# City of Saskatoon

## GREENHOUSE GAS EMISSIONS INVENTORY, FORECAST & TARGET

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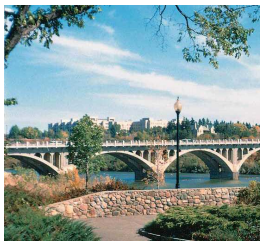

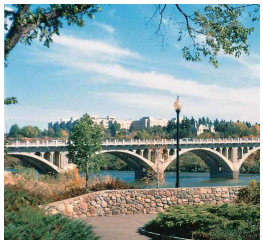

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**BAU –** business as usual

**GHGs –** equivalent CO2 (used to describe greenhouse gas emissions in equivalent volume of carbon dioxide.

**GHG –** greenhouse gas

**GJ –** gigajoules (one gigajoule is equal to one billion joules)

**ICLEI –** ICLEI – Local Governments of Sustainability (formerly the International Council for Local Environmental Initiatives)

**kWh –** kilowatt hours

**LAP** – Local Action Plan

**PCP –** Partners for Climate Protection

**t** – tonnes; typically the unit of measure in which emissions are calculated

**VKT** – Vehicle kilometres traveled (measure of kilometres traveled within community that can be used to estimate fuel consumption and subsequent greenhouse gas emissions)

# EXECUTIVE SUMMARY

In 2004, the City of Saskatoon joined the Partners for Climate Protection (PCP) and committed to taking action on climate change. The PCP, led by the Federation of Canadian Municipalities (FCM) and ICLEI-Local Governments for Sustainability, is a network of more than 120 Canadian municipal governments who have committed to reducing greenhouse gases (GHG) in their corporate operations and in the community-at-large. PCP is the Canadian component of ICLEI's international Cities for Climate Protection (CCP) Campaign that includes more than 600 communities making similar efforts.

*Up to half of Canada's GHG emissions are under the direct or indirect control or influence of municipal governments.*

The PCP has five milestones:

Milestone One: Create a GHG Emissions Inventory and Forecast
Milestone Two: Set a Reduction Target
Milestone Three: Develop a Local Action Plan
Milestone Four: Implement the Local Action Plan
Milestone Five: Measure Progress and Report Results

Up to half of Canada's GHG emissions are under the direct or indirect control or influence of municipal governments. Municipalities are a key component to the Federal government's commitment to the Kyoto Protocol, which involves a 6% reduction in GHG emissions from 1990 levels by 2008 to 2012.

*ICLEI worked with a project team of City of Saskatoon staff.*

The City of Saskatoon has already made strides towards achieving GHG reductions in its corporate operations. Measures such as building retrofits, vehicle fleet downsizing, traffic light retrofitting and waste management have already resulted in annual GHG reductions of over 6,000 tonnes from corporate operations and over 21,600 tonnes of GHG reductions from the community sector. However, Saskatoon needs to take a much more aggressive approach in order to achieve the targets recommended in this report: a 27% reduction of corporate emissions from 2003 levels by 2013 and a 6% reduction from 2003 emission levels in the community. This approach needs to focus on the key local drivers, such as the use of cleaner fossil fuels for energy production, transportation and corporate building and vehicle fleet stock.

ICLEI worked with a project team of City of Saskatoon staff to gather energy consumption and waste information. With this information an inventory of 1990 and 2003 GHG emissions was established for both corporate operations and the community at large. The measures that have already been implemented and those that have potential were also examined to generate forecasts of future GHG emission scenarios. The scenarios are described as:

- Business as Usual (BAU) – no new emission reduction measures.
- Planned – moderate uptake of measures that are already planned.
- Typical – includes measures with greater impact that require additional effort and investment.
- Optimistic - includes measures with even greater impact that require more effort and investment.

*Complete details of the analysis are provided later on in this report.*

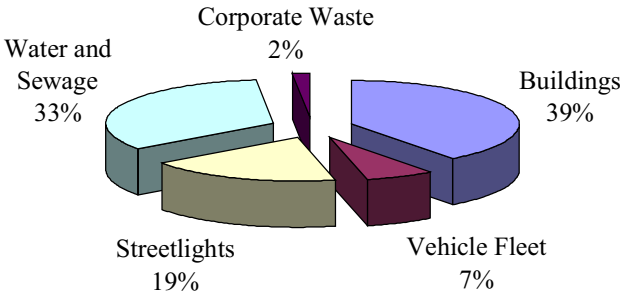
The following two pages present a brief overview of the results of this analysis for both corporate operations and the community-at-large. Complete details of the analysis are provided later in this report.

## CORPORATE INVENTORY, FORECASTS & TARGET

*Between 1990 and 2003, Saskatoon's corporate* ***GHG emissions increased 23%.***

Between 1990 and 2003, Saskatoon's corporate GHG emissions increased by 23%, from 74,044 tonnes to 91,298 tonnes. This increase can be attributed to the growing infrastructure needs of the community in which population grew by 3% during the same time period and employment in all sectors increased. Figure 1 illustrates the percentage contribution of each sector of Saskatoon's corporate operations total emissions profile. Buildings represent 39% of the GHG emissions from corporate operations, followed by water and wastewater operations and street lighting. This distribution illustrates those sectors that offer the greatest potential for GHG reductions.

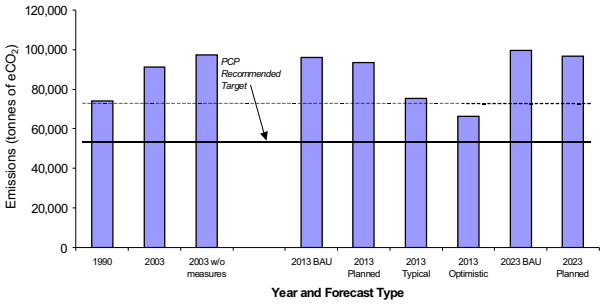
**Figure 1-** ***2003 Corporate GHG Emissions Distribution***




*Saskatoon's efforts to date have already resulted in over* ***6,000 tonnes of annual GHG savings*** *through measures such as building retrofits, fleet downsizing, traffic light retrofitting, and waste management.*

ICLEI Energy Services worked with the project team to gather information about the energy efficiency and emission reduction measures that have been put in place, are planned, or could be implemented to help Saskatoon reduce GHG emissions in the future. Saskatoon's efforts to date have already resulted in over 6,000 tonnes of annual GHG savings through measures such as building retrofits, vehicle fleet downsizing, traffic light retrofitting, water loss reduction efforts, and waste management. However, there is a lot more GHG reduction potential remaining. Different 'scenarios' or forecasts were generated to estimate the future emission reduction potential in corporate operations. Figure 2 illustrates the results of this analysis and demonstrates there is great potential to reduce GHG emissions to well beyond 2003 levels by 2013.

**Figure 2**- *Corporate GHG Emissions Scenarios*




*It is recommended that the City adopt a corporate target of* ***27% below 2003 levels by 2013****.*

The research team recommends that the City of Saskatoon adopt a corporate target of a 27% reduction below 2003 GHG emission levels by 2013. This target would achieve the level of emissions projected in the optimistic forecast. This target is ambitious yet achievable if the City adopts several new measures that have already proven effective in communities across Canada.

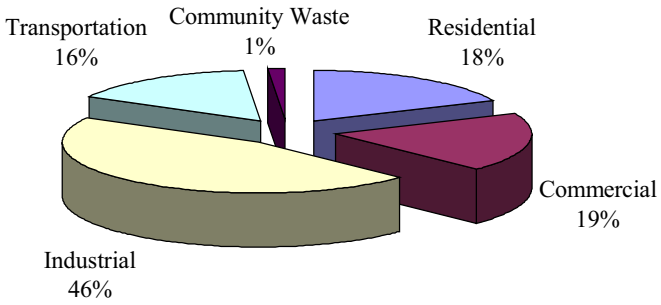
## COMMUNITY INVENTORY, FORECASTS & TARGET

*Community GHG mitigation activities have resulted in over 21,600* ***tonnes of annual GHG savings.***

Greenhouse gas emissions from the community-at-large increased by 45%, from 2,466,239 tonnes in 1990 to 3,583,339 tonnes in 2003. Similar to the corporate sector increase, this increase can be attributed to the fact that both the population and local economy have grown.

Figure 3 illustrates the percentage contribution of each sector in Saskatoon's community GHG profile. The industrial sector was by far the largest producer of GHG emissions, followed by the residential, commercial and transportation sectors. This distribution demonstrates that it would be most affective to gear GHG reduction efforts at the industrial, residential, commercial and transportation sectors.

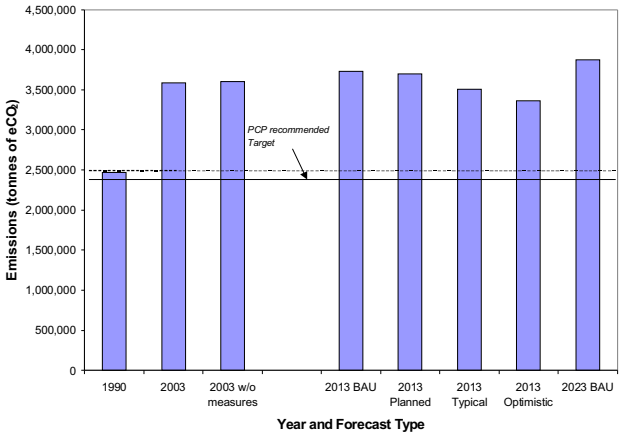
**Figure 3** - *2003 Community GHG Emissions Distribution*




*It is recommended that Saskatoon adopt a community target that is similar in ambition to their corporate target: a* ***6% reduction below 2003 by 2013.***

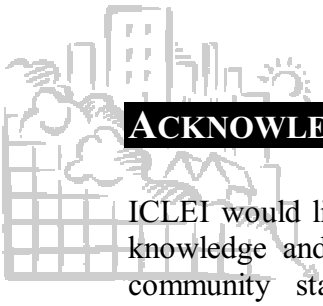
By working with the project team, IES analyzed some of the measures already implemented at the community level. These community measures have achieved over 21,600 tonnes of annual GHG savings to date. However, there is much more potential to achieve significant GHG reductions in the community at large. Some forecasts were developed to examine the future potential for GHG emissions reductions (Figure 4). Three scenarios with different levels of measure implementation demonstrate that there is a great potential for significant emission reductions in the community-at-large. It is recommended that Saskatoon adopt a community target of 6% emission reductions below 2003 levels by 2013. This recommendation is based on the emissions reductions projected in the optimistic forecast.

**Figure 4** - *Community GHG Emissions Scenarios*



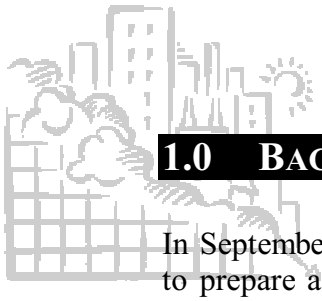
## NEXT STEPS

It is recommended that City of Saskatoon Council formally adopt the corporate and community targets suggested in this report. The next step is to focus on creating a Local Action Plan to achieve the targets, implement the plan, and then monitor and verify to ensure the plan is achieving the outcomes it targeted. At this point Saskatoon should revisit and revise its targets.



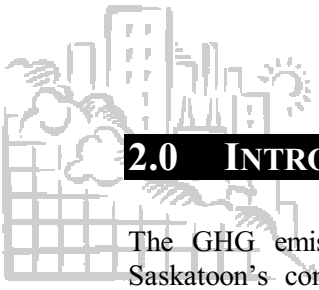
## ACKNOWLEDGEMENTS

ICLEI would like to thank the staff of the City of Saskatoon for contributing their time, knowledge and ideas to this project. In addition, the research team thanks the many community stakeholders in the private, non-profit and institutional sectors that generously contributed information and ideas to this project. These groups and individuals are identified in Table 1 and Table 2 of this report.



# 1.0 BACKGROUND

In September 2004 ICLEI Energy Services (IES) was retained by the City of Saskatoon to prepare a greenhouse gas (GHG) emission inventory. The City received funding from the Federation of Canadian Municipalities' Green Municipal Fund program to undertake the project. The work described here within includes inventories of Saskatoon's corporate and community sectors. Subsequent to the completion of inventories for the years 1990 and 2003, work was undertaken to complete milestone two of the project to establish targets for GHG reductions within each sector. In time, the information generated through the completion of the GHG inventory will be used by the City of Saskatoon to develop, implement and monitor a local action plan for GHG reductions to meet its targets.



## 2.0 INTRODUCTION – GHG EMISSIONS ANALYSIS

The GHG emissions analysis summarized in this report was completed in part to fulfill Saskatoon's commitments to the Partners for Climate Protection (PCP). PCP is a national program developed by the Federation of Canadian Municipalities and ICLEI that brings Canadian municipal governments together to reduce local production of GHG (GHG) emissions and improve quality of life in participating communities. Currently, 124 municipal governments belong to the PCP and over 600 municipalities participate in ICLEI's equivalent international program Cities for Climate Protection. Saskatoon joined the PCP in 2004 and immediately began to pursue the PCP milestones.

IES's GHG emissions analysis consists of two parts: Milestones One and Two. In addition, IES has included recommendations for future GHG emissions reduction initiatives that may be included by Saskatoon as part of their Local Action Plan to achieve their emission reduction targets as per Milestone Three of the program.

Milestone One is a GHG emissions inventory, which involves a summary, analysis and forecast of the energy consumption, energy costs, land-filled waste and the corresponding GHG emissions. A typical PCP Milestone One report would include a community and corporate section. The community section focuses in on the GHG emissions of the residential, commercial, industrial, transportation and community waste sectors and the corporate section centres on municipal buildings, vehicle fleet, streetlights, water and wastewater operations and municipally produced waste.

Milestone Two, the GHG emission reduction target, can be established at any time but is generally completed after a municipality has undertaken a GHG inventory. Targets are generally established with input from citizens, non-profit groups, the private sector and municipal staff. Emission reduction targets are usually based on a percentage reduction in emissions below the baseline year.

PCP Members follow a five-milestone process:

1. Milestone One: Create a GHG Emissions Inventory and Forecast
   - Complete a GHG inventory and forecast for both municipal operations and the community. Data from 1994 or the year with the best available information should be used for the base year; energy use and emissions should be forecast for the next 10 or 20 years for municipal operations and the community.
2. Milestone Two: Set a Reduction Target
   - After a community has completed its GHG inventory, it can establish a reduction target. Preferred targets are a 20% reduction in GHG emissions from municipal operations, and a minimum six per cent reduction for the community, both within 10 years of joining PCP.
3. Milestone Three: Develop a Local Action Plan
   - Development and finalization of a local action plan that aims to reduce emissions and energy use in municipal operations and the community is the next course of action after establishing reduction goals.
4. Milestone Four: Implement the Local Action Plan
   - The creation of strong collaboration between municipal government and community partners is necessary to carry through on commitments made in the LAP and maximize benefits from GHG reductions.
5. Milestone Five: Measure Progress and Report Results
   - The last step for PCP communities is to maintain support for the LAP by monitoring, verifying and reporting GHG reductions.

Given the voluntary nature of the PCP, a municipality may adjust its target to reflect the results achievable by the strategies incorporated into its Local Action Plan. The municipality may adjust the target at any time to reflect new opportunities and challenges that may arise as a community grows and strives to reduce its greenhouse gas emissions.

The Emission Reduction Target section in this report provides a summary of the historic activities that have reduced GHG emissions in the past (these are referred to by the PCP as measures) and a summary of some of the future GHG measures that could lead the Region towards reducing GHG emissions. Multiple future GHG emission scenarios are described:

- BAU (Business as Usual)
- Planned
- Typical
- Optimistic

The BAU forecast projects future GHG emissions in the City of Saskatoon if no further emission reduction measures were put in place. The Planned forecast scenario includes future measures that the City of Saskatoon plans to implement. The Typical and Optimistic forecasts include new measures recommended by the project team applied with different levels of rigour and subsequently assuming differ level of GHG reduction success. Each forecast was based on:

- Projected growth in population and corporate operations
- Effectiveness of historic and current energy and GHG initiatives implemented by the City
- Effectiveness of energy and GHG emission reduction initiatives implemented by other municipal governments and corporations
- Input from the corporate project team

## 2.1 METHODOLOGY

At the on-set of this project an interdepartmental team (a.k.a. project team) of City of Saskatoon staff was brought together to develop a plan of action (see Appendix B – GHG Working group participants). The departments represented on the team were chosen because they were necessary for the collection of data or they were involved in activities that related to the GHG analysis directly or indirectly. The following business units and/or sections of business units were on the team:

- Environmental Protection
- Saskatoon Light & Power
- Transit Services Branch
- Waste Management
- Asset Management Department
- Water and Wastewater Treatment
- Vehicle Fleets

One of the first tasks for the team was to determine the years for which ICLEI would complete GHG emissions inventories. One major factor to be considered when choosing an inventory year is the availability of energy consumption data from which to calculate GHG emissions. The team set two years for which inventories would be completed, 1990 (to be consistent with Canada's commitments to the Kyoto Protocol) and 2003 (to represent current trends). It was resolved that collection of data for the year 1990 may not be feasible in all cases and accordingly, growth indicators would be used to back-cast data where necessary. The team also decided that fuel and electricity consumption data would be derived using departmental energy costs for 1990 and 2003 provided by the department responsible for the energy consumption. Where the level of consumption was not available, energy costs would be used to estimate consumption. With energy costs data, energy consumption can be estimated where the average energy costs are known. Subsequently, the GHG emissions can be calculated based on GHG emissions coefficients for each unit of energy (see Appendix C for the energy coefficients used for Saskatoon's inventory). With the data supplied in this manor, ICLEI was able to calculate GHG emissions at the departmental level. This methodology is considered a 'top-down' approach to data collection, whereas a 'bottom-up' approach would involve summarizing data from each facility or fleet vehicle. A bottom-up approach allows for a much more detailed analysis, but it also requires much more time and effort dedicated to data collection. The team resolved to proceed with a bottom-up approach wherever detailed energy consumption information was available, and use energy cost information to estimate consumption where necessary.

The sources and type of data collected for the completion of the inventory are summarized in Table 1 and Table 2 below.

