,712,733	9,528,004	180.5	213.7	209.6

Water, Sewer, and Community Facilities are the largest users of electricity in the City. While electricity accounts for over 60% of the City's energy budget, it accounts for only 10% of the

City's GHG emissions. This is an important point to recognize as the City must determine if the desire is to reduce energy costs or reduce GHG emissions as these two goals are not as strongly linked as is sometimes believed.

The largest individual user of electricity is the Sunwave Centre which has electricity costs of approximately $110,000. **Table 4.2** summarizes the Top 5 users of electricity in the City.

Table 4.2 – Highest Electricity Consumers

Facility	Consumption (kWh)	Cost (2007)
Sunwave	2,195,100	$110,444.66
Water Pollution Control Centre	2,064,079	$97,866.44
Canoe Pump Station Zone 2	858,547	$67,162.23
City Hall	684,504	$34,312.26
SASCU	684,360	$33,522.23

The five facilities summarized in **Table 4.2** account for over 55% of electricity costs.

Looking forward, based on rate increases that BC Hydro is expecting, the City could be spending approximately $650,000 on electricity in 2008 and $710,000 in 2009 if current consumption patterns remain the same. Beyond 2009, it is expected that BC Hydro will introduce further rate increases as it strives to meet the provincial mandate for electrically self-sufficiency and carbon neutral electricity by 2016. Further, the City will likely spend more on electricity as it introduces new infrastructure, particularly the new Water Treatment Plant, which could become one of the larger consumers of electricity in City's operations.

It has been reported that electricity consumption will not be subject to the provincial carbon tax. However, until all electricity is deemed to be carbon neutral, the City will need to include GHG emissions resulting from electricity in their inventory. Assuming a carbon offset cost of approximately $30 per tonne, the City would have to pay approximately $6,000 based on current consumption patterns, though with increases in consumption due to the construction of the Water Treatment Plant, this could increase. However, if the province is successful in achieving its mandate of carbon neutral electricity by 2016, the City will not need to worry about offsetting GHG emissions from electricity.

4.2 Natural Gas Use Summary

The City of Salmon Arm has 17 buildings that use natural gas. While most of the buildings use Terasen Gas for natural gas delivery, two of the Community Facilities – the Sunwave Centre and

the SASCU Recreation Centre, utilize private marketers who offer more flexible pricing options for natural gas. Over the last three years, the amount of money the City has spent on natural gas has decreased significantly from $347,000 in 2005 to approximately $298,000 in 2007. This is due in large part to the decreases in price that followed the transferring of the Sunwave Centre and the SASCU Recreation Centre from Terasen Gas to private marketers. Consumption has not decreased nearly as much, with 2005 consumption being approximately 26,400 GJ and 2007 consumption being approximately 24,900 GJ. In total, GHG emissions from natural gas were 1,270 tonnes, representing approximately 63% of the City's GHG emissions. **Table 4.3** summarizes natural gas data for the past three years.

Table 4.3 – Natural Gas Consumption Summary

	Cost			Consumption (GJ)			GHG Emissions (tonnes CO_2E)		
	2005	**2006**	**2007**	**2005**	**2006**	**2007**	**2005**	**2006**	**2007**
Civic	$15,884	$9,312	$8,548	803.8	899.3	685.0	41.0	45.9	34.9
Lighting	$0	$0	$0	0.0	0.0	0.0	0.0	0.0	0.0
Protective Services	$44,396	$38,458	$42,548	3,046.1	3,029.6	3,346.0	155.4	154.5	170.6
Public Works	$12,099	$10,392	$12,267	793.9	775.4	940.9	40.5	39.5	48.0
Sewer	$42,072	$34,013	$33,320	3,150.6	2,759.4	2,734.3	160.7	140.7	139.4
Water	$2,185	$1,718	$1,619	144.3	108.1	108.1	7.4	5.5	5.5
Community Facilities	$230,463	$168,948	$200,403	18,451.2	15,637.1	17,093.5	941.0	797.5	871.8
Parks	$0	$0	$0	0.0	0.0	0.0	0.0	0.0	0.0
Total	$347,099	$262,840	$298,704	26,390	23,209	24,908	1,346	1,184	1,270

The largest individual user of natural gas, in terms of consumption, is the Sunwave Centre which uses approximately 8,600 GJ of natural gas per year. **Table 4.4** summarizes the Top 5 users of natural gas in the City. The top 5 natural gas users account for approximately 85% of natural gas costs and consumption.

Table 4.4 – Highest Natural Gas Consumers

Facility	Consumption (GJ)	Cost (2007)
Sunwave Centre	8,582.00	$111,237.70
SASCU	6,719.00	$66,106.20
Water Pollution Control Centre	2,734.30	$33,319.79
RCMP	1,980.00	$24,544.44
Curling Rink	1,321.20	$16,613.00

As indicated earlier, Terasen Gas has reduced its commodity rates for natural gas. This will result in substantial savings for the City. This rate reduction could result in savings of $50,000 to $60,000 per year. These cost savings will be negated by the need to pay carbon taxes and for carbon offsets by 2012. By 2012, the City will be required to pay carbon taxes of $1.4898/GJ. This will result in an additional cost of approximately $35,300. Assuming a cost of $30 per tonne for carbon offsetting, the City will also have to pay $36,300 if GHG emissions are not reduced.

4.3 Petroleum Products Use Summary

The City of Salmon Arm uses gasoline and diesel for the majority of their fleet and heavy duty equipment. 35 vehicles of various sizes and 2 pieces of equipment utilize gasoline while 17 vehicles and 11 pieces of equipment utilize diesel. Over the last three years, the City has consumed an average of 96,000 litres of gasoline and 100,000 litres of diesel. In total, fuel costs were $195,000 in 2007 and resulted in almost 550 tonnes of GHG emissions. Public Works, Utilities (Water & Sewer), and Parks accounted for most of the expenditures. **Table 4.5** summarizes gasoline use while **Table 4.6** summarizes diesel consumption.

Table 4.5 – Gasoline Consumption Summary

	Cost			Consumption (litres)			GHG Emissions (tonnes CO_2E)		
	2005	2006	2007	2005	2006	2007	2005	2006	2007
Civic	$2,939	$3,137	$3,592	2,164.0	2,300.0	2,496.0	5.2	5.5	6.0
Lighting	$0	$0	$0	0.0	0.0	0.0	0.0	0.0	0.0
Protective Services	$0	$0	$0	4,748.8	6,639.0	6,086.1	11.4	16.0	14.7
Public Works	$28,801	$29,669	$35,074	30,086.0	32,809.0	36,376.0	72.5	79.1	87.7
Sewer	$9,087	$11,409	$11,936	9,708.0	11,968.0	12,090.0	23.4	28.8	29.1
Water	$25,825	$24,557	$23,374	29,079.0	26,899.0	24,342.0	70.1	64.8	58.7
Community Facilities	$0	$0	$0	0.0	0.0	0.0	0.0	0.0	0.0
Parks	$16,592	$13,439	$17,653	19,000.0	14,107.0	17,181.0	45.8	34.0	41.4
Total	$83,244	$82,210	$91,630	94,786	94,722	98,571	228	228	238

Table 4.6 – Diesel Consumption Summary

	Cost			Consumption (litres)			GHG Emissions (tonnes CO_2E)		
	2005	2006	2007	2005	2006	2007	2005	2006	2007
Civic	$0	$0	$0	0.0	0.0	0.0	0.0	0.0	0.0
Lighting	$0	$0	$0	0.0	0.0	0.0	0.0	0.0	0.0
Protective Services	$0	$0	$0	2,624.0	3,323.1	3,653.4	7.2	9.2	10.1
Public Works	$56,399	$54,784	$81,278	63,943.0	S8,177.0	8S,216.0	176.5	160.6	23S.2
Sewer	$0	$0	$0	0.0	0.0	0.0	0.0	0.0	0.0
Water	$11,800	$18,605	$18,125	13,939.0	39,123.0	19,173.0	38.5	108.0	52.9
Community Facilities	$0	$0	$0	0.0	0.0	0.0	0.0	0.0	0.0
Parks	$1,981	$4,688	$4,412	1,704.0	2,398.0	4,359.0	4.7	6.6	12.0
Total	$70,180	$78,077	$103,815	82,210	103,021	112,401	227	284	310

Looking forward, it is difficult to predict how price changes in petroleum will continue. While there is some speculation that due to the high prices that there will be a reduction in demand which will lead to price decreases, there is also speculation that fuel prices will continue to increase. Currently, due to the City's bulk purchase of fuels, which they obtain quotes for each week, the City pays approximately 7 – 8% less than the retail fuel pump price. For example, while pump prices for the week of July 4th were $1.423/litre, the City was paying $1.334/litre.

Regardless, the carbon tax being introduced by the provincial government will have an impact on fuel costs. By 2012, the City will be spending approximately $16,000 on carbon taxes. In addition, if there are no reductions to fuel use, the City will also pay $16,400 for carbon credits.

4.4 Summary

To provide a holistic assessment of energy consumption patterns in Salmon Arm, total energy consumed, energy costs, and GHG emissions from each source of energy, as well as for each section of municipal operations, have been calculated. This provides broad-based guidance on where to focus future energy investments and will help determine where there is significant ability to make substantive changes.

In order to put into context the amount of energy used in Salmon Arm, and the resultant cost and GHG emissions, a summary of other municipalities has been undertaken. It is important to note that this is for contextual purposes, and each municipality varies in terms of infrastructure

included as well as climatic conditions which impact energy use. **Table 4.7** summarizes this comparison.

Table 4.7 – Municipal Energy Use Comparison

Municipality	Population	Energy Consumed	Cost	GHG Emissions (CO_2E)
Salmon Arm (2007)	17,000	18,600 mWh	$1.0 million	2000 tonnes
Kamloops (2007)	85,000	60 GWh	$6.3 million	7700 tonnes
Merritt (2006)	8,000	7,400 mWh	$0.55 million	710 tonnes
Dawson Creek (2005)	12,000	18,300 mWh	$0.9 million	2300 tonnes
Maple Ridge (2005)	73,000	24,800 mWh	$1.4 million	3300 tonnes

4.4.1 Energy Consumption

For Salmon Arm, the largest consumer of energy from municipal operations, as illustrated in **Figure 4.1**, is for Community Facilities, while Water and Sewer works also contribute significantly to energy consumption. In terms of type of energy consumed, as summarized in **Figure 4.2**, the City utilizes electricity and natural gas the most with petroleum resources being used significantly less. While electricity and petroleum resources consumption have increased, natural gas use has actually decreased over the last three years.

