City of Bellevue, Washington
Greenhouse Gas Emissions Inventory

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ICLEI
Local Governments for Sustainability

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Executive Summary

The scientific consensus is that human-induced climate change is a reality, and represents one of the most pressing environmental problems facing this generation and those to come.

The time to act is now. In the 20th Century the planet has experienced warming temperatures that are unparalleled in the geologic record. The past decade has been the warmest in recorded history, and the world's pre-eminent climate scientists have overwhelming evidence that human activity is the cause. Scientific studies by the University of Washington's Climate Impacts Group also show that allowing this warming trend to continue at present rates could result in decreased agricultural output, increased catastrophic weather events such as forest fires, drought and floods, and the displacement of entire populations due to rising sea levels.

Bellevue has chosen to do its part. Bellevue recognizes that in order to have an impact on this global phenomenon, each community must take responsibility for its local actions. Recent actions that Bellevue has engaged in include:

- On February 20, 2007 the Bellevue City Council passed Resolution 7517, which adopted the goal of reducing GHG emissions to 7% below 1990 levels by 2012.
- In August 2007, the City of Bellevue became a signatory to the U.S Mayor's Climate Protection Agreement, joining over 800 communities in all 50 states to affirm its commitment to reduce greenhouse gas (GHG) emissions in a manner consistent with the international targets set by the Kyoto Protocol.
- In order to implement these resolutions, the City of Bellevue joined more than 400 U.S. local governments and 1000 local governments worldwide in ICLEI's Cities for Climate Protection® (CCP) Campaign. In partnering with ICLEI, Bellevue has committed to ICLEI's Five Milestone Process to fight global warming:

    Milestone 1: Conduct a baseline emissions inventory and forecast;
    Milestone 2: Adopt an emissions reduction target;
    Milestone 3: Develop a Climate Action Plan for reducing emissions;
    Milestone 4: Implement policies and measures; and
    Milestone 5: Monitor and verify results.

The emissions inventory summarized in this report represents the completion of Milestone 1, the first step in this process. This inventory, along with goals set by the City Council, will be used to develop a local action plan to enable the City of Bellevue to reduce GHG emissions in a strategic and systematic manner.

Inventory results. An emissions inventory was conducted for the years 2001 and 2006. The 2001 analysis represents the baseline year, against which emissions in all future years will be compared. The 2006 analysis represents an interim year that can be used to calculate the rate of emissions change from 2001 to the present. Emissions were also backcast to 1990. While detailed data was not available to inventory the emissions for years prior to 2001, it was considered valuable to have an estimate of 1990 emissions because this is the base year for measuring achievement of the Kyoto Protocol, City of Bellevue Resolution 7517, and the U.S Mayor's Climate Protection Agreement.

In both years analyzed, the total Bellevue community emissions were inventoried with a separate analysis of emissions from City of Bellevue municipal government operations. The municipal

government emissions represent a sub-set of the larger community emissions analysis. The inventory found that:

- The City of Bellevue released 1,692,197 metric tons of carbon dioxide equivalent (CO_2e) in 2001 and 1,775,479 metric tons in 2006. That amounts to 14.9 metric tons per capita in 2001 and 15.0 metric tons per capita in 2006.
- If current trends continue, the City of Bellevue is projected to emit **14.2% more GHGs than the base year by 2012** and 25.4% more than 2001 in 2020.
- In order to meet the reduction goals that the City Council has adopted for the year 2012, according to forecasts of emissions growth, Bellevue would need to have reduced its projected annual emissions by 629,921 metric tons by 2012 from the levels it would otherwise emit that year.

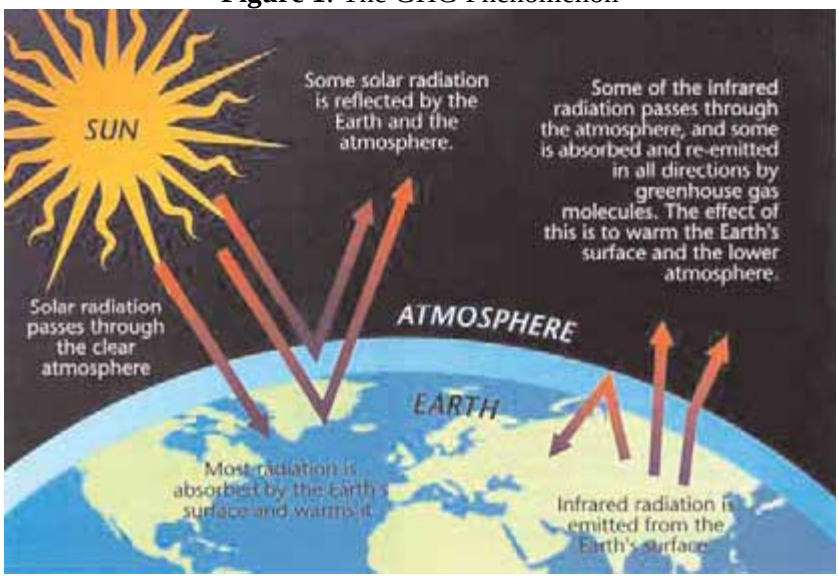
This data indicate that there is much work to be done. However, the City of Bellevue has displayed leadership and foresight in its decision to confront this issue today. In addition to mitigating the effects of climate change, efforts to reduce GHG emissions and energy use will also benefit the city by saving money, increasing overall air quality, and augmenting the many programs that make the city a more livable community.

I. Introduction

A. Introduction to Climate Change Science

The Earth's atmosphere is naturally composed of a number of gases that act like the glass panes of a greenhouse, retaining heat to keep the temperature of the Earth stable and hospitable for life at an average temperature of 60ºF. Carbon dioxide (CO_2) is the most prolific of these gases. Other contributing gases include methane (CH_4), nitrous oxide (NO_2), ozone (0_3), and halocarbons. Without the natural warming effect of these gases the Earth's surface temperature would be too cold to support life (Figure 1).

Figure 1: The GHG Phenomenon



Source: US Environmental Protection Agency

While the existence of GHG in the atmosphere is necessary for life on Earth, human beings are changing the proportions of these gases in the atmosphere, most significantly by adding CO_2 from the burning of fossil fuels. Atmospheric CO_2 concentrations have increased from between 270-280 parts per million (ppm) in pre-industrial times to more than 380 ppm today.[1]

[1] United Nations Intergovernmental Panel on Climate Change - IPCC (2007) "Climate Change 2007: The Physical Science Basis. Summary for Policy Makers" http://www.ipcc.ch/SPM2feb07.pdf

Figure 1a: Modeling of Human vs. Natural Impacts

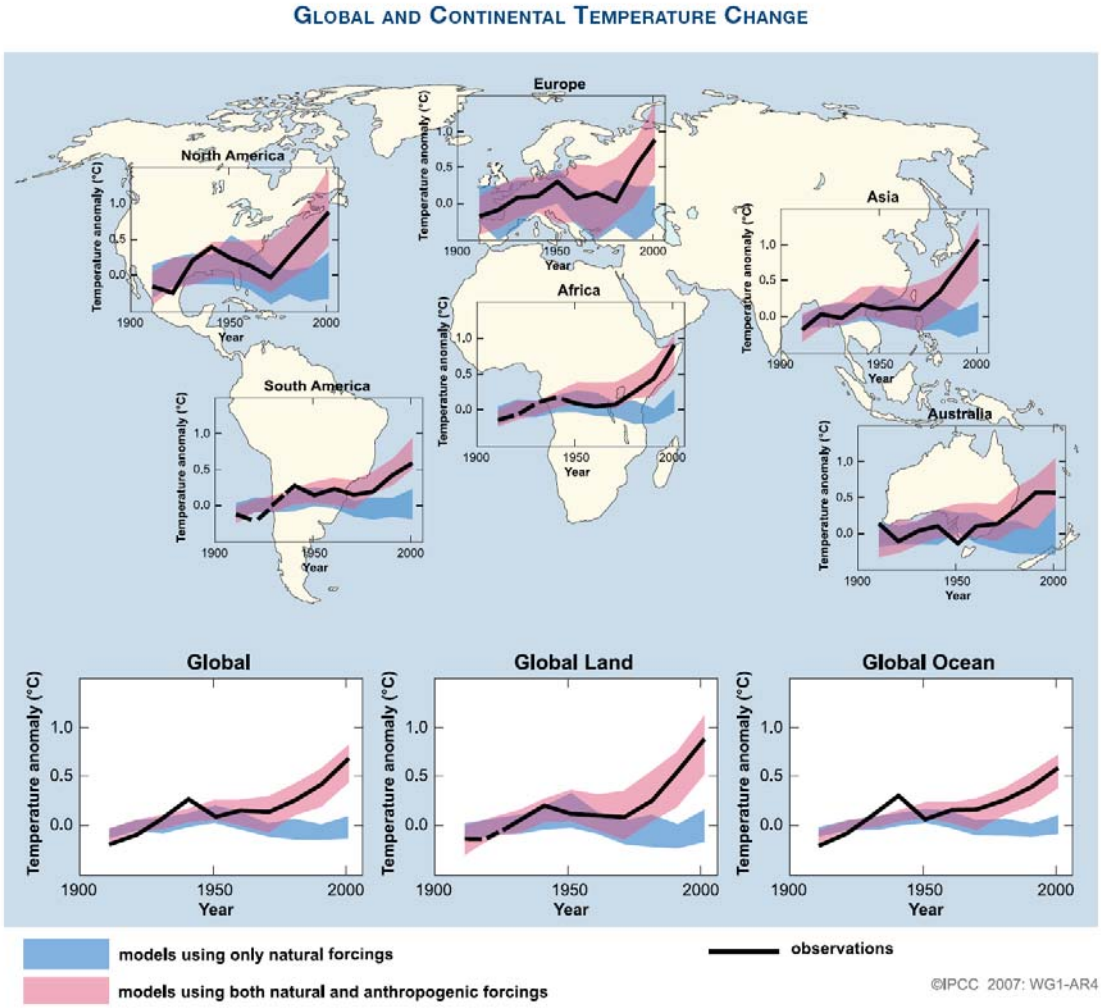


Figure 1a reflects a comparison of observed continental and global scale changes in surface temperature with results simulated by climate models using natural and anthropogenic forcings. Decadal averages of observations are shown for the period 1906 to 2005 (black line) plotted against the centre of the decade relative to the corresponding average for 1901-1950. Lines are dashed where spatial coverage is less than 50%. Blue shaded bands show the 5-95% range for 19 simulations from five climate models using only the natural forcings due to solar activity and volcanoes. Red shaded bands show the 5-95% range for 58 simulations from 14 climate models using both natural and anthropogenic forcings.[2]

If current emissions levels continue, the atmospheric CO_2 concentration is projected to reach 730-1020 ppm by 2100. The current atmospheric concentration of carbon dioxide exceeds by far the natural range over the last 650,000 years (180 to 300 ppm) as determined from ice core measurements.[3]

[2] United Nations Intergovernmental Panel on Climate Change - IPCC (2007). "Climate Change 2007: The Physical Science Basis. Summary for Policy Makers," http://www.ipcc.ch/SPM2feb07.pdf

[3] United Nations Intergovernmental Panel on Climate Change - IPCC (2007) "Global Climate Projections. In: Climate Change 2007: The Physical Science Basis"
http://ipcc-wg1.ucar.edu/wg1/Report/AR4WG1_Pub_Ch10.pdf

What is the IPCC?

The Intergovernmental Panel on Climate Change (IPCC) was established in 1988 by the World Meteorological Organization (WMO) and the United Nations Environment Program (UNEP) to establish a scientific consensus on the issue of global warming. The IPCC does not conduct research, but provides a process for climate experts from the world's leading universities and government institutions to synthesize the most recent scientific findings every five to seven years. The IPCC has issued comprehensive assessments for political leaders in 1990, 1996, 2001 and 2007.

The Fourth Assessment Report (AR4) was released in February of 2007 and represents the most comprehensive synthesis of climate change science to date. Experts from more than 130 countries have contributed to this assessment over a six year period. More than 450 lead authors have received input from more than 800 contributing authors, and an additional 2,500 experts peer-reviewed the draft documents. The IPCC received the Nobel Peace Prize in recognition of this work.

Source: Intergovernmental Panel on Climate Change[4]

Over this same geologic time period, methane concentrations have increased from 715 parts per billion (ppb) to more than 1774 ppb, and nitrous oxide, (N_2O) concentrations have increased by 270 ppb to 319 ppb.[5] In addition to these naturally occurring gasses, humans have introduced synthetic gasses with heat-trapping capacity into the atmosphere, such as hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). Though relatively low in concentration, these gasses are of particular concern because they have a heat trapping capacity between 1,500 and 22,000 times stronger than CO_2.[6]

Elevated concentrations of GHG in the atmosphere have had a destabilizing effect on the global climate, fueling the phenomenon commonly referred to as global warming. **The 2007 United Nations Intergovernmental Panel on Climate Change (IPCC) report states that "warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures."**[7] The IPCC is referring to the 1.3°F increase in surface temperature over the last century.[8] These increases in global temperature have accelerated recently, with 11 of the 12 warmest years on record occurring between 1995 and 2006.[9]

The climate and the atmosphere will not necessarily react in a linear fashion to increased GHG emissions. That is to say that you cannot simply predict that for each ton of carbon dioxide emitted, the Earth will warm a certain amount. The Earth's climate has a number of feedback loops and tipping points that scientists fear will accelerate global warming beyond the rate at which it is currently occurring. For example, as CO_2 emissions have increased in recent human history, the oceans and terrestrial ecosystems have been absorbing a significant portion of these gases. With continued warming, scientists anticipate a decrease in the ability of oceans and

[4] About the IPCC.2007. http://www.ipcc.ch/about/faq.htm
[5] United Nations Intergovernmental Panel on Climate Change - IPCC (2007). "Climate Change 2007: The Physical Science Basis. Summary for Policy Makers," http://www.ipcc.ch/SPM2feb07.pdf
[6] United Nations Intergovernmental Panel on Climate Change - IPCC (2001). "Third Assessment Report. Climate Change 2001: The Scientific Basis," http://www.ipcc.ch/pub/wg1TARtechsum.pdf
[7] United Nations Intergovernmental Panel on Climate Change - IPCC (2007). "Climate Change 2007: The Physical Science Basis. Summary for Policy Makers," http://www.ipcc.ch/SPM2feb07.pdf
[8] Ibid
[9] Ibid

terrestrial ecosystems to absorb GHG, causing anthropogenic CO_2 emissions to have a more substantial impact on global climate.[10] Another example of a compounding effect can be found in the polar ice caps. Ice is highly reflective and acts like a giant mirror, reflecting the sun's rays back into space. As the planet warms and some of this ice melts, a darker land or ocean surface is revealed. This darker surface will tend to absorb more heat, and may accelerate the speed at which the planet warms with each ton of GHG emitted.

Findings and Projections from the 2007 IPCC Report:

- "Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level."
- "Global atmospheric concentrations of carbon dioxide, methane and nitrous oxide have increased markedly as a result of human activities since 1750 and now far exceed pre-industrial values."
- "The global increases in carbon dioxide concentration are due primarily to fossil fuel use and land-use change, while those of methane and nitrous oxide are primarily due to agriculture."
- "The observed widespread warming of the atmosphere and ocean, together with ice mass loss, support the conclusion that it is *extremely unlikely* that global climate change of the past fifty years can be explained without external forcing [including anthropogenic sources], and *very likely* that it is not due to known natural causes alone."

Source: IPCC WGI Fourth Assessment Report Summary for Policy Makers[11]

B. Effects & Impacts of Climate Change

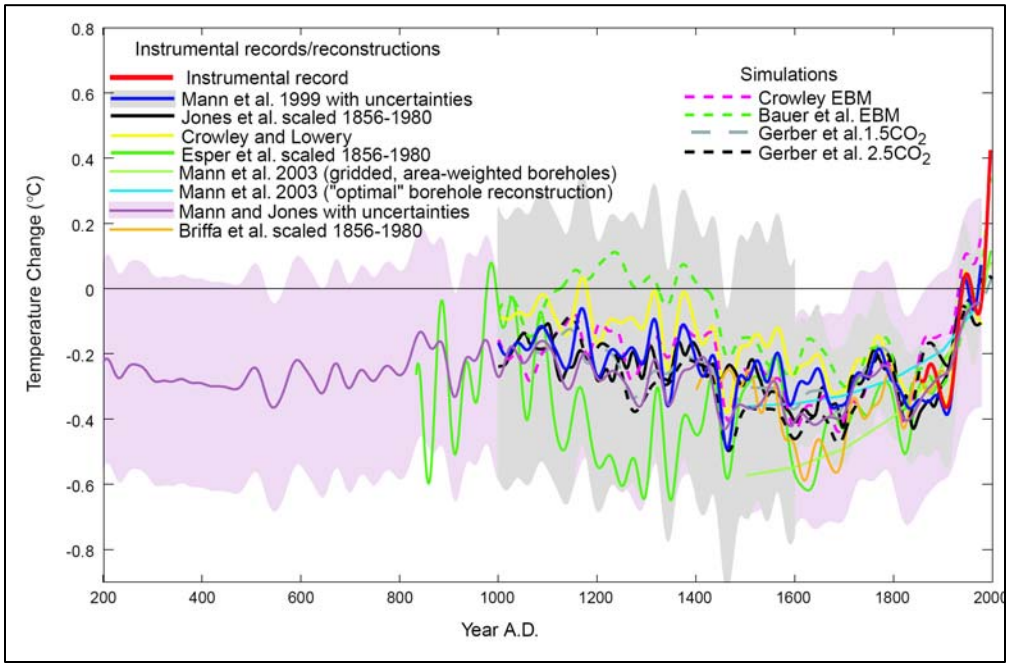
Global Impacts

Changes in temperature and climate will have a dramatic impact on plants and animals that are adapted to present climactic conditions. Surface temperatures are on course to increase by between 3.2 and 7.2ºF by the year 2100, with temperatures in the Arctic expected to increase by twice the global average.[12] In addition to causing average temperature increases, rising levels of GHG have a secondary destabilizing effect on a number of different microclimates, conditions, and systems. The increase in the temperature of the oceans is projected to accelerate the water cycle, thereby increasing the severity and rate of both storms and drought which, along with decreased snow pack, could disrupt ecosystems, agricultural systems and water supplies.[13]

As Figure 2a below indicates, following almost 2000 years of steady or slightly declining temperature, there has been a rapid increase in global surface temperature over the past century, which is inconsistent with the geologic record. Figure 2b shows that increasing global temperatures have already led to the widespread melting of snow and ice around the world. Melting snow and ice in Greenland and Antarctica have, in turn, contributed to a rise in sea level.[14] Rising sea levels could lead to significant environmental and ecosystem disturbances, as well as major population displacement and economic upheaval.

