City of Bellevue, Washington
2011 Greenhouse Gas Emissions Inventory

Updated December 2012

ICLEI
Local Governments for Sustainability

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Executive Summary

Bellevue has chosen to do its part. Bellevue recognizes that in order to have an impact on this global climate change, 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 1,000 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 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 5 - monitoring of the City's progress towards reducing greenhouse gas emissions. 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. The 2011 inventory serves as a snapshot of the City's progress toward meeting greenhouse gas emission reduction goals. 2001 and 2006 interim years are described in detail in the first GHG inventory, which was completed in 2007.

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 a net of 1,569,631 metric tons of carbon dioxide equivalent (CO_2e) in 2001; 1,572,987 metric tons in 2006; and 1,577,511 net metric tons in 2011.
- Per capita, emissions have been declining from 14.1 metric tons per capita in 2001, 13.4 metric tons per capita in 2006, and 12.8 metric tons per capita in 2011.
- In 2011, the City emitted more GHGs than in 2001 and 2006.
- In order to meet the reduction goals that the City Council has adopted for the year 2012 (7% below 1990 emission levels), Bellevue will need to reduce its annual emissions by 339,308 metric tons (a 22% reduction).

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. 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 September 2012, 38 states have completed or are currently working on comprehensive Climate Action Plans.[1] 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, 23 of these states have passed legislation setting GHG targets.[2]

Washington State

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

Climate Action and Green Jobs (HB 2815) adopted comprehensive limits on global warming pollution and creates a statewide effort for job training in the clean energy sector. The legislation:[3]

- Established 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.
- Established a green economy jobs initiative. the Evergreen Jobs Iniative, with the goal of increasing the number of green economy jobs to 25,000 by 2020.
- Directed 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.
- Required 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).[4]
- Established 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) directed the State to develop tools to assist local governments reduce their climate impact. The legislation:[5]

- Directed the State Department of Commerce to provide cities and counties with a tool to inventory, measure and estimate land use related GHG emissions.
- Created 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.

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

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

[3] See HB 2815 http://environmentalpriorities.org/climate-action/wa-climate-action

[4] 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.

[5] See HB 6580 http://environmentalpriorities.org/local-solutions/local-solutions-to-global-warming

- Required 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.

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 1,000 signatures from mayors representing over 88 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 % below 1990 levels by the year 2012. For more information about the MCPA, visit:
http://www.usmayors.org/climateprotection/agreement.htm

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 local governments around the world. ICLEI was launched in the United States in 1993 and has grown to over 1,200 cities and counties providing national leadership on climate protection and sustainable development. ICLEI developed the methodology used in creating Bellevue's GHG inventories.

King County

King County's goal is to collaborate with other local governments in the region with the aim of reducing greenhouse gas emissions throughout the region to 80 percent below 2007 levels by 2050.

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

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. The City of Bellevue utilized the CACP software for most of its inventory. The cases where the methodology differed from CACP are described in detail below.

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. All CO_2e in this report is expressed in metric tons ($MTCO_2e$). 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).

NOTE: While completing the 2011 inventory, certain methodology from previous inventory years was updated, and grid conversion factors that were used improperly were corrected. These inventory results should replace the previous report.

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) and 2011 calendar year (most current year) are also included in this report. It is important to be clear that municpal and community-wide categories are not cumulative. The community-wide inventory is the total, and the municipal government category is a specific subset of that total. [6]

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 the geographic boundaries of Bellevue was included, as well as the emissions required to provide that energy ("Scope 1" and "Scope 2" emissions). This means that, even though the electricity used by residents is produced elsewhere, this energy and its associated emissions appear in the inventory. "Scope 3" emissions from goods, services, and materials consumed by Bellevue residents outside of the geographic boundaries of Bellevue were largely NOT included because of difficulty in data collection and normalization, but typically Scope 3 emissions are two to three times that of Scope 1 and 2 combined.

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 and City of Bellevue Transportation (total vehicle miles traveled), and the City of Bellevue Utilities (waste generated).

[6] 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.