**Table 1 – Sources of Data Compiled for Community Greenhouse Inventory**

| Sector | Source (department/contact) | Type of data provided |
|---|---|---|
| **Community** | | |
| Transportation | Traffic, Angela Gardiner | Vehicle kilometers traveled per year 1960-2003 |
| Transportation (transit fleet) | Abe Driedger, Transit Services | Fuel use, km traveled by fleet |
| Residential | Traffic, Angela Gardiner | Population 1960-2003 |
| Industrial/Commercial | Dana Irvine, Development Services Branch | ICI area in Saskatoon |
| Res./Ind./Com. | Ray Vannevel, SaskPower | Community electricity |
| Res./Ind./Com. | Rob Chan, City of Saskatoon Saskatoon Light & Power | Community electricity |
| Res./Ind./Com. | Rob McPherson, SaskEnergy | Fuel use, community sectors |
| Res./Ind./Com. | Matti Paquette, Superior Propane | Fuel use, community sectors |
| Res./Ind./Com. | Dave Chave, Mid Sask. Ag. Services (Imperial Oil Ltd.) | Fuel use, community sectors |
| Res./Ind./Com. | Randy Drimmie, Saskatoon Co-op | Fuel use, community sector |
| Res./Ind./Com. | John Juzkow, Millsap Fuel Distributors Ltd. (PetroCanada) | Fuel use, community sector |
| Res./Ind./Com. | Kathy Shirkey, Saskatoon Regional Economic Development Authority (SREDA) | Explanations for growth in energy use in industrial sector |

**Table 2 – Sources of Data Compiled for Corporate Greenhouse Inventory**

| Sector | Source (department/contact) | Type of data |
|---|---|---|
| **Corporate** | | |
| Electricity buildings/street lights | Rob Chan, Saskatoon Light & Power<br>Ray Vannevel, SaskPower | Consumption and cost information |
| Traffic lights | Corey Day, Municipal Engineering Branch | Number of lights, cost, consumption |
| Buildings | Maurice Miktynshyn, Asset Management Department | Historic/current consumption, size, cost based on general ledger accounts |
| Water treatment | Tim Sedgewick, Water and Wastewater Treatment Branch | Water treatment plant consumption/cost; admin buildings consumption and cost |
| Wastewater treatment | Rob Court, Water and Wastewater Treatment Branch | Consumption info. & costs |
| Waste | Wade Gasmo, Public Works Branch | Tonnage land filled per year |
| Vehicle fleet | Walter Wandzura, Vehicle and Equipment Services | Fuel consumed/km traveled/# of vehicles |
| Fire fleet | Lana Kenney, Fire Services | Fire fleet energy consumption/km/# of vehicles |

# 3.0 COMMUNITY INVENTORIES

## 3.1 METHODS

Electricity consumption information for the residential and commercial sectors for the years 1990 and 2003 was provided by the City of Saskatoon's Electric Services and SaskPower, the provincial electricity provider. SaskPower did not include electricity distributed by the City of Saskatoon's Electric Services in its data. Neither the City-owned utility nor SaskPower separate industrial and commercial energy use in their billing systems. In order to separate electricity used in the industrial sector from commercial energy use in Saskatoon, the research team first determined, the relative contribution of each sector to total energy use in the province of Saskatchewan during 1990 and 2003[1]. The resulting distribution was then applied to the energy load estimate provided by the utilities to determine the approximate electricity use in Saskatoon's industrial and commercial sectors for the years 1990 and 2003.

SaskEnergy provided estimates of its natural gas sales to the residential, commercial and industrial sectors. Within the data they provided, SaskEnergy noted that their customer classification (residential, commercial and industrial) is based on their billing codes and does not necessarily correlate to the nature of the business being served. At a later date, SaskEnergy was able to provide more information on the large natural gas users included in their industrial category and these businesses could be defined as "industrial" under the North American Classification System (see Appendix A – North American Classification System). Several sources within Saskatoon's fuel retail community indicated that fuel sales of gasoline and diesel for non-transport use within Saskatoon are split fairly evenly between four major fuel providers: Millsap Fuels, Mid Sask Ag. Services, Saskatoon Cooperative Ltd, and Shell Canada. Three of the big four fuel providers cooperated with this project. From the data provided, it appears that two of the fuel companies had similar market shares (company A and B), however one of the three data providers (company C) had fuel sales that were significantly (approximately five times) higher than the other two. To compensate for the absence of information from the fourth company, ICLEI added 25% to the sales figures provided by the other providers. Propane information was provided by a fifth company who also provided an estimate of their market share of total propane sales in the City, which was used to calculate total propane use. This company was unable to break down their sales by sector. Note that numbers in tables located in this section and throughout the report, may not add exactly due to rounding.

## 3.2 OVERVIEW

Per capita emissions from all community sources increased from 12 tonnes of GHGs in 1990 to 17 tonnes of GHGs in 2003.

[1] In 1990, the industrial sector accounted for 52% of the total amount of electricity used in the commercial and industrial sectors (the commercial sector used 48%). In 2003, the industrial sector accounted for 68% of total energy (commercial and industrial) and the commercial sector used 32%.

The preceding statement reveals an increase of per capita emissions of approximately five tonnes (approximately 40%). However, the majority of new emissions were created in the industrial sector. If per capita emissions are calculated including only emissions from the transportation and residential sectors per capita emissions only increased from 5 to 6 tonnes per capita per year (approximately 10%) between 1990 and 2003. The preceding estimate would still include emissions that are attributable to transportation from commercial and industrial vehicles traveling in the City. For the sake of comparison, per capita emissions attributable to industrial sources alone increased from 3 to 8 tonnes per capita (approximately 160%) between 1990 and 2003.

While each of the residential, commercial, industrial, transportation and waste sectors present opportunities for savings, the results of this inventory will highlight those sectors with the greatest absolute emissions growth between 1990 and 2003. The City will need to develop a strategy to address these high emission, high growth sectors in its local action plan.

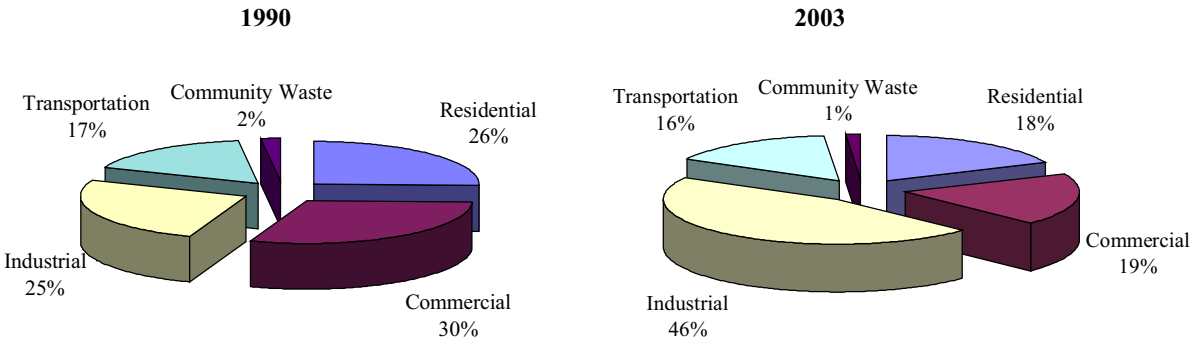
Table 3 provides growth indicators for each of the residential, commercial and industrial sectors within. These indicators are useful to compare changes in energy consumption between the 1990 and 2003 and corresponding changes in the character of the related sector. Growth indicators were provided by the Saskatoon Regional Economic Development Authority for as far back as 1993 and for all years between 1993 and 2004. Growth indicators can be used to measure the efficiency of growth in terms of changes in GHG production relative to the indicator value.

**Table 3 – Growth Indicators in Saskatoon's Community Sector 1993-2003**

| Growth Indicator | 1993 | 2003 | % Change between years |
|---|---|---|---|
| Population | 198,987 | 205,300 | +3 |
| Commercial employees | 81,200 | 101,100 | +25 |
| Industrial employees | 18,700 | 20,000 | +7 |
| Total employees | 99,900 | 121,100 | +21 |

Figure A illustrates percentage contribution of each sector to Saskatoon's community GHG emissions total. The contribution of industrial source GHGs to the community emissions profile increased from 25% in 1990 to 46% in 2003. As a result of the dramatic increase of industrial-sources emissions, the relative emissions of each other sector declined between 1990 and 2003. In the next section, the absolute changes in each sector will be discussed.

**Figure A – 1990 and 2003 Community GHG Relative Distribution of Emissions by Sector**



The greatest absolute increase in emissions was in the industrial sector (165%). Transportation section emissions increased 31%, followed by residential sector emissions (4%). GHG emissions from the commercial sector dropped 9% during the same period.

As seen in the summary of the growth indicators presented above, the number of industrial employees grew by only 7% compared to growth of approximately 25% in the commercial sector while industrial sector emissions increased 165% versus an 9% decline in commercial emissions. To determine why industrial emissions rose so dramatically relative to employment, the research team consulted local energy providers and the Saskatoon Regional Economic Development Authority (SREDA). As discussed in the section 3.2, emissions resulting from large increases in energy consumption in the industrial sector; emissions related to natural gas consumption alone grew by over 1,000,000 tonnes of GHGs. There are several possible explanations for this growth. Firstly, since 1990, several industrial consumers have had significant increases in their natural gas requirements: 1) Mitchell's Gourmet Foods built a new processing plant in 2001, and Centennial Foods constructed a large processing plant (2002); 2) Westco Storage constructed a $10 million, 87,000 square foot cold storage facility (2003); 3) VCOM and Hitachi Canada industries expanded their operations in 2003 and 2001, 2002 and 2004 respectively. During one of the project meetings, members of the team asked ICLEI to find out if some of the natural gas customers could have been reclassified from commercial to industrial users between 1990 and 2003. When asked about the possibility of reclassification, SaskEnergy replied that it would prohibitively time consuming to review their billing information for the thirteen year period in order to determine if reclassification had occurred. Between 1990 and 2003, use of natural gas by customers classified as commercial users continued to increase while use by those classified as industrial users also increased. This observation would suggest that there was no significant loss of commercial consumers to the industrial classification and would support the idea that the significant growth in the industrial sector is in fact due to increased industrial activity.

**Table 4 – 1990 & 2003 Community Inventory Summary**

| Sector | Energy (GJ) | GHG (tonnes) |
|---|---|---|
| **1990** | | |
| Residential | 8,432,754 | 632,958 |
| Commercial | 7,996,007 | 736,807 |
| Industrial | 5,895,404 | 618,179 |
| Transportation | 6,231,766 | 429,053 |
| Waste | NA | 49,242 |
| **Total** | **28,555,931** | **2,466,239** |
| **2003** | | |
| Residential | 8,831,730 | 659,433 |
| Commercial | 8,080,587 | 671,365 |
| Industrial | 22,951,175 | 1,641,199 |
| Transportation | 8,168,058 | 562,285 |
| Waste | NA | 49,057 |
| **Total** | **48,031,550** | **3,583,339** |

## 3.3 RESIDENTIAL, COMMERCIAL & INDUSTRIAL

A summary of the total electricity consumption and GHGs produced within Saskatoon's residential, commercial and industrial sectors is provided in Table 5. Overall, electricity use increased 26%, while emissions grew 14%. The discrepancy between the increase in energy use and emissions growth results from electricity generation using a fuel mix that produced fewer emissions per unit of energy produced in 2003 than in 1990. The largest growth in electricity use was in the industrial sector (71%), followed by the residential sector (17%). Electricity use in the commercial sector fell by 11% and emissions declined 19% during the same time period.

**Table 5 - Residential, Commercial & Industrial Sector Electricity Data Summary**

| Sector | kWh | GJ | GHG (tonnes) |
|---|---|---|---|
| **1990** | | | |
| Residential | 295,715,659 | 1,064,576 | 260,555 |
| Commercial | 471,613,415 | 1,697,808 | 415,539 |
| Industrial | 455,344,179 | 1,639,239 | 401,204 |
| **Total** | **1,222,673,253** | **4,401,623** | **1,077,298** |
| **2003** | | | |
| Residential | 344,683,183 | 1,240,859 | 275,756 |
| Commercial | 419,422,791 | 1,509,922 | 335,549 |
| Industrial | 776,424,990 | 2,795,130 | 621,160 |
| **Total** | **1,540,530,964** | **5,545,911** | **1,232,465** |

Table 6 provides estimated energy consumption and GHG emissions generated by all non-electricity energy use within Saskatoon's residential, commercial and industrial sectors for the years 1990 and 2003. Overall, GHG emissions resulting from primary energy sources increased approximately 91% between 1990 and 2003. The largest increase in emissions was experienced in the industrial sector (370%), followed by small increases in commercial (5%) and residential (3%) emissions. A large increase in natural gas use in the industrial sector accounts for the vast majority of new emissions.

**Table 6 - Residential, Commercial & Industrial Sector Fuel Consumption**

| Sector | Natural Gas ($m^3$) | Fuel Oil (L) | Diesel (L) | Propane (L) | Gasoline (L) | GHG (tonnes) |
|---|---|---|---|---|---|---|
| **1990** | | | | | | |
| Residential | 197,121,352 | 59,182 | 42,405 | 992,978 | 0 | 372,403 |
| Commercial | 164,362,986 | 631 | 3,561,961 | 1,294,659 | 231,412 | 321,268 |
| Industrial | 108,787,851 | 0 | 256,963 | 7,529,148 | 95,420 | 216,975 |
| **Total** | **470,272,189** | **59,813** | **3,861,329** | **9,816,785** | **326,832** | **910,646** |
| **2003** | | | | | | |
| Residential | 203,049,947 | 61,060 | 43,750 | 1,024,481 | 30,000 | 383,677 |
| Commercial | 170,503,374 | 786 | 4,434,905 | 1,611,946 | 288,125 | 335,816 |
| Industrial | 535,474,929 | 0 | 274,827 | 8,052,565 | 102,054 | 1,020,039 |
| **Total** | **909,028,250** | **61,846** | **4,753,482** | **10,688,992** | **420,179** | **1,739,532** |

## 3.4 TRANSPORTATION

This section summarizes emissions from private car use in Saskatoon and public transit fuel use. Overall, emissions in this sector increased 31% (or 133,232 tonnes of GHGs) between 1990 and 2003. Table 7 below summarizes emissions from private vehicle use and transit in Saskatoon.

**Table 7 – Transportation Fuel Data Summary**

| Year | GHG (tonnes) |
|---|---|
| **1990** | 429,053 |
| **2003** | 562,285 |

### 3.4.1 PRIVATE TRANSPORTATION

Saskatoon's Traffic Engineering group provided data for annual vehicle kilometres traveled (VKT) within the City from 1990 to 2003. This data was used to estimate fuel consumption in the City and subsequent GHG emissions.

**Table 8 – Private Transportation VKT and GHGs in 1990 and 2003**

| Year | Total Vehicle Kilometres Traveled | GHG (tonnes) |
|---|---|---|
| **1990** | 1,120,420,171 | 420,283 |
| **2003** | 1,476,784,852 | 553,960 |

### 3.4.2 PUBLIC TRANSIT

Transit Services provided fuel consumption and cost information for the bus fleet. Fuel consumption and emissions decreased approximately 5% between 1990 and 2003 as the number of vehicles decreased by 14% and the distance traveled by the remaining bus fleet dropped 6% (see Table 9).

**Table 9 – Transit Fuel Consumption, Costs, GHGs and Travel Distance/Time for the Years 1990 and 2003**

| Vehicle Type/Year | Diesel fuel Consumption (Litres/Year) | Fuel Costs ($) | GHG emissions (tonnes) | Distance traveled (km/yr) | Number of vehicles |
|---|---|---|---|---|---|
| **1990** | 3,211,454 | 1,336,683 | 8,769 | 5,830,000 | 133 |
| **2003** | 3,048,703 | 1,783,033 | 8,325 | 5,497,325 | 114 |

## 3.5 WASTE

Waste tonnage and waste stream materials distribution information was provided by Saskatoon's Utility Services' Environmental Engineering Branch for the years 1999 and 2003. Additional waste goes to a private landfill within the City. ICLEI contacted the owner of this landfill to determine the volume of waste that the landfill receives annually, however he did not wish to cooperate with this study. City staff reported that the volume of waste that goes to the private landfill would likely be very low in comparison to waste received by the City's landfill. Total land filled waste and subsequent GHG emissions produced during the years 1999 and 2003 are summarized in Table 10. Total emissions decreased by 185 tonnes between 1999 and 2003. Per capita emissions dropped from 0.25 to 0.24 tonnes during the same time period.

**Table 10 – Waste Sent to Landfill in 1999 and 2003**

| Year | Waste to Landfill (tonnes) | GHG (tonnes) |
|---|---|---|
| **1999** | 102,225 | 49,242 |
| **2003** | 101,842 | 49,057 |

## 3.6 COMMUNITY INVENTORY SUMMARY

Table 11 summarizes the changes that have characterized Saskatoon's community sector GHG profile between 1990 and 2003. Overall, energy consumption has increased 68% while GHGs have grown 45%.

**Table 11 – Percentage Change in Energy Consumption and GHGs Generated by the Community Sector Between 1990 and 2003**

| Sector | GHGs (%) | GJ (%) | GHGs (t) | GJ |
|---|---|---|---|---|
| Residential | 4 | 5 | 26,474 | 398,976 |
| Commercial | -9 | 1 | -65,442 | 84,580 |
| Industrial | 165 | 289 | 1,023,020 | 17,055,771 |
| Transportation | 31 | 31 | 133,232 | 1,936,292 |
| Community Waste | 0 | NA | -185 | NA |
| **Total** | **45** | **68** | **1,117,099** | **19,475,619** |

# 4.0 CORPORATE INVENTORIES

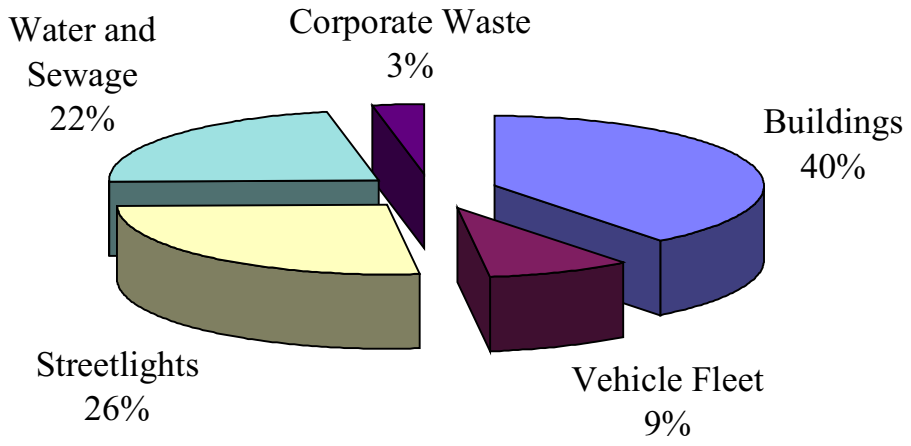
## 4.1 OVERVIEW

Corporate GHG emissions amount to approximately two percent of the entire community profile in 1990 and 2003. This distribution is typical of those found within PCP communities. Saskatoon's corporate energy consumption, energy costs and GHG emissions for the years 1990 and 2003 are summarized in Table 12 and Table 13.

**Table 12 – Corporate Inventory 1990 Data Summary**

| Sector | Energy (GJ) | Cost ($) | GHG (tonnes) |
|---|---|---|---|
| Buildings | 250,989 | 2,640,858 | 29,291 |
| Vehicle Fleet | 91,514 | 1,133,344 | 6,353 |
| Streetlights[2] | 80,103 | 3,857,175 | 19,605 |
| Water & Wastewater Treatment | 98,228 | 1,320,927 | 16,495 |
| Waste | NA | NA | 2,300 |
| **Total** | **520,834** | **8,952,304** | **74,044** |

**Figure B - 1990 Corporate GHG Emissions Distribution by Operation**

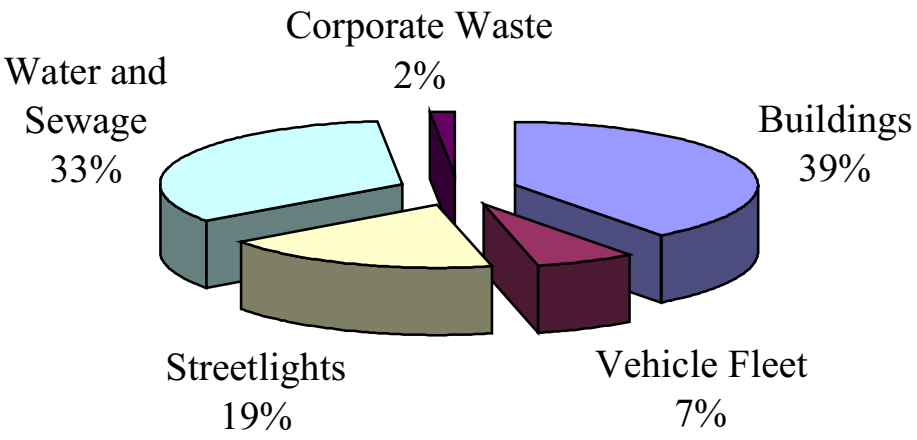



[2] Street lights include traffic lighting and sports/ball field lighting.