Figure 4.1 – Energy Consumption by Municipal Operation

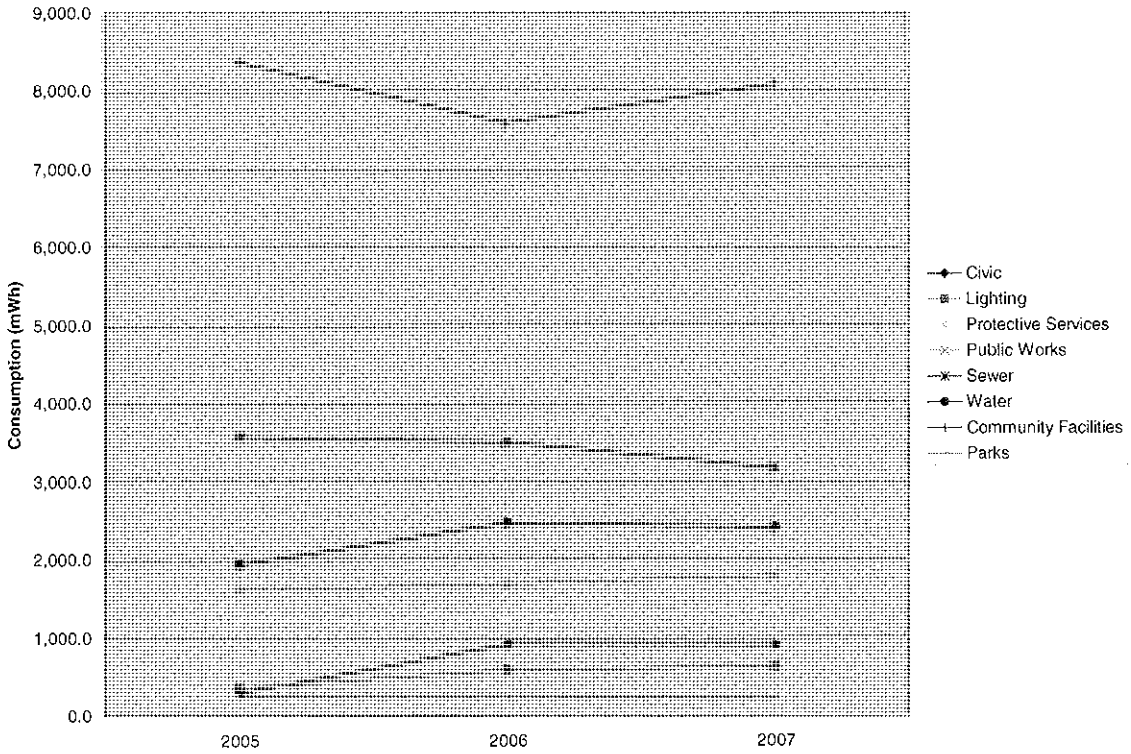
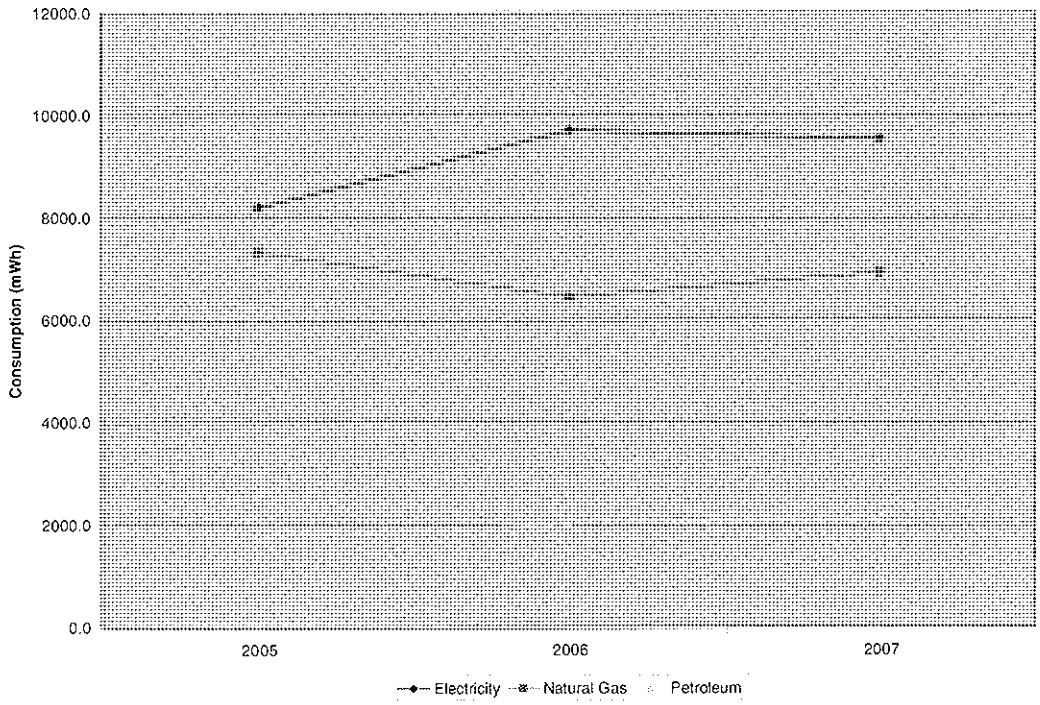


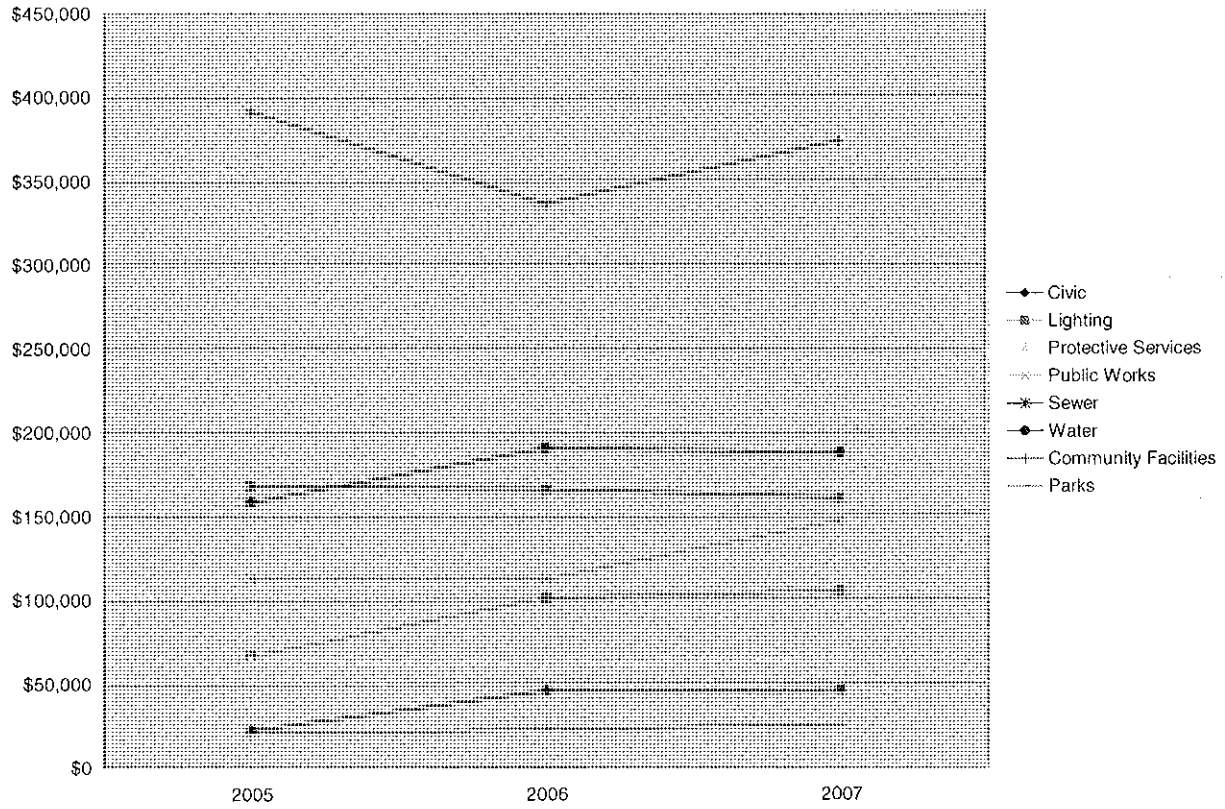
Figure 4.2 – Energy Consumption by Source



4.4.2 Energy Costs

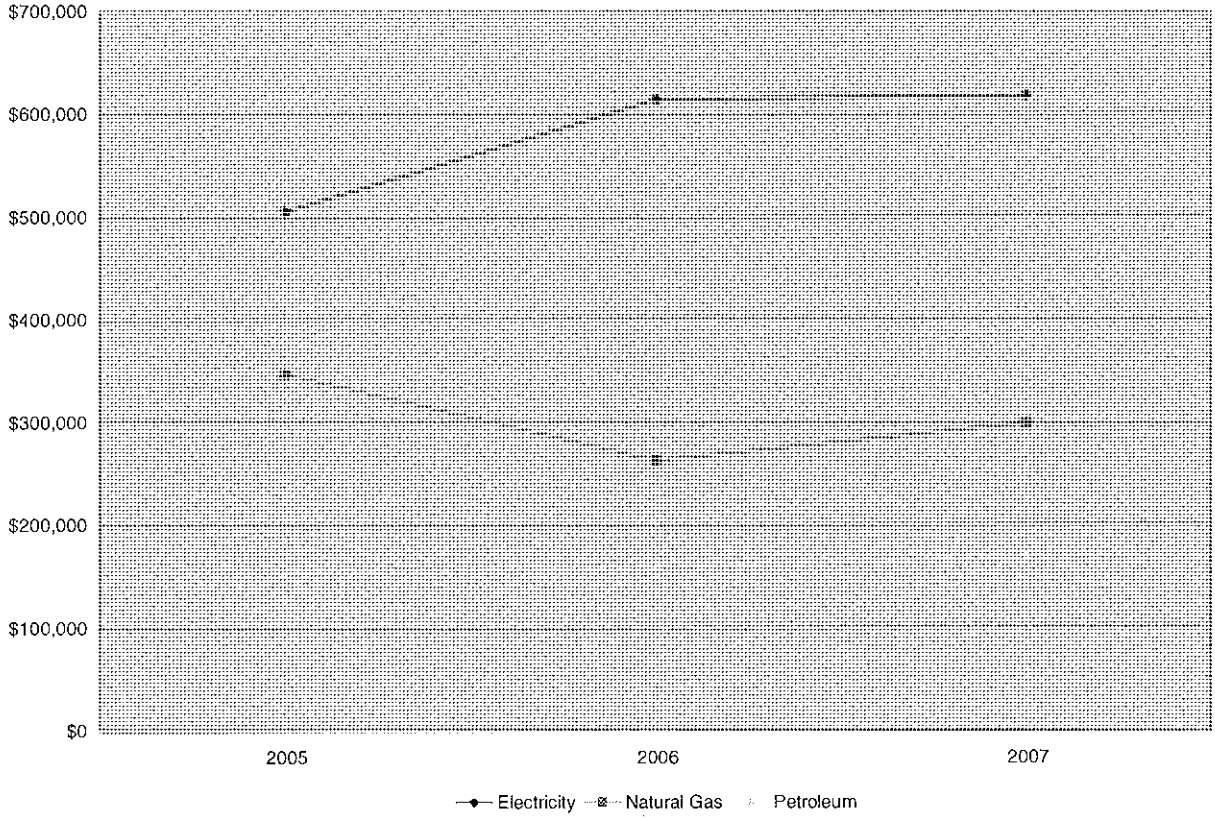
In total, the City of Salmon Arm spent approximately $1.1 million on energy in 2007, which represents an increase of approximately 6% from 2006. As illustrated in **Figure 4.3**, Community Facilities accounts for the highest energy costs followed by Water, Sewer, and Public Works. With the impending construction of the Water Treatment Plant, it can be assumed that energy costs for Water costs will increase significantly.