For the municipal inventory, the primary data sources were Puget Sound Energy (electricity and natural gas), vehicle fleet records, City of Bellevue Utilities (waste generated), Commute Trip Reduction survey (employee commuting), and City of Bellevue Finance (paper use and business travel)

The waste sector of both the municipal and community inventories deserves additional explanation. Two distinct methodologies can be used to estimate emissions associated with landfills and waste disposal. The "waste in place" methodology estimates the emissions in the inventory year as a result of all materials currently in landfills (no matter the year they were disposed) that are located within a city's geographic border. Because Bellevue sends its waste to King County's Cedar Hills landfill, "waste in place" emissions were not included in this inventory.

The other common method, called "waste commitment", estimates emissions associated with all waste generated from within Bellevue in the inventory year, regardless of when or where those emissions actually occur.[7] This "waste commitment" methodology, employed in calculations in this inventory, includes emissions even if they occur outside the Bellevue geography or after inventory year. For example, it includes emissions from waste, generated by Bellevue residents, that is taken by truck to the Cedar Hills landfill. Both methods include estimates of fugitive landfill emissions that result from the unintended release of landfill gas from the decomposition of organic materials at a landfill, combustion or treatment of landfill gas in flares, transmission in pipelines, and/or conversion to alternative energy. When organic materials are landfilled, as they decay, they produce methane and carbon dioxide. Methane is measured in the waste commitment method because the methane emissions would not occur if the materials were not landfilled. The carbon dioxide that results from the decaying materials is not counted under the waste commitment method because it is considered part of the natural carbon cycle of growth and decomposition.[8]

The waste commitment methodology estimates the total quantity of fugitive methane expected from the garbage disposed of in the inventory year, throughout its entire decay process in the landfill. The decay process takes many years, so the fugitive methane is only partly emitted during the inventory year, and partly in future years. Estimating future emissions associated with waste generated in the present may align better with the policy choices available today (e.g., waste and recycling programs and infrastructure) than would counting the actual current emissions of in-region landfills.

The inventory uses a version of the EPA's Waste Reduction Model (WARM), adjusted to account for the fact that Bellevue's waste is sent to King County's Cedar Hills landfill, which captures 90% of methane produced in the landfill (consistent with King County's methodology). WARM compares GHG and energy impacts of landfilling, recycling, incineration, composting, and source reduction. It also accounts for carbon sequestered in a landfill as an offset to emissions.

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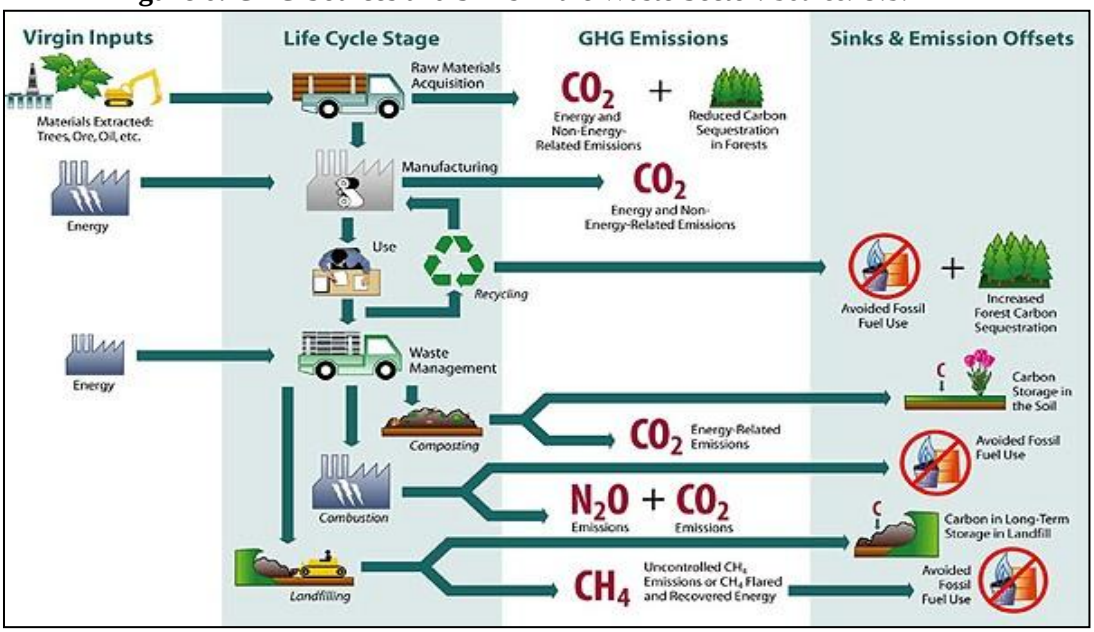
[7] Based on a review of WARM supporting documents (ICF. 2009. "*WARM component-specific decay rate methods*."Memorandum from ICF International to United States Environmental Protection Agency. October 30, 2009), it appears that EPA's WARM model counts methane released up to 100 years after disposal. After this period, it is assumed that no more methane is released and any remaining carbon is permanently stored.