**Table 13 – Corporate Inventory 2003 Data Summary**

| Sector | Energy (GJ) | Cost ($) | GHG (tonnes) |
|---|---|---|---|
| Buildings | 348,778 | 3,975,899 | 36,270 |
| Vehicle Fleet | 87,365 | 1,482,112 | 6,047 |
| Streetlights | 76,160 | 4,718,266 | 16,925 |
| Water & Wastewater Treatment | 182,692 | 2,518,018 | 30,437 |
| Waste | NA | NA | 1,619 |
| **Total** | **694,995** | **12,694,295** | **91,298** |

**Figure C – 2003 Corporate GHG Emissions Distribution by Operation**



## 4.2 BUILDINGS

The City of Saskatoon's Asset Management Department tracks energy expenses in their General Ledger (GL) Report. The department provided their GL reports for 1990 and 2003. For the year 1990, aggregated costs for electricity, natural gas and water were provided by the City for each facility or facility grouping. The City was able to provide costs for each utility for the year 1992; accordingly, the relative cost of each utility was calculated and used to estimate the 1990 costs. ICLEI then used the average cost per unit of energy paid provided by other facilities throughout the city to estimate consumption.

There were several facilities for which Asset Management could not provide energy consumption cost or consumption information. In such cases, facility managers or staff at individual facilities were contacted for information.

Building size (square metres) was provided by Asset Management along with the year in which each facility was constructed or renovated. In many cases, it was difficult to match the building area with the facility listed in the General Ledger Reports because buildings may be grouped in the GL report under one identification code and/or building names in the GL were different than those presented in the building area summary report. However, total area was determined for both 1990 and 2003.

Overall, energy consumption in Saskatoon's buildings increased 39% between 1990 and 2003, and emissions increased 24% during the same time period (see Table 14 below for detailed energy consumption information); energy costs increased by 51%. Emissions per thousand square meters also increased from 122 to 157 tonnes GHGs.

**Table 14 – Building Energy Consumption, Cost and Emissions by Fuel type and Building Area for 1990 and 2003**

| Category | Volume of electricity consumed (kWh or $m^3$) | Energy (GJ) | Cost ($) | GHG (t) | Area (000 $m^2$) |
|---|---|---|---|---|---|
| **1990** | | | | | |
| Electricity | 23,760,846 | 85,539 | 1,740,536 | 20,936 | |
| Natural gas | 4,444,006 | 165,450 | 900,322 | 8,355 | |
| **Total** | **NA** | **250,989** | **2,640,858** | **29,291** | **241** |
| **2003** | | | | | |
| Electricity | 30,178,713 | 108,643 | 2,498,171 | 24,144 | |
| Natural gas | 6,450,022 | 240,134 | 1,477,728 | 12,126 | |
| **Total** | **NA** | **348,777** | **3,975,899** | **36,270** | **231** |

## 4.3 VEHICLE FLEET

The vehicle fleet includes all motorized vehicles operated by the City of Saskatoon, excluding transit vehicles (as they fall under the community inventory). Facilities Services provided data for the fuel consumption, costs and kilometres traveled by vehicles used by parks, public works, police and other administration. Saskatoon's Fire Services provided total fuel cost information for the fire fleet vehicles. Using costs per unit of fuel paid by the rest of the vehicle fleet and an estimated breakdown of 75% diesel and 25% gasoline consumption, the research team estimated consumption information for 1990 and 2003.

The City of Saskatoon's Payroll staff provided total kilometres traveled by employee vehicles for the years 2001 to 2004. This information was used to estimate total fuel use by those employees for business purposes.

Energy consumption and emissions decreased by 5% between 1990 and 2003.

**Table 15 – Total Energy Consumption, Cost and GHG emissions for Saskatoon's Vehicle Fleet in 1990 and 2003.**

| Year | Energy (GJ) | Cost ($) | GHG (t) |
|---|---|---|---|
| 1990 | 91,514 | 1,133,344 | 6,353 |
| 2003 | 87,365 | 1,482,112 | 6,047 |

Fuel consumption information by vehicle type was provided for 2003, but was unavailable for 1990. The composition of Saskatoon's vehicle fleet in 1991 by vehicle type is summarized in Table 16. 2003 fuel use by vehicle type is summarized in Table 17. The number of vehicles in Saskatoon's vehicle fleet increased from 564 in 1990 to 748 in 2003, yet fuel use decreased. This decline in fuel use per vehicle could be a testament to the effectiveness of the City's measures to improve the efficiency of its vehicle fleet through actions such as vehicle right-sizing. This measure and others are discussed further in section 5.4.

**Table 16 – 1991 Vehicles by Model**

| Model | Number of Vehicles |
|---|---|
| Cars | 2 |
| Vans | 62 |
| ¼ ton trucks | 13 |
| ½ ton trucks | 116 |
| ¾ ton trucks | 41 |
| 1 ton trucks | 68 |
| 6 Yd. dump trucks | 28 |
| 12 Yd. dump trucks | 18 |
| Garbage packer trucks | 24 |
| Aerial bucket trucks | 14 |
| Power unit/semi trailer | 0 |
| Mobile Boiler trucks | 3 |
| Digger/derrick trucks | 8 |
| Specialty trucks | 17 |
| Sander/speed plow trucks | 14 |
| Loaders (bucket) | 13 |
| Motor Graders | 14 |
| Excavators (backhoes/scraper) | 10 |
| Plows/sweeper (sidewalk) | 8 |
| Asphalt spreaders/planer | 3 |
| Rollers/compactors | 25 |
| Tractors | 6 |
| Compressors (Trailer Mounted) | 12 |
| Street sweepers | 19 |
| Rough terrain cranes | 2 |
| Forklifts | 7 |
| Large S.P. snowblowers | 3 |
| Crosswalk painters | 0 |
| Sewer M.H. Cleaners (trailer) | 3 |
| Portable tar heaters (trailer) | 6 |
| Water/Sewer pumps (trailer) | 0 |
| Slip in sanders/tree chipper | 5 |
| **Total** | **564** |

**Table 17- 2003 Fuel Use by Vehicle Type in Saskatoon**

| | Number of Vehicles | Gasoline (L) | Diesel (L) | Cost | GHG (t) |
|---|---|---|---|---|---|
| Fire fleet | 57 | 33,277 | 99,832 | 82,528 | 351 |
| Police fleet | 150 | 516,710 | | 318,124 | 1,220 |
| Mini vans | 33 | 58,213 | | 35,840 | 137 |
| Full size vans | 83 | 187,246 | | 115,282 | 442 |
| ¼ ton trucks | 59 | 78,768 | | 48,495 | 186 |
| ½ ton trucks | 72 | 126,055 | | 77,608 | 298 |
| ¾ ton trucks | 53 | 135,515 | | 83,433 | 320 |
| 1 ton trucks | 108 | 202,579 | 63,322 | 163,708 | 651 |
| Single axles | 60 | 3,243 | 241,919 | 150,939 | 668 |
| Tandem axles | 73 | 0 | 580,018 | 357,101 | 1,584 |
| Employee vehicle use | NA | 79,676 | NA | 49,054 | 188 |
| **Total** | **748** | **1,421,282** | **885,259** | **1,482,112** | **6,045** |

## 4.4 STREET LIGHTS

The street lighting sector represented within this inventory includes traffic, street, holiday and sports/ballfield lighting operated by the City of Saskatoon. SaskPower also provided energy consumption information for those light standards that they supply power to. In addition, miscellaneous energy use, recorded by the City of Saskatoon's Electric Services as "Flat Rate Services" was also included in this section (Table 22). The flat rate services categories include a variety of municipal operations, including crosswalk lighting, school warning lights, the library bookmobiles and etc. While not all the electricity used in this rate class is lighting related, it was concluded by the researcher team that a large enough percentage to the consumption was to warrant inclusion of this section. Saskatoon's Electric Services' staff provided energy consumption and cost information for street, holiday and sports/ballfield lighting. Saskatoon's Municipal Engineering Branch provided traffic lighting energy consumption data.

In general, energy consumption decreased 5% between 1990 and 2003 resulting in decreased GHGs emissions of approximately 14% during the same period (see Table 18). Several energy efficiency measures - including a retrofit of street lights - undertaken by the City helped contribute to the improved efficiency of street lighting.

**Table 18 – Light Sector Energy Consumption, Costs and Related GHG Emissions for the Years 1990 - and 2003**

| | Electricity (kWh) | Energy (GJ) | Cost ($) | GHG (t) |
|---|---|---|---|---|
| 1990 | 22,250,782 | 80,103 | 3,857,175 | 19,605 |
| 2003 | 21,155,434 | 76,160 | 4,718,266 | 16,925 |

Despite an increase in the number of city-supplied[3] street lights in operation between 1990 and 2003 from 12,169 to 16,226, electricity use decreased by approximately 22% (see Table 19). The City also purchased 9% less energy from SaskPower for those streetlights supplied by the provincial utility (see Table 20). Energy consumption by traffic lighting decreased approximately 7% between 1990 and 2003 (Table 21) and while the exact change in the number of street lights is not known, there has been growth in lighting in new subdivisions and business areas.

**Table 19 – Street Light Energy Consumption, Costs and Number of Units in 1990 & 2003, powered by Saskatoon Light & Power**

| Year | Electricity (kWh) | Energy (GJ) | Cost ($) | GHG (t) | Number of Units (ones) |
|---|---|---|---|---|---|
| 1990 | 14,318,040 | 51,545 | 2,711,565 | 12,616 | 12,169 |
| 2003 | 11,119,269 | 40,029 | 2,761,452 | 8,896 | 16,226 |

[3] "City-supplied" refers to those street lights that are powered by Saskatoon Light & Power. The number of street lights that are supplied by SaskPower was not available at the time this report was written.

**Table 20 – Street Light Energy Use and Costs in 1990 & 2003, powered by SaskPower**

| | Electricity (kWh) | Energy (GJ) | Cost ($) | GHG (t) | Number of Units (ones) |
|---|---|---|---|---|---|
| 1990 | 4,891,225 | 17,608 | 924,442 | 4,310 | NA |
| 2003 | 4,472,722 | 16,102 | 1,109,235 | 3,578 | NA |

**Table 21 – Traffic Light Energy Use, Costs and Number of Units in 1990 & 2003**

| | Electricity (kWh) | Energy (GJ) | Cost ($) | GHG (t) | Number of Units (ones) |
|---|---|---|---|---|---|
| 1990 | 2,986,568 | 10,752 | 211,637 | 2,631 | NA |
| 2003 | 2,766,932 | 9,961 | 232,347 | 2,214 | NA |

**Table 22 – Other Lighting-related Consumption and Costs in 1990 and 2003**

| | Electricity (kWh) | Energy (GJ) | Cost ($) | GHG (t) |
|---|---|---|---|---|
| 1990 | 54,949 | 198 | 9,532 | 48 |
| 2003 | 2,796,511 | 10,067 | 615,232 | 2,237 |

## 4.5 WATER & WASTEWATER TREATMENT

Energy use related to water and wastewater treatment and pumping services was provided by staff at Saskatoon's water and wastewater treatment facilities.

From 1990 to 2003 energy use related to water treatment and pumping increased 86% (see Table 23 for details). Expenditures on water treatment and pumping grew by 91% and resultant GHG emissions increased 85% during the same time period. During this period, the wastewater treatment operations were significantly expanded to improve treatment and overall water quality.

**Table 23 – Water & Wastewater Treatment Data by Year**

| Year | Energy (GJ) | Cost ($) | GHG (tonnes) |
|---|---|---|---|
| 1990 | 98,228 | 1,320,927 | 16,495 |
| 2003 | 182,692 | 2,518,018 | 30,437 |

Table 24 and Table 25 summarize the sources of energy used for water treatment and pumping during 1990 and 2003. Electricity is the most common source of energy at the water and wastewater facilities in both years, followed by natural gas and small amounts of fuel oil and propane. Overall, emissions attributable to the water and wastewater treatment sectors increased by 13,942 tonnes between 1990 and 2003.

**Table 24 – 1990 Water & Wastewater Treatment Data by Energy Source**

| Facility Type | Electricity (kWh) | Natural gas ($m^3$) | Fuel Oil (L) | Propane (L) | Cost ($) | GHG (t) |
|---|---|---|---|---|---|---|
| Wastewater Treatment Plant | 1,718,400 | 44,000 | 0 | 0 | 118,150 | 1,597 |
| Biosolids Operation | 177,840 | 0 | 0 | 11,625 | 19,155 | 174 |
| Lift Stations | 420,000 | 70,200 | 2,200 | 0 | 227,400 | 508 |
| Water Treatment Plant | 9,856,346 | 919,215 | 0 | 0 | 559,373 | 10,413 |
| Reservoirs and QE Low Lift | 4,314,725 | 0 | 435 | 0 | 396,849 | 3,803 |
| **Total** | **16,487,311** | **1,033,415** | **2,635** | **11,625** | **1,320,927** | **16,495** |

**Table 25 – 2003 Water & Wastewater Treatment Data by Energy Source**

| Facility Type | Electricity (kWh) | Natural gas ($m^3$) | Fuel Oil (L) | Propane (L) | Cost ($) | GHG (t) |
|---|---|---|---|---|---|---|
| Wastewater Treatment Plant | 16,659,146 | 405,089 | 0 | 0 | 1,056,080 | 14,089 |
| Biosolids Operation | 237,120 | 0 | 0 | 15,500 | 25,540 | 213 |
| Lift Stations | 420,000 | 70,200 | 2,200 | 0 | 227,400 | 474 |
| Water Treatment Plant | 11,812,477 | 1,101,646 | 0 | 0 | 707,275 | 11,521 |
| Reservoirs and QE Low Lift | 5,171,043 | 0 | 550 | 0 | 501,723 | 4,139 |
| **Total** | **34,299,786** | **1,576,935** | **2,750** | **15,500** | **2,518,018** | **30,437** |

## 4.6 CORPORATE WASTE

Corporate waste generally accounts for one to three percent of all waste generated within a municipality. The most historic year for which the City of Saskatoon's waste management division was able to provide waste tonnage information for was 1999. Accordingly, the data provided in this section is for the years 1999 and 2003. Saskatoon's human resource staff provided information about the number of full-time equivalent (FTE) positions with the City for each year.

To accurately calculate the GHG emissions attributable to corporate waste, the municipality must keep records of the quantity and content of the waste it produces. The City of Saskatoon does track the amount of waste produced within its facilities along with the distribution of different materials (e.g. wood waste, concrete and etc.) that comprise its waste stream.

Table 26 provides an estimate of the amount of waste generated by Saskatoon's corporate activities.

**Table 26 - Corporate Waste Produced per Year in Tonnes**

| Year | Full-Time Employees | Waste Generated | GHG (t) |
|---|---|---|---|
| 1999 | 2,613 | 4,774 | 2,300 |
| 2003 | 2,746 | 3,361 | 1,619 |

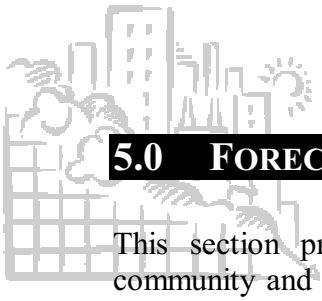
Although the City had over 1000 more full time equivalent positions in 2003 than it did in 1999, 1,413 fewer tonnes of waste were generated during its business operations. Related GHG emissions decreased by 681 tonnes of GHGs (or 30%). This decrease in waste production during a period of obvious employment growth is a testament to Saskatoon's commitment to doing business more efficiently.

## 4.7 CORPORATE INVENTORY SUMMARY

Overall emissions from Saskatoon's corporate operations increased 23% between 1990 and 2003 (see Table 27). The greatest absolute emissions increase was in the water and wastewater sector, followed by the building sector. Emissions from the vehicle fleet, street lights and corporate waste all decreased between the inventory years. These conclusions reveal sectors of the City's operations in which new emissions reduction opportunities present themselves and those areas in which the City has achieved significant emission reductions from past and existing measures.

**Table 27 – Growth in Energy Consumption and GHGs Generated per Corporate Sector Between 1990 and 2002**

| Sector | Cost (%) | GHGs (%) | GJ (%) | GHGs (t) | GJ |
|---|---|---|---|---|---|
| Buildings | 51 | 24 | 39 | 6,979 | 97,788 |
| Vehicle fleet | 31 | -5 | -5 | -307 | -4,149 |
| Streetlights | 22 | -14 | -5 | -2,680 | -3,943 |
| Water and wastewater | 91 | 85 | 86 | 13,942 | 84,464 |
| Corporate waste | NA | -30 | NA | -681 | NA |
| **Total** | **42** | **23** | **33** | **17,253** | **174,160** |



# 5.0 FORECASTS & MITIGATION MEASURES

This section provides an outlook on the possible GHG scenarios in Saskatoon's community and corporate operation's future. In creating these scenarios, an analysis of the impact of historic and future GHG reduction activities (a.k.a. measures) that have been undertaken with the City was completed. It is necessary to know the impact or expected impact of measures in order to develop forecasts of future GHG emissions and set a GHG reduction target that is feasible yet challenging. City of Saskatoon community members are currently implementing many of the measures summarized in this analysis, while other new measures have been recommended by IES for potential inclusion in the City's Local Action Plan.

In order to gain a better understanding of Saskatoon's future GHG emissions, multiple GHG emission forecast scenarios were developed:

- Business as Usual (BAU) forecast
- Planned
- Typical
- Optimistic

The BAU forecast projects future GHG emissions in the City if no further emission reduction measures were put in place. The Planned forecast projects GHG emissions if only those measures currently planned by the City are implemented. The Typical scenario adds new potential measures that the region could implement to further reduce its emissions. The Optimistic forecast examines the potential GHG reductions of planned and new measures given more intense levels of application, broader participation and greater emission reduction success. The forecasts were based on:

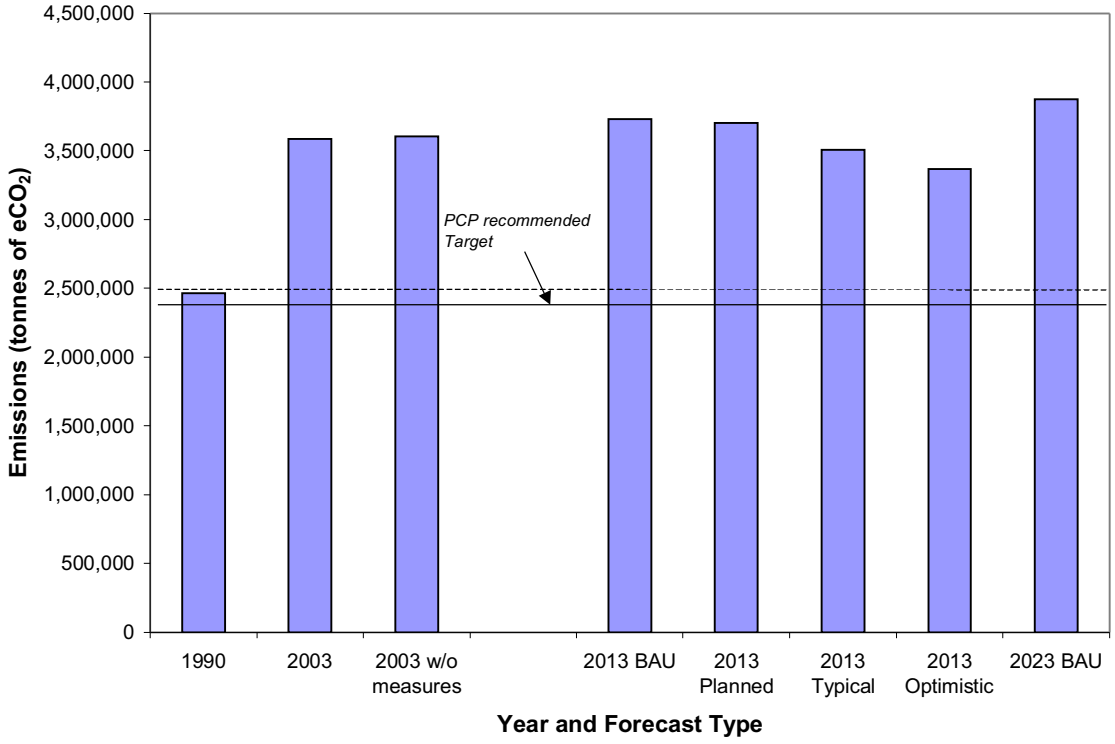
- Projected growth in population and corporate operations
- Effectiveness of historic and current energy and GHG initiatives implemented by the Region
- Effectiveness of energy and GHG emission reduction initiatives implemented by other municipal governments and corporations

This section of the report is broken down into two main discussions: 1) corporate forecasts and 2) community forecasts. These sections are in turn disaggregated into planned, typical and optimistic scenarios based on the level of emissions reductions sought. Finally, the corporate forecast section is further divided into emission targets for each of the buildings, vehicle fleet, street lighting, water and wastewater and waste sectors.