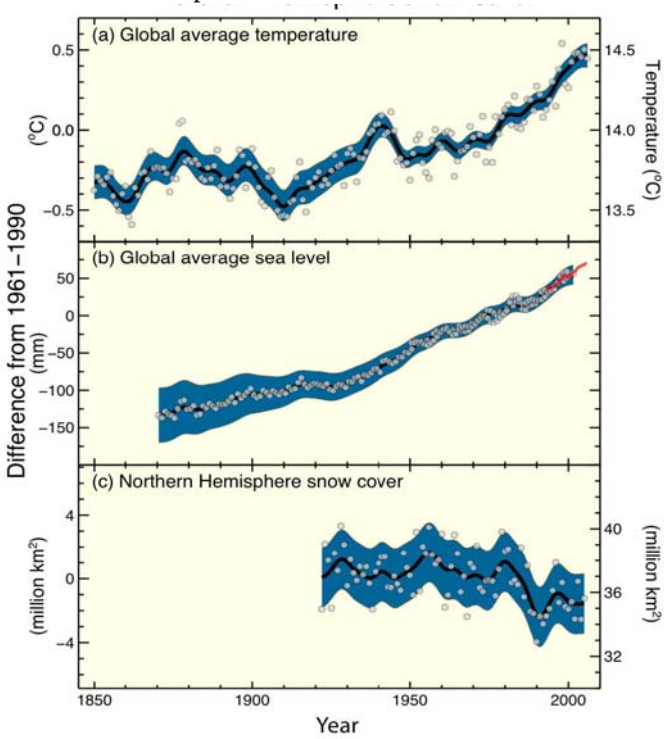
[10] United Nations Intergovernmental Panel on Climate Change - IPCC (2007). "Climate Change 2007: The Physical Science Basis. Summary for Policy Makers," http://www.ipcc.ch/SPM2feb07.pdf
[11] Ibid
[12] Ibid
[13] Ibid
[14] Ibid

Figure 2a: Global Temperature Reconstructions for the Past 2000 Years



Source: Mann et. al. 2003 "On Past Temperatures and Anomalous Late 20th Century Warmth" EOS, TRANSACTIONS AMERICAN GEOPHYSICAL UNION, VOL. 84, NO. 44, PAGE 473

Figure 2b: Changes in Global Temperature, Sea Level, and Snow Cover Over the Past Century



Source: IPCC "Climate Change 2007: The Physical Science Basis. Summary for Policy Makers"

In addition to increased temperatures, other secondary impacts of climate change have already been observed. These impacts include:[15]

- The extent of Arctic sea ice has shrunk by 2.7% per decade since 1978;
- Significantly increased precipitation levels in eastern parts of North and South America, northern Europe and northern and central Asia between 1900 and 2005;
- More intense and longer droughts have occurred over wider areas since the 1970s, particularly in the tropics and subtropics;
- The frequency of heavy precipitation events has increased over most land areas;
- Frost has become less frequent, while heat waves have become more frequent over the past 50 years;
- An increase in the intensity of hurricanes in the North Atlantic since 1970; and
- A decrease in ocean salinity at mid- to high-latitudes and an increase in the tropics, suggesting changes in precipitation and evaporation.

Secondary impacts are more difficult to predict, as they are caused by multiple factors that vary by region. It is also important to understand that while the average global temperature has risen and will continue to rise, the net result in individual locations will vary widely.

Local Impacts

Climate change is a global problem influenced by an array of interrelated factors that have concrete consequences for the Pacific Northwest. A 2005 report by the University of Washington's Climate Impacts Group found that climate change will significantly challenge the region's natural and built systems.[16] (All subsequent mention of climate impacts in Northwest, aside from the studies directly cited, reference the Climate Impacts Group 2005 study.)

***Natural disasters*:** Local climate trends will reflect these continued increases in both average air and water temperatures. Additionally, sea level rise is likely to occur faster than global averages, and earlier snowmelt may cause changes in river and stream flows. Sea level rise and increased seasonal flooding could incur considerable costs as these phenomena pose risks to property, infrastructure and even human life.

***Impact on water*:** Water quality and quantity are also at risk to be depleted as a result of changing temperatures. With warmer average temperatures, more winter precipitation will fall in the form of rain instead of snow, shortening the winter snowfall season and accelerating the rate at which the snow pack melts in the spring.

These snow melt patterns increase the threat for spring flooding and decrease the storage of the natural water tower in the Cascades, meaning less water will be available for agricultural irrigation, hydro-electric generation and the general needs of a growing population. As we have seen in recent years, water resources for agricultural and residential use may become scarce, especially during the summer months.

***Impact on plants and animals*:** The local native plants and animals are also at risk as temperatures rise. Scientists are reporting that more species are moving to higher elevations or

[15] United Nations Intergovernmental Panel on Climate Change - IPCC (2007). "Climate Change 2007: The Physical Science Basis. Summary for Policy Makers," http://www.ipcc.ch/SPM2feb07.pdf

[16] Casola, Kay, Snover et. al.(2005). "Climate Impacts on Washington's Hydropower, Water Supply, Forests, Fish, and Agriculture."Climate Impacts Group, University of Washington. http://www.cses.washington.edu/db/pdf/kc05whitepaper459.pdf

more northerly latitudes. Increased temperatures also provide a foothold for invasive weed and insect species, as well as other non-native threats.

Nearby shore habitat such as coastal wetlands and salt marshes are at risk of being inundated by rising sea levels. Increased flow and salinity of water resources would also seriously affect the food web and mating conditions for fish that are of both economic and recreational interest to residents. These trends compound the challenges already posed to dwindling populations of salmon, at all stages of their lifecycle.

Additionally, these trends alter the natural cycle of flowering and pollination, as well as the temperature conditions necessary for a thriving locally adapted agriculture. Perennial crops in particular will be challenged.

***Public health impact*:** Warming temperatures and increased precipitation can accelerate the breeding of mosquitoes, thus engendering diseases for which mosquitoes are vectors, such as the West Nile virus. Increased temperatures also pose a risk to human health because it increases ozone levels and air pollution toxicity, which are tied to increased rates of asthma and other pulmonary diseases. Furthermore, the anticipated increase in hotter days poses heat-stroke risks particular for the elderly, young, those already sick, and people who work outdoors.

Regional evidence: The impacts of climate change are already here, and are expected to continue to escalate if the levels of heat trapping pollution continue to increase. Figure 3a shows precipitation trends; 3b shows trends in April 1 snow pack.

These figures show widespread increases in average annual precipitation for the period 1920 to 2000 and decreases in April 1 snow water equivalent (an important indicator for forecasting summer water supplies) for the period 1950 to 2000. The size of the dot corresponds to the magnitude of the change.

Figure 3a: Precipitation trends (1920-2000)

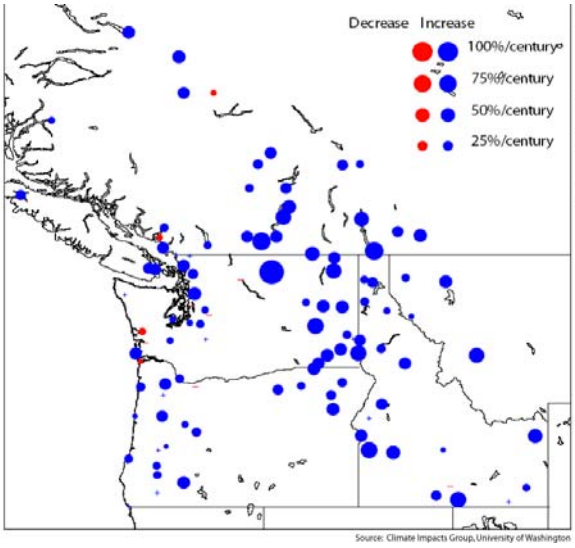
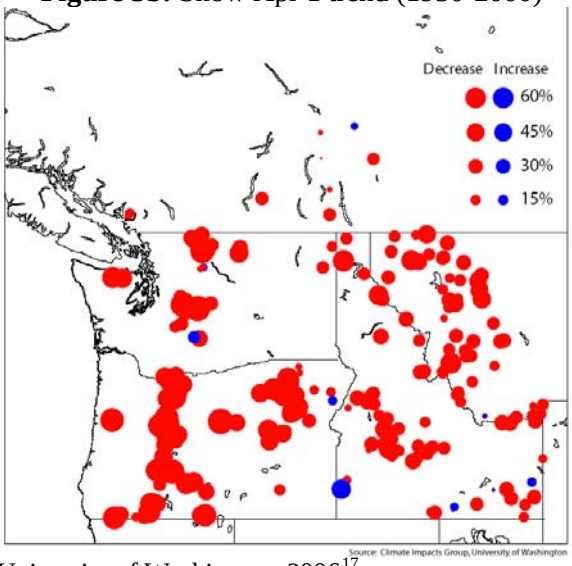


Figure 3b: Snow Apr 1 trend (1950-2000)

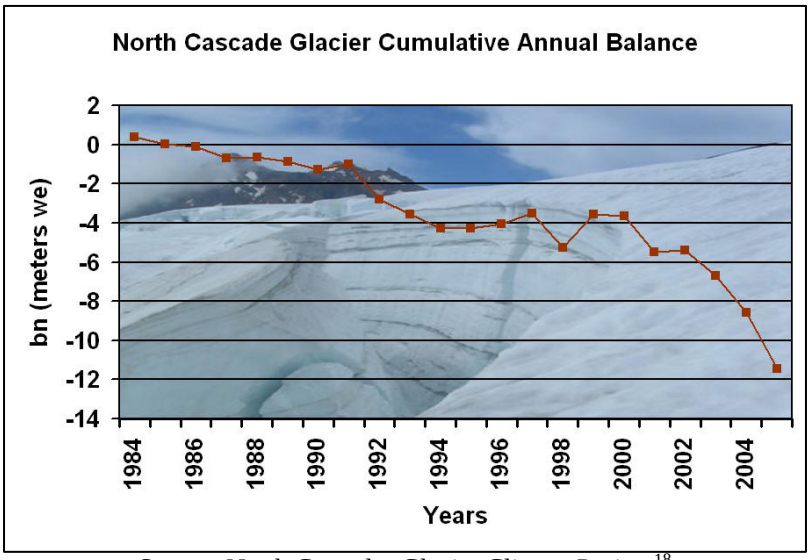


Source: Climate Impacts Group, University of Washington, 2006[17]

[17] Climate Impacts Group. 2006. "Pacific Northwest 20th Century Climate Change." http://www.cses.washington.edu/cig/pnwc/cc.shtml#figure1

Figure 4a below indicates the rate that glaciers in the North Cascades are shrinking. The loss of glacier volume since 1984 represents 20 to 40 %of entire glacier volume. Figure 4b illustrates that this change has been dramatic and rapid enough to be observed with the naked eye.

Figure 4a: Rate of recession of glaciers in the North Cascades



Source: North Cascades Glacier Climate Project[18]

Figure 4b: Eyewitness North Cascades Glacier Recession

Source: North Cascades Glacier Climate Project[19]

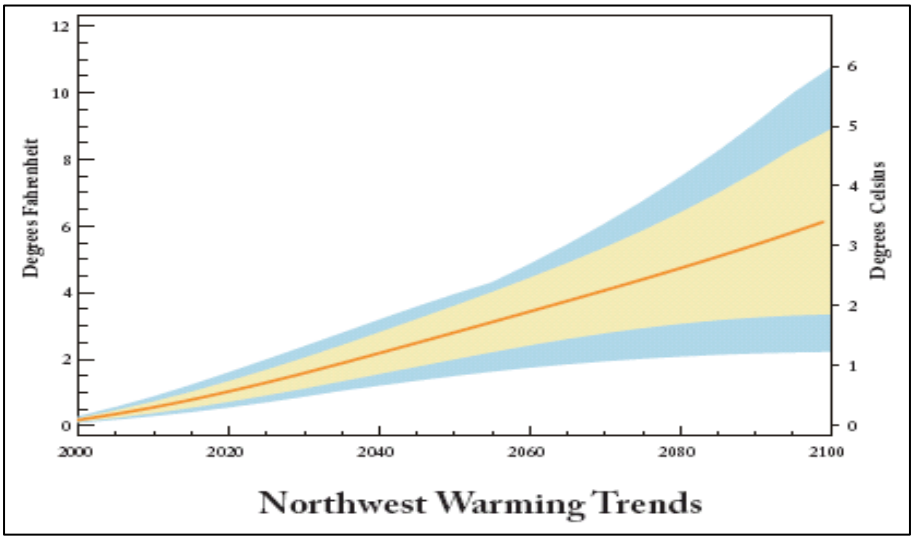
Scientists have calculated a number of predicted increases in average temperature in the Northwest under ten different climate change study scenarios. Figure 5 below illustrates these

[18] North Cascades Glacier Climate Project. 2006. http://www.nichols.edu/departments/Glacier/
[19] North Cascades Glacier Climate Project. 2006. http://www.nichols.edu/departments/Glacier/

predictions. Each scenario makes different assumptions about the levels of heat trapping pollution that humans will emit over the next one hundred years. The orange line indicates the average temperature from all of the scenarios. The yellow area indicates the temperature range that two-thirds of the scenarios fall within. The blue area indicates the full range of variability of all of the scenarios.

It is important to note that there is very little variability in short-term predictions of the average global temperature over the next twenty to thirty years. This is due to the significant lag time inherent in the climate system: the impact of gases already in the atmosphere will determine the impacts felt in the near term. Moreover, despite the proliferation of energy saving technologies, existing power plants and vehicles will continue to be used in the short term. The short- and medium-term implications of climate change are therefore largely unalterable. However, longer-term outcomes, meaning those relating to outcomes that will be felt between 2040 and 2100, will be shaped by the actions taken today.

Figure 5: Temperature under increased emissions scenarios



Source: University of Washington Climate Impacts Group. 2005. "Uncertain Future"

C. Action Being Taken on Climate Change

National and State Action

State Actions: Many states have begun to consider the affects of climate change. As of June 2008, 38 states have completed or are currently working on comprehensive Climate Action Plans.[20] The most common state laws call for studies of the impacts of climate change and require inventories of the states' GHG emissions and the creation of commissions to study the possible implications of GHG trading systems. However, seventeen of these states have passed legislation setting GHG targets.[21]

In addition to these individual state actions, there are two regional coalitions coordinating an interstate agreement to mitigate climate change in North America. The Western Climate Initiative

[20]Pew Center on Global Climate Change:
http://www.pewclimate.org/what_s_being_done/in_the_states/action_plan_map.cfm
[21] Pew Center on Global Climate Change: .
http://www.pewclimate.org/what_s_being_done/in_the_states/emissionstargets_map.cfm

was announced in February 2007, by the governors of Arizona, California, New Mexico, Oregon and Washington. Since that time, Utah, British Columbia, and Manitoba have joined the Initiative. Under the Initiative, the participating states have agreed to cut GHG emissions levels to 15% below 2005 levels by 2020 by establishing and implementing a market-based system by August 2008.[22] The Regional Greenhouse Gas Initiative (RGGI) of the Northeastern and Mid-Atlantic states has also set reduction targets for GHG pollution emitted from the generation of electricity, and is trying to establish a market-based regional cap-and-trade program they hope to put into effect by 2009.[23]

Washington State

In spring 2008, Governor Gregoire signed two policies into legislation that may impact local governments' management of GHG emissions.

Climate Action and Green Jobs (HB 2815) adopts comprehensive limits on global warming pollution and creates a statewide effort for job training in the clean energy sector. The legislation:[24]

- Establishes limits on statewide global warming pollution in the Clean Air Act. Emission levels must be: No higher than 1990 levels by 2020; At least 25% below 1990 levels by 2035; At least 50% below 1990 levels by 2050.
- Establishes a green economy jobs initiative**.** The bill authorizes and funds labor market research to establish a job training grant program to be funded in 2009.
- Directs the Department of Ecology to work with other Western States (via the Western Climate Initiative) to develop a market-based system to implement limits on global warming emissions.
- Requires emission reporting from large sources (public and private) of global warming pollution (facilities that produce direct emissions of at least 10,000 metric tons of CO_2 equivalent (eCO_2) per year and large fleets that emit at least 2,500 metric tons of eCO_2 per year).[25]
- Establishes benchmarks for reducing vehicle-miles traveled (VMT), and requires the Department of Transportation to develop strategies to achieve those benchmarks: Decrease annual per capita VMT 18% by 2020, 30% by 2035, and 50% by 2050.

Local Solutions to Global Warming (Substitute Bill SB 6580) directs the State to develop tools to assist local governments reduce their climate impact. The legislation:[26]

- Directs the State Department of Community Trade and Economic Development (CTED) to provide cities and counties with a tool to inventory, measure and estimate land use related GHG emissions.
- Creates a competitive grants program for cities and counties already taking action or interested in beginning to address climate change through land use and transportation planning.
- Requires a report from stakeholders to the legislature by the end of 2008 to make recommendations of the policy changes necessary for local governments to address climate change through land use and transportation plans.

[22] Washington Department of Ecology http://www.ecy.wa.gov/climatechange/CATdocs/06052007CATsummary.pdf
[23] Regional Greenhouse Gas Inventory - http://www.rggi.org/agreement.htm
[24] See HB 2815 http://environmentalpriorities.org/climate-action/wa-climate-action
[25] The City of Bellevue meets this threshold for its vehicle fleet and will be subject to reporting requirements. However, the City is not responsible for direct emissions and will not be subject to reporting facilities emissions.
[26] See HB 6580 http://environmentalpriorities.org/local-solutions/local-solutions-to-global-warming

Some other bills that have been passed by the Washington State Legislature in recent years with significant impact on GHG emissions include the following:

SB 6001 (2007) This bill sets goals to reduce the state's GHG emissions to 1990 levels by 2020, 25% below 1990 levels by 2035, and 50% below 1990 levels by 2050. This bill also set power plant performance standards to prevent coal plants that do not sequester CO2 emissions from being build in the state, as well as applying to new out-of-state electricity produced at coal plants.