[8] US EPA. 2010. "Documentation for Greenhouse Gas Emission and Energy Factors Used in the Waste Reduction Model (WARM): Introduction & Background". http://epa.gov/climatechange/wycd/waste/downloads/background-and-overview10-28-10.pdf; p.14

Bellevue's inventory also uses WARM to account for 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.

Although Bellevue's inventory uses WARM for waste and recycling emissions, it uses a more recent analysis from the California Air Resources Board to provide the greenhouse gas emission reduction factor associated with composting. This factor accounts for emission reductions associated with increased carbon storage in soil, decreased water use, decrease soil erosion, reduced fertilizer and herbicide use, and emissions due to the composting process.[9]

Figure 6: GHG Sources and Sinks in the Waste Sector: Source: U.S. EPA[10]



B. Inventory Results

<u>Current Year Emissions Inventory: 2011</u>

In the most current year of data, 2011, the community of Bellevue emitted approximately 1,653,341 metric tons of CO_2e and sequestered approximately 75,830 metric tons of CO_2e (via landfills and recycling), resulting in net emissions of 1,577,511 metric tons CO_2e. This net amount represents an 0.29% increase from 2006 emissions.[11]

- The transportation sector remained the largest single producer of GHG emissions, with the combustion of gasoline and diesel responsible for 47% of total gross community

[9] California Air Resources Board (2011). "Method for Estimating Greenhouse Gas Emission Reductions from Compost from Commercial Organic Waste." http://www.arb.ca.gov/cc/protocols/localgov/pubs/compost_method.pdf

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

[11] Gross emissions in 2011 were 0.32% higher than gross 2006 emissions.

emissions. The commercial sector was the second largest producer, responsible for 30% of the total community emissions.

- The largest single source of emissions was gasoline used for transportation, producing 38.9% of all emissions.
- Natural gas combustion in all sectors accounted for 15.5% of total community emissions.

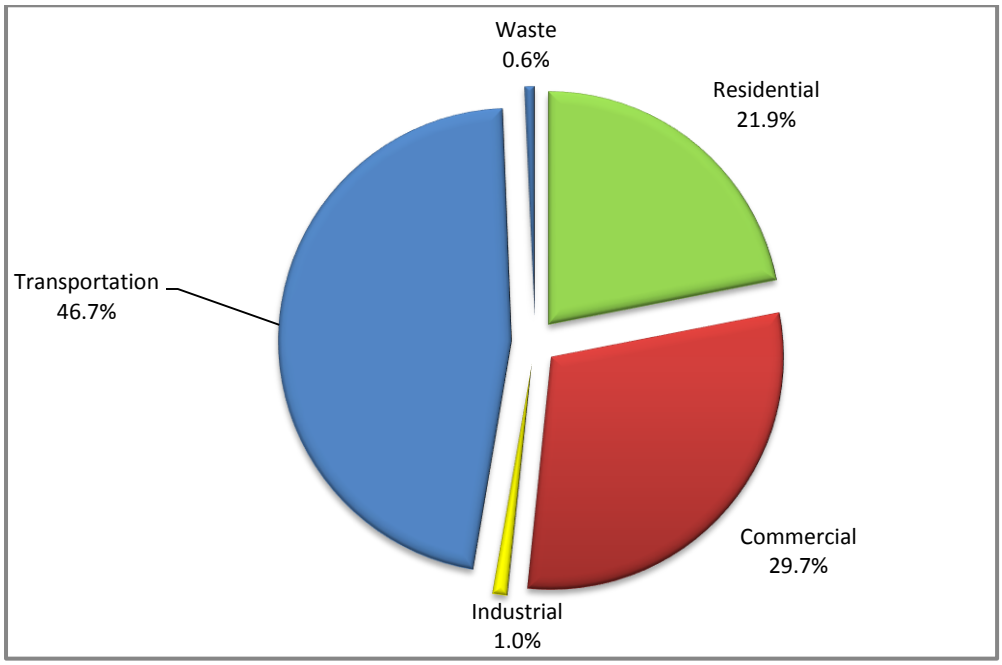
Table 2, Figure 10, Figure 11, and Figure 12 below show the breakdown of community emissions by source and sector in 2011.