Figure 4.3 – Energy Costs by Municipal Operation



In terms of the cost of the various sources of energy, the City's spending on electricity accounts for approximately 60% of total energy expenditures, followed by natural gas and petroleum resources. Even with carbon taxation, carbon offsetting, and more significant increases in petroleum and natural gas prices, it is likely that the City will continue to spend more on electricity than the other forms of energy. **Figure 4.4** summarizes energy expenditures by the source of energy.

Figure 4.4 – Energy Costs by Source



4.4.3 Greenhouse Gas Emissions

Over the past three years, the City of Salmon Arm's GHG emissions have been between 1900 and 2000 tonnes CO_2E. Similar to the costs of energy and total energy consumed, Community Facilities operations are the cause of most of the GHG emissions from municipal operations, amounting to almost 50% of total emissions. **Figure 4.5** summarizes GHG emissions by municipal operation.

In reviewing the source of GHG emissions in the City, the use of natural gas accounts for approximately 60% of municipal GHG emissions. **Figure 4.6** summarizes GHG emissions by energy source.

Figure 4.5 – GHG Emissions by Municipal Operation

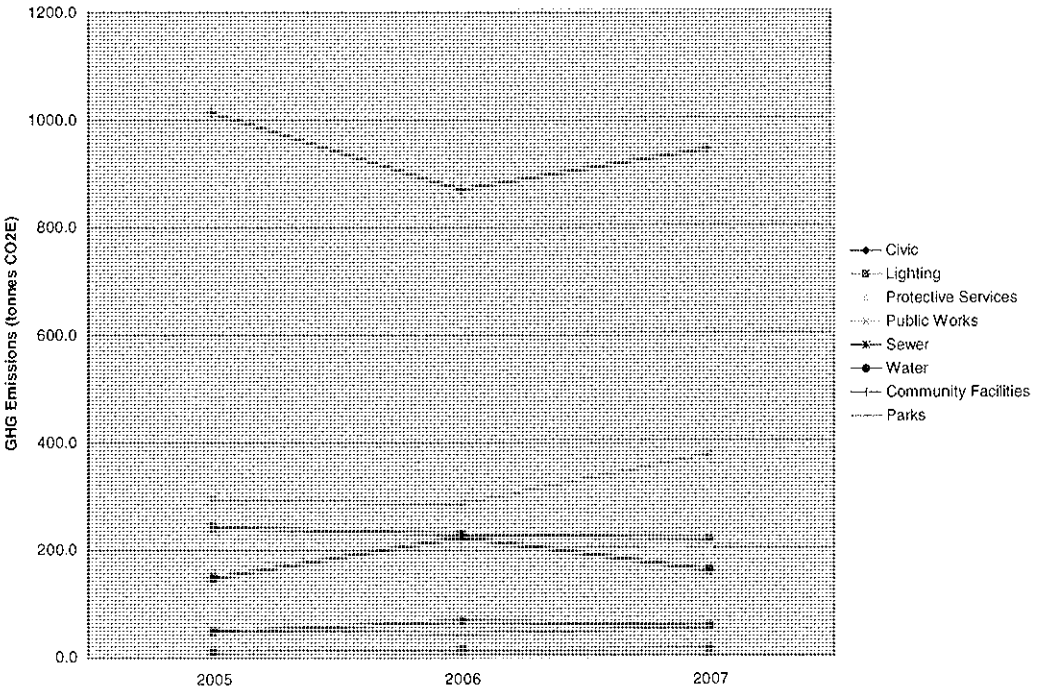
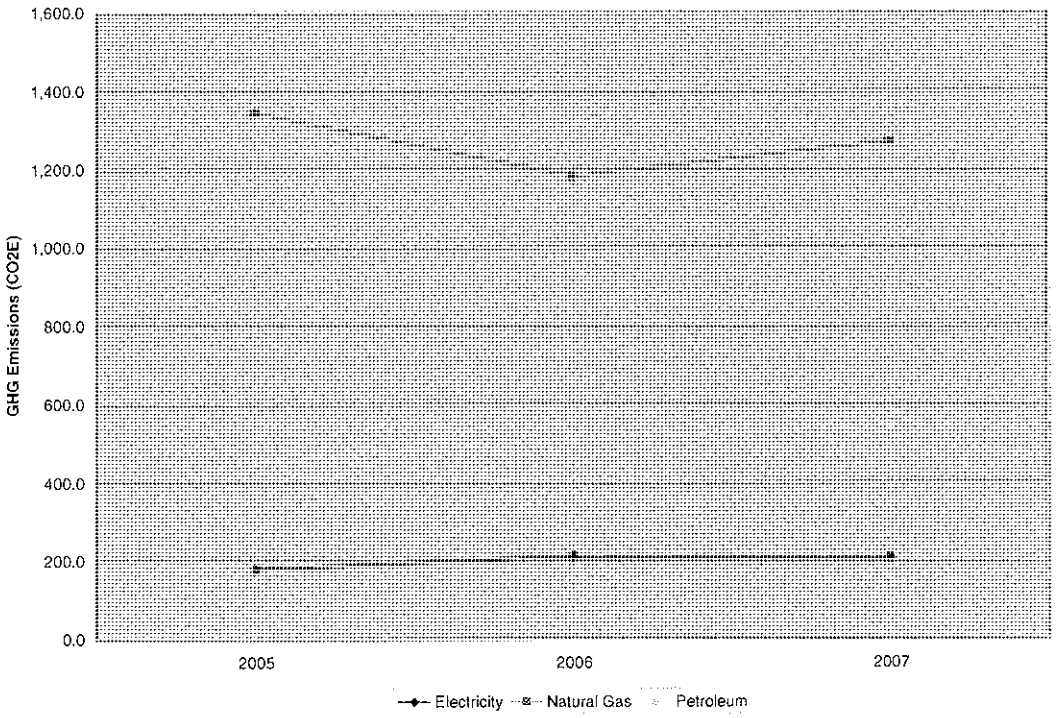


Figure 4.6 – GHG Emissions by Energy Source



4.4.4 Impacts of Carbon Costs

With increasing attention to climate change, and the widespread belief that human-caused carbon emissions and their equivalents are responsible to a large degree, there has been greater attention paid to calculating the cost of these carbon emissions. Two cost measures that will be in place are the BC carbon tax, and the Climate Action Charter carbon offsetting for municipalities.

The BC carbon tax aims to tax energy supplies at a rate of $30 per tonne of CO_2E by 2012, though not including electricity. While municipalities will have to pay this tax on fossil fuels, by virtue of being a signatory to the Climate Action Charter, the City of Salmon Arm will be eligible to receive a rebate on this tax. This rebate will amount to approximately $50,000. The City should determine if this rebate should flow to general revenue or should be designated for a program to help reduce the City's carbon emissions.

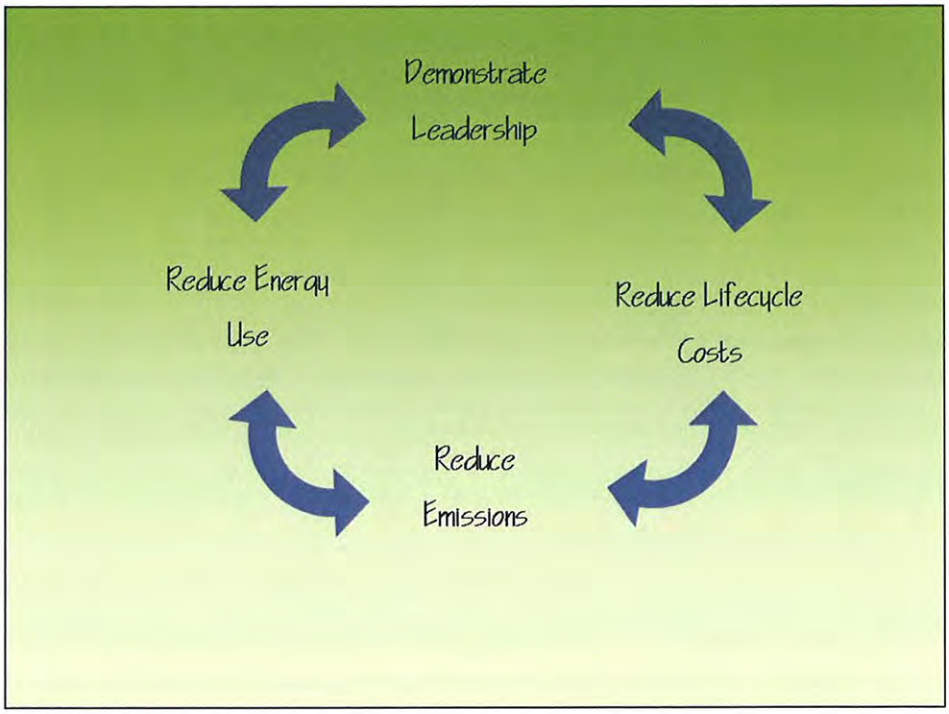
Carbon offsets range in price but general conservative estimates affix the price at approximately $30 per tonne of CO_2E. The City will need to pay approximately $60,000 per year for carbon offsets in the future if no steps are taken to reduce emissions. In order to offset its carbon, the City, in general, has two potential models to work with. The first would involve purchasing offsets from an outside organization, such as the Pacific Carbon Trust, which would in turn invest the proceeds into projects that would reduce emissions. These projects could be located anywhere in the world, though the operators of the Pacific Carbon Trust have indicated that it will designate the funds for projects in BC. Regardless, there is a significant risk that the City will see its money invested in projects that will not benefit the local economy. Another model that the City should consider is to develop its own carbon offsetting initiative and invest its offsets in local projects. For example, the City could purchase solar hot water heaters for a number of homes in Salmon Arm which replace natural gas. While the City would likely have to pay more for offsetting each tonne of carbon, they could be assured that the money would be invested in the local economy. This would help build the local capacity of the community, help the City achieve any goals it sets for greenhouse gas emissions in the OCP, reduce community GHG emissions, and provide an opportunity for more enhanced education about alternatives available.