HB 2738 (2006) This bill created a renewable fuel standard that requires biodiesel comprise a small percentage of all diesel sold in Washington and that all gasoline be blended with a small percentage of ethanol. The percentage of the renewable fuels mandated for sale will be increased over time as the Department of Agriculture determines if the state's farmers have the capacity to meet the demand.

I-937 (2006) This voter passed initiative established a state renewable energy portfolio standard. It mandates that 3% of the state's energy come from non-hydro renewable sources by 2012 and 15% renewable sources by 2020.

Local Action

A substantial effort is being pursued on the local level to address climate change.

U.S Mayor's Climate Protection Agreement

A national effort called the U.S Mayor's Climate Protection Agreement (MCPA) was established by Seattle Mayor Greg Nickels to promote local adherence to the goals of the Kyoto Protocol – an international agreement addressing global warming pollution and ratified by 164 countries. On February 16, 2005, the Agreement was launched and now includes over 800 signatures from mayors representing over 72 million Americans in all 50 states, Washington, D.C., and Puerto Rico. Signing the agreement makes a pledge that a city will reduce its GHG emissions consistent with the Kyoto Protocol, which declares reductions of 7 %bellow 1990 levels by the year 2012. For more information about the MCPA, visit: http://www.seattle.gov/mayor/climate

ICLEI—Local Governments for Sustainability

Additionally, ICLEI—Local Governments for Sustainability has been a leader on both the international and national level for almost fifteen years, representing over 1000 local governments around the world. ICLEI was launched in the United States in 1993 and has grown to over 400 cities and counties providing national leadership on climate protection and sustainable development. Today in Washington, ICLEI is working with 29 cities and counties on local climate policies – and forging a strong network between these governments.

D. ICLEI and the Cities for Climate Protection Campaign

ICLEI's mission is to improve the global environment through local action. The Cities for Climate Protection® (CCP) Campaign is ICLEI's flagship campaign designed to educate and empower local governments worldwide to take action on climate change. ICLEI provides resources, tools, and technical assistance to help local governments measure and reduce GHG emissions in their communities and their internal municipal operations.

ICLEI's CCP Campaign was launched in 1993 when municipal leaders, invited by ICLEI, met at the United Nations in New York and adopted a declaration that called for the establishment of a worldwide movement of local governments to reduce GHG emissions, improve air quality, and enhance urban sustainability. The CCP Campaign achieves these results by linking climate change mitigation with actions that improve local air quality, reduce local government operating costs, and improve quality of life by addressing other local concerns. The CCP Campaign seeks to achieve significant reductions in U.S. GHG emissions by assisting local governments in taking action to reduce emissions and realize multiple benefits for their communities.

ICLEI uses the performance-oriented framework and methodology of the CCP Campaign's Five Milestones to assist U.S. local governments in developing and implementing harmonized local approaches for reducing global warming and air pollution emissions, with the additional benefit of improving community livability. The milestone process consists of:

- Milestone 1: Conduct a baseline emissions inventory and forecast
- Milestone 2: Adopt an emissions reduction target
- Milestone 3: Develop a Climate Action Plan for reducing emissions
- Milestone 4: Implement policies and measures
- Milestone 5: Monitor and verify results

On February 20, 2007, the City of Bellevue adopted Resolution 7517 to take action for climate protection and officially joined the 350 communities participating in ICLEI's CCP Campaign. In August 2007, Bellevue became a signatory to the U.S. Mayors' Climate Protection Agreement.

II. Emissions Inventory

A. Reasoning, Methodology & Model

ICLEI's Cities for Climate Protection methodology allows local governments to systematically estimate and track GHG emissions from energy and waste related activities at the community-wide scale and those resulting directly from municipal operations. The municipal operations inventory is a subset of the community-scale inventory.

Once completed, these inventories provide the basis for creating an emissions forecast and reduction target, and enable the quantification of emissions reductions associated with implemented and proposed measures.

1. CACP Software and Inventory Method

Software: To facilitate local government efforts to identify and reduce GHG emissions, ICLEI developed the Clean Air and Climate Protection (CACP) Software package with Torrie Smith Associates Inc. The CACP software has been used by over 350 U.S. cities and counties to reduce their GHG emissions.

Although the software provides the City of Bellevue with a sophisticated, useful tool that offers the best available technology, calculating emissions with precision is difficult. The software depends upon numerous assumptions, and can be limited by the quantity and quality of available data. **With this in mind, it is useful to think of any specific number generated by the model as an approximation, rather than an exact value.**

This software estimates emissions derived from energy consumption and waste generation within a community. The CACP software determines emissions using specific factors (or coefficients) according to the type of fuel used. Emissions are aggregated and reported in terms of equivalent carbon dioxide units, or CO_2e. Converting all emissions to equivalent carbon dioxide units allows for the consideration of different GHG in comparable terms. For example, methane is twenty-one times more powerful than carbon dioxide in its capacity to trap heat, so the model converts one ton of methane emissions to 21 tons of CO_2e.

The emissions coefficients and approach employed by the software are consistent with national and international inventory standards established by the Intergovernmental Panel on Climate Change (1996 Revised IPCC Guidelines for the Preparation of National Inventories) and the U.S. Voluntary GHG Reporting Guidelines developed by the Energy Information Administration (EIA form 1605).

Inventory Methodology: The inventory is composed of **two categories**, which are analyzed independently: **municipal government emissions** and **community-wide emissions**. The inventory of the community emissions explores all sources within the Bellevue city limits. The municipal operations inventory includes only those sources that are under the operational control or financial purview of the City of Bellevue municipal organization.

The City of Bellevue has chosen to develop community and municipal operations inventories based on the 2001 calendar year (baseline year). In addition, interim year inventories from the 2006 calendar year (interim year) are also included in this report. It is important to be clear that

these two categories are not cumulative. The community-wide inventory is the total, and the municipal government category is a specific subset of that total. [27]

These two categories are explored independently for several reasons. The community-wide inventory explores sectors (residential, commercial, etc,) which represent large aggregates of data, while a much finer resolution is possible in the municipal operations portion of the inventory (energy use by facility, etc.). Additionally, when attention is turned to the question of where emissions reductions are possible, there will be a different set of options for city-owned facilities than for private sector emissions. For example, the city might opt to implement a procurement policy requiring that certain vehicles in the city fleet be replaced by hybrid vehicles, whereas in the private sector an education program about hybrids or an incentive program would be appropriate.

Each of these categories is further broken down by sources and sectors. **Sources** are the fuel or energy that is the basis of the emissions. In this inventory, the main sources considered are electricity, natural gas, diesel, gasoline, and waste. **Sectors** are the portion of the community or government operations to which the emissions are attributable. In the community inventory the sectors considered are residential, commercial, industrial, transportation, and waste. In municipal operations the sectors considered are buildings, vehicle fleet, employee commute, lights, water/sewer and waste.

It should be noted that when calculating Bellevue's community emissions inventory, all energy consumed in Bellevue was included. This means that, even though the electricity used by residents is produced elsewhere, this energy and its associated emissions appear in the inventory. The decision to calculate emissions in this manner reflects the general philosophy that a community should take full ownership of the impacts associated with its energy consumption, regardless of whether the generation occurs within the geographical limits of the community. For the same reasons, when calculating Bellevue's community emissions inventory, all waste generated in Bellevue was included, though it is landfilled outside the city. Even though the waste is deposited elsewhere, this energy and its associated emissions appear in the inventory.

2. Inventory Sources and Methodology

The creation of an emissions inventory required the collection of information from a variety of sectors and sources. For the community inventory, the main sources of data were Puget Sound Energy (electricity and natural gas), Puget Sound Regional Council (total vehicle miles traveled), and the City of Bellevue Solid Waste Program (waste generated). For the municipal inventory, the primary data sources were Puget Sound Energy (electricity and natural gas), vehicle fleet records, City of Bellevue Utilities Department (waste generated), and the Commute Trip Reduction survey (employee commuting).

The waste sector of both the municipal and community inventories deserves additional explanation. The CACP Software is designed to be used in communities with a variety of waste disposal methods including open dumps and incineration. The calculations are based on the EPA's Waste Reduction Model (WARM). WARM was developed to assist solid waste managers in determining the GHG impacts of their waste management practices. WARM compares GHG and energy impacts of landfilling, recycling, incineration, composting, and source reduction.

[27] The only piece of data that did not follow the calendar year was the electricity and natural gas data from the new City Hall. Because construction was not complete by January 2006, a full year of City Hall energy and natural gas data from June 2006 to June 2007 was used.

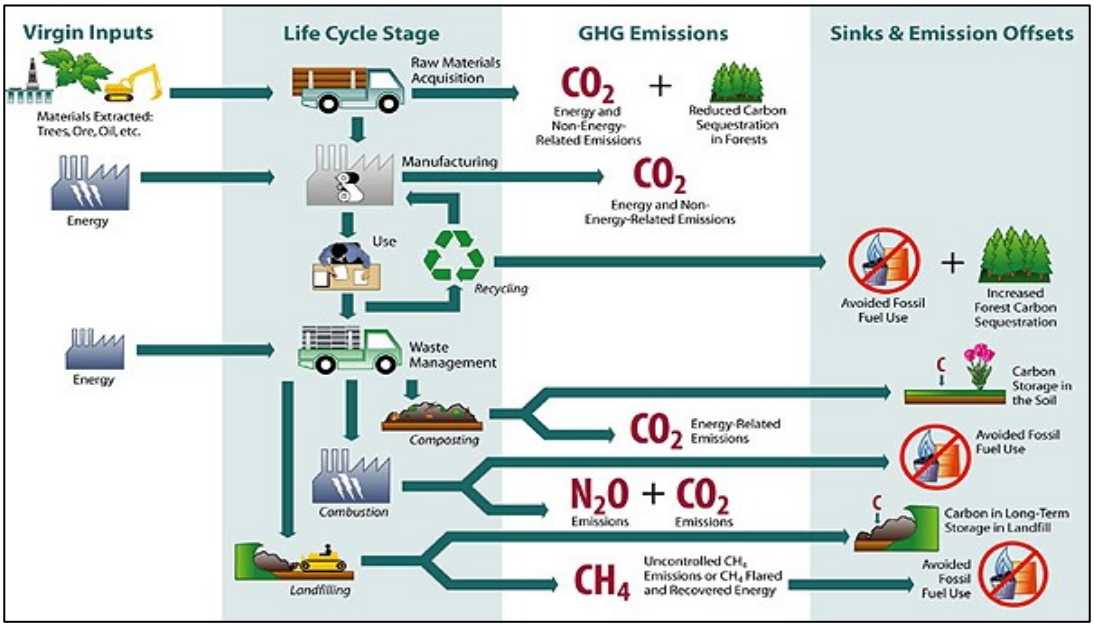
Bellevue's inventory is consistent with this national standard set by EPA. When organic matter like food scraps and yard waste decompose deep in a landfill where there is very little oxygen, it can create methane (CH_4), which traps more than twenty times as much heat as CO_2. In some cases, waste disposal can be a significant part of a community's climate pollution profile. In the case of Bellevue, all of our waste is sent to King County's Cedar Hills Landfill. At this covered landfill, the methane is trapped beneath the surface and 90% of the methane that escapes is flared (burned), which produces the less powerful CO_2.

Unlike the WARM model, ICLEI's waste reporting protocol does not take into account carbon sequestered in a landfill as an offset to emissions. Methane is released as part of the decomposition of organic matter. However, most of the methane at Cedar Hills is flared to CO_2, and these emissions, coupled with the small volume of methane that leaks out of the landfill, are still relatively small compared with other sectors.

This does not mean that the reduction of solid waste generated in our community should not be a priority. Among other benefits, reducing the amount of waste created can preserve natural resources and decrease emissions that result from the transportation of waste. In addition, manufacturing paper and other goods from recycled sources is less energy intensive than harvesting and processing new inputs.[28]

It is also important to note that while the waste-reduction effect of recycling is not reflected in this "end use" or "downstream" analysis, recycling does save a substantial amount of energy by reducing the need for virgin inputs and has a net benefit for the climate. Figure 6 shows GHG sources and sinks in the waste sector.

Figure 6: GHG Sources and Sinks in the Waste Sector: Source: U.S. EPA[29]



[28] U.S. Environmental Protection Agency. (2006). "Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks. http://epa.gov/climatechange/wycd/waste/SWMGHGreport.html

[29] U.S. Environmental Protection Agency (2006). "Global Warming - Waste." U.S. EPA.. Online. http://yosemite.epa.gov/oar/globalwarming.nsf/content/actionswastebasicinfogenerallifecycle.html.

B. Inventory Results

1. Community Emissions Inventory

The Community Emissions Inventory is an estimate of all GHG emissions occurring within Bellevue city limits.

Base Year Emissions Inventory

In the base year 2001, the community of Bellevue emitted approximately 1,692,197 metric tons of CO_2e.

- The transportation sector was the largest producer of GHG emissions, with the combustion of gasoline and diesel accounting for 45.8% of total community emissions. Transportation gasoline emissions alone resulted in 38.1% of total emissions.
- The commercial sector was the second largest producer, responsible for 28.9% of the total community emissions.
- The largest single source of emissions was electricity generation, producing 39.1% of all emissions when the residential, commercial, and industrial sectors are summed.
- Natural gas combustion in all sectors accounted for 14.6% of community emissions.

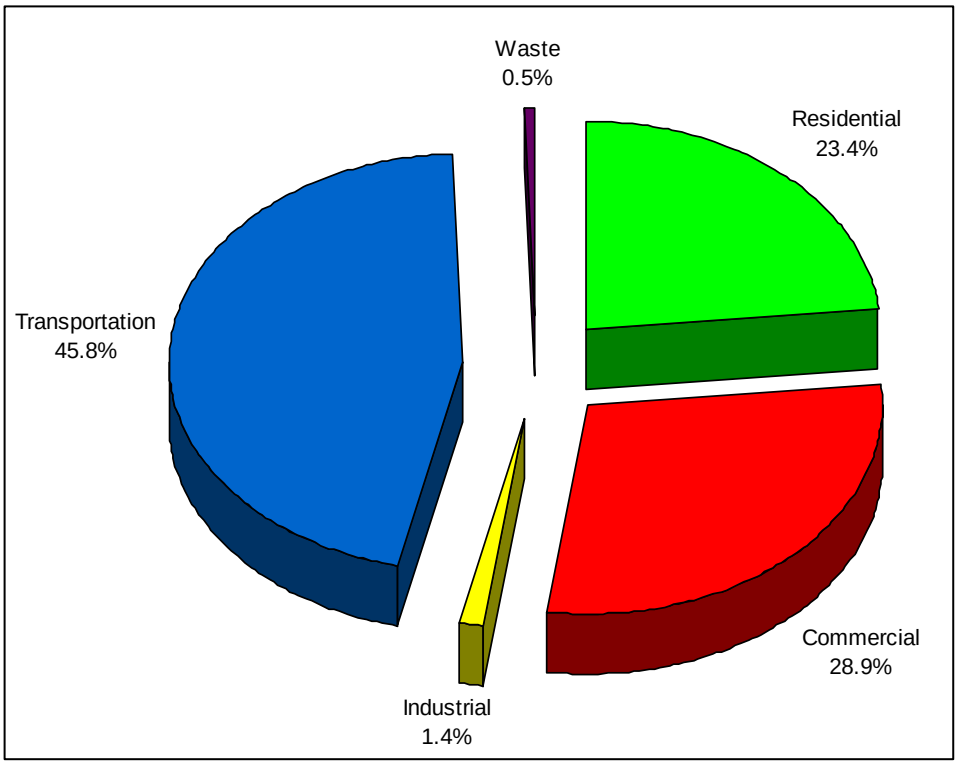
Table 1, Figure 7, Figure 8, and Figure 9 below show the breakdown of community emissions by source and sector.