## 5.1 COMMUNITY FORECASTS

This section summarizes the details of the community GHG emissions forecast completed for Saskatoon. Figure D illustrates the changes in emissions projected between 2003, 2013 and 2023 based on the level of achievement made with planned and potential measures in the residential, commercial, institutional, industrial, transportation and waste sectors. The graph illustrates the change projected for each scenario from the 1990 baseline year (represented as a dotted line in the graph). A second, solid line represents the recommended PCP target of a 6% reduction in GHGs below 1990 levels or a reduction to 2,318,265 tonnes of GHGs.

**Figure D – Community Sector GHGs Emissions Forecasts 1990-2023**




### 5.1.1 BAU FORECAST

The BAU forecast is based on projections in electricity growth through to 2013 and 2023 provided by the City of Saskatoon Electric Services and SaskPower.

Under this scenario it is estimated that GHG emissions in the community sector would increase 51% above 1990 levels and 4% above 2003 levels by 2013. By 2023, emissions would increase 57% above 1990 levels and 8% above 2003.

### 5.1.2 PLANNED FORECAST

This scenario assumes that each of the new measures identified in section 5.4 is applied and achieve moderate rates of participate and application. Emissions savings of 29,130 tonnes could be achieved with these new measures already planned by the City.

Under this scenario it is estimated that GHG emissions in the community sector would increase 50% above 1990 levels and 3% above 2003 levels by 2013.

### 5.1.3 TYPICAL SCENARIO FORECAST

This scenario assumes that each of the new measures identified in section 5.4 is applied and achieve moderate rates of participate and application. In addition, several new measures, such as those recommended by ICLEI and any others developed through the local action planning process would also be implemented. As a result, community emissions would be reduced by 224,370 tonnes of GHGs per year.

Under this scenario 2013 emissions would rise to approximately 42% above 1990 levels and decrease 2% below 2003 emissions.

### 5.1.4 OPTIMISTIC SCENARIO FORECAST

If all of the planned and potential community GHG measures were applied and new measures were implemented with the greatest possible rigour, the City could reduce annual community emissions by approximately 365,079 tonnes.

Emissions would increase by approximately 36% above 1990 levels and decrease 6% below 2003 levels by 2013.

### 5.1.5 COMMUNITY FORECAST SUMMARY

Table 28 summarizes the forecasted scenarios for 2013 and 2023 relative to 1990 and 2003 GHG emission levels.

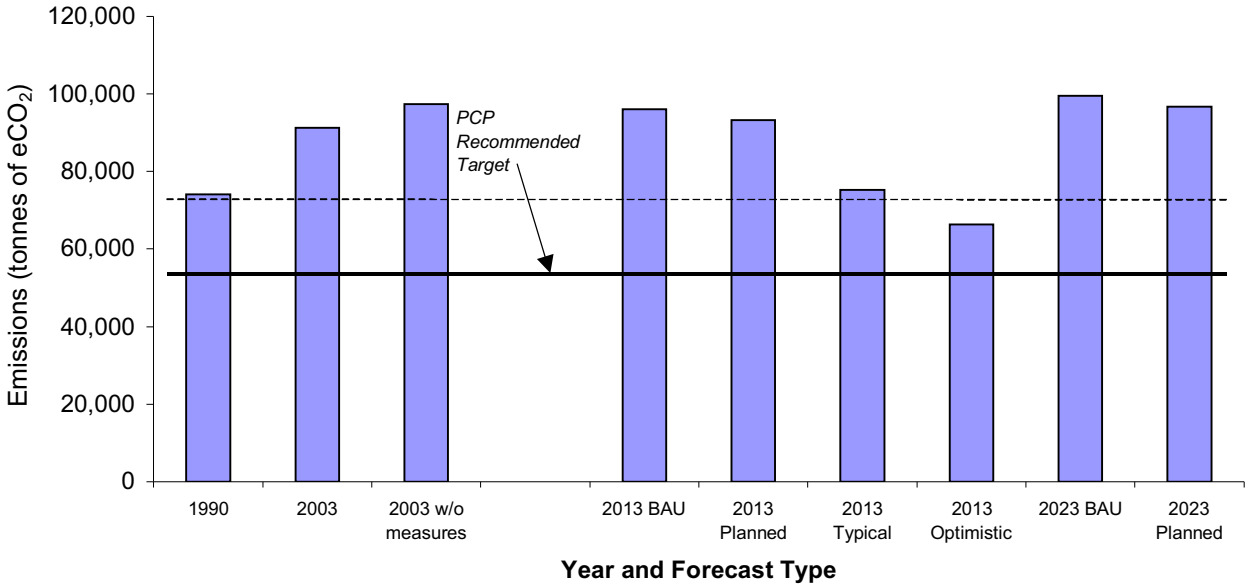
**Table 28 – Forecasted Emissions Growth in Community Relative to 1990 and 2003**

| Forecast Type | 2013 Forecast growth from 1990 (%) | 2013 Forecast growth from 2003 (%) | 2023 Forecast growth from 1990 (%) | 2023 Forecast growth from 2003 (%) |
|---|---|---|---|---|
| **BAU** | +51 | +4 | +57 | +8 |
| **Planned** | +50 | +3 | - | - |
| **Typical** | +42 | -2 | - | - |
| **Optimistic** | +36 | -6 | - | - |

## 5.2 CORPORATE FORECASTS

Potential GHG emissions attributable to Saskatoon's corporate sector were projected for the year 2013 and 2023. Forecasted emissions vary according to the level of GHG reductions that are anticipated within each of Saskatoon's sectors. Figure E illustrates the differences in potential emissions in 2013 and 2023 that would result from Saskatoon's scope of actions. If only measures currently planned were implemented, GHG emissions would rise 26% above 1990 levels by 2013. However, if Saskatoon applied planned measures with more rigor and adopted several new measures proven effective in other communities, emissions could be reduced to 10% below 1990 levels or 27% below 2003 emissions. To meet the recommended PCP target, the City would need to reduce projected 2013 Planned emissions by 34,035 tonnes of GHGs; this target would require a more aggressive commitment to climate action beyond the standard measures undertaken by most communities.

**Figure E – Corporate GHGs Emissions Scenarios Forecasts 1990-2023**




### 5.2.1 BAU FORECAST

In the BAU forecast, the energy use trends evident in Saskatoon's corporate operations remain constant. Emissions would rise to approximately 96,031 tonnes by 2013 and 99,484 tonnes by 2023.

The addition of new buildings, streetlights, water and wastewater treatment would increase energy consumption.

Projections of these changes in infrastructure were provided by members of the project team and are as follows:

1. *Buildings*: no estimates of new growth were provided
2. *Vehicle fleet*: approximately ten new vehicles are purchased for the vehicle fleet each year and thirty vehicles are replaced. The addition of ten new vehicles each year would result in the use of 50 additional vehicles by 2013 or 512 additional tonnes of GHGs (based on average fuel use per vehicle in 2003).
3. *Street lights*: an average of five intersections per year would result in an increase of 50 intersections by 2013 (or an additional 511 tonnes of GHGs); average annual growth of 20 x 250 watt lights per year for roadway construction and widening (roadway classification change) as well as 150 x 100 watt lights per year for subdivision growth and 50 x 100 watt lights per year for pathway lighting would result in approximately 821,250 kWh in 2013 or an additional 657 tonnes of GHGs
4. *Water and wastewater*: estimated growth at wastewater treatment facilities is 1.2% per year which would result in additional GHGs of approximately 1,773 tonnes by 2013 or 3,546 tonnes by 2023, plus an additional 1,280 tonnes of GHGs that will result from the development of ultra-violet treatment at the water treatment plant
5. *Waste*: no growth estimates were available

### 5.2.2 PLANNED FORECAST

This scenario assumes that each of the emissions reductions described in section 5.6 is implemented. New emission reductions of approximately 2,760 tonnes per year would be realized under this scenario.

Under the planned scenario, 2013 emissions would be 26% higher than 1990 levels and 2% above 2003 emission levels.

### 5.2.3 TYPICAL SCENARIO FORECAST

The research team provided savings estimates for several new measures not yet investigated by the City. Details of these measures are provided below in the sector-specific forecast summaries. Approximately 20,790 tonnes of GHGs would be avoided with these new measures.

Under this scenario, emissions would be brought down to 2% above 1990 levels and reduced to 18% percent below 2003 levels.

### 5.2.4 OPTIMISTIC SCENARIO FORECAST

By increasing the scope of the recommended new measures to levels above minimum success rates seen in other communities, further emission reductions were identified. In total approximately 29,710 additional tonnes of GHGs could be reduced under this scenario in addition to reductions already planned.

Under this scenario emissions would drop to 10% below 1990 levels by 2013 and 27% below 2003 levels. Table 29 summarizes the projected emission growth in Saskatoon's corporate GHGs from 1990 through 2023.

**Table 29 – Corporate Emissions Forecast Relative to 1990 and 2003 Emission Levels**

| Forecast Type | 2013 Forecast from 1990 (%) | 2013 Forecast from 2003 (%) | 2023 Forecast from 1990 (%) | 2023 Forecast from 2003 (%) |
|---|---|---|---|---|
| **BAU** | +30 | +5 | +34 | +9 |
| **Planned** | +26 | +2 | +31 | +6 |
| **Typical** | +2 | -18 | - | - |
| **Optimistic** | -10 | -27 | - | - |

## 5.3 CURRENT COMMUNITY MEASURES

Though it may not be exhaustive, Table 30 does include many initiatives undertaken within the City of Saskatoon by the City, local NGOs and private enterprises. As the City of Saskatoon works with local stakeholders to complete a local action plan, additional community GHG reduction measures may be revealed. A brief description of these measures is provided below.

**Table 30 - Current Community Measures Summary**

| Sector | Title | Annual GHGs Savings (t) |
|---|---|---|
| Residential | Energuide for Houses | 2,910 |
| | Homecheck | NA |
| | **Subtotal** | **2,910** |
| Commercial | Broadway Theatre | 0 |
| | Saskatoon Friendship Inn Energy Conservation Project | 20 |
| | Saskatchewan Building Energy Management Program | NA |
| | Ice Rink Energy Management Program | NA |
| | SaskPower Health Care Energy Management | NA |
| | SaskPower Energy Audits | NA |
| | SaskPower Energy Solutions | NA |
| | SaskPower Zero Garbage Recycling Program | NA |
| | Ramada Inn | 780 |
| | University of Saskatchewan CBIP Project | 1,020 |
| | University of Saskatchewan CBIP Project | 50 |
| | Saskatchewan Property Management Corporation | 1,360 |
| | **Subtotal** | **3,230** |
| Industrial | ATCO/SaskPower Cory Cogeneration Station | NA |
| | SaskPower/Husky | NA |
| | SaskPower EPC | NA |
| | Cypress Wind Power Facility (SaskPower) | NA |
| | Transmission Line Projects | NA |
| | SaskPower Generation Projects | NA |
| | **Subtotal** | **0** |
| Transportation | Catalytic Mufflers | NA |
| | Commuter Challenge | 0 |
| | Clean Air Day | NA |
| | Bicycle Facility Network Plan | NA |
| | Hike and Bike Challenge (Saskatchewan Environmental Society) | 10 |
| | Let's Drive Green | 5 |
| | **Subtotal** | **15** |
| Waste | Christmas Tree Recycling Program | 10 |
| | University of Saskatchewan thINK ink cartridge recycling program | NA |
| | City of Saskatoon Yard Waste Collection | 210 |
| | City of Saskatoon recycling depots program (mainly paper) | 14,620 |
| | Home composting program | 680 |
| | **Subtotal** | **15,520** |
| | **Total** | **21,675** |

### 5.3.1 RESIDENTIAL SECTOR

#### 5.3.1.1 Energuide for Houses

Within the City of Saskatoon, 830 B audits have been completed in accordance with Natural Resource Canada's (NRCAN) Energuide for Houses program. The B audit, the second audit in the Energuide process, allows Energuide professionals to go back into resident's homes for a second time to see first-hand all the energy efficiency upgrades that have been made in the home as a result of the recommendations made after the initial audit. The program has resulted in an approximate decrease of at least 2,910 tonnes of GHGs in the community sector each year.

#### 5.3.1.2 Homecheck

SaskPower offers an on-line audit for home-owners that allows them to calculate energy costs and emissions associated with their appliances. Homeowners can then calculate savings associated with upgrading to more energy efficient appliances. SaskPower could not provide estimates of the impact of this program in the City of Saskatoon. However, the program is included here as an important example of public education and outreach in the area of energy efficiency.

### 5.3.2 COMMERCIAL SECTOR

#### 5.3.2.1 Broadway Theatre

During its recent renovations, the theatre undertook several energy efficient upgrades. Insulation was upgraded to R:20 on the roof, R:16 on the walls and R:17 in the attic. An old boiler was replaced with a new, more efficient model (with programmable temperature setbacks). Washroom lighting was replaced with censored lighting and the hours of operation of the marquis were reduced.

#### 5.3.2.2 Saskatoon Friendship Inn Energy Conservation Project

With the help of the Saskatchewan Environmental Society (SES), an energy audit was carried out at the Saskatoon Friendship Inn and several energy conservation opportunities were identified. As a result of subsequent retrofits carried out at the Inn, annual attributable GHG emissions decreased by approximately 20 tonnes of GHGs.

#### 5.3.2.3 SaskPower/SaskEnergy Energy Efficiency Programs

SaskPower and SaskEnergy have implemented a number of residential, commercial and industrial programs designed to reduce the energy consumption of their customers. Because these programs are run province-wide and a few are focused on public education and outreach, no estimates of GHG reductions in the City of Saskatoon could be calculated. Accordingly, the programs are not described in detail in separate sections, but are listed below:

1. Ice Rink Energy Management Program
2. SaskPower Health Care Energy Management
3. SaskPower Energy Audits
4. SaskPower Energy Solutions
5. SaskPower Zero Garbage Recycling Program

#### 5.3.2.4 Ramada Inn

In 2001 staff at the Saskatoon Ramada Inn began replacing light bulbs (e.g. T12s) with more energy efficient compact fluorescent bulbs and T-8s. To date approximately 15% of the lights have been replaced with an eventual goal of 100% replacement. In addition, old boilers have been replaced with more efficient models. As a result the Ramada Inn has cut its annual GHG production by approximately 780 tonnes of GHGs and saved over $100,000 in operating costs.

#### 5.3.2.5 University of Saskatchewan CBIP Project – Kinesiology Building

The University of Saskatchewan constructed its Kinesiology building to CBIP standards (25% better than the Model National Energy Code for Buildings). Approximate annual GHG reductions attributable to this measure would be 1,020 tonnes.

#### 5.3.2.6 University of Saskatchewan CBIP Project – Spinks Building

The University completed an 889 square metre addition to the Spinks building using CBIP standards. The approximate annual GHG reductions associated with this measure would be 50 tonnes.

#### 5.3.2.7 Saskatchewan Property Management Corporation

Through SaskPower's loans for energy efficiency program, retrofits have been undertaken at the SIAST Kelsey campus, the Sturdy Stone building, the Court of Queen's Bench Courthouse, the Provincial Courthouse, the EA Davies buildings (beside SIAST), the Calder Centre and the Department of Highway's Equipment Repair Depot. Through this program, electricity consumption has been reduced by approximately 1,702,600 kWh per year and GHGs have decreased by 1,360 annually.

### 5.3.3 INDUSTRIAL SECTOR

#### 5.3.3.1 SaskPower Measures

SaskPower has implemented a number of measures designed to reduce the GHG emissions it produces to meet the electricity needs of its customers. However, because these measures will reduce emissions associated with electricity fed into the provincial grid, it is not possible to allocate a share of these reductions to Saskatoon's industrial sector.

### 5.3.4 TRANSPORTATION SECTOR

#### 5.3.4.1 Catalytic Muffler Conversions

Environment Canada and Canadian Urban Transportation Association (CUTA) sponsored eight conversions within the transit fleet. The City had planned all of its conversions to be completed by the end of the 2004 calendar year. While catalytic mufflers can reduce the release of the chemical precursors to smog, and improve air quality, they do little to help reduce the generation of GHGs and therefore no climate change benefit is attributable to this measure.

#### 5.3.4.2 Commuter Challenge

Several Saskatoon businesses and individuals take part in the Government of Canada's annual Commuter Challenge. As a result of their week-long commitment to taking alternative forms of transportation to work, these members of the community have reduced their annual GHG emissions by approximately 0.2 tonnes of GHGs.

#### 5.3.4.3 Clean Air Day

Saskatoon Transit in cooperation with the Canadian Urban Transit Association (CUTA) runs an annual event aimed at raising awareness of the benefits of transit use. The event includes such activities as a prize draw to encourage ridership. While no GHG emissions can be quantified for this measure, Clean Air Day in an important example of public education and outreach.

#### 5.3.4.4 Bicycle Facility Network Plan

The City's cycling network plan explores potential links between new and existing trails and ways to improve safety and convenience of routes for cyclists in the City of Saskatoon. Resource constraints have limited the City's ability to implement the plan. At the time of the writing of this report no information could be provided on the potential impact of this program on the number of cyclists or the number of automobile trips that could be replaced by cycling in the City.

#### 5.3.4.5 Hike and Bike Challenge (Saskatchewan Environmental Society)

The Hike and Bike program is a weeklong transportation campaign held during environment week to encourage the use of alternative transportation and active living.

In 2003, teams (300 people) participated and in 2004 there were over 65 teams (750 participants). The Saskatchewan Environmental Society and the local public health office administer the program. Approx. 10 tonnes of GHGs were avoided in 2004.

#### 5.3.4.6 Let's Drive Green

Through Environment Canada's Let's Drive Green Vehicle Emissions Clinics, trained Environment Canada staff travel from community to community and set up a free vehicle emissions testing station for the public. In addition to emissions testing for their vehicles, drivers receive tips for reducing their fuel consumption and subsequent GHG emissions. While no study has been completed of the benefits of the program, GHG reductions attributable to the driver education program have been estimated at five tonnes by organizations in other similar-sized communities.

### 5.3.5 WASTE

#### 5.3.5.1 City of Saskatoon Christmas Tree Recycling Program

The City of Saskatoon offers curbside collection of Christmas trees from its residents. The trees are chipped and used as mulch by the City. In 2003, 34 tonnes of trees were collected resulting in reduced GHGs emissions at the landfill by 10 tonnes.

#### 5.3.5.2 City of Saskatoon Yard Waste Collection

In 1999, the City initiated a curbside yard waste collection program. Yard waste (branches, leaves and etc.) is collected twice per year for two four-week periods during which waste is collected once a week from each household. This program reduces annual GHG emissions by approximately 210 tonnes.

#### 5.3.5.3 Recycling Depot Program

Through this program, the city collects recyclable materials from households at several recycling depots. Most of the material that goes to the depots is paper. Annual attributable GHG reductions are approximately 14,620 tonnes.