5.0 MOVING FORWARD

As mentioned, energy costs account for a significant portion of Salmon Arm's overall expenditures. It can be expected that the amount of money spent on energy will continue to increase over the long-term, and likely at a rate higher than prevailing general inflation. As such, energy costs will become a larger portion of the City's budget. Therefore, opportunities to reduce energy use should be explored as a means of maintaining good fiscal leadership, as well as environmental stewardship.

The City of Salmon Arm's actions with its infrastructure and operations offers the City a unique opportunity to demonstrate leadership to the community at large about the relationship between energy consumption, capital, operation and maintenance costs, and greenhouse gas emissions. This would help Salmon Arm begin to achieve some of the objectives relating to energy use in the latest OCP. This relationship is summarized in **Figure 5.1**.

Figure 5.1 – Relationship Between Energy, Costs, and Emissions



Being deliberate and taking decisive action to reduce energy use will set the City apart from others in terms of meeting environmental obligations, and demonstrating to the community that the issue is important, but can be managed. More pragmatically, taking decisive action, over the long-term, will save the City money, and put the City in a much more favourable position to

compete for funding grants from senior government agencies, particularly as the provincial government has indicated that actions municipalities take on climate change will influence how grant money is distributed.

In this section, a number of broad initiatives are outlined which relate to buildings, infrastructure, and fleet that should be considered to help the City begin to take action on energy consumption. Before that, though, a series of broad, organizational initiatives that relate to energy management as a whole are described.

5.1 Organizational Initiatives

There are a number of broad initiatives that the City should consider to promote more sustainable energy use. These include the following:

Identify goals and targets for energy and GHG emissions reductions – while the City's commitment to becoming carbon neutral by 2012 represents the primary goal for GHG reductions, the City should set more detailed goals and targets as they relate to energy use, budget spent on energy, and absolute reductions in GHG emissions. This will help the City prioritize whether they want to focus solely on energy use reduction, GHG reductions, or a balance of both. These goals and targets provide the organization with a clear direction on how ambitious it needs to be in reducing energy use and thus should inform all subsequent programs and policies.

Develop Council policies supporting energy and GHG actions – a Council policy should be developed that mandates energy efficiency in municipal operations and provides guidance to staff on how energy and GHG emissions should be considered in the municipal realm. This will enshrine the goals and targets mentioned above and provide the support for staff initiatives and investments in programs, capital works, and equipment and contractor purchases that result in more sustainable use of energy and fewer GHG emissions.

Complementary policies should be developed that empower staff to directly link energy considerations to purchases of new capital and equipment. One opportunity to consider is to develop a framework for analyzing life-cycle costs of new purchases, including for the design and engineering of new infrastructure, which would include energy and GHG emissions as a component of lifetime operations and maintenance. These supporting policies are required to ensure that energy management is taken seriously in the municipal organization and will demonstrate to suppliers the importance of the issue.

Initiate an Internal Energy Management Committee – building on the work of the Technical Steering Committee for this energy plan, the City should develop an internal energy management committee that includes representatives from the various City departments including both management and on-the-ground workers. This will help the various departments to work collaboratively on developing and implementing energy-related initiatives and to organize investment of resources into the various initiatives.

Develop an ongoing monitoring framework – the City should develop an ongoing monitoring framework for energy use and greenhouse gas emissions. This can be a relatively simple exercise of developing and updating spreadsheets as information on the various energy accounts are received, or could be more substantive using custom designed programs that could be used for tracking and disseminating information. The monitoring framework will allow the City to determine how their existing energy management programs are working and determine areas for future investment. It will also help the City achieve its commitments under the Climate Action Charter.

Information collected from the ongoing monitoring should be tracked over time and distributed to employees so that they can better understand how energy is being used and be able to discern what measures are resulting in substantial changes. Information relating to buildings should be posted within buildings so that the public can see the impact of each individual building on energy consumption and GHG emissions.

Develop a carbon offsetting strategy – the City should develop a carbon offsetting strategy in order to be clear on where funds dedicated to offset purchases will be invested. This will help the City adequately prepare for when it needs to be carbon neutral in 2012.

Provide employee education opportunities – critical to the success of an energy management program is to have good employee engagement from the outset. Employee engagement requires a combination of empowerment, education, and training to ensure employees fully understand energy issues, and how they can make a difference within the organization. The City of Richmond, for instance, has trained much of its staff on energy management issues. Engaging employees in energy management can be as simple as providing educational materials in well thought out locations (i.e. stickers above light switches reminding people to turn off lights) to facilitating more active participation in energy conservation programs (i.e. decisions around heating and cooling loads). Educating employees about the impact their behaviour has on energy use is critical. Programs like BC Hydro PowerSmart program for electricity use, Natural Resources Canada's AutoSmart program for driving, and Green Buildings BC are examples of programs that the City may wish to participate in for the expressed purpose of educating employees. In fact, the City is already a participant in the BC Hydro PowerSmart

program and receives information on conservation techniques from them. Based on the survey of employees, it appears that there is a desire for there to be more educational opportunities surrounding energy programs.

Ensure routine maintenance of all infrastructure components – routine maintenance is a key to energy efficiency and will ensure that all equipment is optimized for peak performance, while using less energy. This includes cleaning of ducts, checking of motors, and reviewing controls to ensure they are set properly. The City has regular and preventative maintenance programs for its major infrastructure components.

Embrace accreditation of buildings and fleet – the City should look at embracing accreditation options for their buildings and fleet as a mandate of operation. While some programs have high up-front costs, often times, over the long-term, these costs can be captured in increased energy efficiency. Examples include the evolving LEED Complete for existing buildings and E3 Fleets, both of which are programs that could provide frameworks for the City achieving certain energy efficiency objectives. There is also an emerging program for measuring wastewater treatment plant efficiencies through an EnergyStar program. The City should explore the programs that are available and participate in those that match the City's values and objectives. Participating in these programs will allow the City to better benchmark its performance relative to other communities. The City has started to work towards accreditation of its fleet through the E3 Fleets initiative.

5.2 Buildings

In 2007, buildings accounted for over $500,000 in costs for energy and resulted in GHG emissions of over 1200 tonnes. The Sunwave Centre, and SASCU accounted for greater than 60% of the total energy costs and thus likely represent the areas where the most emphasis should be provided. In terms of next steps, the following should be considered:

Perform building audits – the City should look at having more intensive building audits performed for high energy use buildings. These audits would provide greater detail on where targeted investments could be made to reduce energy use. BC Hydro and Terasen Gas can provide resources for more intensive energy studies that will look at all components of buildings to determine where the energy loads are emanating. For larger buildings with higher electricity consumption, this will help identify when peak loads are occurring and why and will help with reducing these peak loads as they are subject to a surcharge from BC Hydro. BC Hydro offers a number of programs that could help with assessing energy use in individual buildings. These include assessments of compressors, blowers, and fans, which may be applicable to the Sunwave

Centre and the WPCC, as well as general building energy assessments. These can be discussed with the City's BC Hydro account manager.

The Sunwave Centre is the largest user of energy. Typical energy improvements for arenas include:

- Low emissivity ceiling.
- Maintaining proper ice thickness.
- Waste heat recovery systems which heat stands and water.
- Using light colours on exterior doors to reduce heat gain.
- Use of capacitors to improve power factor.
- High efficiency energy refrigeration equipment.
- Soft start systems for all large motors which reduce power consumption.

Terasen Gas offers free energy assessments on buildings that spend more than $20,000 on natural gas annually. Buildings that could qualify include the Sunwave Centre, SASCU, and the RCMP building. Green Buildings BC, operated by the Community Energy Association, can also help in this regard, both for new buildings and retrofit situations.

Based on the energy expenditures for each of the buildings, building audits that integrate natural gas and electricity use would be valuable at the Sunwave Centre, SASCU Recreation Centre, RCMP building, Public Works building, City Hall, and the Curling Rink.

Investigate hot water heating – hot water heating can result in significant energy usage but also significant opportunity for energy savings. For facilities, it is wise to examine optimizing the performance of the existing hot water tank. Turning down the temperature of the hot water heating can result in small, but significant savings. According to the American Council for an Energy Efficient Economy, for each 10ºF reduction in water temperature, savings of 3%–5% of energy costs can be achieved. However, many health advisers suggest that hot water storage be maintained at 60ºC or higher to reduce the chance of bacteria growth. Other initiatives such as insulating older tanks and insulating hot water pipes can also lower energy consumption for a relatively low cost.

If a new hot water system is to be considered, there are other options for hot water that can be examined. Tankless water heaters and solar hot water heating systems can offer significant electricity and natural gas savings depending on the demand for hot water. Tankless water heaters work by heating a coil that the water runs through and is most effective in smaller installations, where hot water demand is not significant, for example a kitchen. Solar hot water heaters rely on the sun's energy to provide hot water heating by having roof mounted tanks. This type of hot water heating is even effective in the winter time though a supplementary supply may be required. Geothermal heating and cooling systems can also be used to heat water but

are only efficient if part of the overall heating and cooling system, similar to the system used for City Hall.

An important consideration before installing a new system is to ensure that it does not have a greater capacity than is required both now and in the future. Hot water tanks should be sized appropriately as there is significant waste of energy heating water that does is not used often.

Improve building envelopes – ensuring that buildings are properly insulated will reduce heating and cooling needs. This includes treatments for doors and windows as well as walls and the roof. Performed as part of a building audit, a review of the building envelope will identify where there are significant leaks that will cause cool air to enter in the winter or cool air to be lost in summer and suggest mechanisms for reducing these losses. Improvements can include better insulation in walls and for the roof and glazing for windows, provision of insulating shades, or replacement with low-emissivity windows. A recent report indicated that utilizing heat reflectivity on roofs could lower energy costs in the summer by 20%. A building audit should be performed prior to investing in such improvements.

Review ventilation requirements - substantial amounts of energy can be saved when reviewing ventilation requirements. Ventilation, in many buildings, is one of the greatest users of electricity and there are many opportunities to improve ventilation performance. A simple method is to install room controls for ventilation to ensure that the ventilation system is only used when the room is in use. Carbon dioxide sensors and other occupancy sensors can be used to monitor the number of people in a room and adjust ventilation to facilitate good indoor air quality. CO_2 sensors are particularly useful in larger rooms that have infrequent use such as a theatre, dressing room, boardrooms and similar. Further optimizing the ventilation system to better match actual requirements can result in significant electricity savings. A further simple step is to ensure air filters are cleaned routinely as dirty air filters adversely impact efficiency.