Table 1: Bellevue Community Emissions Summary - 2001

Sector	Equiv CO_2 Emitted (metric tons)	% of Total	Energy Consumed (million Btu)
Residential	396,674	23.4%	4,676,326
Commercial	489,223	28.9%	4,340,724
Industrial	23,364	1.4%	263,336
Transportation	775,244	45.8%	9,928,808
Waste	7,692	0.5%	N/A
TOTAL	**1,692,197**	**100%**	**19,209,194**

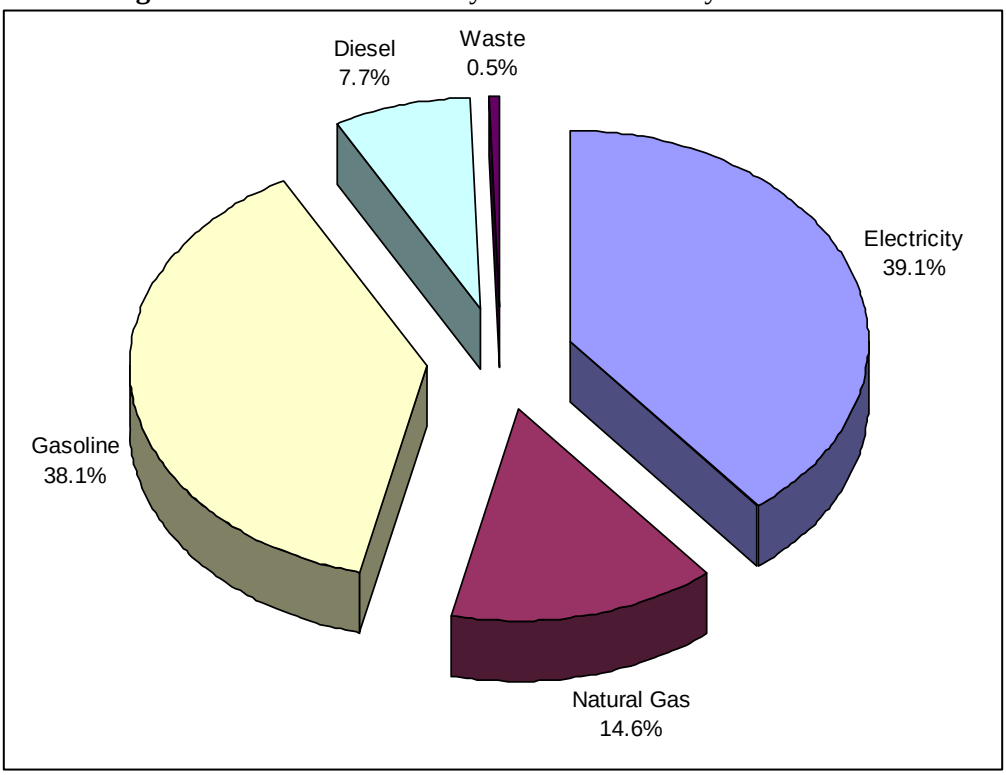
Source: CACP Model Output

Figure 7: Bellevue Community GHG Emissions by Sector - 2001



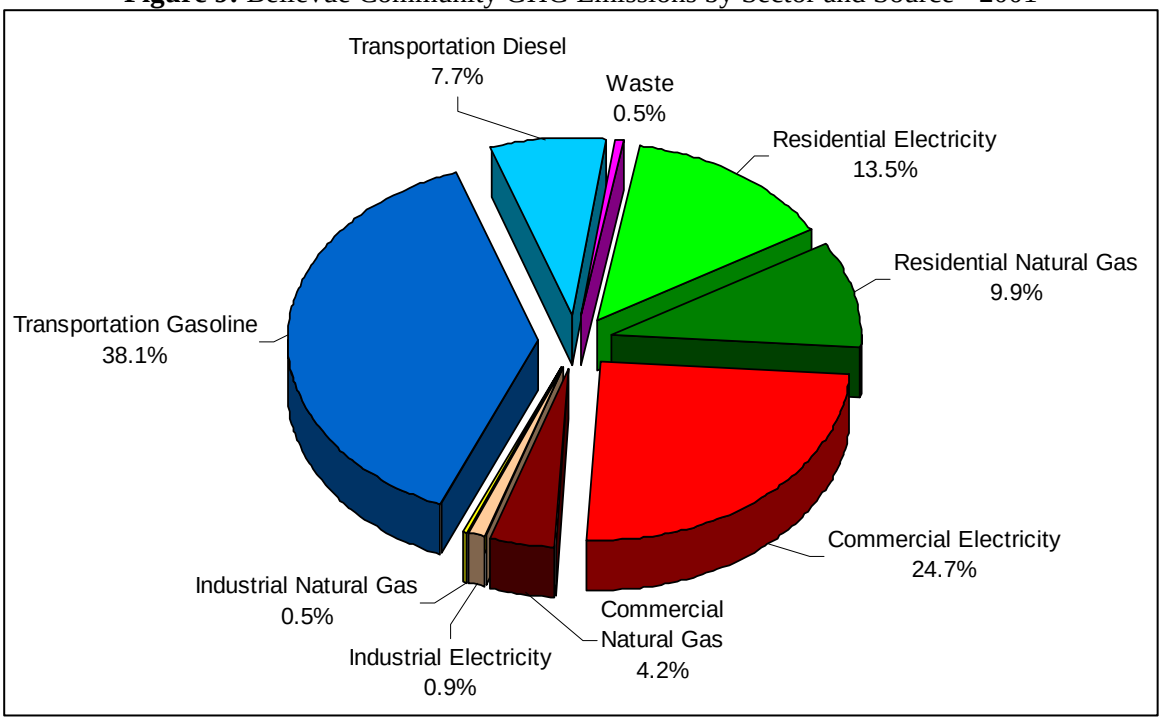
Source: CACP Model Output

Figure 8: Bellevue Community GHG Emissions by Source – 2001



Source: CACP Model Output

Figure 9: Bellevue Community GHG Emissions by Sector and Source - 2001



Source: CACP Model Output

Interim Year Emissions Inventory

In the interim year 2006, the community of Bellevue emitted approximately 1,775,479 metric tons of CO_2e, an increase of 4.9% over 2001.

- The transportation sector remained the largest single producer of GHG emissions, with the combustion of gasoline and diesel responsible for 43.0% of total community emissions. Transportation gasoline emissions resulted in 35.5% of total emissions.
- The commercial sector was the second largest producer, responsible for 32.0% of the total community emissions.
- The largest single source of emissions was electricity generation, producing 43.1% of all emissions when the residential, commercial, and industrial sectors are summed.
- Natural gas combustion in all sectors accounted for 13.5% of total community emissions.

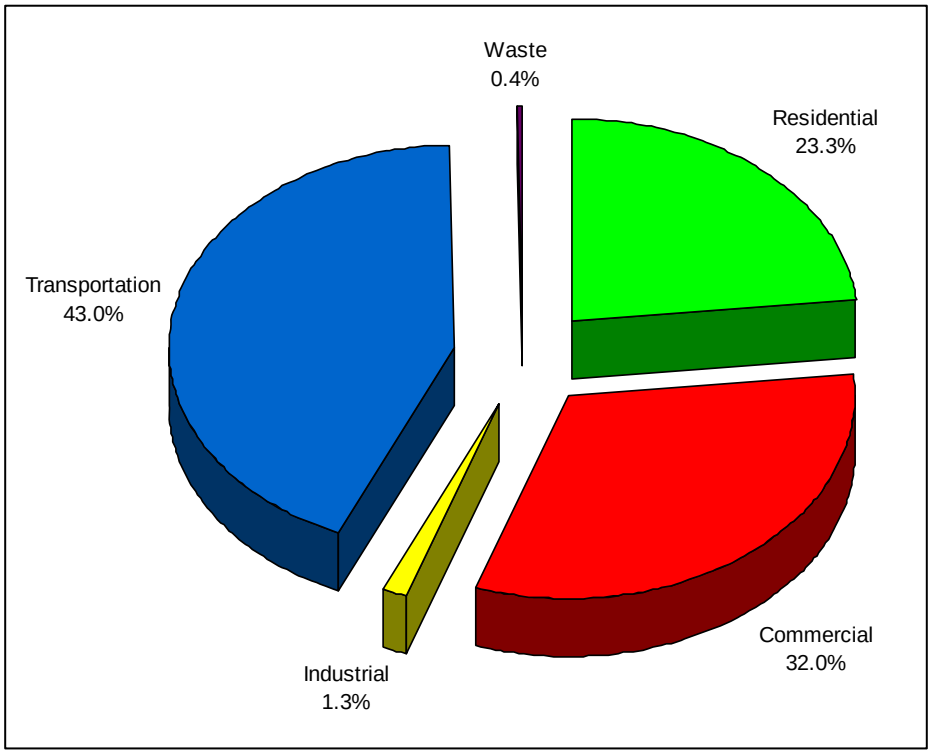
Table 2, Figure 10, Figure 11, and Figure 12 below show the breakdown of municipal emissions by source and sector in 2006.

Table 2: Bellevue Community Emissions Summary - 2006

Sector	Equiv CO_2 Emitted (metric tons)	% of Total	Energy Consumed (million Btu)
Residential	414,580	23.3%	4,574,509
Commercial	567,279	32.0%	4,717,355
Industrial	23,767	1.3%	259,618
Transportation	763,176	43.0%	9,811,510
Waste	6,678	0.4%	N/A
TOTAL	**1,775,479**	**100%**	**19,362,992**

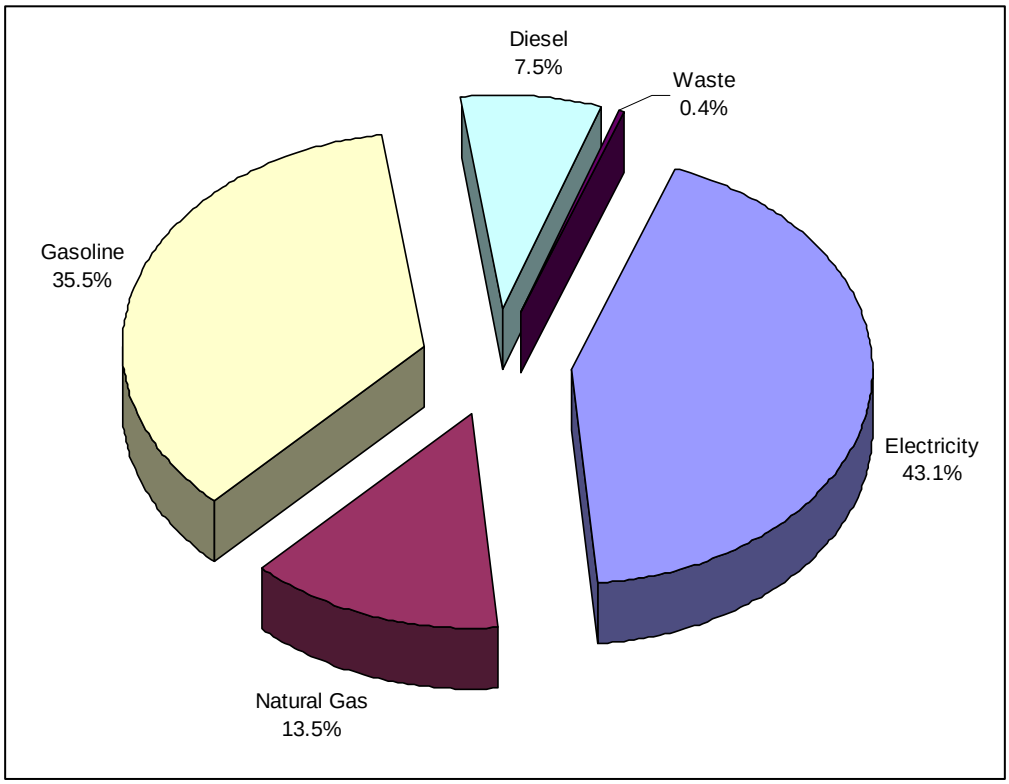
Source: CACP Model Output

Figure 10: Bellevue Community GHG Emissions by Sector – 2006



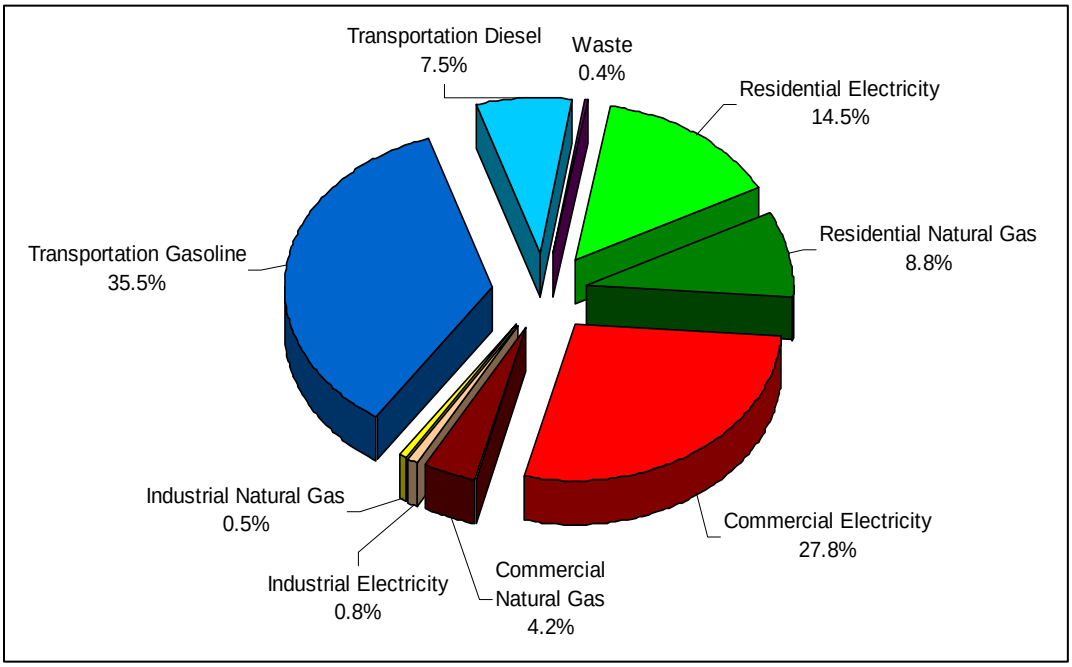
Source: CACP Model Output

Figure 11: Bellevue Community GHG Emissions by Source - 2006



Source: CACP Model Output

Figure 12: Bellevue Community GHG Emissions by Source and Sector - 2006



Source: CACP Model Output

Comparison Between Base and Interim Year Inventories

Between 2001 and 2006 total Bellevue community emissions increased 4.9% (Table 3). However, the increase in emissions was not consistent between sectors and fuel sources.

- The commercial sector saw an increase in emissions of 16.0% between 2001 and 2006, primarily resulting from an increase in electricity use.
- The residential sector saw a large increase in electricity use and a moderate decrease in natural gas emissions, leading to a sector-wide increase of 4.5%.
- The waste sector saw a 13.2% emissions decrease which was likely attributable to a large decrease in garbage sent to the landfill as a result of increased recycling options and participation in these programs. All waste was disposed of at the Cedar Hills landfill operated by King County. The only landfill in the city of Bellevue, the closed Eastgate landfill, produced an estimated 783 metric tons of e CO_2 in 2001 and 610 metric tons of CO_2e in 2006. However, neither of these numbers was ultimately included in the community inventory due to the extremely limited information regarding the volume and composition of the waste deposited between 1951 and 1964 (See Appendix A for more detailed information).
- Even though the number of vehicle miles traveled (VMT) on roads in Bellevue increased 2.5% between 2001 and 2006 (with freeway VMT increasing 1.9% and arterial road VMT increasing 3.5%)[30], the model shows a transportation sector emissions decrease of 1.6% for the same period. This apparent decrease in emissions can be attributed to an assumed increase in fuel efficiency across the whole vehicle fleet (an average of the efficiency of all the cars on the road in a particular year is calculated by EPA), which is imbedded in the background calculations made within the CACP software.
- The fact that the 2.5% increase in total VMT was less than the 3.8% increase in residential population over the same time period could be attributed to a number of factors:
    - The Puget Sound Regional Council (PSRC) has found that increased population growth does not necessarily equate to comparative growth in VMT.[31] While the population grew in Bellevue and the Puget Sound Region between 2001 and 2006, there was also an increase in congestion, which forces drivers to find alternative means of travel.
    - The City of Bellevue experienced large increases in the use of public transportation between 2001 and 2006. The 2005 U.S. Census figures show that compared to 2000, fewer Bellevue residents are driving to work alone and more are using public transportation. The percentage of Bellevue residents who drove alone to work dropped from 74 %in 2000 to 68.8 %in 2005. From 2002 to 2005, citywide transit ridership also increased 42 %and downtown Bellevue ridership increased 70 percent. In downtown Bellevue, 14 %of commute trips are taken by transit, up from 12 %in 2002.[32] While this data only accounts for the trips taken by Bellevue residents - and not the travel of other residents through Bellevue - there has also been a general increase of 6.44 % in transit ridership across the Puget Sound between 1999 and 2006.[33] Furthermore, between 2003 and 2007

[30] Personal Communication. All VMT data from PSRC regional transportation model provided by planner Kris Overby in email communications.
[31] Personal Communication, Larry Blaine, PSRC August 30, 2007.
[32] Washington Dept. of Transportation. http://www.wsdot.wa.gov/NR/rdonlyres/83B5FC39-9708-4B08-ADD0-C3D82D8CDEC0/0/GTECFolio.pdf
[33]PRSC. Travel Trends 2006. http://www.psrc.org/publications/pubs/trends/t6mar07.pdf

alone, Sound Transit's total system-wide ridership in the first quarter of these years increased 160 %from 1.91 million to 3.14 million rides.[34]

The 4.5% increase in residential GHG emissions between 2001 and 2006 outpaced the 3.8% increase in residential population over the same time period. Overall, there was a 1.2% per household increase in residential community emissions. The 16.0% increase in commercial sector emissions also outpaced the 6.5% increase in commercial square footage and an overall .05% increase in total jobs. (While the number of jobs in the city dropped dramatically from 133,000 after the recession of 2001, the total number of jobs were estimated by the City of Bellevue to be 133,500 in 2006).[35] Table 4 shows GHG emissions by sector, relative to various population and zoning indicators .

- The increase in emissions from the residential and industrial sectors correlated with the increase in households and industrial square footage fairly well, leading to small increases in normalized emissions.
- In contrast, increased emissions from the commercial sector far outpaced the increase in commercial square footage.
- In addition, the slight decrease in emissions from the transportation sector is especially notable as this absolute decrease in emissions occurred while the residential population was growing. The total job numbers at the end of this period were not markedly higher than the beginning of the period, although there were fluctuations during the period.

Table 3: Comparison Between 2001 and 2006 Community Emissions by Sector and Source

Sector & Source	2001 Equiv CO_2 Emitted (metric tons)	2006 Equiv CO_2 Emitted (metric tons)	% Change
Residential - Electricity	228,679	257,735	+12.7%
Residential - Natural Gas	167,995	156,845	-6.6%
Commercial - Electricity	417,906	493,481	+18.1%
Commercial – Natural Gas	71,317	73,798	+3.5%
Industrial – Electricity	14,622	15,015	+2.7%
Industrial - Natural Gas	8,742	8,752	+0.1%
Transportation - Gasoline	645,296	630,345	-2.3%
Transportation - Diesel	129,948	132,831	+2.2%
Waste	7,692	6,678	-13.2%

Source: CACP Model Output

[34]Sound Transit – Ridership. http://www.soundtransit.org/x6176.xml
[35]City of Bellevue Economic Trends Update. (Draft) 2008.