#### 5.3.5.4 Backyard Composting Subsidy Program

The City of Saskatoon has distributed over 11,000 backyard composts to its residents in the past four to five years. In another community, 17,000 composters were sold and leaf collection was reduced by 300 tonnes/year (or 0.0176 t/household). Other studies have shown that households who use their composter regularly will divert approx. 9.82 kg/week in food and yard waste; regular compost use by those who have purchased one from the municipality are around 60%. Using these results, approximate annual GHG reductions achieved through this program would be 680 tonnes.

## 5.4 FUTURE COMMUNITY MEASURES

Table 31 provides an overview of the some of the future measures that are planned for the community. These measures will be (were) implemented after the 2003 baseline year. While this list is not exhaustive, it does capture some of the major projects planned. A brief description of these measures is provided later on in this section and specific information about how the GHG reduction impacts were calculated is provided in an accompanying Excel Sheet. The highlighted measures are new measures recommended by the research team, which have not yet been investigated in the community.

**Table 31 - Future Community Measures Summary**

| Sector | Title | Annual GHGs Savings (t) | | |
|---|---|---|---|---|
| | | **Planned** | **Minimum** | **Typical** |
| **Residential** | Ecoplan (Saskatchewan Housing Corporation) | 810 | 810 | 810 |
| | CBIP Affordable Housing | 450 | 450 | 450 |
| | Neighbourhood Home Ownership Program | 60 | 60 | 60 |
| | Residential Energy Efficiency | NA | 28,740 | 43,110 |
| | **Subtotal** | **1,320** | **30,060** | **44,430** |
| **Commercial** | University of Saskatchewan Energy Conservation Plan | 11,920 | 11,920 | 11,920 |
| | Loans for Non-Profit Organizations Pilot Project | 600 | 600 | 600 |
| | Cogeneration Projects | 13,640 | 13,640 | 13,640 |
| | University of Saskatchewan Potential for Green Residence | NA | NA | NA |
| | Wind Turbine | 920 | 920 | 920 |
| | Improved Energy Efficiency | NA | 33,570 | 67,140 |
| | **Subtotal** | **27,080** | **60,650** | **94,220** |
| **Industrial** | Improved Energy Efficiency program | NA | 82,060 | 164,120 |
| | **Subtotal** | **NA** | **82.060** | **164,120** |
| **Transportation** | Biobus (Trial) | 10 | 10 | 10 |
| | Biobuses (Entire Fleet) | 420 | 830 | 1,660 |
| | Transit Idle Shut Down | 10 | 10 | 10 |
| | Implement AutoSmart program in driver training | NA | NA | NA |
| | Hybrid transit vehicles | NA | 100 | 210 |
| | Anti-idling Program | NA | 4,860 | 9,720 |
| | Carpooling initiatives | NA | NA | NA |
| | Walking school bus | NA | NA | NA |
| | Smart Driver Program for local vehicle fleets | NA | NA | NA |
| | Shift to Sustainable Modes of Transportation | NA | 33,240 | 33,240 |
| | **Subtotal** | **440** | **39,050** | **44,850** |
| **Waste** | Curbside recycling and composting programs | 290 | 290 | 290 |
| | Pay-as-you-throw program | NA | 12,260 | 17,170 |
| | **Subtotal** | **290** | **12,550** | **17,460** |
| | **Total** | **29,130** | **224,370** | **365,079** |

### 5.4.1 RESIDENTIAL SECTOR

#### 5.4.1.1 Ecoplan (Saskatchewan Housing Corporation)

Between 2003 & 2005 energy consumption in Senior Citizen's housing directly managed by the province of Saskatchewan will be reduced 10% through lighting/boiler retrofits & improved controls. Approximately 1500-2000 housing units in Saskatoon will be affected by this program resulting in annual GHG reductions of 810 tonnes of GHGs and annual cost savings of $100,000.

#### 5.4.1.2 Saskatchewan Housing Corporation – CBIP program

Between 2003 & 2009 approximately 333 to 400 affordable housing units will be built and funded by the Saskatchewan Housing Corporation (SHC) in Saskatoon. These units will meet CBIP requirements (potentially even R2000 standards). This program will achieve annual GHG reductions of approximately 450 tonnes.

#### 5.4.1.3 Neighbourhood Home Ownership Program

Beginning in 2003, $1500 grants will be provided to cooperative housing projects that undertake energy efficiency projects. Approximately 10-30 cooperative housing projects in Saskatoon have purchased facilities that may undertake such projects. These projects could result in approximate annual GHG reductions of 60 tonnes of GHGs.

#### 5.4.1.4 Residential Energy Efficiency

According to NRCan 830 B audits have been completed within the City. Research has shown that participation rates of 25% are achievable when a program combines education, and incentives. By working with local Energuide providers and utilities to promote the program, the City could improve participation to 10% of households or even 15%. If 10% of households achieved the average level of energy efficiency improvements seen in Saskatoon houses that have completed B audits, emissions would be reduced by 28,740 tonnes of GHGs. If 15% of households achieved the same level of reductions, emissions would be reduced by approximately 43,110 tonnes per year.

### 5.4.2 COMMERCIAL SECTOR

#### 5.4.2.1 University of Saskatchewan Energy Conservation Plan

The University hopes to initiate an energy conservation plan in 2005 that would result in approximate annual energy savings of 100 million megajoules or 11,920 fewer tonnes of GHGs.

#### 5.4.2.2 Loans for Non-Profit Organizations Pilot Project (Saskatchewan Environmental Society)

Through this program, loans are provided for retrofitting of buildings owned or managed by non-profits. At the time of writing of this report, several audits had been completed. The SES expects results to take a few years to be implemented but estimates that the program will eventually result in 600 tonnes of GHGs reductions.

#### 5.4.2.3 University of Saskatchewan Cogeneration project

The university is investigating the possibility of developing an organic waste processing facility, which may include gasification or anaerobic digestion technologies to produce electricity and/or thermal heat. This project could reduce annual emissions by approximately 13,640 tonnes of GHGs.

#### 5.4.2.4 University of Saskatchewan Potential for Green Residence

In 2007/2008 the University will construct a new student residence. Discussions are currently underway within the university committee to determine the potential for developing an energy efficient, green facility.

#### 5.4.2.5 Wind Turbine

The City is currently investigating the feasibility of developing a 1 Megawatt wind power project. Given the limited amount of detail available at the time this report was written, the research team could not provide an estimate of the associated GHG reductions.

#### 5.4.2.6 Improved Energy Efficiency

The City could work with the commercial sector to promote energy efficiency through programs such as CBIP. A typical estimate would be a 5% reduction in energy use. A more optimistic reduction would be 10%. A 5% reduction would result in annual GHG reductions of 33,570 tonnes. A 10% improvement in energy efficiency would result in annual GHG savings of 67,140.

### 5.4.3 INDUSTRIAL SECTOR

#### 5.4.3.1 Improved Energy Efficiency Program

Through general upgrades to lighting and heating and more specific process-related upgrades, industrial sector businesses in the City could improve their energy efficiency. Programs that have proven successful at engaging industry to reduce energy consumption, such as the Canadian Industry Program for Energy Conservation (CIPEC), Energuide for Industry could be promoted to local industry to achieve these reductions. A conservative estimate would be a 5% improvement in energy efficiency resulting in annual GHG reductions of 82,060 tonnes of GHGs. A 10% improvement in energy efficiency would result in annual GHG reductions of approximately 164,120 tonnes.

### 5.4.4 TRANSPORTATION SECTOR

#### 5.4.4.1 Biobus (Trial)

Over next two years, two transit buses will be run on a blend of 5% biodiesel (B5) fuel to test the potential for use of biodiesel in the entire transit fleet. This pilot project will result in emission reductions of approximately seven tonnes. This project will result in annual GHG reductions of approximately 10 tonnes.

#### 5.4.4.2 Biobus (Entire Fleet)

If the City converted its entire bus fleet to a B5 mix, annual emissions would be reduced by approximately 420 tonnes. If B10 were used in the bus fleet emissions would be reduced by 830 tonnes per year. A B20 mix would reduce annual emissions by 1,660 tonnes.

#### 5.4.4.3 Transit Shut Down

In 2004, Transit Services implemented a program to reduce engine idling by transit vehicles during the summer months. Between June 1 and September 30$^{th}$, drivers were asked to shut down their engines under certain conditions (e.g. if they were idling for longer than five minutes, if the temperature was higher than 10°C and etc.). The program resulted in the following benefits:

- Fuel usage was reduced by .90 litres per 100 kilometres travelled as compared to last year
- A reduction of 4,396 litres used to travel the same distance.
- Damaging engine idle time was reduced by as much as 1,395.5 hours.
- No safety or passenger related complaints were reported.
- Green House Gas (CO2) reduction of 11, 869.2 kilograms or 11.87 metric tones

Transit Services is continuing the program and has estimated that the program could result in savings of over $8,700 in 2005.

#### 5.4.4.4 Implement AutoSmart Program for Driver Training

The City could work with local driving schools (including transit) to implement NRCan's AutoSmart program. The program teaches fuel-efficient driving habits that reduce fuel use and related emissions. This program is important to spurring sustainable behaviours in the community, but no emissions reduction could be calculated for it do to the nature of the program.

#### 5.4.4.5 Purchase Hybrid Transit Vehicles

The City could purchase diesel hybrid vehicles for its vehicle fleet. These vehicles are estimated to be 25% more efficient than conventional diesel buses. A conservative estimate would be a replacement of 5% of the vehicle fleet with hybrid vehicles, resulting in 100 tonnes of GHG reductions per year.

A more optimistic scenario would be the replacement of 10% of the vehicle fleet with hybrids, which would achieve 210 tonnes of GHG reductions each year.

#### 5.4.4.6 Anti-idling Program

Several communities have implemented NRCan's community anti-idling program. The program, based on community based social marketing (CBSM) techniques has proven effective in getting people to commit to turning off their vehicles when parked. A typical GHG reduction for a community the size of Saskatoon would be 4,860 tonnes. A more optimistic estimate would be an annual GHG reduction of 9,720 tonnes per year.

#### 5.4.4.7 Carpooling Initiatives

The City of Saskatoon could promote carpooling in the community through the promotion of an online carpooling match service (e.g. www.carpool.ca), with incentives (e.g. carpooling lanes, preferred parking spaces for carpooling and etc.).

#### 5.4.4.8 Walking School Bus

Many communities have set up walking school buses. These programs allow children to walk to school in groups with adult volunteers. Children are engaged in a healthy, sustainable form of transportation and parents are freed from worries about their child's safety. (see www.walkingschoolbus.org for more information). While this in an important education and outreach program, no GHG reductions can be quantified.

#### 5.4.4.9 SmartDriver Program for Local Vehicle Fleets

The NRCan SmartDriver program can be used to teach vehicle fleet drivers fuel-efficient driving techniques. When implemented with corporate vehicle fleets in Toronto, the minimum impact on fuel use was a 10% reduction (Leitold, 2002). Information on the number of local vehicle fleets would need to be collected in order to calculate the potential impact of this measure.

#### 5.4.4.10 Shift to Sustainable Modes of Transportation

Boulder Colorado, is a City with a population of approx. 105,000 and density of approximately 4000 people per square mile. A 6% modal shift from single occupancy vehicle (SOV) transport to alternative transport (transit, cycling) was achieved through measures such as the purchase of smaller buses to run more frequently (every 10 min.-along major loops), transit discounts for bulk business purchases (e.g. for university students) and vivid communication (a race across town between cyclists and cars to prove how quick cycling had become in the city). A simple estimate would be a 6% reduction in SOV or annual GHG reductions of 33,240 tonnes.

### 5.4.5 WASTE

#### 5.4.5.1 Curbside recycling and composting program

In late October 2003, Saskatoon Curbside Recycling began offering residents of Saskatoon curbside pickup of their recyclable materials. For a small fee, the company collects materials from customers twice per month. The company collects approximately 240 tonnes of fibrous materials (paper, boxboard and etc.), which results in GHG reductions of approximately 290 tonnes. In 2004, the company had signed up 1000 customers. The company plans on increasing its collection efforts in the city.

#### 5.4.5.2 Pay-As-You-Throw (PAYT) Program

In the United States, 2000 communities have implemented a Pay-as-You Throw program. These programs set a limit for the number of bags of garbage each household can set out for free, after the limit, households are charged a fee for each additional bag of garbage. The fees associated with garbage production beyond the one bag per household limit can be used to fund waste diversion or collection efforts. To be successful, this program should be run in conjunction with a curbside recycling program. In communities that have implemented PAYT programs, land filled waste has been reduced 25-35% on average. If 25% of waste currently produced were avoided, annual GHGs would be reduced by approximately 12,260 tonnes. If 35% of the waste were avoided, annual GHG emission would be reduced by approximately 17,170 tonnes.

## 5.5 CURRENT CORPORATE MEASURES

Table 32 provides an overview of the measures, which the City of Saskatoon has already implemented within their operations, and the estimated GHG reduction impact they have had. A brief description of these measures is provided below and specific information about how the GHG reduction impact was calculated is provided in an accompanying spreadsheet in **Appendix G**. With these measures, the City produced emissions of 87,719 tonnes of GHGs in 2003. Without these actions, emissions would have been 94,519 tonnes.

Where zero emission reductions are listed next to a measure, the reductions were less than 0.5 tonnes per year.

**Table 32 - Current Corporate Measures Summary**

| Sector | Title | Annual GHG Savings (t) |
|---|---|---|
| Buildings | Green Loan Program - A.C.T. Arena and four other facilities | 1,280 |
| | Alice Turner Branch Library | 190 |
| | Operations Centre - Electric Utility | 80 |
| | Fire Hall #9 CBIP | 50 |
| | General Building Retrofits | 2,820 |
| | **Subtotal** | **4,420** |
| Vehicle Fleet | Fleet right-sizing | 40 |
| | Propane vehicles | 60 |
| | Natural gas police vehicle | 10 |
| | **Subtotal** | **110** |
| Street lights | LED traffic signals | 160 |
| | Mercury Vapour converted to High Pressure Sodium Street Lamps | 1,430 |
| | Credit Union Centre | 0 |
| | **Subtotal** | **1,590** |
| Water and Wastewater | Water Audit | NA |
| | **Subtotal** | **0** |
| | **Total** | **6,120** |

### 5.5.1 BUILDINGS

#### 5.5.1.1 Green Loan Program – A.C.T. Arena

In 1997, the City of Saskatoon's A.C.T. Arena was the first building to receive a municipal loan for energy efficient retrofits for the City's Green Loan Program. Retrofits related to the loan program were carried out at five of Saskatoon's largest facilities including a recreation facility and three pools. Approximately 255 tonnes of GHGs per year were avoided at the Arena and annual cost savings of $33,000. Similar measures were undertaken at four other City facilities, resulting in a total of approximately 1,280 tonnes of GHGs reductions per year.

#### 5.5.1.2 Alice Turner Branch Library

Completed in 1998, the Alice Turner Library was built to energy efficient Commercial Building Incentive (CBIP) and C-2000 standards. CBIP facilities are at least 25% more efficient than the Model National Energy Code for Buildings (MNECB). As a result of its progressive design, operations of the library produce 190 fewer tonnes of GHGs per year than a standard building and produce $15,813 in annual cost savings.

#### 5.5.1.3 Operations Centre, Electric Services

Several energy efficiency upgrades have been undertaken at Saskatoon's Operations Centre. In 1997 the heating, ventilation and air conditioning (HVAC) system was set to turn off outside of normal business hours. In 2003/2004 the building management system was replaced and the hot water heating pump was changed to a variable flow system. Building management now controls the interior lighting system and some areas have sensors while others are on a schedule. In addition, the southern walls of the main office have been shaded by mature trees and more trees were planted along eastern wall. All of these measures have resulted in GHG reductions of at least 80 tonnes of GHGs per year.

#### 5.5.1.4 Fire Hall #9 CBIP

According to the consultants who managed the retrofit, annual electricity savings would be approximately 56,494 MJ, annual natural gas savings would be 736,749 MJ or annual GHG savings of 50 tonnes per year.

#### 5.5.1.5 General Building Retrofits

Within the City's buildings, all lights have been switched from T12 to more efficient T8, HIDs and indirect lighting. DDC controls have been installed. These measures have resulted in GHG savings of approximately 2,820 tonnes per year.

### 5.5.2 VEHICLE FLEET

#### 5.5.2.1 Right-Sizing

In the last few years, the City of Saskatoon has replaced several large vehicles with smaller more fuel-efficient models capable of doing the same job as the bigger vehicles. To date, 38 full-sized vans have been replaced by mini-vans and one quarter tonne trucks have replaced 58 half tonne trucks. The replacement of the vans with mini-vans has resulted in approximate annual GHG reductions of 40 tonnes of GHGs.

#### 5.5.2.2 Propane Vehicles

The City purchased four propane vehicles. Since purchase they have traveled a total of 760,000 km and used 289,000 litres of propane. These vehicles have reduced emissions by 60 tonnes of GHGs since their date of purchase.

#### 5.5.2.3 Natural Gas Police Vehicle

In 2002, one natural gas vehicle was purchased for use by the police department. The vehicle did not fully function in its capacity as a police vehicle and has since been put to other use within the City's operations. The vehicle has resulted in approximate annual GHG reductions of 10 tonnes of GHGs.

### 5.5.3 STREET LIGHTS

#### 5.5.3.1 LED Replacement Program - Pilot Program

In 2003, the City refitted three intersections with low-emitting diode (LED) traffic signals to test the performance of these more efficient bulbs in the hopes that they would be a workable, more efficient lighting option to use in all of the City's traffic lights. As a result of this pilot project, the City reduced its annual GHG production by approximately 160 tonnes of GHGs.

#### 5.5.3.2 Credit Union Centre

At the Credit Union facility, lighting in the parking lot was upgraded using more energy efficient technology. Building lighting was upgraded so that it could be shut off automatically. At the time this report was written, information was not available on the savings generated by this measure.

#### 5.5.3.3 Switch from Mercury Vapour to High Pressure Sodium Street Lighting

All of the City of Saskatoon's old mercury vapour street lights have been replaced with more efficient high pressure sodium lights. The replacement program began in 1996 and finished in 2000. As a result of this retrofit program, Saskatoon has reduced its GHG production by approximately 1,430 tonnes of GHGs each year.

### 5.5.4 WATER AND WASTE WATER

#### 5.5.4.1 Water Audit

No information was provided about this measure and its impacts on energy consumption.

## 5.6 FUTURE CORPORATE MEASURES

Table 33 provides an overview of the measures, which the City of Saskatoon has planned for the future or implemented after 2003. A brief description of these measures is provided below and specific information about how the GHG reduction impact was calculated is provided in at accompanying Excel Sheet. The highlighted measures are new measures that are recommended for further study by the research team and have not yet been investigated by the City.