Review air conditioning – it is likely that many of the buildings rely on some form of air conditioning for cooling needs. Regular maintenance of filters and coils on the air conditioning unit as well as cleaning ducts periodically will help ensure that the existing system will operate efficiently. Ensuring that ducts are airtight is also important to central air conditioning performance. The City is currently reviewing many of its existing systems, including its geothermal system, with contractors.

If a new system is to be examined, either a heat pump or complete geothermal heating and cooling system should be considered. Either system works more efficiently than a standard air conditioner and can tie into the existing duct work.

Turn it down/Turn it off campaign – one area where there can be more effective use of energy is to implement turn-it-down/turn-it-off campaigns. This is particularly useful for lighting, and to a lesser extent, computers and other office equipment. Employees should be educated to turn lights, computers, and other pieces of equipment off while not in use. As well, there should be a review of whether certain pieces of equipment are necessary. Examining whether air conditioning and heating could be turned down would also help to reduce energy usage. With both heating and cooling, ensuring that controls are set to be mindful of when people are using buildings is an important consideration. For example, heating and air conditioning should be turned down during the evenings and weekends when buildings are not in use. Adopting a philosophy of heating and cooling people, and not space, is important. Hallways, stairwells, and other corridors do not have the same heating and cooling requirements as offices and meeting areas. The City already does many of these things. Electronic thermostats are located in many of the City buildings which provides better control of heating and cooling. City computers/monitors are turned off at night and employees are encouraged to turn off lights when areas are not in use.

A number of employees mentioned that air conditioning could be utilized less in the summer and that heating could be turned down in the winter, particularly in off-peak times. This should be investigated.

A number of employees mentioned that the garage doors at the Public Works buildings are left open for periods of time, even during the winter. This can result in a significant waste of energy and needs to be addressed to reduce heat loss.

The City should also work to reduce any "phantom loads", which is the electricity used to keep an appliance or other piece of equipment in stand-by mode or to power internal and/or external clocks, even when the appliance is not in actual use. To demonstrate the magnitude of phantom loads, the average microwave uses more energy, over the course of a year, to operate the digital clock than to operate the microwave itself. While these loads are not overly significant at an individual level, cumulatively they can have a significant impact on energy usage. The largest likely impact for the City would be the use of computers which often times are left on at night. Turning the computers off at night and/or having an auto-sleep program for the computer will help reduce electricity use.

Replace office equipment – having an office equipment replacement initiative that encourages energy efficiency when existing equipment becomes obsolete will help the City evolve to a more energy efficient workplace. Taking advantage of obsolescence cycles for equipment will allow the City to make changes incrementally rather than investing all at once. If the City is to replace the equipment anyway, the small premium that may be required to obtain the more efficient product will be easier to manage. However, depending on the type of equipment, and the age of the

existing equipment, it may in fact be more cost effective from energy, operations, and maintenance perspectives to replace it immediately rather than waiting for the end of useful life. The City should remain apprised of these situations.

When replacing equipment, the emphasis should be on purchasing products that result in significant energy efficiency. A two-step thought process related to purchases should be considered. First, the City should look at the size of equipment being used – i.e. is a 20 cu. ft fridge necessary when a 12 cu. ft fridge would suffice. Right-sizing equipment will ensure that the City is not wasting energy on unused capacity. Second, the City should look for the most energy efficient product available at the desired size.

This replacement scheme should be applied to computers, televisions, appliances (i.e. in staffrooms), etc.

Review interior lighting needs - many office buildings were developed using standards for lighting that have long been outdated due to the ambient light created by items such as computers. An illumination standard of 100 foot candles is typically used for offices when 30 foot candles often suffices. Exploiting daylighting opportunities will also reduce lighting needs. Reviewing these lighting needs will likely result in less lighting being required and therefore electricity savings.

As a first step, interior lights that are using incandescent lightbulbs should be replaced. This includes replacing exit signs with LED lighting which uses 90% less electricity and last 10 – 25 years as well as any lamps and other lighting fixtures that could be replaced with compact fluorescent bulbs (CFLs). CFLs will save between 50 and 75% in annual lighting costs over incandescent bulbs. Even though these bulbs are initially more expensive, they give off less heat and last up to ten times longer than incandescent ones.

Standard fluorescent tube lighting has also evolved, particularly with respect to the ballast, to reduce energy consumption. Switching ballasts can reduce lighting energy by as much as 35%. BC Hydro has a series of incentives relating to lighting upgrades that the City should take advantage of. A building audit through BC Hydro will take note of such issues.

An additional step would be to install occupancy sensors in rooms that are not used often but have higher periodic lighting needs, such as a boardroom or staff room.

Install appropriate controls for heating equipment – by having electronic thermostats, and proper controls for boilers where these are not in place, the City will be more able to better

manage the natural gas usage. The City should examine its buildings to determine what kind of controls are in place and whether there are opportunities to upgrade these controls.

Consider alternate sources of heating – there are two alternate sources of heating and cooling that have become more popular in recent years. These include geothermal and solar thermal heating. Geothermal is an efficient and generally clean way to heat and cool buildings. Geothermal energy involves drilling loops of pipe into the ground to use the earth's constant temperature to provide heating and cooling. In the winter, the heat from the earth is carried into buildings through the loop system while in the summer heat from the building is extracted and sent into the ground, while cool air is brought in. The systems are also typically used to heat water. Geothermal systems generally come in two systems – open loop and closed loop. In an open loop system, two unconnected pipes are drilled into the ground and generally into an aquifer. Water from the aquifer is pumped up and through a heat exchanger and is then condensed and distributed throughout a building. Once the water cycles through the system it is discharged back into the aquifer. In a closed loop system, a solution such as glycol is used to transfer heat from the ground and into the heat exchanger where it is distributed and sent back into the ground to be pumped up again.

While geothermal systems typically have high initial capital costs, the payback period for the investment can be relatively quick. It is important to note, however, that a geothermal system is more difficult to implement in an existing building and can become cost prohibitive depending on the accessibility to an area for the loops.

Solar thermal systems, while mainly focusing on heating water, can be expanded for space heating as well. Options include typical solar panels combined with a heating distribution systems and solar walls, which collect heat and distribute this through the ventilation systems. Solar walls would appear to be advantageous for applications such as the SASCU Recreation Centre.

Consider alternate electricity supply – there are opportunities for alternate electrical supply. The use of solar photovoltaics and micro-wind turbines at various locations throughout the City could supplement electricity use on large buildings and potentially provide all electricity for smaller buildings and would take advantage of the City's plentiful supply of sunshine. While still cost prohibitive in many cases, they are often times a highly visible demonstration of energy stewardship.

Consider using green roofs on existing and future buildings– green roofs can have substantial benefits to reducing heating and cooling loads, along with other environmental benefits. Green roofs can be installed on existing roofs though structural studies would be

required to determine if the additional weight can be accommodated. The City should consider green roofs for some of its larger facilities, both as an energy management tool as well as a way to mitigate stormwater run-off.

5.3 Infrastructure

Providing energy for infrastructure, including outdoor lighting, water, and sewer services costs over $400,000 in 2007 and resulted in 257 tonnes of CO_2E emissions. Options to potentially reduce this include:

Replace outdoor street lighting – LED lighting and low-pressure sodium provides significant energy consumption benefits. An additional benefit is that lights that are LED generally last significantly longer, such that lower operations and maintenance costs more than compensate for any premium paid. Since the benefits of LED are immediate and long-lasting, the City should consider switching existing energy inefficient bulbs to LED. The City has started a program to replace bulbs in its ornamental street lights with LED fixtures. Further, the City should consider installing motion sensors on ornamental lights to save money on electricity costs. This also has the added benefit of reducing light pollution in the community.

Enhance water conservation efforts - since the amount of energy used for water distribution is related somewhat to the amount of water demand, there could be a significant reduction in the amount of energy for the water system if there is a reduction in the water demand. Promoting corporate and civic water conservation initiatives, such as what is done with the City's WaterWise program, will result in significant energy savings. These energy savings could be further increased if the City chooses to implement universal water metering. It has been estimated that the installation of water meters would result in a reduction of water use of 15 – 30%. In the meantime, parks, and other City-spaces should be xeriscaped, where feasible and rainwater collection and distribution considered to offset the pumping of water. Moisture sensors should also be installed to ensure that parks are only watered when needed. Naturalized landscaping has the added benefit of reducing other maintenance requirements such as mowing grass, which will reduce equipment fuel requirements. Further, reducing energy use could build a further argument for having residential and commercial water meters.

Perform water system audit – the City should consider undertaking a water system energy audit to determine more precisely where energy is being used, which would complement its overall water system audit. This would potentially include monitoring of individual water pumps and other pieces of equipment to determine how efficient existing equipment is.

Optimize pumps – it is likely that at least some of the City's water pumps are not optimized for peak performance from an energy perspective. There are many ways to achieve better performance out of the City's water pumps, which accounts for a significant amount of electricity usage. Good maintenance of pump motors is critical to reducing electricity usage. A relatively simple method of improving performance would be to optimize impellers, which would require some minor machining to ensure that the pumping power meets the needs of the system. This would need to balance the energy savings with the potential increase in maintenance. Another way to improve performance would be to install variable frequency drives on pump motors which would allow the pump to better match pumping needs.

Replace old pumps – Salmon Arm has several older pumps that are likely oversized and energy inefficient. These could be replaced with pumps that use less horsepower and have variable frequency drives that optimize pumping power.

5.4 Fleet and Equipment

Fuelling fleet and equipment components have significant costs and greenhouse gas emissions attached to them. Liquid fuels have the highest price volatility attached to them but generally are trending upwards. Thus, while petroleum fuels represent the smallest energy expenditure for the City, this may not remain true for very long. The City has already started to address their fleet issues by joining the E3 Fleets program. Building on this, the City should consider the following with their vehicles and equipment to reduce use of petroleum resources:

Adopt an anti-idling policy – the City should adopt an anti-idling policy for all City fleet vehicles, in addition to the anti-idling program it is operating for the Public Works department. While previous beliefs were that diesel vehicles needed to be idled for more than 5 minutes in the winter, and that start-up of gasoline vehicles was damaging to component parts and wasted more fuel, the general consensus from research suggests that heavy diesel engines do not need to idle for more than 3 minutes and that turning on and off a gasoline or diesel engine is equivalent to running the engine for 10 seconds and does not damage the engine. Generally, an hour of idling for a heavy duty diesel truck consumes approximately 4 litres of fuel, which is equivalent to approximately 10 kg of GHG emissions. Many fleets have been able to reduce fuel consumption by 10 – 15% by reducing unnecessary idling. By adopting and acting upon an anti-idling policy for municipal vehicles, the City will be better placed to adopt a community-wide bylaw that restricts idling vehicles for the public.