Table 3A: Comparison Between 2001 and 2006 Community Emissions by Sector

Sector	2001 Equiv CO_2 Emitted (metric tons)	2006 Equiv CO_2 Emitted (metric tons)	% Change
Total Residential – Electricity and Natural Gas	396,674	414,580	+4.5%
Total Commercial - Electricity and Natural Gas	489,223	567,279	+16.0%
Total Industrial – Electricity and Natural Gas	23,364	23,767	+1.7%
Total Transportation – Gasoline and Diesel	775,244	763,176	-1.6%
Waste	7,692	6,678	-13.2%
All Sectors	1,692,197	1,775,479	+4.9%

Source: CACP Model Output

Please note that the percentage change in the "All Sectors" category is not the sum of "% Change" down that column, but the percent increase of CO2 between 2001 and 2006 in the "All Sectors" row.

Table 4: Comparison Between 2001 and 2006 Community Emissions Relative to Indicators

Sector	2001 Equiv CO_2 Emitted (metric tons)	2006 Equiv CO_2 Emitted (metric tons)	% Change
Residential Emissions (per household)	8.2	8.3	+1.2%
Commercial Emissions (per 1000 ft^2)	12.7	13.9	+9.4%
Industrial Emissions (per 1000 ft^2)	3.7	3.8	+2.7%
Transportation Emissions (per capita)	6.8	6.5	-4.4%
Waste Emissions (per capita)	0.068	0.057	-16.2%
Total - All Sectors (per capita)	**14.9**	**15.0**	**+0.7%**

Source: CACP Model Output

Please note that the percentage change in the "All Sectors" category is not the sum of "% Change" down that column, but the percent increase of CO2 between 2001 and 2006 in the "All Sectors" row.

2. Municipal Operations Emissions Inventory

The government operations inventory is an estimate of GHG emissions produced by sources under the operational or financial control of the City of Bellevue municipal organization.

Base Year Emissions Inventory

In the base year of 2001, Bellevue's municipal operations generated 14,716 metric tons of CO_2e.

- The largest source of emissions was electricity, accounting for 48.7% of all government operations emissions.
- Building emissions were the largest sector in 2001, producing 29.2% of Bellevue's municipal emissions.
- The employee commuting and vehicle fleet sectors were the second and third largest emitters producing 21.9% and 21.4% of municipal emissions, respectively.

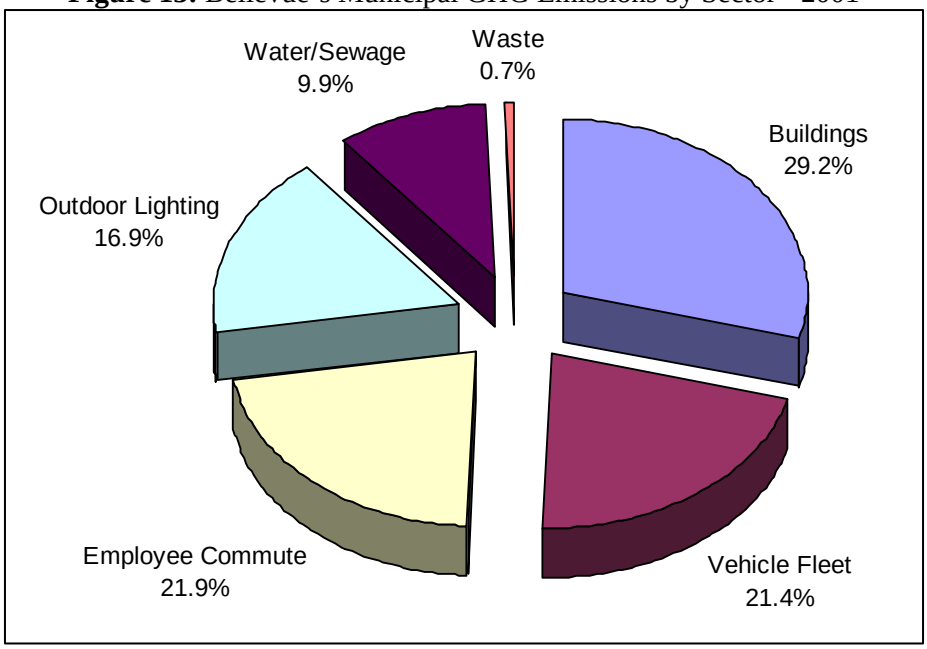
Table 5, Figure 13, Figure 14, and Figure 15 show the breakdown of municipal operations emissions by source and sector. Figure 16 shows a breakdown of the costs associated with Bellevue's 2001 energy use. It should be noted that the costs listed below for outdoor lighting include those associated with not just energy, but also the leasing and maintenance of streetlights and traffic signals by Puget Sound Energy (PSE).

Table 5: Bellevue Municipal Emissions Summary – 2001

Sources	Equiv CO_2 Emitted (Metric Tons)	% of Total	Energy Consumed (million Btu)	Cost ($)
Buildings	4,297	29.2%	42,820	652,915
Vehicle Fleet	3,153	21.4%	40,498	414,338
Outdoor Lighting	2,489	16.9%	18,273	1,174,533
Water/Sewage	1,459	9.9%	10,960	236,293
Employee Commute	3,223	21.9%	41,316	N/A
Waste	95	0.7%	N/A	0
TOTAL	**14,716**	**100%**	**153,867**	**2,478,079**

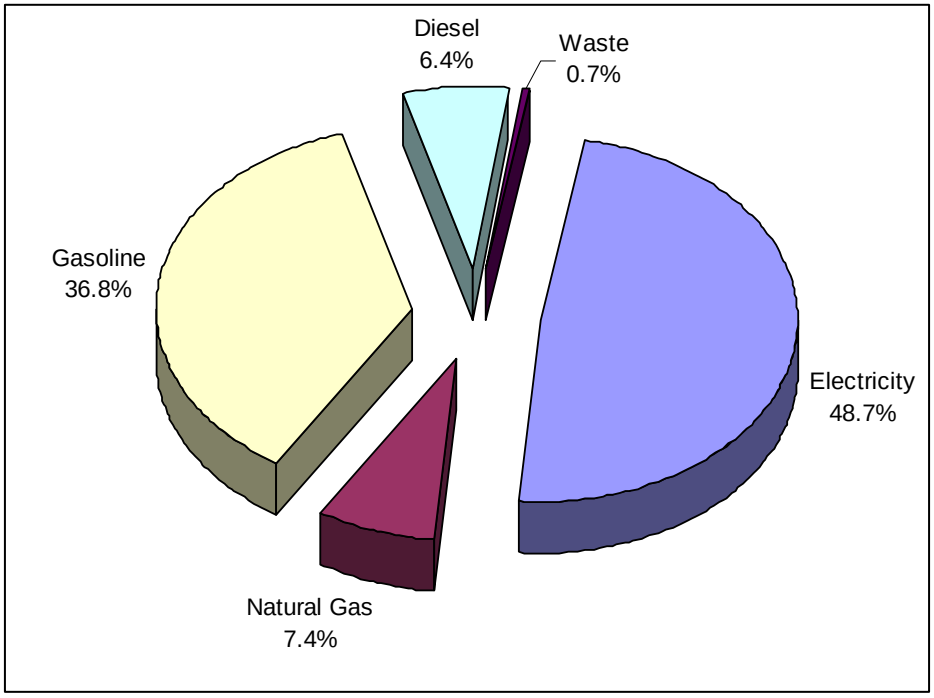
Source: CACP Model Output

Figure 13: Bellevue's Municipal GHG Emissions by Sector - 2001



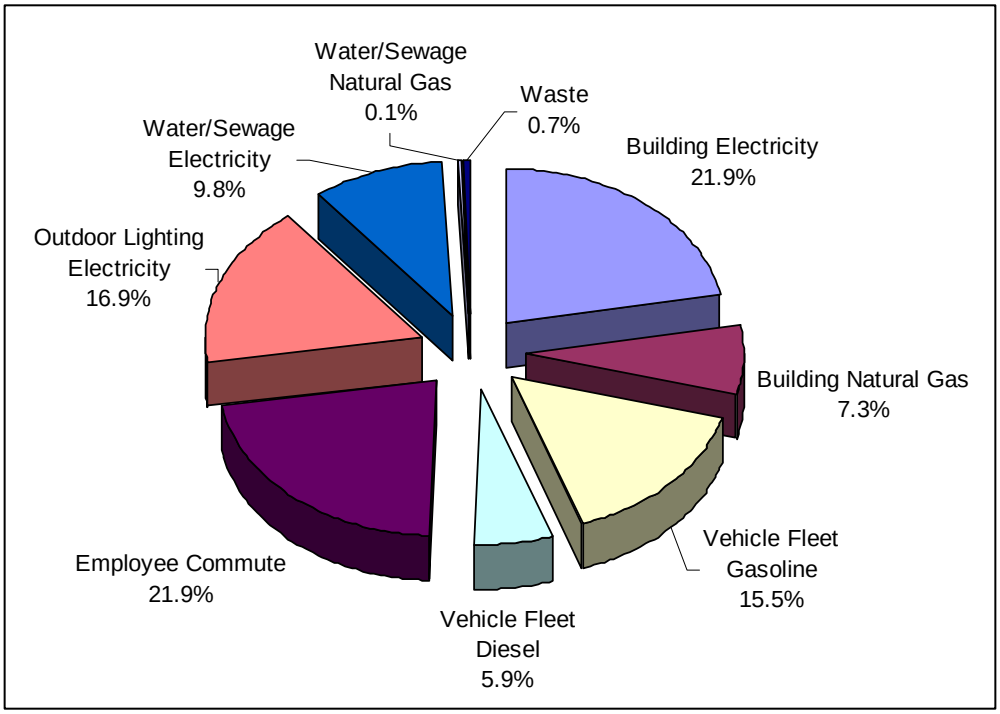
Source: CACP Model Output

Figure 14: Bellevue's Municipal GHG Emission by Source - 2001



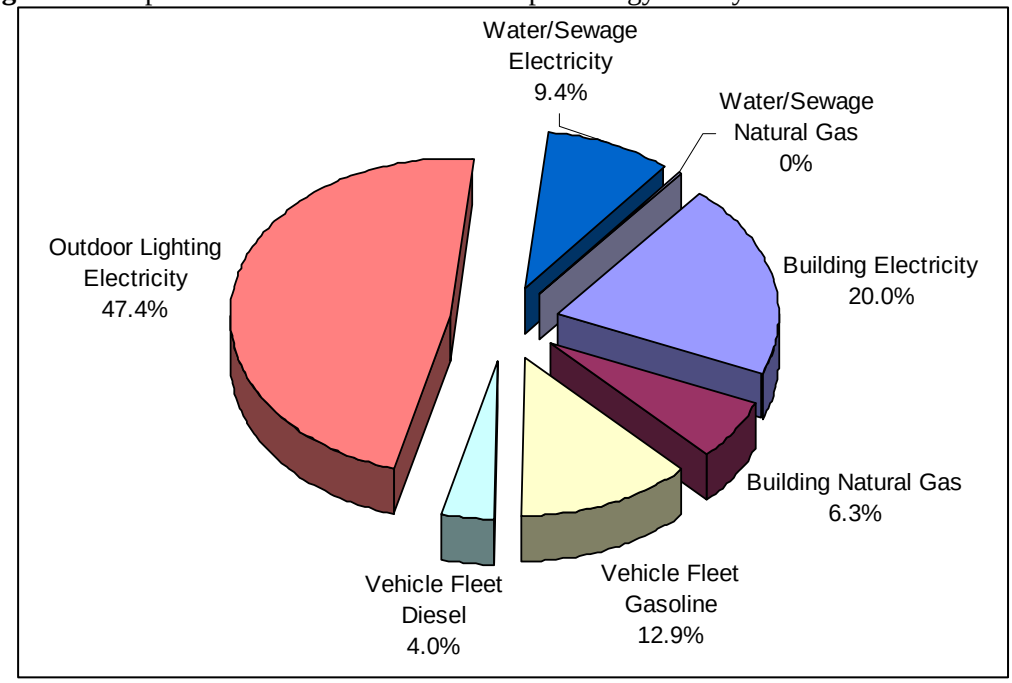
Source: CACP Model Output

Figure 15: Bellevue's Municipal GHG Emissions by Source and Sector - 2001



Source: CACP Model Output

Figure 16: Expenditures on Bellevue's Municipal Energy Use by Source and Sector - 2001



Source: CACP Model Output

Municipal emissions in Bellevue in 2001 constituted about 1% of Bellevue's total community emissions. Local government emissions typically fall between 2 to 5 % of overall community emissions. Bellevue's emissions are lower than this average because the city's water and waste water treatment are operated by King County. The wastewater treatment process produces GHG emissions through direct emissions from waste and intensive energy use for water remediation and pumping. Excluding emissions from this sector results in significantly lower municipal emissions, as wastewater and water treatment usually comprises the single largest governmental energy use and expenditure.

Figures from the 2003 King County Greenhouse Gas Inventory indicate that the County's Wastewater Treatment operations total 42,313 Metric Tons of CO_2e yearly.[36] This figure is nearly triple the *entire* GHG emissions from Bellevue's municipal operations. At this time, it was not possible to obtain the percentage of King County's Wastewater Treatment operations that can be attributed to the City of Bellevue.[37] However, given the magnitude of emissions in this sector, if the City were to account for these emissions, it would likely increase the proportion of municipal emissions to within the range of 2 to 5 % of overall community emissions.

Interim Year Emissions Inventory

In the interim year of 2006, Bellevue's municipal operations generated 18,423 metric tons of CO_2e, an increase of 25.2% over 2001.

- The largest source of emissions was electricity, accounting for 59.1% of all government operations emissions.
- Building emissions were the largest sector in 2006, producing 42.1% of Bellevue's municipal emissions.
- The vehicle fleet and outdoor lighting were the second and third largest emitting sectors producing 18.8% and 16.2% of eCO_2, respectively.

Table 6, Figure 17, Figure 18, and Figure 19 show the breakdown of municipal operations emissions by source and sector. Figure 20 shows the costs associated with Bellevue's 2006 energy use.

In 2006, municipal emissions in Bellevue constituted about 1%of the community's total emissions. As stated above, local government emissions typically fall between 2 to 5 %of overall community levels. As explained, Bellevue's emissions as a percentage of the community inventory is lower than average because water and wastewater treatment activities are not included in this inventory.

[36] King County. (2003). 2003 Inventory of King County Air Emissions. http://dnr.metrokc.gov/dnrp/air-quality/pdf/2003-inventory-report.pdf

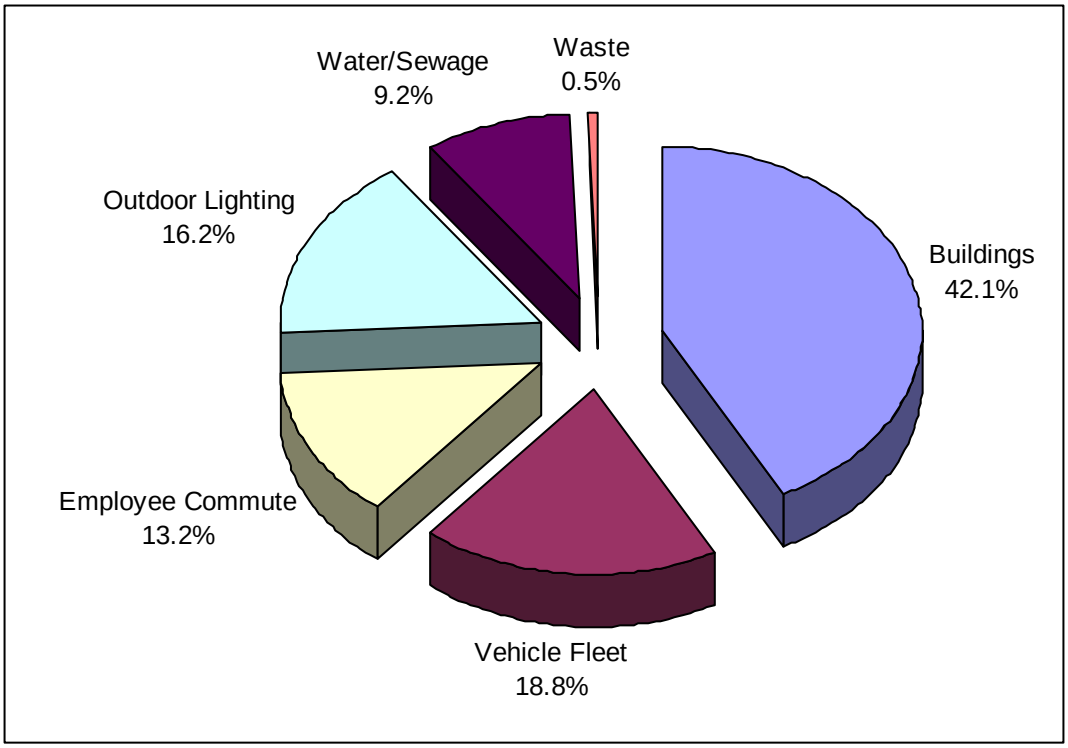
[37] Personal Communication with King County Energy Manager Dave Van Holden. (Oct 10, 2007). A request was placed to obtain this information from King County.