Table 2: Bellevue Community Emissions Summary – 2011

Sector	Equiv CO_2 Emitted		% of Net Total	% of Gross Total	Energy Consumed (million Btu)
Residential		362,572	23.0%	21.9%	4,801,662
Commercial		491,106	31.1%	29.7%	5,186,037
Industrial		16,777	1.1%	1.0%	216,059
Transportation		772,643	49.0%	46.7%	10,707,685
Waste	Gross:	10,243	0.6%	0.6%	
	Net:	-65,587	-4.2%	-4.0%	
GROSS TOTAL		**1,653,341**	**105%**	**100.0%**	
NET TOTAL		**1,577,511**	**100%**	**95.4%**	**20,911,443**

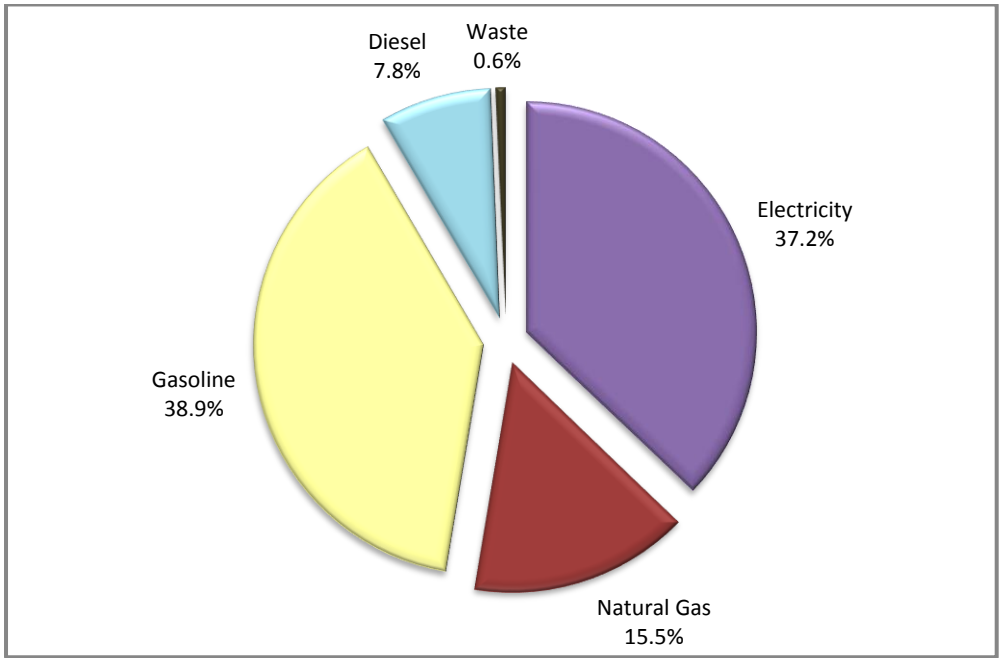
Source: CACP Model Output

Figure 10: Bellevue Community GHG Emissions by Sector (Gross Total) – 2011



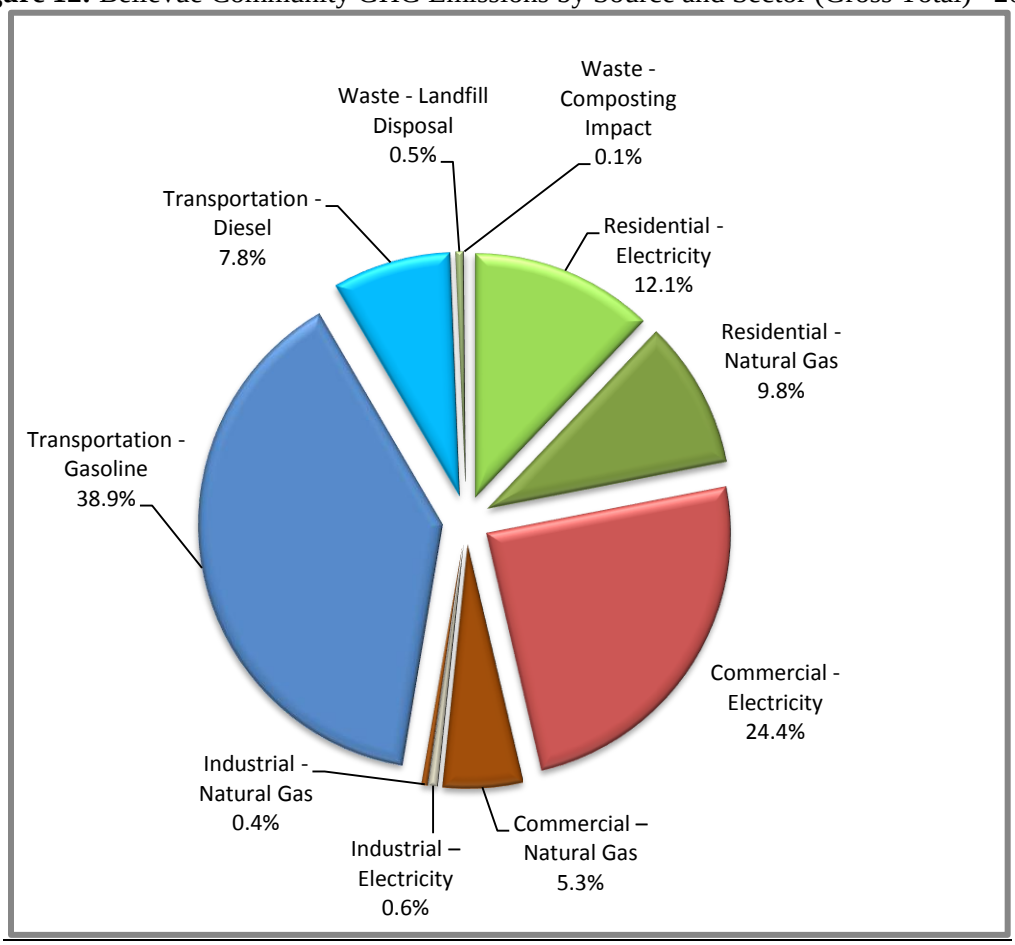
Source: CACP Model Output

Figure 11: Bellevue Community GHG Emissions by Source (Gross Total) - 2011



Source: CACP Model Output

Figure 12: Bellevue Community GHG Emissions by Source and Sector (Gross Total)– 2011



*Does not include landfill sequestration nor avoided emissions from recycling
Source: CACP Model Output

Comparison Between Interim Year Inventories: 2006 and 2011

Between 2006 and 2011, total net Bellevue community emissions increased 0.29% (Table 3).

- The commercial sector saw an increase in emissions of 1.5% between 2006 and 2011, resulting from a largeincrease in natural gas use.
- The residential sector saw a decrease in electricity use and an increase in natural gas emissions, leading to a sector-wide decrease of 2.3%.
- The waste sector saw a 1.0% net emissions decrease which was likely attributable to increased recycling rates.
- The model shows a transportation sector emissions increase of 1.2% between 2006 and 2011, with a population increase of 14.9% over the same time period. This less-than-expected increase 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 ICLEI CACP software.