**Table 33 - Future Measures Planned by the City of Saskatoon**

| Sector | Title | Annual $eCO_2$ savings | | |
|---|---|---|---|---|
| | | **Planned** | **Typical** | **Optimistic** |
| **Buildings** | Arenas - expansions | NA | NA | NA |
| | City Yard Buildings - CBIP or better | 290 | 290 | 290 |
| | Farmers Market | NA | NA | NA |
| | Heat Exchangers on Pools | NA | NA | NA |
| | CBIP or better design standards for new facilities | NA | NA | NA |
| | Additional Building Retrofits | NA | 1,810 | 3,630 |
| | Revolving Fund to support energy efficiency projects | NA | NA | NA |
| | **Subtotal** | **290** | **2,100** | **3,920** |
| **Vehicle Fleet** | Implement an anti-idling campaign | NA | 600 | 1,210 |
| | Implement SmartDriver program in driver training | NA | NA | NA |
| | Convert vehicles to Biodiesel mix | NA | 130 | 270 |
| | Purchase hybrids (or similar ultra low-emission vehicles) | NA | 40 | 80 |
| | **Subtotal** | **0** | **770** | **1,560** |
| **Street Lights** | Traffic lighting LED program | 1,730 | 1,730 | 1,730 |
| | Holiday Lighting LED conversion | 40 | 40 | 40 |
| | Decrease streetlighting density | 0 | 290 | 730 |
| | **Subtotal** | **1,770** | **2,060** | **2,500** |
| **Water and Wastewater** | Variable Speed Drives | 700 | 700 | 700 |
| | Leak detection/reduction program | 0 | 6,090 | 9,130 |
| | Full-cost pricing | 0 | 4,870 | 6,390 |
| | Domestic Water Conservation Program | 0 | 3,890 | 4,470 |
| | Purchase Green Power | 0 | 310 | 1,040 |
| | **Subtotal** | **700** | **15,860** | **21,730** |
| | **TOTAL** | **2,760** | **20,790** | **29,710** |

### 5.6.1 BUILDINGS

#### 5.6.1.1 Arena Expansions – Waste Heat Capture and Reuse

The City of Saskatoon is planning to expand its arenas. Waste heat generated by compressors within the arena could be used to the change rooms in the expanded facility. Information was not available on the size of the expansion or the potential energy savings, thus an estimate of GHG reductions could not be provided at the time this report was written.

#### 5.6.1.2 City Yard Buildings to Commercial Building Incentive Program (CBIP) standard or better

Discussions are underway within the City regarding the possibility of building the city yard facilities to 25% or more energy efficiency than the Model National Energy Code for Buildings (MNECB). If the new buildings use approximately the same amount of energy as the existing, annual GHG emissions could be reduced by approximately 290 tonnes.

#### 5.6.1.3 Investigating potential to improve efficiency during renovations

The City is exploring opportunities to improve the energy efficiency of its buildings during renovations. For example, the Farmers' Market may be retrofitted using Leadership in Energy and Environmental Design (LEED) standards. No information was available on the size or energy use of the current facility therefore an estimate of GHG reductions associated with LEED technology could not be provided.

#### 5.6.1.4 Heat Exchangers on Pools

The City is considering the installation of heat exchangers on pools to reduce heating loads in its pool facilities. At the time of the writing of this report, there was not enough information to calculate the savings from this measure.

#### 5.6.1.5 CBIP or Better Design Standards for New Facilities

Staff would like to incorporate CBIP standards into the design of new facilities. At the time this report was written, no estimate was provided of future growth in Saskatoon's building stock and therefore no estimate could be made of the impact of this policy.

#### 5.6.1.6 Additional Building Retrofits

To date, Saskatoon has reduced emissions from buildings by approximately 15% (based on information supplied by the project team. It is generally acknowledged amongst energy efficiency professionals that a 25% reduction in building energy use can be achieved with limited effort and investment. Accordingly, by investigating further energy efficiency options, the city could reduce energy use in its buildings by an additional 5% or 10%. Additional annual GHG reductions of 1,810 to 3,630 tonnes could be achieved.

#### 5.6.1.7 Establish a Revolving Fund to Support Energy Efficiency Projects

A revolving fund finances specific types of projects with reliable and predictable paybacks. Money is repeatedly recycled back to the fund from these investments, and the fund is sustained over the long term. By creating a permanent fund to provide low-interest loans to cover the capital costs of GHG reductions, municipalities can overcome the challenges of limiting projects to those with short payback periods and low capital costs. Many Canadian cities (e.g. Toronto, Regina, Edmonton, Vancouver and others) have developed funds to enable staff to implement progressive measures to reduce energy use. This measure will be key to supporting the additional building retrofits described above and many of the other more ambitious energy efficiency measures recommended within this report.

### 5.6.2 VEHICLE FLEET

#### 5.6.2.1 Implement an Anti-idling Campaign

Many communities all across Canada have successfully implemented anti-idling campaigns in their vehicle fleets. A typical estimate would be a 10% reduction in fuel use or 600 tonnes of GHGs (this was the minimum reduction found in vehicle fleets that participated in Toronto's Repair Our Air Campaign); a more aggressive reduction would be 20% (1,210 tonnes of GHG reductions).

#### 5.6.2.2 Implement a SmartDriver Training Program

NRCan has developed a SmartDriver training course that teaches fuel efficient driving techniques to reduce fuel consumption and related emissions. At the time this report was written the research team was working with NRCan to obtain estimates of the efficacy of this program.

#### 5.6.2.3 Run Diesel-Powered Vehicles with a Biodiesel Fuel Mix

City-owned diesel powered vehicles could be run on a mix of biodiesel fuel. The City is currently testing out a mix of 5% biodiesel (B5) in its transit fleet. The GHG emission reductions associated with biodiesel are approximately equivalent to the proportion of biodiesel in the mix. For example a 5% biodiesel mix would result in approximately 5% reduction in GHG emissions, and a 10% biodiesel (B10) mix would result in approximately 10% reduction in emissions. A typical program might implement a B5 mix in all diesel-powered vehicles resulting in emission reductions of 5% and would result in approximately 130 tonnes of GHG reductions per year. A more optimistic application might use a 10% biodiesel mix and would result in approximately 270 tonnes of GHG reductions per year.

#### 5.6.2.4 Purchase Hybrids (or Similar Ultra Low-Emission Vehicles)

Hybrid vehicles use up to 50% less fuel and produce 80% fewer emissions than conventional motor vehicles. A conservative estimate assumes that five of the approximately 40 new vehicles purchased each year by the City of Saskatoon are hybrid vehicles. These vehicles would reduce GHG emissions by approximately 40 tonnes per year. A more optimistic scenario would be the replacement of 10 of 40 new vehicles with hybrids, resulting in annual GHG emission reductions of 80 tonnes.

### 5.6.3 STREET LIGHTING

#### 5.6.3.1 Traffic Lighting – Light Emitting Diode (LED) Replacement Program

In 2005, all traffic signals will be replaced with LEDs (within three years). In the City of Saskatoon's test scenario, the use of LEDs resulted in energy efficiency improvements of approximately 78%. Once this technology is applied to all of the City's traffic signals, GHGs will be reduced by approximately 1,730 tonnes.

#### 5.6.3.2 Holiday Lighting LED Replacement Program

In 2005 some LED holiday lights will be purchased for the City's lighting displays; the City eventually plans to convert all of its holiday lights to LEDs. Given that LED holiday lights use approximately $1/16^{th}$ the energy of standards coloured lights, this measure would reduce GHG emissions by approximately 40 tonnes.

#### 5.6.3.3 Decrease Street Light Density

The distance between the street light standards could be increased slightly to reduce energy efficiency while maintaining adequate lighting to address safety concerns. A conservative estimate would be a 2% reduction in the number of new streetlights needed, resulting in annual GHG reductions of 290 tonnes. A more optimistic estimate would be a 5% reduction in the number of lights, which would result in annual GHG emission reductions of 730 tonnes[4].

### 5.6.4 WATER AND WASTEWATER TREATMENT

#### 5.6.4.1 Variable Speed Drives

Installed at the wastewater treatment facility, this technology could reduce annual energy consumption by approximately 5% and reduce annual GHG emissions by approximately 700 tonnes.

#### 5.6.4.2 Leak detection/reduction program

The Halifax Regional Municipality (HRM) was one of the first municipalities in Canada to implement the International Water Association's standards for leakage reduction. Through this program, HRM was able to reduce its water treatment by 23%, thereby avoiding plant expansion. A conservative estimate would be a reduction in GHG emissions of approximately 20% or 6,090 tonnes per year. A more optimistic estimate would be a reduction of approximately 30% or 9,130 tonnes of GHGs per year. These reduction estimates are based on 20% and 30% reductions in the amount of energy used for water treatment.

#### 5.6.4.3 Full-Cost Pricing for Water Use

Currently, the City operates on a flat-rate pricing system. There is little incentive to conserve water under this system. Water use decreases up to 30% following implementation of metered or volume-based pricing. A typical estimate of savings associated with full-cost pricing would be a 20% reduction in water use and energy use associated with treatment and pumping. A more optimistic estimate would be a 30% reduction. A 20% reduction would result in 4,870 tonnes of GHG emission reductions each year and a 30% reduction would result in 6,390 tonnes of GHG reductions.

[4] Note that estimated reductions are for those lights powered by the City of Saskatoon only and do not include those lights supplied by SaskPower.

#### 5.6.4.4 Domestic Water Conservation Program

Many municipalities have implemented successful residential water conservation programs. With community based social marketing techniques (see www.cbsm.com for more information), Durham Region, in Ontario's Greater Toronto Area, was able to reduce lawn watering by 32% (or 215 L/household per day) with its water conservation program. The City of Kamloops, BC used an education and outreach program to reduce residential water consumption by 21%. The results experienced by these two communities are very similar to the success seen elsewhere. A typical estimate would therefore be a 20% reduction in water use and related energy consumption associated with treatment and pumping which would result in annual GHG reductions of 3,890 tonnes; a more aggressive campaign could result in reductions of up to 4,470 tonnes.

#### 5.6.4.5 Purchase Green Power

SaskPower currently sells green power at a cost of $2.50 for a 100 kWh block. By working with SaskPower to negotiate a bulk purchasing deal, the City could offset some of its emission with green power. A conservative estimate would be to purchase green power to offset 2% of the energy for water and wastewater treatment. A more optimistic target would be to purchase 10% green power to offset emissions. A 2% commitment to green power would result in emission reductions of approximately 310 tonnes of GHGs. A 10% commitment to green power would result in annual GHG reductions of approximately 1,040 tonnes.

# 6.0 INVESTMENT, SAVINGS & PAYBACK

## 6.1 EMISSION REDUCTION COST OVERVIEW ESTIMATED SAVINGS, INVESTMENT & PAYBACK WITH A DEEP-RETROFIT APPROACH

Achieving any of the reduced emission scenarios outlined in this report will require a broad range of measures with varying costs and paybacks. To gain a rough estimate of the investment required, these measures have been aggregated into a comprehensive plan with a single investment and payback goal. This deep retrofit approach will allow for an aggregated payback of up to seven years. In effect, short-term paybacks in the two to three year range will offset the cost of longer-term paybacks over the seven-year target. See Appendix F – Principles of A Deep Retrofit Approach for an explanation of the principles of a deep retrofit approach.

For each of the corporate forecasts developed in section 5.2 the potential cost savings and the initial investment required to realize these savings were determined based on the deep retrofit approach. Table 34 summarizes the results of the estimated annual financial savings that the implementation of each scenario would result in. Annual savings range from approximately $383,758 (if only planned measures were implemented) to $4,130,964 under the most optimistic GHG reduction scenario.

The estimate of the investment required ranges from approximately $2.7 million to $28.9 million. These can be daunting figures when considered in isolation. However, many of the expenses needed to implement the forecast scenarios are already covered by existing budgets and staffing costs. There are also many sources of outside funding to support these initiatives that the City will want to consider when designing and implementing various measures.

**Table 34 – Estimated GHG, Energy and Cost Savings and Associated Investment Requirements for the 2013 Corporate Scenarios**

| 2013 Forecast type | GHG saved (tonnes) | Energy to be reduced (GJ) | Estimated annual savings ($) | Initial investment required ($) |
|---|---|---|---|---|
| **Planned** | 2,760 | 21,010 | 383,758 | 2,686,308 |
| **Minimum** | 20,790 | 158,262 | 2,890,701 | 20,234,909 |
| **Typical** | 29,710 | 226,164 | 4,130,964 | 28,916,746 |

# 7.0 TARGET RECOMMENDATIONS

With a good understanding of potential future GHGs emissions attributable to Saskatoon's corporate and community sectors, ICLEI and the project team were tasked with setting a GHG reduction goal that is both challenging and achievable.

In order to define a GHGs emissions reduction target, three questions must be answered:

1. What will the baseline year be?
2. What will the forecast year be?
3. What will the GHGs emission reduction target be?

Most PCP members who have established GHGs reduction targets have adopted the PCP's preferred target of a 20% reduction in emissions for municipal operations and a minimum 6% reduction in the community, both within ten years of joining the PCP. The suggested 6% reduction in the community is based on Canada's Kyoto Protocol commitment while the 20% corporate operations target was designed to be more rigorous because it is an area over which the corporation has direct control and can demonstrate substantial leadership. The four future GHGs emissions forecasts were developed to ensure Saskatoon adopts a target that is achievable in light of the ongoing growth in the region and expanded corporate services and community activities.

In order to establish and achieve a target that is ambitious yet achievable, ICLEI recommends the following targets be adopted and endorsed by City of Saskatoon Council:

***For the corporate sector, it is recommended that the City of Saskatoon adopt an emission reduction target of a 27% reduction in GHGs below 2003 levels by 2013.***

***For the community sector, it is recommended that the City of Saskatoon adopt an emission reduction target of a 6% reduction below 2003 levels by 2013.***

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# 8.0 RECOMMENDATIONS

In order to achieve the PCP milestones, ICLEI recommends the City of Saskatoon undertake the following actions:

1. Council should endorse the target recommendations outlined within this report.
2. Consider all the new measures recommended by ICLEI in sections 5.6 and 5.4 to achieve the recommended targets
3. Work with City business units to develop a local action plan to reduce emissions from corporate activities
4. Work with community stakeholders to develop a local action plan to reduce emissions within the community sector. The Roadmap 20/20 process currently underway in Saskatoon, may be a good vehicle for engaging stakeholders in the local action planning process.
5. Further study is needed to determine what effect increased participation in curbside recycling would have on existing recycling programs (i.e. the depots) and participation in recycling in general

By developing strategies to reduce GHGs within the corporate and community sectors, the City will establish itself as leader in sustainable development in Canada and will accrue the benefits associated with GHG reduction measures, including (amongst other benefits) improved local air quality, better quality of life and job creation.

# 9.0 WORKS CITED

Leitold, M. The Anti-idling Project of the Ecology Action Centre. Final Report. Halifax. 2002.

D'Entremont, R. The Current Level of Composting in the City of Woodstock. March 2001. Online: http://www.csr.org/wdo_reports/WDO%20Composting%20Report%20-%20Metric.pdf

Better Buildings for Greater Vancouver. Internal Revolving Funds. January 16, 2002. Online: http://www.betterbuildings.ca/content/page.asp?a=20&zid=10

# APPENDIX A – NORTH AMERICAN CLASSIFICATION SYSTEM

Source: Statistics Canada (online: www.statscan.ca)

| | |
|---|---|
| Industries - Goods | Agriculture, fishing & hunting |
| | Mining and oil and gas extraction |
| | Utilities |
| | Construction |
| | Manufacturing |
| Industries - Services | Wholesale trade |
| | Retail trade |
| | Transportation and warehousing |
| | Information and cultural industries |
| | Finance and insurance |
| | Real estate and rental and leasing |
| | Professional, scientific and technical services |
| | Management of companies and enterprises |
| | Administrative and support, waste management and remediation services |
| | Educational services |
| | Health care and social assistance |
| | Arts, entertainment and recreation |
| | Accommodation and food services |
| | Other services (except public administration) |
| | Public Administration |

## APPENDIX B – GHG WORKING GROUP PARTICIPANTS

| Name & Title | Division/Business Unit |
|---|---|
| Eve Casavant, P. Eng. | Environmental Protection |
| Rob Chan, P. Eng. | Saskatoon Light & Power |
| Troy Daw | Environmental Protection |
| Abe Driedger | Transit Services Branch |
| Kelly Emke | Environmental Protection |
| Wade Gasmo | Waste Management |
| Maurice Mikytyshyn, F.M.A. | Asset Management Department |
| Tim Sedgewick | Water and Wastewater Treatment |
| Walter Wandzura | Fleets |
| Kelly Emke | Environmental Protection |
| Troy Daw | Environmental Protection |

## APPENDIX C – SASKATCHEWAN EMISSION COEFFICIENTS

The following table outlines the emissions generated during the production of one-kilowatt hour of electricity in the province of Saskatchewan during the years 1990 to 2000.

| Year | CO2 (kg/kWh) | N2O (kg/kWh) | CH4 (kg/kWh) |
|---|---|---|---|
| 1990 | 0.871 | 0.0099 | 0.000201 |
| 1991 | 0.864 | 6.73E-05 | 0.000199 |
| 1992 | 0.933 | 0.0105 | 0.000212 |
| 1993 | 0.868 | 0.00988 | 0.0002 |
| 1994 | 0.913 | 0.0104 | 0.00021 |
| 1995 | 0.884 | 0.0101 | 0.000204 |
| 1996 | 0.89 | 0.0101 | 0.000208 |
| 1997 | 0.827 | 0.00923 | 0.00019 |
| 1998 | 0.874 | 0.00962 | 0.00019 |
| 1999 | 0.82 | 0.00909 | 0.000188 |
| 2000 | 0.794 | 0.00585 | 0.000176 |

# APPENDIX D – CHANGES IN BUILDING TENURE (1990-2005)

| Building name | Change to size/tenure | Year |
|---|---|---|
| Lakeview Pavilion and Paddling Pool | Building demolished | 1999 |
| 259 A 3rd Ave South | Leased to third party by City | 1998-Present |
| Gun Range | Renovated (2,500 sq. f) | 1994 |
| Res Victoria Park | Leased to third party by City | 1990 |
| Gathercole Building | Demolished | 2004 |
| Alice Turner Library | Constructed | 1999 |
| Commissary | Constructed | 1991 |
| Kinsmen Park Rides (Concession) | Building replaced | 2001 |
| Lakeview Pavilion | Demolished | 2002 |

# APPENDIX E – DISTRIBUTION OF MATERIALS IN COMMUNITY WASTE

**Table 35: Distribution of Material in Municipal Land filled Waste (1999 and 2003)**

| Material | 1999 | | 2003 | |
|---|---|---|---|---|
| | Absolute value (tonnes) | Relative value (% of total waste) | Absolute value (tonnes) | Relative value (% of total waste) |
| Mixed solid waste | 2,162.15 | 45.3 | 1,811.99 | 53.9 |
| Concrete | 13.06 | 0.3 | 37.14 | 1.1 |
| Building material | 1,281.75 | 26.8 | 33.34 | 1.0 |
| Rubble | 100.58 | 2.1 | 79.89 | 2.4 |
| Shingles | 0.52 | 0.0 | 0.00 | 0.0 |
| Buried waste | 8.84 | 0.2 | 0.98 | 0.0 |
| Lime | 2.46 | 0.1 | 0.86 | 0.0 |
| Wire | 0.61 | 0.0 | 0.00 | 0.0 |
| Car parts | 0.00 | 0.0 | 0.00 | 0.0 |
| Sharps (medical waste) | 0.00 | 0.0 | 0.00 | 0.0 |
| Asbestos (bagged) | 9.77 | 0.2 | 0.00 | 0.0 |
| Manure | 0.00 | 0.0 | 0.00 | 0.0 |
| Animal carcasses | 1.23 | 0.0 | 5.85 | 0.2 |
| Wood waste (clean) | 1,193.36 | 25.0 | 1,391.03 | 41.4 |
| **Total** | **4,774.33** | **100.0** | **3,361.08** | **100.0** |

**Table 36: Distribution of Material in Community Land-filled Waste (1999 and 2003)**

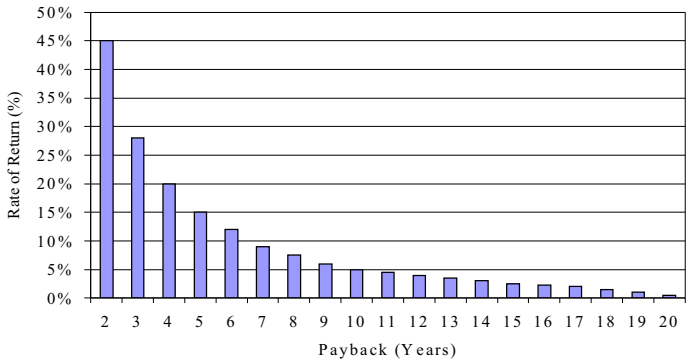
| Material | 1999 | | 2003 | |
|---|---|---|---|---|
| | Absolute value (tonnes) | Relative value (% of total waste) | Absolute value (tonnes) | Relative value (% of total waste) |
| Mixed solid waste | 92,249.17 | 90.2 | 94,836.50 | 93.1 |
| Concrete | 94.99 | 0.1 | 555.04 | 0.5 |
| Building material | 2,927.03 | 2.9 | 2,295.13 | 2.3 |
| Rubble | 109.85 | 0.1 | 250.03 | 0.2 |
| Shingles | 3,092.13 | 3.0 | 2,165.33 | 2.1 |
| Buried waste | 10.11 | 0.0 | 36.50 | 0.0 |
| Lime | 91.34 | 0.1 | 45.45 | 0.0 |
| Wire | 996.21 | 1.0 | 4.88 | 0.0 |
| Car parts | 0.00 | 0.0 | 0.00 | 0.0 |
| Sharps (medical waste) | 29.29 | 0.0 | 267.45 | 0.3 |
| Asbestos (bagged) | 13.88 | 0.0 | 23.00 | 0.0 |
| Manure | 0.00 | 0.0 | 2.25 | 0.0 |
| Animal carcasses | 0.00 | 0.0 | 0.02 | 0.0 |
| Wood waste (clean) | 2,610.87 | 2.6 | 1,361.89 | 1.3 |
| **Total** | **102,224.87** | **100.0** | **101,843.47** | **100.0** |

# APPENDIX F – PRINCIPLES OF A DEEP RETROFIT APPROACH

After estimating the energy and GHGs emissions savings potential available in the Saskatoon's buildings, vehicle fleets, and streetlights, the costs related to achieving these savings can be estimated given a payback period. Most municipalities use simple paybacks to assess whether or not to proceed with a recommended measure, by examining its implementation cost and predicted annual energy savings.