Develop a tire pressure monitoring program – a Tire Pressure Program would direct vehicle users and maintenance staff to maintain vehicle tire pressures in their optimum pressure range. This is a requirement of the E3 Fleets initiative. In Olympia, Washington, the Department of

Public Works was able to achieve fuel savings in the range of 20% by having tire pressure checked regularly (i.e. weekly). Olympia is now beginning to install computerized tire pressure gauges in many of their vehicles to provide more real-time information on tire pressure. According to Natural Resources Canada, each tire that is under–inflated by 2 psi (14 kPa) causes a 1% increase in fuel consumption.

Develop a monitoring program for the fleet - similar to its requirements as part of the E3 Fleets program, the City should collect or interpolate data relating to:

- Vehicles and equipment classified by description;
- Engine size;
- Gross vehicle weight rating;
- Miles per gallon;
- Type of fuel;
- Annual kilometers driven;
- Average cost per litre of fuel;
- Total fuel consumption per vehicle;
- Average fuel cost per kilometer driven;
- Frequency of tune-ups; and
- Carbon dioxide calculation based on fuel use.

Vehicle logs are a critical component of this monitoring program. Every time a vehicle is filled with fuel, there should be a log entered that indicates the amount of fuel and the cost per litre.

By developing this monitoring program in conjunction with obligations for the E3 Fleet Program, the City will be able to determine what vehicles are operating inefficiently and seek steps to rectify the situation. This data should be updated on a yearly basis in order to calculate impacts from vehicle usage, both to determine cost of vehicle operation and to determine the level of GHG emissions.

Shift from 2 stroke to 4 stroke engines and/or electrical equipment – the City likely uses some two-stroke engines in some of its small equipment. Two-stroke engines are generally less fuel efficient and emit greater amounts of harmful non-greenhouse gas emissions than four-stroke engines. For example, according to the Clean Air Foundation, a standard gas lawnmower emits the same amount of common air pollutants in one hour as driving a car for 500 km.

Use alternative fuelled vehicles – the City should consider the use of alternate fuels carefully. While biofuels have increased in popularity and do have a substantial impact on tailpipe emissions, there is still debate on whether fuels, such as biodiesel, actually result in a net reduction of carbon, with studies having a great deal of variability in the results. The production of biodiesel, while growing, will be limited until alternate sources are made viable as there is simply not the arable land mass to support wide-scale biodiesel production and food crops at the same time. Therefore, based on the science that is available, the City should not pursue a vehicle policy that includes biodiesel.

Despite the drawbacks to biodiesel, there are other fuels and power sources available that could result in fewer emissions for nearly the equivalent cost. Natural gas powered vehicles are slowly growing in popularity and while they are not completely clean, they do result in fewer emissions than traditional petroleum resources. If natural gas is available in Salmon Arm, the City may wish to consider retrofitting some of its existing diesel fleet to operate on natural gas. Another more innovative option may be to use biogas generated from a source such as methane captured from the WPCC to fuel vehicles.

Hybrid vehicles are also becoming more popular, and, depending on how they are driven, can result in substantial fuel savings. Low-emission and zero-emission vehicles have been recently approved for use on lower speed roads throughout BC and, according to ZapCar, a manufacturer of electric vehicles, are comparably priced to conventional automobiles. These vehicles can safely operate at approximately 60 km/h and could be used in urban environments to reduce GHG emissions.

Further, hybrid power is being used with more frequency in heavy duty trucks. As the City replaces its existing fleet of trucks and heavy equipment, it should consider using hybrid technology, even though this will require a premium be paid.

Right-size vehicles and optimize their use – the City should examine its vehicle fleet and ensure that vehicles are being used appropriately. This assessment would look at whether vehicles are being used for the right tasks – for example not using a large pickup truck to drive to meetings, and whether vehicles are the appropriately sized engines – not having engines that are larger than necessary. Further, the City should look at daily tasks and determine the most efficient means, from a travel perspective, to accomplish these tasks. Therefore, staff would be encouraged to

Many of the employees surveyed noted that many trips could be made with smaller vehicles and that trips could be clustered to be more fuel efficient. This should be explored further.

combine trips wherever practical to achieve efficiencies in operation. The City's Public Works foremen have already started to right-size their vehicles by moving to a smaller vehicle for most trips.

Implement a vehicle purchasing policy - the City should develop guiding principles for purchasing new vehicles that include some specifications regarding fuel use, emissions standards and appropriately sizing vehicles for intended use.

Use dual batteries in vehicles – many trucks need to be left on to continue powering on-board electrical equipment such as lights and radios, even when they are not moving. By adding an auxiliary power system, the City could reduce the amount that vehicles need to idle. Thus, consideration should be given to retrofitting vehicles with auxiliary power systems to reduce fuel consumption. It should be noted that this has already been done with some vehicles in the fleet.

5.5 Integrated Resource Management

Integrated Resource Management (IRM) explores ways of using what is traditionally considered waste to develop energy or other resources. This is desirable as finding ways to use waste in innovative and proactive manners can save costs and environmental impacts. It is also becoming an important component of infrastructure funding grants, as evidenced in the BC Building Canada Fund application. A common example of IRM is the use of biosolids from wastewater treatment plants as part of compost, something that the City is already doing. There are many potential applications of integrated resource management to develop clean energy in Salmon Arm. These include:

Using waste heat from the arena – arena's generate significant amounts of waste heat. Often times this heat is wasted rather than being used for another purpose. Waste heat from the Sunwave Centre could be used in a number of ways. This includes internal uses such as heating water and/or public stands, or used externally to help heat the SASCU pool. The City should explore potential uses for this waste heat.

Explore sewage waste heat recovery – the City should considering exploring its sewer system to identify opportunities for generating energy. Two potential examples are waste heat from sewage pipes, whereby a heat exchanger is installed around pipes and distributed to buildings, and methane capture and conversion to energy at the WPCC. These types of systems are being used worldwide. There are also opportunities to develop a digester for biosolids and use that to generate methane which can be used for energy generation.

Explore replacing Pressure Relief Valves (PRVs) with microturbines – several municipalities throughout North America have begun to generate electricity from microturbines in their water distribution systems, typically as a replacement for PRVs. The feasibility of such a system is dependent on the size of the main and the force of the water. Currently the City has 2 PRV stations and thus there may be only limited opportunity for this.

Review opportunities for district heating and cooling – there may be opportunities for district heating and cooling in the community that the City could take advantage of and promote. These types of systems rely on certain densities to be efficient and to offer timely payback periods. One opportunity in Salmon Arm may be to take advantage of bioenergy through forest product waste. There may be potential to implement a district heating system that would connect the Sunwave Centre, Curling Rink, and SASCU Recreation Centre, with other surrounding land uses, as the energy needs for these facilities would presumably be enough to warrant the initial capital costs.

Determine feasibility of methane capture – there may be a potential to capture methane from anaerobic processes at the WPCC and use this for energy generation. Capturing the methane and using it for energy would greatly decrease the amount of GHG emissions and could offset energy used at the plant and elsewhere. Another potential opportunity would be to develop a composting digester for biosolids and other natural materials and capture and use the methane from that process.

6.0 IMPLEMENTATION

In Section 5, a number of ideas were presented that could be considered ambitious and may require significant resources – human, financial, and capital – to be realized. Most of the initiatives focus on four key areas: organizational support, behavioural change, investments in energy conservation, and investment in new energy supply. To get started, some of the broad organizational initiatives outlined in Section 5.1 need to be addressed. This will provide the City with the "top-down" leadership and the "bottom-up" buy-in for the more specific initiatives. This organizational support also provides the parameters for how ambitious the City will be and subsequently what level of investment can be expected. Once the organizational initiatives steps are in place, the City can choose to either start small and build momentum to more significant investments, or start large and attempt high impact/high cost initiatives first. Starting small would involve a number of the initiatives that focus on behavioural change, such as implementing a Turn-it-off/Turn-it-down campaign within buildings. These initiatives are low cost and have less community visibility. However, they can be quite effective in reducing energy use and building a culture of energy awareness in the organization. Starting large would involve significant investments in more visible capital upgrades, such as energy conservation improvements and alternate energy supply. The advantage of such an investment is that it generally has a high impact early on in the process and can be quite visible in the community, thus demonstrating leadership in this regard. The disadvantage is that such initiatives do not necessarily raise the energy awareness of employees in the organization. The preferred approach, in the case of Salmon Arm, would be to have a mixture of both small scale and large scale initiatives over the course of time. Thus, the City can use low cost methods to build the culture of energy awareness within the organization, while demonstrating leadership to the community through larger investments in capital upgrades, with the two levels of investment combining to make a substantial impact on energy use and GHG emissions.

Table 6.1 on the following page summarizes each of the initiatives mentioned in Section 5 based on the type of program (i.e. organizational, behavioural, energy conservation, alternate supply), their order of magnitude cost, potential impact to GHG emissions and energy use, and type of outside support that could be provided. Order of magnitude costs could be characterized in the following way:

- Low – less than $5,000
- Moderate - $5,000 - $25,000
- High - $25,000 and greater

Impacts to energy use and GHG emissions could be characterized as:

- Low – less than 10% reduction
- Moderate – 10 – 20% reduction
- High – 20% and greater reduction

It is important to note that neither the costs nor the impacts to energy use and GHG emissions have been quantified. Therefore it must be recognized that these categories are provided for guidance only and that a more intensive study would be required to more accurately quantify these measures.

In addition, a level of priority has been attached to each of the initiatives. In general, the timing of implementing these initiatives could be considered:

- High – in the next year
- Moderate – next 1 – 3 years
- Low – beyond 3 years

Once again, it is important to note that these timelines are provided for guidance only. If there is an opportunity to move more quickly on lower priority initiatives, the City should consider this.