Table 6: Bellevue Municipal Emissions Summary - 2006

Sources	Equiv CO_2 Emitted (Metric Tons)	% of Total	Energy Consumed (million Btu)	Cost ($)
Buildings	7,758	42.1%	70,300	1,306,707
Vehicle Fleet	3,460	18.8%	44,480	823,852
Outdoor Lighting	2,989	16.2%	20,597	1,201,319
Water/Sewage	1,678	9.2%	11,619	316,449
Employee Commute	2,439	13.2%	31,401	N/A
Waste	100	0.5%	N/A	0
TOTAL	**18,423**	**100%**	**178,397**	**3,648,327**

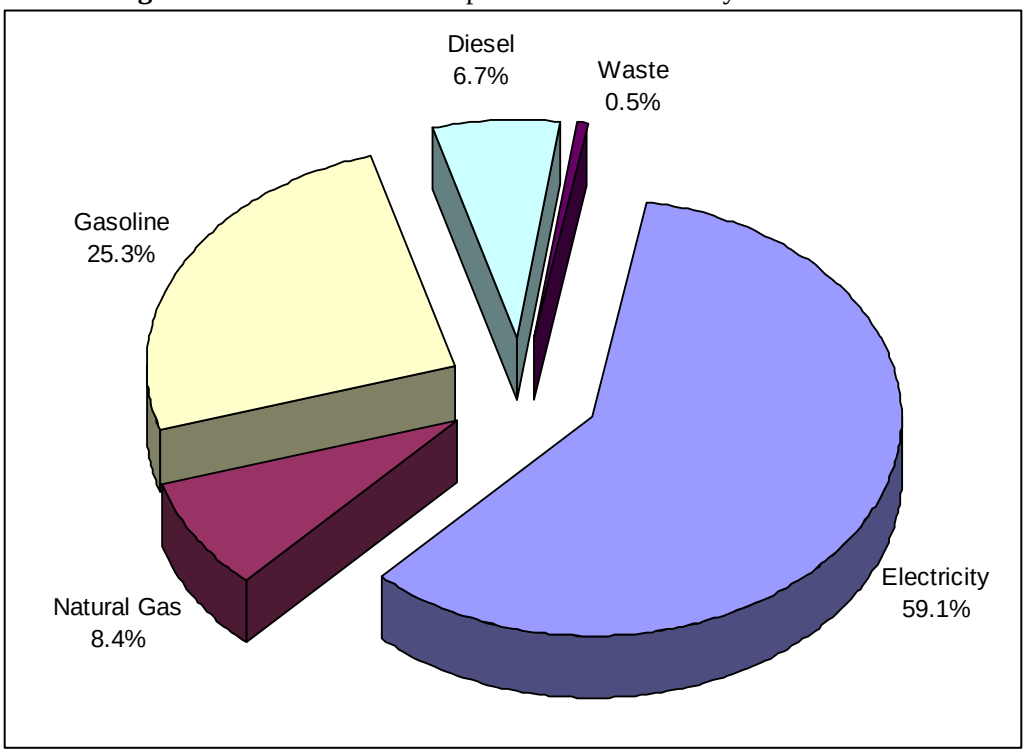
Source: CACP Model Output

Figure 17: Bellevue's Municipal GHG Emissions by Sector - 2006



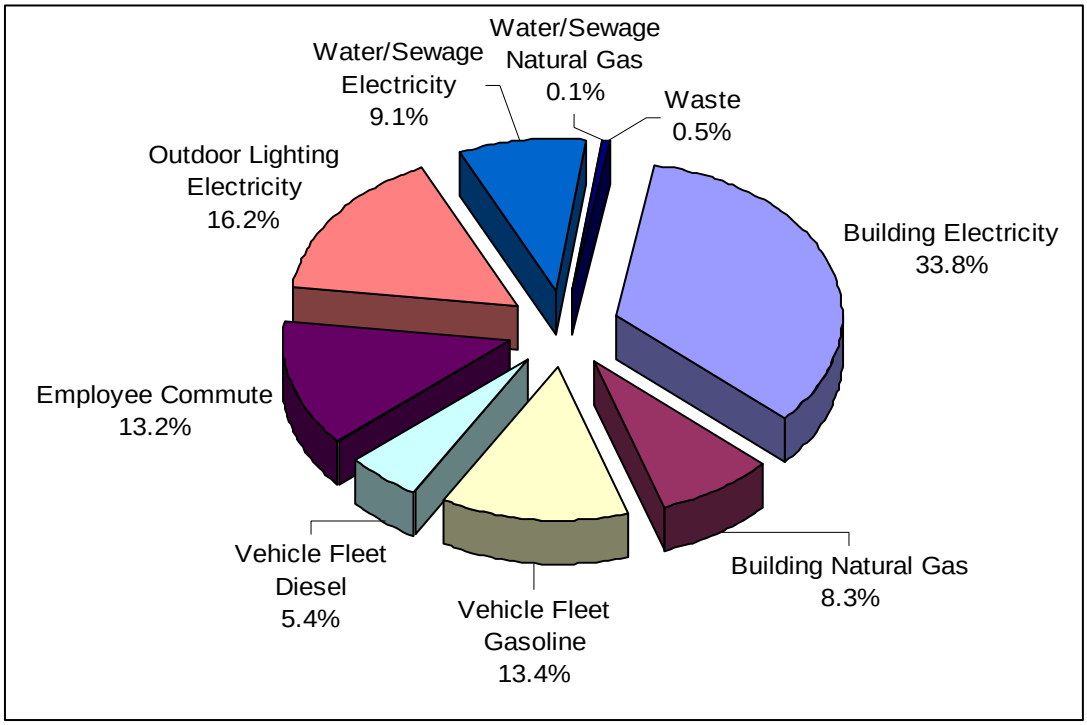
Source: CACP Model Output

Figure 18: Bellevue's Municipal GHG Emissions by Source – 2006



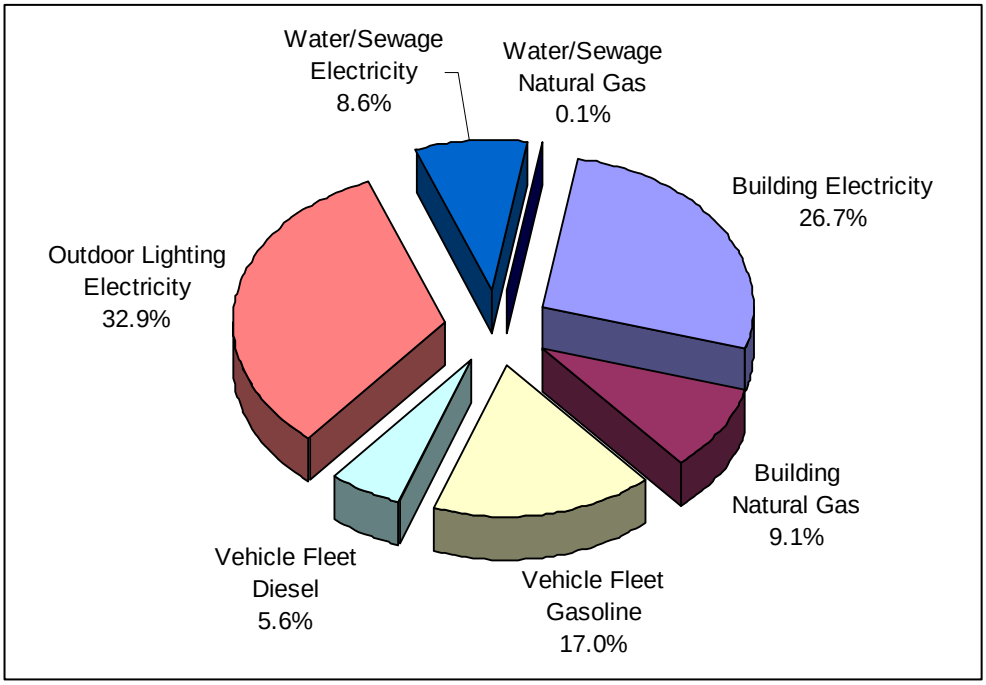
Source: CACP Model Output

Figure 19: Bellevue's Municipal GHG Emissions by Source and Sector - 2006



Source: CACP Model Output

Figure 20: Expenditures on Bellevue's Municipal Energy Use by Source and Sector - 2006



Source: CACP Model Output

Comparison Between Base and Interim Year Inventories

Between 2001 and 2006 GHG emissions from City of Bellevue municipal operations increased 25.2% (Table 7).

- About 93% of the 3,707 metric ton increase in total municipal emissions was from the building sector, with 87% of the increase in building sector emissions coming from an increase in electricity use. However, with the opening of the new City Hall, as well as a number of new Parks facilities, there was a significant increase in the square footage dedicated to city operations between 2001 and 2006.
- When examined on a square foot basis (not including the footage from the City Hall's two parking garages), the increase in building emissions was 20.0% (Table 8). In addition, City Hall construction activities continued after move-in, and the building commissioning process was not completed for nearly a year thereafter, which may have led to larger energy usage than what can be expected for future years. This will be discussed in more depth in the Buildings Sector summary below.
- In addition to the large increase in building emissions, with the exception of employee commuting, emissions from all municipally controlled sectors increased between 2001 and 2006 (Table 7).
- Employee Commute emissions decreased 24.3% between 2001 and 2006 with a significant concurrent increase in bus and vanpool ridership. This is likely attributable to the FlexPass and other Commute Trip Reduction (CTR) incentives.

Changes in all other sectors are discussed in greater detail below.

Table 7: Comparison between 2001 and 2006 Municipal Emissions by Source

Sector & Source	2001 Equiv CO_2 Emitted (metric tons)	2006 Equiv CO_2 Emitted (metric tons)	% Change
Buildings – Electricity	3,223	6,221	+93.0%
Buildings - Natural Gas	1,074	1,537	+43.1%
Vehicle Fleet – Gasoline	2,280	2,463	+8.0%
Vehicle Fleet – Diesel	873	996	+14.1%
Water/Sewage – Electricity	1,436	1,672	+16.4%
Water/Sewage - Natural Gas	24	5	-79.2%
Outdoor Lighting – Electricity	2,489	2,989	+20.1%
Employee Commute – Gasoline & Diesel	3,223	2,439	-24.3%
Waste	95	100	+5.3%

Source: CACP Model Output

Table 7A: Comparison between 2001 and 2006 Municipal Emissions by Sector

Sector	2001 Equiv CO_2 Emitted (metric tons)	2006 Equiv CO_2 Emitted (metric tons)	% Change
Total Buildings – Electricity and Natural Gas	4,297	7,758	+80.5%
Total Vehicle Fleet – Gasoline and Diesel	3,153	3,460	+9.7%
Total Water/Sewage – Electricity and Natural Gas	1,459	1,678	+15.0%
Outdoor Lighting	2,489	2,989	+20.1%
Employee Commute	3,223	2,439	-24.3%
Waste	95	100	+5.3%
All Sectors	14,716	18,423	+25.2%

Source: CACP Model Output

Please note that the percentage change in the "All Sectors" category is not the sum of "% Change" down that column, but the percent increase of CO2 between 2001 and 2006 in the "All Sectors" row.

Table 8: Comparison Between 2001 and 2006 Municipal Emissions Relative to Indicators

Sector	2001 Equiv CO_2 (metric tons)	2006 Equiv CO_2 (metric tons)	% Change
Buildings Emissions (per 1000 ft^2)	6.5	7.8	+20%
Vehicle Fleet Emissions (per FTE)	2.6	2.7	+3.8%
Outdoor Lighting Emissions (per capita)	0.02	0.03	+50%
Water/Sewage Emissions (per capita)	0.012	0.014	+16.6%
Waste Emissions (per FTE)	0.077	0.081	+5.1%
Employee Commute (per FTE)	2.6	2.0	-23.0%

Source: CACP Model Output

Building Emissions

GHG emissions increased between 2001 and 2006 in all city managed buildings. (Figure 21 shows groupings of buildings with the highest emissions, sorted by departments by which they are managed. Figures 22 and 23 show electricity and natural gas usage for the same groupings.) Facilities included in the Civic Services category include:

- City Hall, Bellevue Service Center;
- The Leavitt Building;
- The Police Annex; and
- The shop at 14822 BelRed Rd.

Facilities included in the Fire Department category include:

- All Fire Stations; and
- Public Safety Training Center, and a communications antenna.

It should be noted that total buildings emissions also include a small amount of energy usage at the two police substations and in the Bellevue Service Center parking lot managed by the Utilities Department (which are not captured in these graphs). Emissions from the two police substations increased from 18.1 metric tons in 2001 to 23.2 metric tons in 2006 (28.9%) and emissions from the utilities site increased from 5.5 metric tons to 6.6 metric tons (20.5%).

As discussed above, most of the increase in building emissions was from electricity usage associated with City Hall.

- In 2001, old City Hall, the Police Annex, and the Leavitt Building used a combined 2.9 million kWh of electricity and 34,000 therms of natural gas. This energy usage produced a combined total of 1,526 metric tons CO_2e.
- In 2006, the new City Hall building replaced the function of all of these buildings. The new building used 6.9 million kWh of electricity and 97,000 therms of natural gas. The increased energy usage at the new building produced 3,944 metric tons of CO_2e in total. However, if

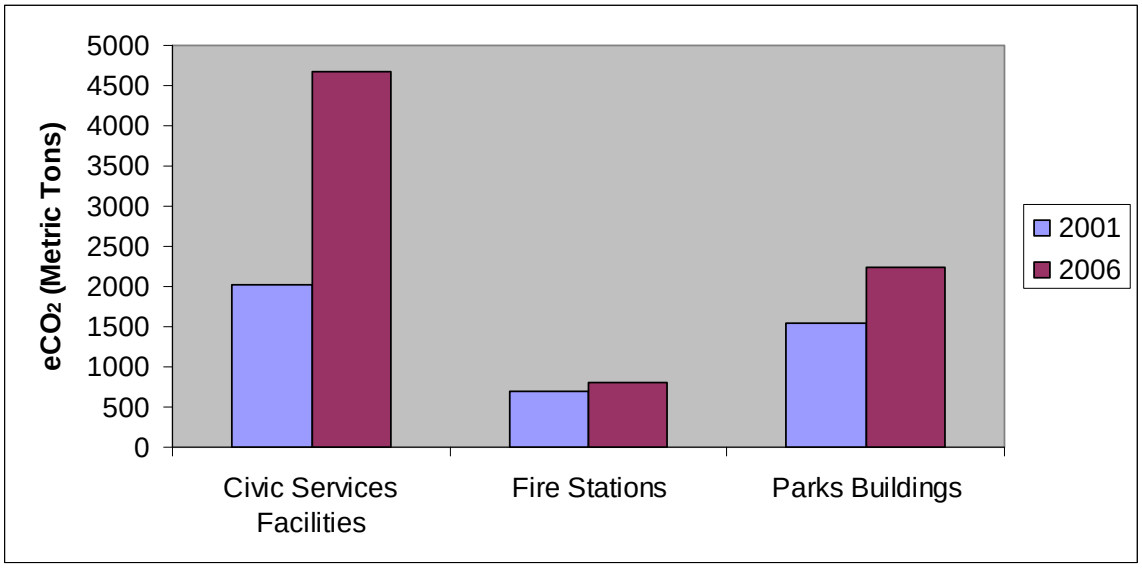
the emissions from the estimated energy use of the parking garages are not factored in, this number drops to 3,758 metric tons CO_2e.

- While emissions from City Hall buildings more than doubled, the size of these buildings increased from approximately 170 thousand square feet in 2001, to 377 thousand square feet in the new building, not including the two covered parking garages that total an additional 289 thousand square feet.
- When the emissions are examined on per 1000 ft^2 basis, emissions from Bellevue City Hall buildings only increased from 9.0 to 10.0 metric tons per 1000 ft^2 between 2001 and 2006 (this does not include either the energy use or the square footage from the parking garages).
- If the energy and square footage from the parking garage is included, emissions for new City Hall fell to 5.9 metric tons per 1000 ft^2 in 2006.

The new City Hall building did not just replace the old buildings, as many new functions were added. These functions included increased event space and usage, the addition of the regional 911 Call Center, two new computer server rooms, and police space used 24 hours a day, which increased in size from 24 to 69 thousand square feet.

Additionally, because of the learning and adaptation required to manage the new building in the first year of operations and occupancy, it is likely that increased energy savings may be realized in future years. An aggressive energy conservation approach on installation of new equipment during the City Hall renovation led to a grant from PSE for $169,000, which supported the installation of energy saving mechanisms that are estimated to save the City of Bellevue approximately $60,000 per year in utility expenses. It should also be noted that energy usage in the new City Hall building in its first year of operation consumed about half of the energy than it did when it was the Qwest Data Center, which was managed and used for different purposes.[38]

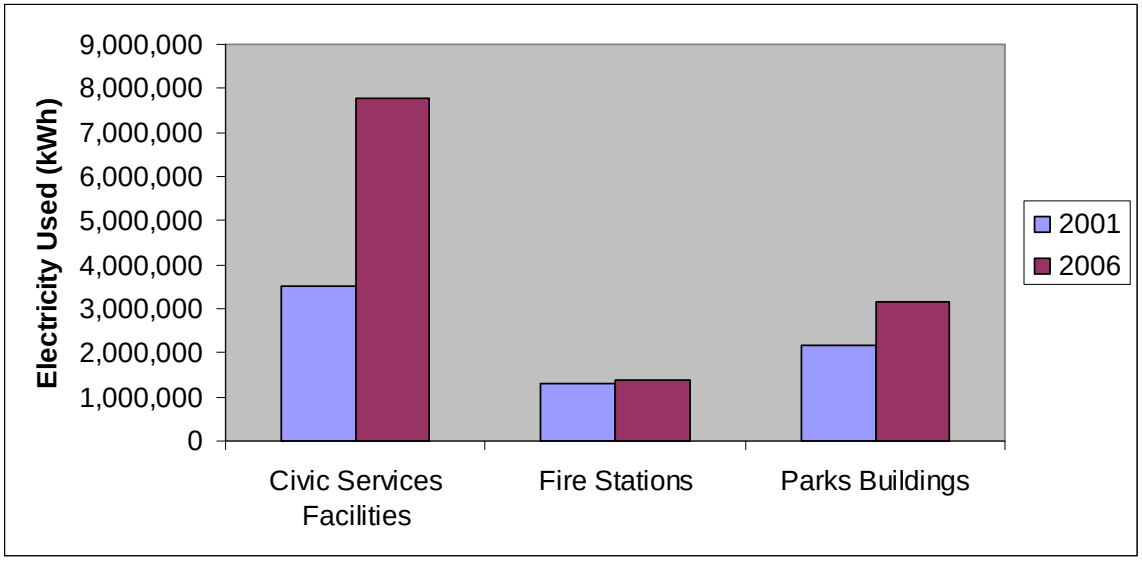
Figure 21: GHG Emissions from Municipal Buildings and Facilities in 2001 and 2006



Source: CACP Model Output

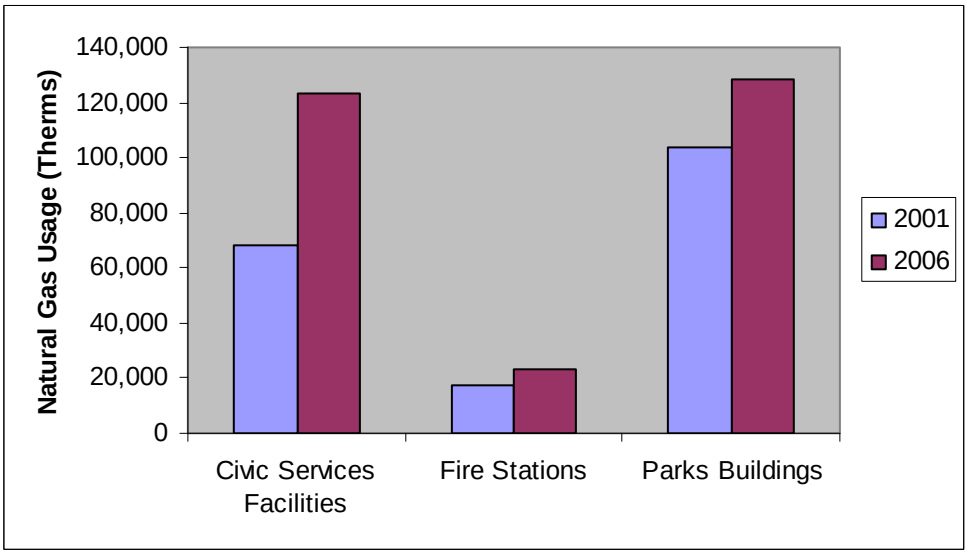
[38] Personal Communication, Steve Sackenreuter, Facilities Manager, City of Bellevue.