Simple Payback = Cost / Savings

**Figure F: Rate of Return vs. Payback[5]**

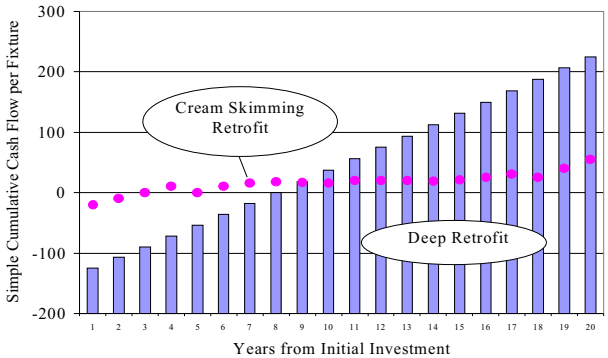



Municipalities tend to take a safe approach to measure implementation, investing in measures with short payback periods (typically two to five years) and high rates of return. Figure F illustrates the relationship between payback periods and rates of return. Essentially, a shorter payback period equates to a longer useful life and higher the rate of return. A two-to five-year payback corresponds to a 15 to 45 percent return on investment, which is considered exceptional.

With low-risk investments such as energy efficiency, most investors tend to settle for a much lower rate of return. The most effective approach to energy and GHGs emissions reduction is not necessarily to obtain high rates of return and short payback periods. In fact, this approach known as 'cream skimming'; can actually make it more difficult to perform comprehensive retrofits in the future.

**Figure G: Cream Skimming vs. Deep Retrofits[6]**

Figure G illustrates that measures that produce the greatest energy savings take longer to 'breakeven'. The overall benefits of 'deeper' retrofits in relation to energy and costs savings will be far greater in the long-term than those of short-term payback measures.




[5] ICLEI, Profiting from Energy Efficiency! A Financing Handbook for Municipalities, ICLEI Policy & Practice Series, September, 1993.
[6] Ibid.

By expecting high rates of return like 15 to 45% only 20 to 35% of the total gross potential savings available are achieved. At lower rates of return energy savings start to rise. Municipalities that want to get the most out of their investments over the long-term should therefore consider rates of return comparable to other capital investments, in the order of 5 to 10% (which translates to a 7- to 10-year payback).

# APPENDIX G – SASKATOON'S GHG REDUCTION MEASURES: CALCULATIONS, ASSUMPTIONS AND RESULTS

## Water & Sewage Sector Measures

Notes: Cells with shaded backgrounds indicate recommended new measures that have not yet been implemented by the City of Saskatoon

| ***Water & Sewage Sector Historic & Current Measures*** | | | Planned | Typical | Optimistic | | |
|---|---|---|---|---|---|---|---|
| *Title* | *Description* | *Calculation Notes* | *Annual eCO2 Savings (t)* | *Annual eCO2 Savings (t)* | *Annual eCO2 Savings (t)* | *Annual Energy Cost Savings ($)* | *Source* |
| Water Audit | Information was not submitted for this report | | NA | NA | NA | NA | For further information, please contact Rob Court, Operations Manager Water Treatment, City of Saskatoon |
| **Total Historic & Current** | | | **0** | **0** | **0** | **0** | |

| ***Water & Sewage Sector Future Measures*** | | | | | | | |
|---|---|---|---|---|---|---|---|
| *Title* | *Description* | *Calculation Notes* | *Annual eCO2 Savings (t)* | *Annual eCO2 Savings (t)* | | *Annual Energy Cost Savings ($)* | *Source* |
| Variable Speed Drives | | This technology could reduce annual energy consumption in the WWTP operations by approximately 5% | 700 | 700 | 700 | NA | Tim Sedgewick |
| Leak detection/reduction program | The Halifax Regional Municipality (HRM) was one of the first municipalities in Canada to implement the International Water Association's standards for leakage reduction. Through this program, HRMwas able to reduce its water treatment by 23%, thereby avoiding plant expansion. | Anecdotal evidence suggests that leak reduction programs can uncover and avoid losses of up to 30% of total treated water; for the purpose of this estimate, it was assumed that a typical reduction would be 20% and an aggressive estimate would be 30%. Note: Each of the proceeding calculations accounts for the emission reductions that would result from implementation of the other measures. | 0 | 6,090 | 9,130 | NA | http://www.infraguide.ca/newsletter_v2_1/leadstory/leadstory_e.asp |
| Full-cost pricing | Currently, city operates on flat rate pricing. Therefore there is little incentive to conserve water. | Water use decreases up to 30% following implementation of metres or volume-based pricing: A typical estimate would be 20% reduction, a more optimistic would be 30% | 0 | 4,870 | 6,390 | NA | Environment Canada - Guidelines for Municipal Water Pricing page 3. 1990. Roger MacNeill and Donald Tate |
| Domestic Water Conservation Program | Introduce conservation program to reduce water use during peak times | With social marketing techniques, Durham Region, ON was able to reduce lawn watering by 32% (or two hundred and fifteen litres of water per household per day at a program cost of $45/household); the City of Kamploops has reduced water use during summer months by 21% through its water conservation program. A conservative estimate would be 20% reduction, a more optimistic would be 30% | 0 | 3,890 | 4,470 | NA | http://www.cbsm.com |
| Purchase Green Power | SaskPower currently sells green power at a cost of $2.50 for 100 kWh; however, it is likely that the City could negotiate a bulk rate for its purchases | A conservative estimate would be to purchase 2% of the total energy used for W&WTP operations as green energy, a more optimistic would be 10% | 0 | 310 | 1,040 | NA | |
| **Total Future** | | | **700** | **15,860** | **21,730** | **NA** | |
| | | | | | | | |
| **Total Historic, Current & Future** | | | **700** | **15,860** | **21,730** | **NA** | |

For more information on water conservation, please see the following website:
Canadian Municipal Water Conservation Initiatives (CMHC)
http://www.cmhc-schl.gc.ca/publications/en/rh-pr/tech/01-121-E.htm

## Vehicle Fleet Measures

| *Vehicle Fleet Historic & Current Measures* | | | Planned | Typical | Optimistic | | |
|---|---|---|---|---|---|---|---|
| *Title* | *Description* | *Calculation Notes* | *Annual eCO2 Savings (t)* | *Annual eCO2 Savings (t)* | *Annual eCO2 Savings (t)* | *Annual Energy Cost Savings ($)* | *Source* |
| Fleet right-sizing | 38 full sized vans replaced by mini-vans; 58 1/2 tonne trucks replaced by 1/4 tonne trucks | Assumed that fuel efficiency of mini vans is approx. 19% better than vans (based on average of all vans and minivans classified by EPA; used 2003 fuel use/vehicle to estimate savings (=38 t) | 40 | 40 | 40 | NA | Walter Wandzura |
| Propane vehicles | Four vehicles running on propane; two converted and two factory built. The vehicles have traveled a total of 760,000 km and used 289,000 L of propane; propane units replaced gasoline units | Fuel efficiency seemed very low (38 L/100 km). Converted litres to GJ, found equivalent gasoline litres required to produce energy in 289,000 L of propane | 60 | 60 | 60 | NA | Walter Wandzura |
| Natural gas police vehicle | In 2002, one natural gas vehicle was purchased for use by the police department. The vehicle did not fully function in its capacity as a police vehicle and has since been put to other use. | To date, $1906.00 of fuel has been used in the vehicle. Current natural gas costs are approximately $0.67/kg, therefore fuel use has been approximately 2,845 kg. Savings would be seven tonnes if replacing diesel and 6 tonnes if replacing gasoline | 10 | 10 | 10 | NA | Walter Wandzura |
| **Total Historic & Current** | | | **110** | **110** | **110** | **NA** | |

| *Vehicle Fleet Future Measures* | | | | | | | |
|---|---|---|---|---|---|---|---|
| *Title* | *Description* | *Calculation Notes* | *Annual eCO2 Savings (t)* | *Annual eCO2 Savings (t)* | *Annual eCO2 Savings (t)* | *Annual Energy Cost Savings ($)* | |
| Implement an anti-idling campaign | Several communities have successfully implemented anti-idling campaigns in their fleets | A typical estimate would be a 10% reduction in fuel use (this was the minimum reduction found in fleets that participated in Toronto's Repair Our Air Campaign); a more aggressive reduction would be 20% | NA | 600 | 1,210 | NA | |
| Implement SmartDriver program in driver training | | | NA | NA | NA | NA | |
| Convert vehicles to Biodiesel mix | Convert fleet vehicles that currently run on diesel to Biodiesel mix | A typical estimate would be a mix of 5% biodiesel in all vehicles, a more aggressive mix would be a 10% mix | NA | 130 | 270 | NA | |
| Purchase hybrids (or similar ultra low-emission vehicles) | Hybrid vehicles use up to 50% less fuel and produce up to 80% fewer emissions. | It is usually most cost-effective to replace vehicles with the highest annual kilometres traveled (as the higher capital costs of alternatively fueled vehicles will be offset by reduced fuel expenses, a conservative estimate would be to purchase 5 (of 40) new/replacement vehicles as hybrids; a more optimistic measure would be to purchase 10 (of 40) new vehicles as hybrids. Estimated savings assume hybrid vehicles result in 80% fewer emissions. | NA | 40 | 80 | NA | |
| **Total Future** | | | **0** | **770** | **1,560** | **NA** | |
| | | | | | | | |
| **Total Historic, Current & Future** | | | **110** | **880** | **1,670** | **NA** | |

## Street lighting Measures

| ***Street lighting Historic & Current Measures*** | | | Planned | Typical | Optimistic | | |
|---|---|---|---|---|---|---|---|
| *Title* | *Description* | *Calculation Notes* | *Annual eCO2 Savings (t)* | | | *Annual Energy Cost Savings ($)* | *Source* |
| LED traffic signals | Installed at three intersections in 2003; based on results of test intersections provided by Corey Day | | 160 | 160 | 160 | NA | Corey Day |
| Mercury Vapour converted to High Pressure Sodium Street Lamps | Started in 1996 and finished by 2000. 125 W Mercury Vapour lights replaced with 100 W HPS; 175 W MV replaced with 150 W HPS; 400 W MV replaced with 250 W HPS | Based on 3285 hours of operation of lights each year | 1,430 | 1,430 | 1,430 | NA | Rob Chan |
| Credit Union Centre | Upgraded lighting in parking lot, upgraded lighting in building so that it can be shut off | | NA | NA | NA | NA | Maurice Mikytyshyn |
| **Total Historic & Current** | | | **1,590** | **1,590** | **1,590** | **NA** | |

| ***Street lighting Future Measures*** | | | | | | | |
|---|---|---|---|---|---|---|---|
| *Title* | *Description* | *Calculation Notes* | *Annual eCO2 Savings (t)* | | | *Annual Energy Cost Savings ($)* | *Source* |
| Traffic lighting LED program | In 2005, all signals will be replaced with LEDs (within three years) | In the test scenario; energy consumption decreased approx. 78% with installation of LEDs | 1,730 | 1,730 | 1,730 | NA | Cory Day |
| Holiday Lighting LED conversion | In 2005, some LEDs will be purchased for City lighting displays with the eventual goal being total conversion to LEDs (goal is to replace entire stock with LEDs | In 2003 the City's lighting display resulted in 41 tonnes of eCO2. It is assumed that an equal number of lights will be displayed in the future and that they will use 1/16th the energy of the current displays | 40 | 40 | 40 | NA | Rob Chan |
| Decrease street lighting density | The space between streetlights could be increased in new areas to reduce the number of lights needed | A conservative estimate would be 2% reduction in the number of new streetlights needed, a more optimistic would be a 5% reduction (City supplied lights only) | 0 | 290 | 730 | NA | |
| **Total Future** | | | **1,770** | **2,060** | **2,500** | **NA** | |
| | | | | | | | |
| **Total Historic, Current & Future** | | | **3,360** | **3,650** | **4,090** | **NA** | |

**Building Sector Measures**

| *Buildings Historic & Current Measures* | | | Planned | Typical | Optimistic | | |
|---|---|---|---|---|---|---|---|
| *Title* | *Description* | *Calculation Notes* | *Annual eCO2 Savings (t)* | *Annual eCO2 Savings (t)* | *Annual eCO2 Savings (t)* | *Annual Energy Cost Savings ($)* | *Source* |
| Green Loan Program - A.C.T. Arena and four other facilities | In 1997, A.C.T. Arena was the first building to receive municipal loan for energy efficiency retrofits. $250,000 was provided for lighting, reflective ceilings and ice temperature control equipment. Savings estimated at $33,000/year and decreased energy consumption of 15-20% | Assumed 1990 energy use decreased by 17.5% (would result in emissions savings of 255 tonnes). Four other facilities were converted, estimated savings of $151,000 per year ($184,000 - $33,000) and an approximate cost of $2/Gigajoule, according to Maurice Miktshyn. Estimate seen here assumes same level of savings as seen in A.C.T. Arena | 1,280 | 1,280 | 1,280 | 184,000 | http://www.city.saskatoon.sk.ca/org/news_releases/detail.asp?id=6 |
| Alice Turner Branch Library | | | 190 | 190 | 190 | 15,813 | http://oee.nrcan.gc.ca/newbuildings/buildings/casestudies-etudesdecas/a_turner_e.cfm?PrintView=N&Text=N |
| Operations Centre - Electric Utility | 1997 - HVAC system was set to tum off outside of normal business hours; 2003/2004 building management system was replaced; hot water heating pump changed variable flow; interior lighting system controlled by building management, some areas are sensored some are on schedule; southern wall of main office is shaded by planting of mature trees, more trees planted along eastern wall. | Based on energy reductions provided by Integrated Controls, a 23% decrease in electricity between 2003 and 2004 | 80 | 80 | 80 | NA | Glen Mcdonald via Rob Chan |
| Fire Hall #9 CBIP | | According to the consultants who managed the retrofit, annual electricity savings would be approx. 56,494 MJ, annual natural gas savings would be 736,749 MJ | 50 | 50 | 50 | NA | Source: Daniels Wingerak Engineering Ltd. |
| General Building Retrofits | All lights have been switched from T12 to T8, HIDs and indirect lighting, Direct Digital controls (DDC) | T8 bulbs are approximately 20% more efficient than T12s. Lighting generally accounts for approximately 35% of the energy used in a building, DDC can result in savings of 15%. For this estimate, we've assumed lighting accounts for approx. 30% of all energy used, and that 1/4 of the lighting would be T12s. Total emissions saved from T12-T8 conversions would be 921; If energy was cut 15% from 1990 levels by use of DDC's, the City would save 1,901 tonnes of $eCO_2$. | 2,820 | 2,820 | 2,820 | NA | Maurice Mikytyshyn |
| **Total Historic & Current** | | | **4,420** | **4,420** | **4,420** | **199,813** | |

| *Buildings Future Measures* | | | | | | | |
|---|---|---|---|---|---|---|---|
| *Title* | *Description* | *eCO2 calculation* | *Annual eCO2 Savings (t)* | | | *Annual Energy Cost Savings ($)* | *Source* |
| Arenas - expansions | City may use waste heat from compressors to heat change rooms in expanded facility | NA | NA | NA | NA | NA | Maurice Mikytyshyn |
| City Yard Buildings - CBIP or better | Requesting CBIP or better standard in rfp | Assumes that energy use at existing yard buildings would be reduced by 25% | 290 | 290 | 290 | NA | Maurice Mikytyshyn |
| Farmers Market | May be retrofitted using LEED standards | | NA | NA | NA | NA | Eve Casavant |
| Heat Exchangers on Pools | | | NA | NA | NA | NA | |
| CBIP or better design standards for new facilities | Develop and implement CBIP or better design standards for new facilities | | NA | NA | NA | NA | |
| Additional Building Retrofits | | To date, Saskatoon has reduced emissions from buildings by approx. 15% (based on info. collected). A conservative estimate would be 5%, a more aggressive estimate would be 10% (in is generally acknowledged amongst professionals that a 25% reduction in building energy use can be achieved with limited effort), an optimistic effort would be 15% | NA | 1,810 | 3,630 | NA | |
| Revolving Fund to support energy efficiency projects | A revolving fund finances specific types of projects with reliable and predictable paybacks. Money is repeatedly recycled back to the fund from these investments, and the fund is sustained over the long term. By creating a permanent fund to provide low-interest loans to cover the capital costs of GHG reductions, municipalities can overcome the challenges of limiting projects to those with short payback periods and low capital costs. Many Canadian cities (e.g. Toronto, Regina, Edmonton, Vancouver and others) have developed funds to enable staff to implement progressive measures to reduce energy use. | It is difficult to quantify this measure as it is supportive of many other energy efficiency projects identified in this study. However, other communities have realized huge savings in energy and associated costs through revolving fund programs | NA | NA | NA | NA | |
| **Total Future** | | | **290** | **2,100** | **3,920** | **NA** | |
| | | | | | | | |
| **Total Historic, Current & Future** | | | **4,710** | **6,520** | **8,340** | **199,813** | |