Table 6.1: Implementation Summary

Initiative	Type	Department Responsibility	Level of Investment	Potential External Support (Funding or Expertise)	Level of Impact to Energy Use/Cost	Level of Impact to GHG Emissions	Priority	Examples
Organizational								
Identify goals and targets	Organizational	Development Services	Low	N/A	N/A	N/A	High	
Develop Council policies	Organizational	Development Services	Low	N/A	N/A	N/A	High	District of Saanich
Initiate an internal energy management committee	Organizational	Development Services	Low	N/A	N/A	N/A	Moderate	
Develop an ongoing monitoring framework	Organizational	Development Services	Low	N/A	N/A	N/A	High	District of Saanich
Develop a carbon offsetting strategy	Organizational	Development Services	Low	N/A	High	N/A	High	District of Saanich
Provide employee education opportunities	Organizational	Development Services	Low - Moderate	N/A	N/A	N/A	Moderate	City of Richmond
Ensure routine maintenance of all infrastructure components	Energy Conservation	Engineering and Public Works	Low	N/A	N/A	N/A	High	
Embrace accreditation of fleet and buildings	Organizational	Engineering and Public Works	Low	N/A	N/A	N/A	Low	City of Victoria
Buildings								
Perform Building Audits	Organizational	Engineering and Public Works	Moderate	Infrastructure Planning Grants BC Hydro Terasen Gas	N/A	N/A	High	City of Burnaby
Optimize hot water heating – turn down heaters and insulate pipes	Behavioural	Engineering and Public Works	Low	N/A	Moderate	Moderate	High	
Switch to solar hot water heaters on large buildings (i.e. pool, arena, City Hall)	Alternate technology	Engineering and Public Works	High	Gas Tax Programs BC Building Canada Fund Green Municipal Fund	High	Moderate – High	Moderate	Hyde Creek Community Centre – Coquitlam Vancouver International Airport
Switch to tankless water heaters for smaller hot water users	Alternate technology	Engineering and Public Works	Moderate	N/A	Moderate – High	Moderate	Moderate	
Improve building envelopes	Energy conservation	Engineering and Public Works	Moderate – High	BC Hydro Terasen Gas	Moderate – High	Moderate – High	Moderate	
Ventilation - Occupancy Sensors	Energy conservation	Engineering and Public Works	Moderate	N/A	Moderate – High	Low	Moderate	
Ventilation – room controls	Energy conservation	Engineering and Public Works	Moderate	N/A	Moderate – High	Low	Moderate	

Table 6.1: Implementation Summary *continued...*

Initiative	Type	Department Responsibility	Level of Investment	Potential External Support (Funding or Expertise)	Level of Impact to Energy Use/Cost	Level of Impact to GHG Emissions	Priority	Examples
Turn-it-down/Turn-it-off campaign	Behavioural	Development Services	Low	N/A	Low – Moderate	Low – Moderate	High	
Replace office equipment	Energy conservation	Corporate Services	Moderate	N/A	Low – Moderate	Low	High	
Review interior lighting needs	Behavioural	Engineering and Public Works	Low	N/A	Low – Moderate	Low	High	
Install appropriate heating control devices	Energy conservation	Engineering and Public Works	Low	N/A	Moderate	Low – Moderate	High	
Consider alternate sources of heating and cooling	Alternative technology	Engineering and Public Works	High	Gas Tax Programs BC Building Canada Fund Green Municipal Fund	High	High	Moderate	Tournament Capital Centre, Kamloops City Hall, Salmon Arm Ice Box, Kamloops
Alternative electricity	Alternative technology	Engineering and Public Works	High	Gas Tax Programs BC Building Canada Fund Green Municipal Fund	Moderate – High	Low	Low	City of Dawson Creek
Green roofs	Energy conservation	Engineering and Public Works/Development Services	High	Gas Tax Programs BC Building Canada Fund Green Municipal Fund	High	Moderate	Low	City of Chicago
Review natural gas records to determine if rate structures are appropriate	N/A	Corporate Services	Low	N/A	Low	Low	Low	
Infrastructure								
Replace outdoor street lighting	Energy conservation	Engineering and Public Works	Moderate	N/A	Moderate	Low	Moderate	City of Kamloops City of Calgary
Water conservation	Behavioural	Engineering and Public Works	Low – Moderate	N/A	Moderate	Low	High	City of Kelowna
Pump optimization	Energy conservation	Engineering and Public Works	Low	BC Hydro	Moderate	Low	High	
Pump replacement	Energy conservation	Engineering and Public Works	Moderate – High	BC Hydro	Moderate – High	Low	Moderate	
Water system audit	Organizational	Engineering and Public Works	Low	BC Hydro BC Infrastructure Planning Grant	N/A	Low	High	
Fleet and Equipment								
Anti-idling policy	Behavioural	Engineering and Public Works	Low	N/A	Moderate	Moderate	High	City of Dawson Creek
Develop a tire pressure monitoring program	Behavioural	Engineering and Public Works	Low	N/A	Moderate	Moderate	High	Tacoma, Washington City of Dawson Creek

Table 6.1: Implementation Summary *continued...*

Initiative	Type	Department Responsibility	Level of Investment	Potential External Support (Funding or Expertise)	Level of Impact to Energy Use/Cost	Level of Impact to GHG Emissions	Priority	Examples
Develop fleet monitoring program	Behavioural	Engineering and Public Works	Low	N/A	Low	Low	High	
Shift from 2 stroke motors to 4 stroke motors	Alternative Technology	Engineering and Public Works	Low – Moderate	N/A	Low	Low	Low	
Use alternative fuelled vehicles	Alternative Technology	Engineering and Public Works	High	N/A	Moderate	Moderate – High	Moderate	
Right-size vehicles and optimize their use	Energy conservation	Engineering and Public Works	Moderate – High	N/A	Moderate	Moderate	Moderate	
Implement a vehicle purchasing policy	Behavioural	Engineering and Public Works	Low	N/A	Moderate	Moderate	High	
Install auxiliary power systems in vehicles	Energy conservation	Engineering and Public Works	Moderate	N/A	Moderate	Moderate	Moderate	
Integrated Resource Management								
Use waste heat from arena	Alternative Technology	Engineering and Public Works/Recreation	High	Gas Tax Programs Green Municipal Fund BC Building Canada Fund Terasen Gas Innovative Clean Energy Fund	Moderate – High	High	Low	South Cariboo Arena, 100 Mile House
Sewage heat recovery	Alternative Technology	Engineering and Public Works	High	Gas Tax Programs Green Municipal Fund BC Building Canada Fund Terasen Gas Innovative Clean Energy Fund	Moderate – High	High	Low	False Creek Whistler
PRV microturbines	Alternative Technology	Engineering and Public Works	High	Gas Tax Programs Green Municipal Fund BC Building Canada Fund Innovative Clean Energy Fund	Moderate – High	Low	Low	
WPCC methane capture and re-use	Alternative Technology	Engineering and Public Works	High	Gas Tax Programs Green Municipal Fund BC Building Canada Fund Terasen Gas Innovative Clean Energy Fund	Moderate – High	High	Low	City of Prince George

Table 6.1: Implementation Summary *continued...*

Initiative	Type	Department Responsibility	Level of Investment	Potential External Support (Funding or Expertise)	Level of Impact to Energy Use/Cost	Level of Impact to GHG Emissions	Priority	Examples
Composting digesters	Alternative Technology	Engineering and Public Works	High	Gas Tax Programs Green Municipal Fund BC Building Canada Fund Terasen Gas Innovative Clean Energy Fund	Moderate – High	High	Low	
District heating and cooling	Alternative Technology	Engineering and Public Works/Development Services	High	Gas Tax Programs Green Municipal Fund BC Building Canada Fund Terasen Gas Innovative Clean Energy Fund	Moderate – High	High	Low	North Vancouver

APPENDIX A

Employee Survey

Suite 200 - 286 St. Paul Street, Kamloops, BC V2C 6G4
Telephone: 250-374-8311 Fax: 250-374-5334

URBANSYSTEMS.

MEMORANDUM

date:	July 29, 2008
to:	Corey Paiement
cc:	
from:	Dylan Houlihan
file #:	0752.0015.01
subject:	**EMPLOYEE SURVEY SUMMARY**

A survey was developed by Urban Systems to determine what measures employees thought the City of Salmon Arm should take to reduce corporate energy use. The survey was distributed to approximately 100 employees and 33 responses were received. Most of the respondents were from the Engineering and Public Works Department. This memo summarizes the results of this survey.

Survey Respondents

The survey was distributed to employees of all departments. The following list summarizes the number of responses from each department:

- Corporate Services – 2
- Development Services Department – 2
- Engineering and Public Works Department – 29
- Fire Department – 0
- RCMP – 0
- SASCU Community Centre – 0
- Sunwave Centre – 0

Results by each department

Corporate Services:

- Turn down air conditioning and heating in the summer/Achieve better balance in heating and cooling loads (x2)
- Rationalize computer use as many people do not need an individual computer/Turn off computers and monitors at night (x2)
- Reduce idling
- Create a reward program for employees that have the best ideas for energy conservation and who are examples of energy conservation

Development Service Department:

- Use hybrid fleet vehicles
- Solar panels
- Energy efficient windows
- Green roofs
- Turn off lights wherever possible
- Cluster building inspection trips
- Conscious effort to reduce paper consumption

Recurring Themes

Vehicle Fleet and Equipment

- Promoting anti-idling policies
- Right-sizing vehicles for staff so that administrative staff aren't driving large vehicles
- Purchase of alternate-fuelled vehicles and making fuel consumption a priority in the purchase of new vehicles
- Better organize trips in vehicles to reduce mileage such as clustering building inspections
- Likely could have fewer trucks sent to each job site
- Finding a way to power electronics on vehicles without running vehicles
- Better use of smaller equipment by ensuring that fuel is used properly depending on the types of motors, and replacing motorized equipment

Building Energy

- Many respondents mentioned turning down heating and cooling both in overnight/weekend periods, and during work hours as well as turning down the temperature on hot water tanks.
- Many mentioned powering down electronics, such as lights, and computers in particular, when these are not being used and ensuring that there was more energy efficiency for these uses. This also included rationalizing the number of lights and computers in buildings as there is a perception that there could be less of each. Timers and motion detectors for lights were also mentioned frequently.
- Alternate forms of energy, such as solar and geothermal, and energy efficient building materials such as windows were mentioned.
- Keeping the large garage doors closed in the winter would reduce heat loss
- Retrofit older buildings

Water

- Promote water conservation and examine pumps for efficiency

Recycling

- City employees would like to see more recycling and more conscious effort made to reduce the amount of paper used (i.e. for memos, notices, etc.)