Figure 22: Electricity Usage in Municipal Buildings and Facilities in 2001 and 2006



Source: CACP Model Output

Figure 23: Natural Gas Usage in Municipal Buildings and Facilities in 2001 and 2006



Source: CACP Model Output

Vehicle Fleet Emissions

Vehicle fleet emissions from all Bellevue municipal operations increased from 3,153 metric tons in 2001 to 3,460 metric tons in 2006 (Figure 24). Gasoline consumption increased from 234,000 gallons in 2001 to 252,000 gallons in 2006. At the same time, diesel consumption increased from 91,000 gallons to 104,000 gallons (Figure 25). Unfortunately, it is not currently feasible to obtain this information with a departmental break down. During this period, the fleet increased from 858 to 1008 vehicles, indicating a small increase in fuel consumption per vehicle. [39]

Figure 24: Vehicle Fleet GHG Emissions in 2001 and 2006

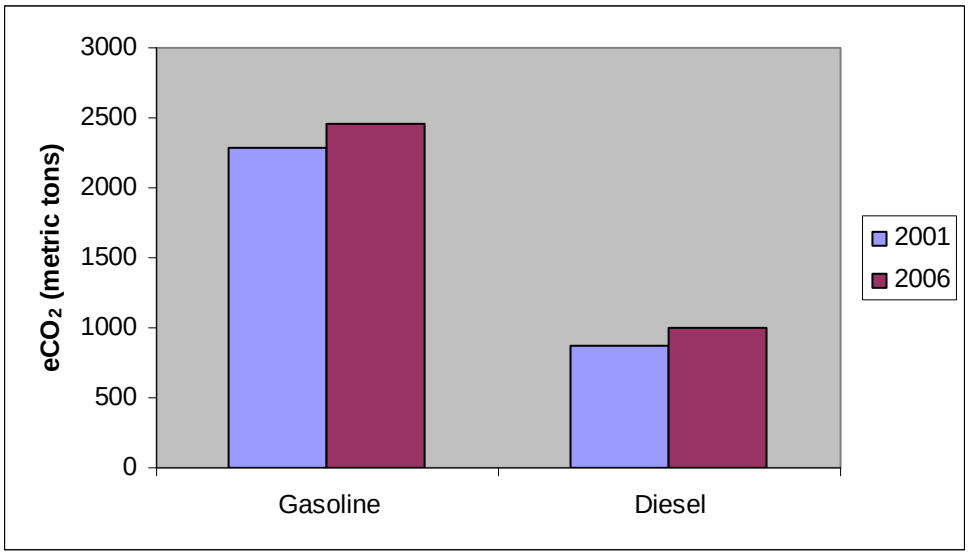
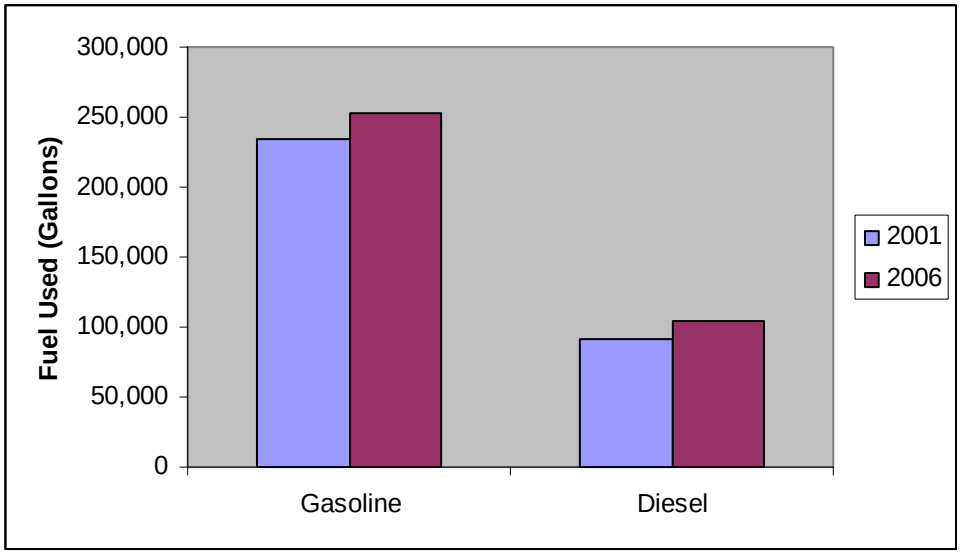


Figure 25: Vehicle Fleet Fuel Used in 2001 and 2006



Source: CACP Model Output

[39] Personal Communication, Todd Shipler, City of Bellevue (October 8, 2007). Until information is obtained about how many vehicles use gasoline vs. how many vehicles use diesel, it will not be possible to analyze fuel consumption trends on a per vehicle basis.

Outdoor Lighting Emissions

The contribution of GHG emissions from traffic signals, streetlights, and outdoor park lighting is shown in Figure 26, with the corresponding energy usage represented in Figure 27. The number of park lights changed very little between 2001 and 2006. There was a decrease in traffic signal energy usage between 2001 and 2006 as a result of installing energy efficient LED lights. At the same time, however, there was a significant increase in streetlight energy usage. The table below shows the increase in streetlights. According to Bellevue Traffic Engineering Manager Mark Poch, the increase in lighting can be attributed to the increase in capital projects that add lights to the roadway network, adding lights in neighborhoods based on citizen requests, and city annexations.[40]

Year	# of Streetlights
1991	4,751
2001	6,900
2006	8,200

Figure 26: GHG Emissions from Municipal Lighting in 2001 and 2006

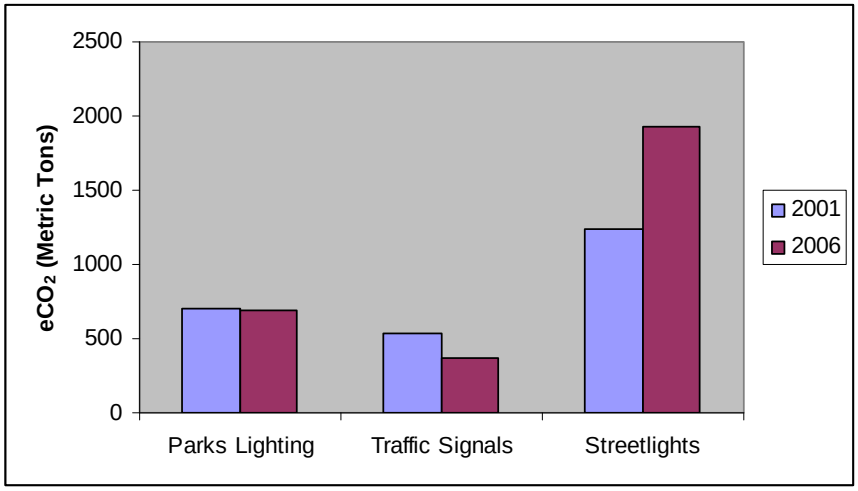
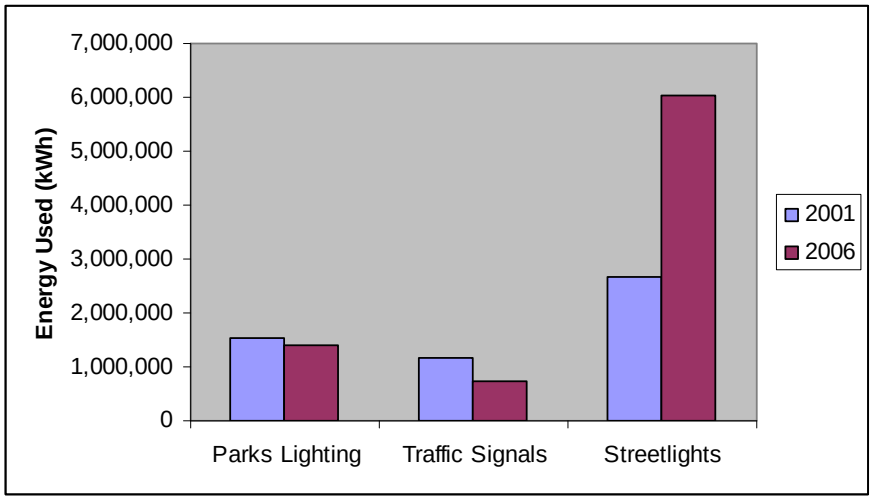


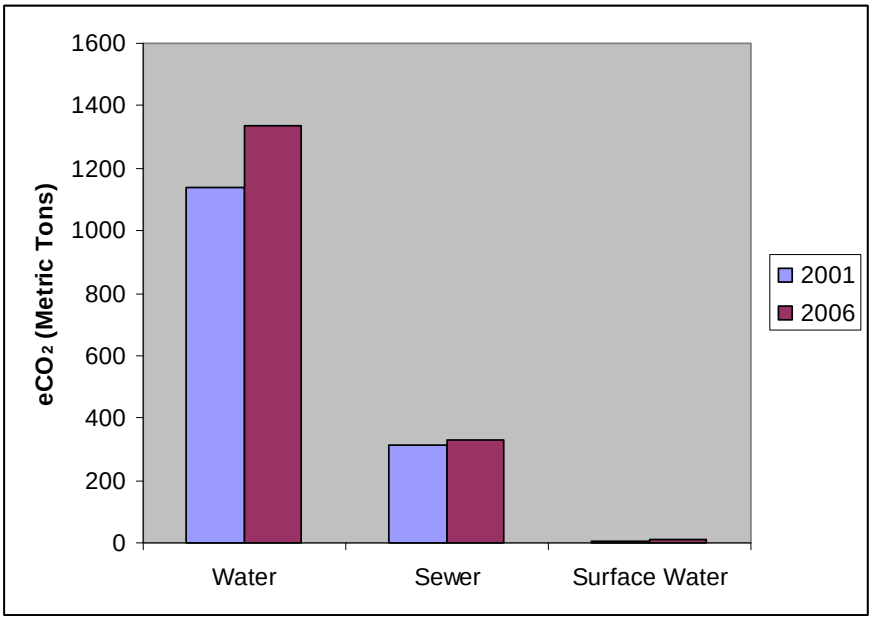
Figure 27: Energy Usage in Municipal Lighting in 2001 and 2006: Source: CACP Model Output



Water/Sewage Pumping Emissions

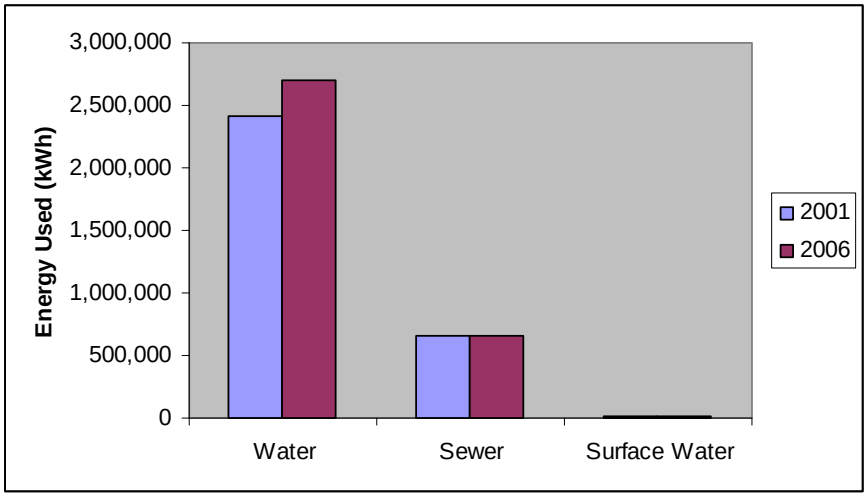
The GHG emissions produced to generate the energy to pump water and wastewater increased from 1,459 to 1,678 metric tons between 2001 and 2006 (Figure 28 and 29). A small amount of energy is also used to pump surface water at flood control sites. Most of this energy is used to pump drinking water from reservoirs to homes. Bellevue's emissions from this sector are much smaller than the majority of similar-sized municipalities in the region because almost all of the city's water and waste water treatment is handled by King County. See page 32 for a more detailed explanation.

Figure 28: GHG Emissions in Municipal Water/Sewage Operations in 2001 and 2006



Source: Source: CACP Model Output

Figure 29: Energy Usage in Municipal Water/Sewage Operations in 2001 and 2006



Source: CACP Model Output

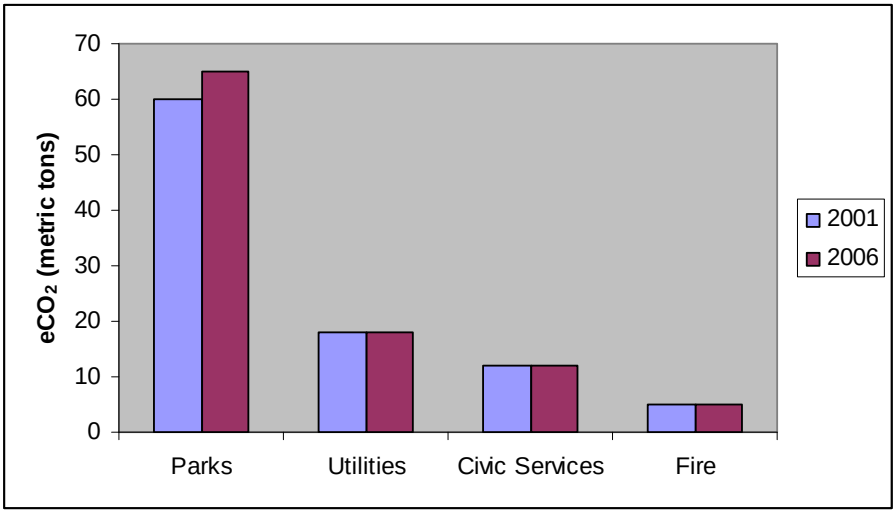
[40] Personal Communication, Mark Poch (October 4, 2007)

Solid Waste Emissions

The majority of waste collected under contract with the City of Bellevue is generated at Park facilities (Figure 30). Most of this is garbage deposited in garbage cans in city parks. It should be noted that waste numbers only existed for 2006. The 2001 numbers were estimated using change in population for Park waste, and the change in number of employees for City operations. These calculations assumed that the amount of waste collected per capita, and produced per City employee, did not change between 2001 and 2006. This assumption also did not take into consideration any increase in recycling during those years.

Although the waste generated from municipal employees and parks is not a significant source of GHG emissions according to the CACP model, waste reduction and recycling is an incredibly important activity. Reducing waste streams and increased recycling can preserve resources, as well as reduce GHG emissions related to manufacturing and waste transportation. For a more complete explanation of the waste portion of the model see page 19.

Figure 30: GHG Emissions From City of Bellevue Waste in 2001 and 2006



Source: CACP Model Output

III. Forecasts and Backcasts

Bellevue's GHG emissions are not fixed. The general trend of population growth coupled with increasing per capita energy use and the local government's attempt to keep services apace with growth, result in a steady increase in annual emissions. Any attempt to achieve an absolute reduction must first take into account this growth. Additionally, conducting an emissions forecast is essential for setting the reduction target, since the amount of GHG emissions Bellevue has pledged to reduce will be in addition to business-as-usual increases.

Having completed the community and municipal operations emissions inventories for the base year 2001 and the interim year 2006, the next step was to forecast future emissions generated by the community and municipal operations. The emissions forecasts represent a business-as-usual prediction of how GHG emissions are likely change over time. Two forecast years were selected: 2012 and 2020. The use of two years will create benchmarks for the achievement of both short- and medium-term goals. (It should be noted that the rapid growth in downtown Bellevue's commercial sectors makes forecasting emissions difficult. The forecasts are based on the continuation of current trends, and should be updated regularly as better information about commercial growth trends become available.)

Emissions were also backcast to 1990. While detailed data was not available to inventory the emissions for years prior to 2001, it was considered valuable to have an estimate of 1990 emissions because this is the base year for measuring achievement of the Kyoto Protocol, City of Bellevue Resolution 7517, and the U.S Mayor's Climate Protection Agreement. For the future, it may also prove valuable as a tool for measuring credit for carbon reductions, which are typically counted against 1990 emissions. This is also the base year that is used by the State of Washington and the Western Climate Initiative for all future GHG reduction targets.

The community forecast and backcast were based on data published by the U.S. Energy Information Administration for regional energy use by energy source and economic sector. These data were then scaled to Bellevue using known or expected population changes from the U.S Census Bureau and the City of Bellevue Planning and Community Development Department, as well as expected job growth in Bellevue from the Planning and Community Development Department. It is important to note that the effects of the recently passed renewable portfolio standard (I-937) were not included in the forecast methodology because the regulations for this standard have not been finalized. The renewable portfolio standard requires the state's largest electric utilities to supply 15% of their electricity sales from eligible renewable resources by 2020. It also requires those electric utilities to pursue low-cost energy conservation opportunities with customers. Additionally, the Washington Climate Advisory Team, which is developing statewide climate policies, is making further recommendations that may modify this standard.