## Residential Sector Measures

| ***Residential Sector Historic & Current Measures*** | | | **Planned** | **Typical** | **Optimistic** | | |
|---|---|---|---|---|---|---|---|
| *Title* | *Description* | *Calculation Notes* | *Annual eCO2 Savings (t)* | | | *Annual Energy Cost Savings ($)* | *Source* |
| Energuide for Houses | Program is implemented by Sunridge in Saskatoon | Numbers provided by NRCan. 830 B audits completed in Saskatoon. Total emission reductions attributable to B audits between 1998 & 2004 was 2908 | 2,910 | 2,910 | 2,910 | NA | Pierre Galland, Assistant Technical Advisor, NRCan |
| Homecheck | On-line audit for home-owners that allows them to calculate energy costs and emissions associated with their appliances - they can then calculate savings associated with upgrading to more energy efficient appliances | | NA | NA | NA | NA | SaskPower online |
| **Total Historic & Current** | | | **2,910** | **2,910** | **2,910** | **NA** | |

| ***Residential Sector Future Measures*** | | | | | | | |
|---|---|---|---|---|---|---|---|
| *Title* | *Description* | *Calculation Notes* | *Annual eCO2 Savings (t)* | | | *Annual Energy Cost Savings ($)* | *Source* |
| Ecoplan (Saskatchewan Housing Corporation) | Between 2003 & 2005 energy consumption in Senior's housing directly managed by the province will be reduced 10% through lighting/boiler retrofits & improved controls; approx. 1500-2000 .units in Saskatoon will be affected | Assuming 40% savings from electricity and 60% from natural gas. | 810 | 810 | 810 | 100,000 | Ray Scieber, Saskatchewan Housing |
| CBIP Affordable Housing | Between 2003 & 2009 between 333 & 400 affordable housing units will built and funded by SHC in Saskatoon - these will meet CBIP requirements (SHC is trying to secure funding to increase CBIP to R2000 standard) | Assuming 333 units constructed, similar level of savings/size as senior housing | 450 | 450 | 450 | NA | Ray Scieber, Saskatchewan Housing |
| Neighbourhood Home Ownership Program | Beginning in 2003, $1500 grants will be provided to cooperative housing projects that undertake energy efficiency projects - 10-30 projects in Saskatoon have purchased facilities that may undertake such projects. | Assuming all 30 projects are implemented and they save $250/year. Assuming 40% savings from electricity, 60% from natural gas for heating (cost of $.09/kWh and $0.25/cm gas) | 60 | 60 | 60 | 7,500 | Ray Saskatchewan Housing |
| Residential Energy Efficiency | Cross-promote Energuide through City; work with church groups to promote energy efficiency | A conservative estimate would be 10% of households; an optimistic would be 15% (reductions based on average seen in audits already completed I.e 3.5 t/household) | 0 | 28,740 | 43,110 | NA | |
| **Total Future** | | | **1,320** | **30,060** | **44,430** | **107,500** | |
| | | | | | | | |
| **Total Historic, Current & Future** | | | **4,230** | **32,970** | **47,340** | **107,500** | |

## Industrial Sector Measures

| ***Industrial Sector Historic & Current Measures*** | | | Planned | Typical | Optimistic | | |
|---|---|---|---|---|---|---|---|
| *Title* | *Description* | *Calculation Notes* | *Annual eCO2 Savings (t)* | *Annual eCO2 Savings (t)* | *Annual eCO2 Savings (t)* | *Annual Energy Cost Savings ($)* | *Source* |
| ATCO/SaskPower Cory Cogeneration Station | Constructed in 2002 at the Potash Mine 6.4 km west of Saskatoon. Annual average capacity of 228 MW. Natural Gas fired. | | NA | NA | NA | NA | http://www.atco.com/Search.asp |
| SaskPower/Husky | | | NA | NA | NA | NA | http://www.saskpower.com/greengen/greenstrat/dc c1.shtml |
| SaskPower EPC | | | NA | NA | NA | NA | http://www.saskpower.com/greengen/greenstrat/dc c1.shtml |
| Cypress Wind Power Facility (SaskPower) | Nine turbines install in 2002 (total capacity 6MW); Sweven turbines added in 03 bringing capacity to 11 MW | | NA | NA | NA | NA | http://www.saskpower.com/greengen/greenstrat/dc c1.shtml |
| Transmission Line Projects | Condie/QE transmission line upgraded in 1997 | | NA | NA | NA | NA | http://www.saskpower.com/greengen/greenstrat/dc c1.shtml |
| SaskPower Generation Projects | 1991-1997 initiatives undertaken in design or operation to reduce GHGs (including e.g. such as boundary dam boiler/turbine optimization, boiler upgrades and etc. | | NA | NA | NA | NA | http://www.saskpower.com/greengen/greenstrat/dc c1.shtml |
| **Total Historic & Current** | | | **0** | **0** | **0** | NA | |

| ***Industrial Sector Future Measures*** | | | | | | | |
|---|---|---|---|---|---|---|---|
| *Title* | *Description* | *Calculation Notes* | *Annual eCO2 Savings (t)* | *Annual eCO2 Savings (t)* | *Annual eCO2 Savings (t)* | *Annual Energy Cost Savings ($)* | *Source* |
| Improved Energy Efficiency program | | A conservative estimate would a 5% reduction, a more optimistic would be a 10% reduction | 0 | 82,060 | 164,120 | NA | |
| **Total Future** | | | **0** | **82,060** | **164,120** | **NA** | |
| | | | | | | | |
| **Total Historic, Current & Future** | | | **0** | **82,060** | **164,120** | **NA** | |

## Commercial Sector Measures

| *Commercial Sector Historic & Current Measures* | | | Planned | Typical | Optimistic | | |
|---|---|---|---|---|---|---|---|
| *Title* | *Description* | *Calculation Notes* | *Annual eCO2 Savings (t)* | *Annual eCO2 Savings (t)* | *Annual eCO2 Savings (t)* | *Annual Energy Cost Savings ($)* | *Source* |
| Broadway Theatre | Upgraded insulation (R:20 on roof, R:16 on walls, R:17 on attic; replaced old boiler with new more efficient model (with programmable temperature setbacks); washrooms placed on sensored lighting, marquis placed on sensor lighting | Natural gas bill has been cut in half, also saving on electricity | NA | NA | NA | NA | Blair McCann, Vice President FOB Theatre |
| Saskatoon Friendship Inn Energy Conservation Project | Partnership between Friendship Inn and Sask. Environmental Society. Retrofits undertaken in July 1999 | Projected savings of $1500 per year and 18 t eCO2 (actual savings in 1999 were $1,100 - expected to rise) | 20 | 20 | 20 | 1,500 | http://www.environmentalsociety.ca/issues/energy/fiecp.html |
| Saskatchewan Building Energy Management Program | Began in 1996 with start-up funds provided by SaskPower and SaskEnergy; audits fo energy and natural gas savings | | NA | NA | NA | NA | SaskPower Environmental Review 2003 |
| Ice Rink Energy Management Program | Initiated in 1995 with intention of assisting municipal rinks with operating costs. | | NA | NA | NA | NA | SaskPower Environmental Review 2003 |
| SaskPower Health Care Energy Management | 1994, partnership between SaskPower, SaskEnergy, NRCAN, Sask. Energy & Mines and Sask. Health to create pilot project to I.d. energy savings at health facilities. Devices installed and staff trained in EE | | NA | NA | NA | NA | SaskPower Environmental Review 2003 |
| SaskPower Energy Audits | Between 1990 and 1994 SaskPower offered an energy audit program to help industrial and commercial consumers find energy savings in their operations. = 29 million kWh in savings at provincial level | | NA | NA | NA | NA | SaskPower Environmental Review 2003 |
| SaskPower Energy Solutions | Created in 1999; provides EPCs and Transformer Maintenance Solution | | NA | NA | NA | NA | SaskPower Environmental Review 2003 |
| SaskPower Zero Garbage Recycling Program | Since 1993, at offices, generating stations, transmission and distribution facilities throughout Sask. Includes waste audits, and recycling | | NA | NA | NA | NA | SaskPower Environmental Review 2003 |
| Ramada Inn | In 2001 started replacing light bulbs with compact fluorescents and T12s replaced with T-8s (15% lights replaced to date - 100% eventually replaced); replaced boilers with more efficient models | Annual cost savings of $100,000 (natural gas for boiler) and $3000 lighting (15%). Savings estimated based on cost of $ /kWh and $/cm | 780 | 780 | 780 | 103,000 | Ramada Inn Maintenance Supervisor |
| University of Saskatchewan CBIP Project Kinesiology Building | Kinesiology Building | Area of building is 18,921 sq. m and is performing at 26% better than MNECB. It was assumed that a typical building's energy use would be 1200 MJ/m2; An MNECB building would use 1085 MJ/m2 and 26% better would be 803 MJ/m2 (all divided equally b/w electricity and natural gas) | 1,020 | 1,020 | 1,020 | NA | Margret Asmuss, Sustainability Coordinator, University of Saskatchewan |
| University of Saskatchewan CBIP Project Spinks Building | Spinks Building Addition | Area of addition is 899 sq. m and is performing at 29% better than MNECB. See assumptions for U of S's Kin. Building | 50 | 50 | 50 | NA | Margret Asmuss, Sustainability Coordinator, University of Saskatchewan |
| Saskatchewan Property Management Corporation | Retrofits at the SIAST Kelsey campus, Sturdy Stone building, Court of Queen's Bench Courthouse, the Provincial Courthouse, EA Davies buildings (beside SIAST), the Calder Centre and the Dept Highways Equipment Highways Equipment Repair Depot | Total electricity reduction for project is 1,702,600 kWh per year. | 1,360 | 1,360 | 1,360 | NA | Margret Asmuss, Sustainability Coordinator, University of Saskatchewan |
| **Total Historic & Current** | | | **3,230** | **3,230** | **3,230** | **104,500** | |

| *Commercial Sector Future Measures* | | | | | | | |
|---|---|---|---|---|---|---|---|
| *Title* | *Description* | *Calculation Notes* | *Annual eCO2 Savings (t)* | | | *Annual Energy Cost Savings ($)* | *Source* |
| University of Saskatoon Energy Conservation Plan | Hope to intiate in 2005, initial savings would be 100,000,000 MJ per year and grow from there | Where savings are provided, but not divided into electricity and natural gas, it assumed 60% for NG and 40% attributable to electricity. Therefore 11,111,111 kWh would be saved (8889 t) and 1,611,604 cm of natural gas (3030 t) | 11,920 | 11,920 | 11,920 | NA | Margret Asmuss, Sustainability Coordinator, University of Saskatchewan |
| Loans for Non-Profit Organizations Pilot Project | Loans provided for retrofitting of buildings owned or managed by non-profits. At time of writing, several audits had been completed, Angie Bugg expects results to take a few years to be implemented | Cost of retrofits estimated at $332,000 which will result in annual savings of $85,000 (20%) and approx. 600 tonnes of GHGs | 600 | 600 | 600 | 85,000 | Angie Bugg, Saskatchewan Environmental Society (dcsask@envirosociety.ca) |
| Cogeneration Projects | City is working with University of Saskatoon and Home Farms to explore feasibility of two cogeneration projects (5MW) and (3.8 MW). U of S project would use organic waste processing facility which may include gasification or anaerobic digestion technologies to produce electricity and/or thermal heat.Savings in HRM ranged from 1200-1900 tonnes/MW. | | 13,640 | 13,640 | 13,640 | NA | Rob Chan |
| University of Saskatoon Potential for Green Residence | US examining potential for new residence (to be constructed in 07/08 to be "green" project (minimize impacts on environment including energy) | | NA | NA | NA | NA | Angie Bugg, Saskatchewan Environmental Society (dcsask@envirosociety.ca) |
| Wind Turbine | City is investigating feasibility of Wind Power (1MW) | | 920 | 920 | 920 | NA | Rob Chan, City of Saskatoon |
| **Improved Energy Efficiency** | Typical reduction would be 5%, a more optimistic would be 10% | | NA | 33,570 | 67,140 | NA | |
| **Total Future** | | | **27,080** | **60,650** | **94,220** | **85,000** | |
| | | | | | | | |
| **Total Historic, Current & Future** | | | **30,310** | **63,880** | **97,450** | **189,500** | |

**Transportation Sector Measures**

| ***Transportation Sector Historic & Current Measures*** | | | Planned | Typical | Optimistic | | |
|---|---|---|---|---|---|---|---|
| *Title* | *Description* | *Calculation Notes* | *Annual eCO2 Savings (t)* | *Annual eCO2 Savings (t)* | *Annual eCO2 Savings (t)* | *Annual Energy Cost Savings ($)* | *Source* |
| Catalytic Mufflers | Environment Canada and Canadian Urban Transportation Association (CUTA) sponsored eight conversions within the transit fleet. All conversions to be completed by the end of the 2004 calendar year. | While these mufflers will reduce smog precursors, they will hav little to no impact on GHGs and therefore no emission reduction is attributable to this measure | NA | NA | NA | NA | Abe Driedger |
| Commuter Challenge | NRCan's annual alternative commute promotion week - participants can sign up online | Estimated impact of 0.2 t GHG reductions (because of rounding shows up as zero here) | 0 | 0 | 0 | NA | www.commuterchallenge.ca (2003 results) |
| Clean Air Day | Saskatoon Transit with CUTA runs events such as prize draw to encourage ridership. June 6 2001 | | NA | NA | NA | NA | http://www.city.saskatoon.sk.ca/org/news_releases/deta .asp?id=500 |
| Bicycle Facility Network Plan | | | NA | NA | NA | NA | City of Saskatoon Website |
| Hike and Bike Challeng (Saskatchewan Environmental Society) | Week long transportation campaign during environment week. In 2003 30 teams (300 people) participated and in 2004 there were over 65 teams (750 participants). Approx. 10 tonnes of GHGs were avoided in 2004 | NA | 10 | 10 | 10 | NA | Alison Brady, Saskatchewan Environmental Society |
| Let's Drive Green | Environment Canada | | 5 | 5 | 5 | NA | Mark Thompson, Program Engineer ph (819) 994-2752 |
| **Total Historic & Current** | | | **15** | **15** | **15** | **0** | |

| ***Transportation Sector Future Measures*** | | | Planned | Typical | Optimistic | | |
|---|---|---|---|---|---|---|---|
| *Title* | *Description* | *Calculation Notes* | *Annual eCO2 Savings (t)* | *Annual eCO2 Savings (t)* | *Annual eCO2 Savings (t)* | *Annual Energy Cost Savings ($)* | *Source* |
| Biobus (Trial) | Over next two years, two transit buses will run on 5% biodiesel | | 10 | 10 | 10 | NA | Abe Driedger |
| Biobus (Entire Fleet) | Estimates savings if entire fleet was converted to biodiesel: planned would be 5%, typical 10% and optimistic would be 20% (did not estimate higher than 20% due to concerns of fuel coagulating in cooler temperatures) | | 420 | 830 | 1660 | NA | |
| Transit Shut Down | Transit has implemented a program to reduce idling during summer months (June 1-Sept. 31st.). In 2004, the program reduced GHG emission by almost 12 tonnes and reduced fuel consumption by over 4,000 L | | 10 | 10 | 10 | NA | Abe Driedger |
| Implement AutoSmart program in driver training | Encourage local driver education programs to adopt NRCan's AutoSmart driver education program | | | | | NA | |
| Hybrid transit vehicles | Purchase diesel hybrid electric vehicles for transit fleet | Estimated 25% more efficient than standard technology; conservative estimate would be replacement of 5% of fleet with hybrids, more aggressive target would be replacement of 10% o fleet with hybrids | 0 | 100 | 210 | NA | |
| Anti-idling Program | Similar to NRCan's Drive Smart program | A conservative estimate would be 10% of community reduces idling by 10 minutes per day would result in people reducing fu use by 100L/year; a more optimistic would be 20% | 0 | 4,860 | 9,720 | NA | |
| Carpooling initiatives | Promote carpooling through community-based social marketing method (e.g. with norms, prompts and etc.) | | 0 | 0 | 0 | NA | |
| Walking school bus | | Important public education and outreach tool (promotes sustainable behaviour to children), Anecdotally, one program resulted in a 20% increase in the number of 8-10 year olds walking to school each day | 0 | 0 | 0 | NA | http://www.walkingbus.com/questions.htm |
| Smart Driver Program for local fleets | One driving for efficiency program implemented in the Netherlands and employing social marketing techniques produced a 5.5% reduction in fleet fu use (results verified six months after program implementation) | | NA | NA | NA | NA | |
| Shift to Sustainable Modes of Transportation | In Boulder Colorado, a City with a population of approx. 105,000 and density of approx 4000/sq. mile (in Boulder proper), a 6% modal shift from single occupancy vehicle (SOV) transport to alternative transport (transit, cycling) was achieved through measures such as: the purchasing and smaller buses to run more frequently - every 10 min.-along major loops (making transit more convenient), transit discounts for bulk business purchases (e.g. for university students), vivid communication (race across town between cyclists and cars | Simple typical estimate assumes 6% shift in modal change and subsequent equitable decrease in emissions. | 0 | 33,240 | 33,240 | NA | http://www.cbsm.com/ |
| **Total Future** | | | **440** | **39,050** | **44,850** | **NA** | |
| | | | | | | | |
| **Total Historic, Current & Future** | | | **455** | **39,065** | **44,865** | **NA** | |

## Waste Sector Measures

| *Waste Sector Historic & Current Measures* | | | **Planned** | **Typical** | **Optimistic** | | |
|---|---|---|---|---|---|---|---|
| *Title* | *Description* | *Calculation Notes* | *Annual eCO2 Savings (t)* | *Annual eCO2 Savings (t)* | *Annual eCO2 Savings (t)* | *Annual Energy Cost Savings ($)* | *Source* |
| Christmas Tree Recycling Program | Trees are collected by City, chipped and used as mulch | 34 tonnes in 2003 | 10 | 10 | 10 | NA | Eve Casavant |
| City of Saskatoon Yard Waste Collection | Began in 1999; waste collected twice year for four weeks/one day per week | 21.74 tonnes collected from subscribers; 972.6 t (Outbound); 60.45 t from 8th St Yards (2003 numbers) | 210 | 210 | 210 | NA | Eve Casavant |
| City of Saskatoon recycling depots program | Paper program began prior to 1990, all others after 1990. | Annual tonnes recycled (from 2003); Old Newspapers 6199 t, Milk cartons 20 t, Cosmo paper 5861 t | 14,620 | 14,620 | 14,620 | NA | Eve Casavant |
| Home composting program | 11,000 composters sold since 2001 | In another community, 17,000 composters were sold, leaf collection was reduced by 300 tonnes/year (or 0.0176 t/household). Other studies have shown that households who use their composter regularly will divert approx. 9.82 kg/week in food and yard waste; regular compost use by those who have purchased one from the municipality are around 60%. | 680 | 680 | 680 | NA | Eve Casavant |
| **Total Historic & Current** | | | **15,520** | **15,520** | **15,520** | **NA** | |

| *Waste Sector Future Measures* | | | **Planned** | **Typical** | **Standard** | | |
|---|---|---|---|---|---|---|---|
| *Title* | *Description* | *Calculation Notes* | *Annual eCO2 Savings (t)* | | | *Annual Energy Cost Savings ($)* | |
| Curbside recycling and composting programs | In Ontario, approx. 15% of waste is diverted through curbside recycling. Source: Recycling Council of Ontario. Assessment of Multi-unit Recycling in Ontario http://www.rco.on.ca/publication/apartment/body.pdf | The planned savings are based on information provided by the Saskatoon Curbside Recycling company that collects approx. 240 tonnes of fibrous materials from its customers each year. The impacts of expansion of this on existing collection at the recycling depot and on the overall level of participation in recycling in Saskatoon are uncertain. Further study is needed. | 290 | 290 | 290 | NA | Dwight Grayston, Saskatoon Curbside Recycling |
| Pay-as-you-throw program | 2000 communities in the US have implemented a Pay-as-You Throw program. These programs set a limit for the number of bags of garbage each household can set out for free, after the limit, households are charged a fee for each additional bag of garbage. The fees associated with garbage production beyond the one bag per household limit can be used to fund waste diversion or collection efforts. To be successful, this program should be run in conjunction with a curbside recycling program | In communities with pay as you throw programs, waste production is reduced from 25-35% on average - conservative estimate would be 25%, a more optimistic estimate would be 35% | NA | 12,260 | 17,170 | NA | |
| **Total Future** | | | **290** | **12,550** | **17,460** | **NA** | |
| | | | | | | | |
| **Total Historic, Current & Future** | | | **15,810** | **28,070** | **32,980** | **NA** | |