Travel

- Promote carpooling by offering City vehicles for carpoolers
- Promote biking/walking to work

Communications

- Publish energy statistics so employees know how specific facilities are using energy and contributing to GHG emissions
- Should communicate municipal energy programs better with the public

APPENDIX B

2007 Energy Summary

City of Salmon Arm Building Energy Inventory

Location	Building Size	Electricity (kwh)	Cost	GHG Emissions (tonnes CO2E)	Natural Gas (GJ)	Cost	GHG Emissions (tonnes CO2E)	Total Energy (mwh)	Total GHG Emissions (tonnes CO2E)	Total Cost	Energy Consumption/ sq. ft
Civic											
City Hall (CSA Building)	41,289	684,504	$34,312	15.1	685.0	$8,548	34.9	874.8	50.0	$42,859.96	0.02
Total		**684,504**	**$34,312**	**15**	**685**	**$8,548**	**35**	**875**	**50**	**$42,859.96**	
Lighting											
Canoe Overhead Street Lighting	0	263,024	$82,343	5.8	0.0	$0	0.0	263.0	5.8	$82,342.50	
Ornamental Street Lighting	0	349,412	$21,549	7.7	0.0	$0	0.0	349.4	7.7	$21,548.69	
10th Street Crosswalk	0	5,665	$417	0.1	0.0	$0	0.0	5.7	0.1	$416.82	
TCH Entrance Sign	0	0	$0	0.0	0.0	$0	0.0	0.0	0.0	$0.00	
TCH Overhead Lighting	0	3,179	$274	0.1	0.0	$0	0.0	3.2	0.1	$274.07	
Lighting for Ross Street Parking Lot	0	5,877	$459	0.1	0.0	$0	0.0	5.9	0.1	$459.15	
South Broadview School Crosswalk Signal	0	2,085	$195	0.0	0.0	$0	0.0	2.1	0.0	$195.35	
Total		**629,242**	**$105,237**	**14**	**0**	**$0**	**0**	**629**	**14**	**$105,236.58**	
Parks											
Lights for Walkway	0	691	$70	0.0	0.0	$0	0.0	0.7	0.0	$69.64	
3801 NE Canoe Beach Drive	0	12,834	$941	0.3	0.0	$0	0.0	12.8	0.3	$941.35	
Raven Park	0	433	$83	0.0	0.0	$0	0.0	0.4	0.0	$82.84	
Wharf	0	8,060	$1,074	0.2	0.0	$0	0.0	8.1	0.2	$1,073.81	
Cemetery	0	5,738	$449	0.1	0.0	$0	0.0	5.7	0.1	$448.78	
Blackburn Park	0	13,718	$1,001	0.3	0.0	$0	0.0	13.7	0.3	$1,000.86	
Total		**41,473**	**$3,617**	**1**	**0**	**0**	**0**	**41**	**1**	**$ 3,617.28**	
Community Facilities											
Little Mountain Clubhouse	5,600	84,778	$6,477	1.9	136.2	$1,950	6.9	122.6	8.8	$8,427.30	0.02
Indoor Sports Complex	0	37,860	$2,740	0.8	335.1	$4,496	17.1	130.9	17.9	$7,235.32	

City of Salmon Arm Building Energy Inventory

Location	Building Size	Electricity (kwh)	Cost	GHG Emissions (tonnes CO2E)	Natural Gas (GJ)	Cost	GHG Emissions (tonnes CO2E)	Total Energy (mwh)	Total GHG Emissions (tonnes CO2E)	Total Cost	Energy Consumption/ sq. ft
Airport Hazard Beacon	0	912	$116	0.0	0.0	$0	0.0	0.9	0.0	$116.04	
Airport Hazard Beacon	0	912	$116	0.0	0.0	$0	0.0	0.9	0.0	$116.04	
Airport Storage	0	13,986	$1,019	0.3	0.0	$0	0.0	14.0	0.3	$1,018.94	
Airport Equipment Shed	0	20,886	$1,496	0.5	235.4	$3,147	12.0	86.3	12.5	$4,643.42	
Airport Terminal	5,000	40,566	$2,855	0.9	76.3	$1,277	3.9	61.8	4.8	$4,132.18	0.01
Airport Building	0	927	$128	0.0	0.0	$0	0.0	0.9	0.0	$127.73	
Total		**260,998**	**$18,663**	**6**	**941**	**$12,267**	**48**	**522**	**54**	**$30,930.88**	
Sewer											
Wharf Street Lift Station	0	159,478	$12,205	3.5	0.0	$0	0.0	159.5	3.5	$12,204.80	
Captain's Cove Lift Station	0	0	$0	0.0	0.0	$0	0.0	0.0	0.0	$0.00	
5391 75TH Ave NE	0	17,242	$1,245	0.4	0.0	$0	0.0	17.2	0.4	$1,245.34	
Tippy Canoe Lift Station	0	0	$0	0.0	0.0	$0	0.0	0.0	0.0	$0.00	
4290 Canoe Drive	0	37,243	$2,849	0.8	0.0	$0	0.0	37.2	0.8	$2,849.04	
WPCC	16,000	2,064,079	$97,866	45.4	2,734.3	$33,320	139.4	2,823.6	184.9	$131,186.23	0.18
10TH Ave SW Lift Station	0	946	$118	0.0	0.0	$0	0.0	0.9	0.0	$118.48	
Rotten Row Lift Station	0	13,746	$1,356	0.3	0.0	$0	0.0	13.7	0.3	$1,356.49	
Total		**2,292,734**	**$115,641**	**50**	**2,734**	**$33,320**	**139**	**3,052**	**190**	**$148,960.39**	
Water											
NW 50th St	0	2,158	$203	0.0	0.0	$0	0.0	2.2	0.0	$202.67	
251 Gleneden Road	0	52,936	$4,053	1.2	0.0	$0	0.0	52.9	1.2	$4,053.31	
Zone 2A Pump Station	0	732	$123	0.0	0.0	$0	0.0	0.7	0.0	$123.09	
5160 NW 40 Ave	0	3,178	$253	0.1	0.0	$0	0.0	3.2	0.1	$253.46	
1591 NE 30th Street	0	296,686	$20,650	6.5	0.0	$0	0.0	296.7	6.5	$20,649.92	
Park Hill Road Pump Station	0	10,247	$763	0.2	0.0	$0	0.0	10.2	0.2	$762.82	
Canoe Pump Station Zone 2	0	858,547	$67,162	18.9	108.1	$1,619	5.5	888.6	24.4	$68,780.73	

City of Salmon Arm Vehicle Fleet Energy Summary

Vehicle	Gasoline (litres)	Fuel Cost	Diesel (litres)	Fuel Cost	Total Energy (mwh)	Total GHG Emissions (tonnes CO2E)
Civic						
2006 Chev Cobalt (Bldg Dept)	866	$873	0	$0	8.4	2.1
2004 Cavalier (Bldg Dept)	1,071	$2,125	0	$0	10.4	2.6
1993 Ford Tempo (Bldg Dept)	559	$594	0	$0	5.4	1.3
Total	**2,496**	**$3,592**	**0**	**$0**	**24.1**	**6.0**
Parks						
2001 Ford F-250 Econoline Cargo Van	2,362	$2,388	0	$0	22.8	5.7
2002 Chev 3/4 ton p/u cw water tank	3,374	$3,416	0	$0	32.6	8.1
2002 Chev 1/2 ton (Parks Foreman)	3,000	$2,932	0	$0	29.0	7.2
2003 Chev 1 ton 2wd dump	5,524	$5,448	0	$0	53.4	13.3
2005 Kubota Mower F3060B	0	$0	1,045	$1,093	11.2	2.9
1998 GMC 1 ton dump	2,921	$3,469	0	$0	28.2	7.0
1999 Kubota F3060 Mower	0	$0	923	$981	9.9	2.5
2003 John Deere 5420 w/bucket	0	$0	2,391	$2,338	25.6	6.6
Total	**17,181**	**$17,653**	**4,359**	**$4,412**	**212.8**	**53.4**
Protective Services						
Engine 1 (Canoe Fire Dept)	0	$0	407	$0	4.4	1.1
Tender 1 (Canoe Fire Dept)	352	$0	0	$0	3.4	0.8
F #211	0	$0	0	$0	0.0	0.0
F#212	0	$0	427	$0	4.6	1.2
F#214	0	$0	842	$0	9.0	2.3
F#218	0	$0	0	$0	0.0	0.0
F#219	0	$0	794	$0	8.5	2.2
F#221	0	$0	516	$0	5.5	1.4
F#222	0	$0	0	$0	0.0	0.0
F#223	0	$0	667	$0	7.2	1.8
F#213	0	$0	0	$0	0.0	0.0
F#216	683	$0	0	$0	6.6	1.6
F#217	1,309	$0	0	$0	12.7	3.2
F#220	1,034	$0	0	$0	10.0	2.5
F#224	2,708	$0	0	$0	26.2	6.5
Total	**6,086**	**$0**	**3,653**	**$0**	**98.0**	**24.8**
Public Works						
1974 Cat grader	0	$0	646	$808	6.9	1.8
1981 GMC Mag truck	2,830	$2,933	0	$0	27.4	6.8
2005 GMC Sierra 3/4 ton	5,190	$4,451	0	$0	50.2	12.5
2000 Bomag Roller	0	$0	0	$0	0.0	0.0
1980 Warney & Swasey Gradall	0	$0	212	$484	2.3	0.6
2001 International 8100 Crane Truck (HIAB)	0	$0	1,419	$1,505	15.2	3.9
1986 Champion Grader 730R	0	$0	4,829	$4,847	51.8	13.3
2005 Walker Zero Radius Mower	272	$264	0	$0	2.6	0.7
2001 Ford F-350 1 ton 4x4 dump/plow	4,804	$4,615	0	$0	46.4	11.6
2007 Elgin Sweeper	0	$0	0	$0	0.0	0.0
2003 Ford F-350 1 ton 4x4 dump/plow	5,119	$5,066	0	$0	49.5	12.3
2004 JD 6420/snow blade/flail	0	$0	2,783	$2,725	29.8	7.7
2007 Jeep Compass (PW Foreman)	0	$0	0	$0	0.0	0.0
1993 Ford F-350 1 ton flatdeck (Carp)	4,759	$4,593	0	$0	46.0	11.5
1993 Ford F-350 1 ton flatdeck (Mech)	1,023	$1,063	0	$0	9.9	2.5
2004 International 7500 Single Axle Dump	0	$0	11,894	$11,478	127.5	32.8
2004 Bobcat S185G Skid Steer	0	$0	3,101	$3,015	33.2	8.6

APPENDIX C

List of Provincial Government Report Websites

List of Provincial Government Reports Websites

BC Energy Plan (2007), Ministry of Energy, Mines, and Petroleum Resources
http://www.energyplan.gov.bc.ca/

BC Climate Action Plan (2008), Ministry of Environment
http://www.livesmartbc.ca/plan/index.html

BC Climate Action Team Report (2008)
http://www.climateactionsecretariat.gov.bc.ca/cat/report.html

BC Bioenergy Strategy (2008), Ministry of Energy, Mines, and Petroleum Resources
http://www.energyplan.gov.bc.ca/bioenergy/

Local Government (Green Communities) Statutes Amendment Act, 2008
http://www.communityenergy.bc.ca/resources-introduction/bill-27-tatiana-robertson-presentation-to-cea-agm-june-9-2008