The municipal emissions forecast and backcast were based on several sets of proxy data: changes in the total number of full time equivalent (FTE) employees, growth of the city's population, and the change between the inventories of 2001 and 2006.

The following tables and charts show changes in annual emissions over time in the community and in municipal operations, respectively.

Table 9: Bellevue Community Emissions Summary and Future Business-As-Usual Projections

Year	Community Analysis CO_2e (Metric Tons)	Community - %Difference from 2001
7% Below 1990	1,300,309	-23%
Backcast Year - 1990	1,398,182	-17.4%
Base Year -2001	1,692,197	N/A
Interim Year - 2006	1,775,479	+4.9%
Target Year Projection - 2012	1,930,230	+14.2%
Target Year Projection - 2020	2,122,211	+25.4%

Source: CACP Model Output

The chart below shows the volume of annual emissions that will need to be curtailed in the interim and forecast years to ensure that the community at large will meet its reduction targets. For example, in 2006 the community would have had to reduce its emissions by 475,170 tons of CO_2e in order to meet the city's stated reduction goal of 7% below 1990 levels. The reductions needed to meet this target in 2012 and 2020 are estimates based on the forecasted growth for emissions levels in these years. These estimates represent the difference between the volume of annual emissions forecast for those years and the 7% below 1990 levels. The volume of reductions is based on emission for the stated year, and is not cumulative.

Table 10: Reduction Estimates for Community Targets

	Community Analysis CO_2e (Metric Tons)
Reduction of Emissions Needed to Meet Target in 2006	475,170
Reduction of Emissions Needed to Meet Target in 2012	629,921
Reduction of Emissions Needed to Meet Target in 2020	821,902

Source: CACP Model Output

Table 11 : Bellevue Municipal Emissions Summary and Future Business-As-Usual Projections

Year	Municipal Operations CO_2e (Metric Tons)	Municipal %Difference from 2001
7% Below 1990	11,485	21.9%
Backcast Year - 1990	12,349	-16.1%
Base Year -2001	14,716	N/A
Interim Year - 2006	18,423	+25.2%
Target Year Projection - 2012	19,865	+34.9%
Target Year Projection - 2020	22,455	+52.5%

Source: CACP Model Output

The chart below shows the volume of annual emissions that will need to be curtailed in the interim and forecast years to ensure that the city will meet its stated reduction targets. For example, in 2006 the city would have had to reduce its emissions by 6,938 tons of CO_2e in order to meet the reduction goal of 7% below 1990 levels. The reductions needed to meet this target in 2012 and 2020 are estimates based on the forecasted growth for emissions levels in these years. These estimates represent the difference between the volume of annual emissions forecast for those years and the 7% below 1990 levels. The volume of reductions is based on emission for the stated year, and is not cumulative.

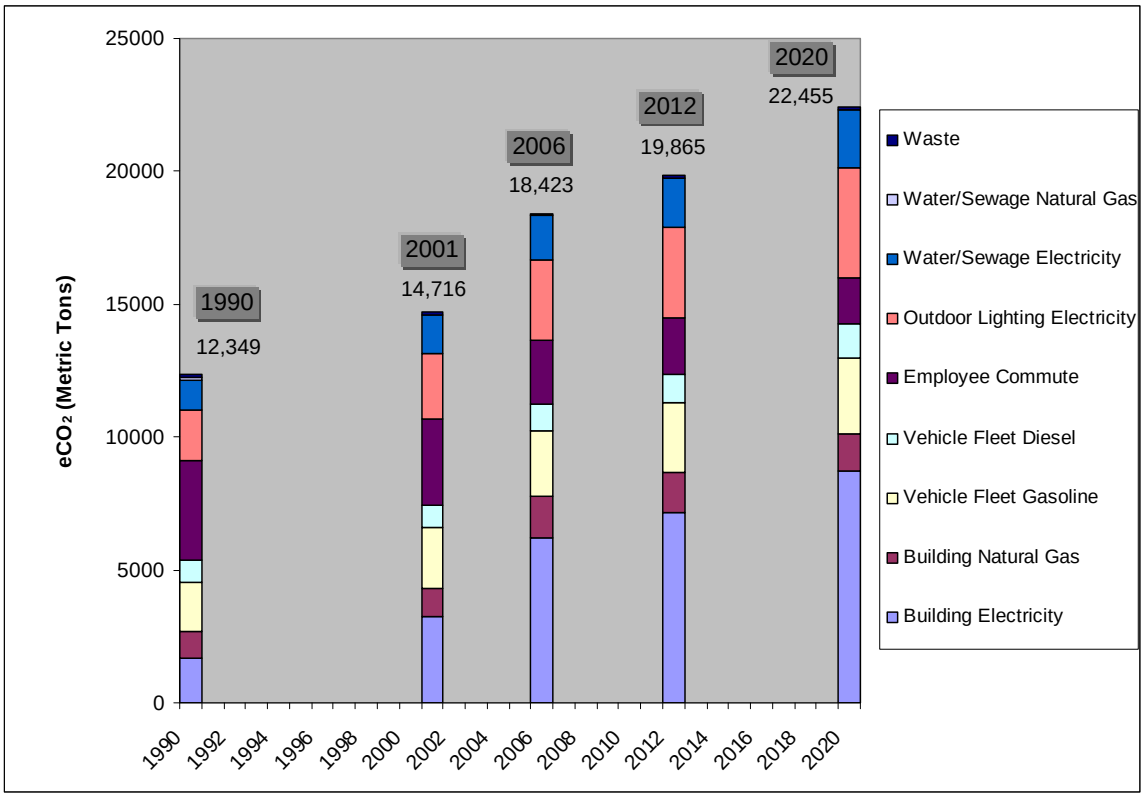
Table 12: Reduction Estimates for Municipal Targets

	Municipal Analysis CO_2e (Metric Tons)
Reduction of Emissions Needed to Meet Target in 2006	6,938
Reduction of Emissions Needed to Meet Target in 2012	8,380
Reduction of Emissions Needed to Meet Target in 2020	10,970

Source: CACP Model Output

In the two stacked bar graphs, the height of the bar for each year is proportional to the total GHG emissions produced in that year. Within each bar, the different colors correspond to different sources and sectors from the emissions inventory. Figure 33 compares the current forecast of the "business-as-usual" trend in community emissions versus two reduction scenarios. The first reflects the capping of emissions at the base year (2001) level. The second reduction scenario shows the reduction necessary to achieve the goal of 7% below 1990 levels, as set out in Resolution 7517.

Figure 31: Bellevue Community GHG Emissions 1990-2020



Source: CACP Model Output

Figure 32: Municipal GHG Emissions 1990-2020

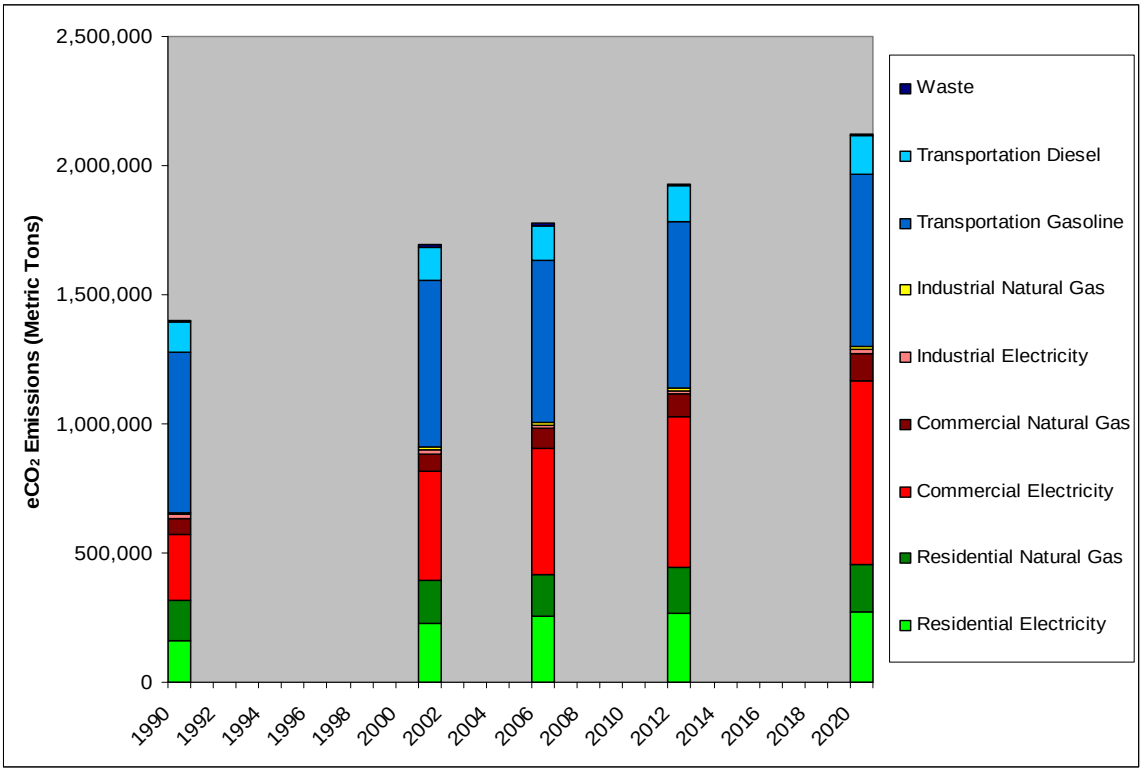
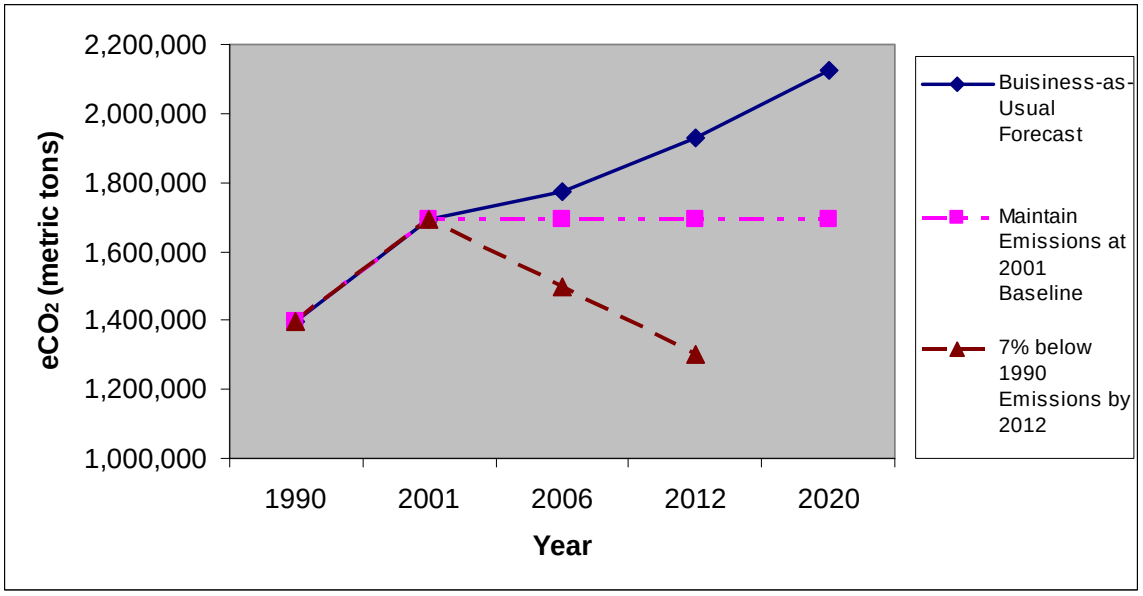


Figure 33: Community Emissions Reduction Scenarios



Source: CACP Model Output

IV. Guide for Next Steps

A. Conclusions

By passing a resolution, setting reduction goals and completing a GHG inventory, the City of Bellevue has taken the first step towards reducing its climate impact. In order to meet the reduction goals laid out in Resolution 7517, however, Bellevue must figure out how it will make the reductions necessary to reduce its GHG emissions to 7% below 1990 levels by 2012. It will take immediate and decisive action to work towards that goal.

B. Recommendations for Future Action

One alternative is to begin with the subset of overall emissions that arise from municipal operations. As a relatively small contributor to total emissions, actions to reduce municipal energy use may have a limited impact on Bellevue's overall community emissions levels. However, municipal action has strong symbolic value and demonstrates leadership that extends beyond the magnitude of emissions actually reduced. Additionally, not only does the municipal government have greater control over municipal operations as compared to the actions of the broader community, but these actions could result in the implementation of improved management systems as well as resulting in energy savings which can alleviate the impacts of rising utility costs.

The ICLEI/ CCP model suggests an evaluation of existing programs as a first step. Evaluating existing programs will allow the city to understand how current policies or procedures may already be working to reduce GHG emissions and lower its rate of emissions. Furthermore, these analyses can provide performance measurements for programs that currently have few metrics for evaluation. With the help of that analysis, new potential measures can be identified and evaluated in order to construct a Municipal Action Plan.

Either on a parallel track or after implementation of the Municipal Action Plan, the city can begin a similar process on a community wide basis which would result in a Community Action Plan.

After implementation of these two sets of actions, the city would monitor progress towards it's goals and assess the effectiveness of the strategic choices. This would be done through periodic emissions measurements, likely on a 5 year cycle. The learning that results from that process would then be used in a continuing emissions reduction effort.

Appendix A - Data Collection Process, Assumptions and Notes

Community Inventory

Electricity and Natural Gas: Overall community electricity and natural gas usage data were gathered through requests to Puget Sound Energy. PSE was able to provide a total number of kWhs and therms natural gas used in the City of Bellevue, divided into Residential, Commercial, and Industrial sectors. These data included all electricity users.

Transportation data: The City-wide vehicle miles travel (VMT) data were taken from the Puget Sound Regional Council transportation model. The total miles traveled were entered into the CACP software, which generated an estimate of emissions based on national vehicle use and mile-per-gallon averages.

Waste: The numbers for total waste was obtained from the Solid Waste Program Administrator within the City of Bellevue Utilities Department who procured the information from Allied Waste. The breakdown of waste components was calculated from the King County Waste Characterization Study. The methane recovery factor for Cedar Hills landfill was gathered by contacting the facility directly, although the number used in the end was from the King County GHG Inventory.

The Eastgate Landfill is a covered and closed landfill within the City of Bellevue. The landfill was operated between 1951 and 1964 by King County, and stored municipal solid waste. The landfill is currently under City of Bellevue management, with a methane recovery system. Very little information exists about the volume of waste stored in the landfill. In order to estimate the amount of waste, the average depth of solid waste was calculated from a geotechnical cross section of the landfill. The area of waste was determined from geotechnical maps as well. This information was used to estimate a volume of waste stored. This was converted to weight using the conversation faction 1,200 lbs per cubic yard for landfill waste. This tonnage number was entered into the waste-in-place module in the CACP software to determine emissions in 2001 and 2006. Given the small quantity of emissions and the limited accuracy of the estimate, this number was not included in the total community emissions inventory.

Municipal Inventory

Electricity and Natural Gas: As with the Community inventory, data for electricity and natural gas were generated through a request to PSE. Municipal account numbers were gathered through the Finance, Utilities, Civic Services, Transportation, and Parks Departments within the City of Bellevue. Data was collected in either kWhs or therms for the calendar year. It should be noted that data for City Hall electricity and natural gas usage was from July 1, 2006 to June 30, 2007 to account for the fact that the new City Hall building opened in March of that year. All electricity and natural gas usage from the old City Hall buildings in 2006 was disregarded.

Vehicle Fleet: The vehicle fleet manager was able to provide records for fueling. These were used to determine the fleet vehicle usage.

Employee Commute – Raw data regarding employee commute was available through Rick Cranford at King County and Ed Hillsman at WSDOT. They supplied Commute Trip Reduction Surveys from 2001 to 2007 for both the City Hall and Bellevue Service Center, which together represent the majority of the City's employees. From the data provided, the weekly VMTs per commuting mode were calculated. It was assumed that the CTR survey week was an average commute week and these numbers were scaled up to yearly figures. A number for average VMTs was used to estimate emissions for people who either work at a different site in Bellevue or did

not respond to the survey. An assumption was made that the 2007 data would have been the same for 2006.

Solid Waste Emissions: The total waste generated in city operations was estimated by the size of containers collected. It was assumed that all waste containers were filled each week. The volume of trash collected was converted to tons using the density of waste for various sectors found at http://www.ciwmb.ca.gov/WasteChar/DispRate.htm. The composition of waste was estimated using numbers from similar sectors found at http://www.ciwmb.ca.gov/WasteChar/BizGrpCp.asp for non-Parks waste. The composition of waste from municipal parks was assessed using a waste characterization survey from Toronto as a proxy. Waste numbers existed only for 2006. These numbers were scaled to 2001 using population growth for Parks waste, and the number of employees for municipal buildings. It was assumed that the waste generated in Parks per capita and per employee remained constant between 2001 and 2006.

The methane recovery factor used for municipal waste was the same as that for community waste.

Forecasting and Backcasting

Community forecasting and backcasting was based on energy demand projections for the Pacific Region provided by the Energy Information Administration. This data was "scaled" to Bellevue's expected population growth based on the projections of population growth and employment numbers compiled by the Planning and Community Development Department. Emissions in the residential, transportation, and industrial sectors were scaled using population growth numbers, while emissions from the commercial sector were scaled using job growth numbers.

Forecast and backcast methodology for municipal operations varied dependent upon the sector. An estimate of full time equivalent (FTE) employee growth was developed with the help of the Planning and Community Development Department. For municipal buildings and waste the average of the FTE growth rate and the growth rate observed between 2001 and 2006 was used. Vehicle fleet and employee commute were assumed to grow at the same rate as FTE's. Emissions from the water/wastewater and outdoor lighting were assumed to grow at a rate equal to the average of the observed growth rate between 2000-2005 and the city's population growth rate from the Planning and Community Development Department.