Table 3: Comparison Between 2001, 2006, and 2011 Community Emissions by Sector and Source

Sector & Source	2001 Equiv CO_2 Emitted (metric tons)	2006 Equiv CO_2 Emitted (metric tons)	2001-2006 % Change	2011 Equiv CO_2 Emitted (metric tons)	2006-2011 % Change
Residential - Electricity	228,679	214,159	-6.3%	200,688	-6.3%
Residential - Natural Gas	167,995	156,845	-6.6%	161,884	3.2%
Commercial - Electricity	417,906	410,047	-1.9%	403,996	-1.5%
Commercial – Natural Gas	71,317	73,798	3.5%	87,110	18.0%
Industrial – Electricity	14,622	12,476	-14.7%	9,891	-20.7%
Industrial - Natural Gas	8,742	8,752	0.1%	6,886	-21.3%
Transportation - Gasoline	645,296	630,345	-2.3%	643,571	2.1%
Transportation - Diesel	129,948	132,831	2.2%	129,072	-2.8%
Waste - Landfill Disposal	10,342	8,789	-15.0%	8,180	-6.9%
Waste - Composting Impact	640	-557	-187.0%	2,063	-470.4%
Waste - Landfill Sequestration	-32,150	-25,238	-21.5%	-20,052	-20.5%
Waste - Recycling Impact	-87,070	-49,260	-43.4%	-55,778	13.2%
All Sectors and Sources - Net	**1,576,267**	**1,572,987**	**-0.2%**	**1,577,511**	**0.29%**
All Sectors and Sources - Gross	**1,695,487**	**1,648,042**	**-2.8%**	**1,653,341**	**0.32%**

*New for 2011 inventory and retroactively populated for past years.
Source: CACP Model Output

Table 3A: Comparison Between 2001, 2006, and 2011 Community Emissions by Sector

Sector	2001 Equiv CO_2 Emitted (metric tons)	2006 Equiv CO_2 Emitted (metric tons)	2001-2006 % Change	2011 Equiv CO_2 Emitted (metric tons)	2006-2011 % Change
Total Residential – Electricity and Natural Gas	396,674	371,004	-6.5%	362,572	-2.3%
Total Commercial - Electricity and Natural Gas	489,223	483,845	-1.1%	491,106	1.5%
Total Industrial – Electricity and Natural Gas	23,364	21,228	-9.1%	16,777	-21.0%
Total Transportation – Gasoline and Diesel	775,244	763,176	-1.6%	772,643	1.2%
Waste - Net	-108,238	-66,266	-38.8%	-65,587	-1.0%
Waste - Gross	10,982	8,789	-20.0%	10,243	16.5%
All Sectors - Net	**1,576,267**	**1,572,987**	**-0.2%**	**1,577,511**	**0.29%**
All Sectors - Gross	**1,695,487**	**1,648,042**	**-2.8%**	**1,653,341**	**0.32%**

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, 2006, and 2011 Community Emissions, Normalized

Sector	2001 Equiv CO_2 Emitted (metric tons)	2006 Equiv CO_2 Emitted (metric tons)	2001-2006 % Change	2011 Equiv CO_2 Emitted (metric tons)	2006-2011 % Change
Residential Emissions (per household)	15.5	13.9	-10.4%	13.4	-3.7%
Commercial Emissions* (per 1000 ft^2)	12.7	13.9	9.4%	7.3	-47.7%
Industrial Emissions (per 1000 ft^2)	3.7	3.8	2.7%	3.5	-8.6%
Transportation Emissions (per capita)	7.0	6.5	-6.8%	6.0	-7.6%
Waste Emissions (per capita)	(0.97)	(0.49)	-49.5%	(0.53)	-1.0%
Waste Emissions (GROSS) (per capita)	0.10	0.07	-34.0%	0.08	16.5%
Total - All Sectors (per capita)	**14.1**	**13.4**	**-5.1%**	**12.8**	**-4.4%**

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.

*These numbers were not verified for 2001 and 2006 due to lack of records.

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.

Interim Year Emissions Inventory: 2011

In the interim year of 2011, Bellevue's net municipal operations generated 14,511 metric tons of CO_2e, an decrease of 12% compared to 2006.

- The largest source of emissions was electricity, accounting for 54% of all gross government operations emissions.
- Building emissions were the largest sector in 2006, producing 46% of Bellevue's gross municipal emissions.
- The vehicle fleet was the second largest emitting sector producing 20.5% of gross 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 2011 energy use.

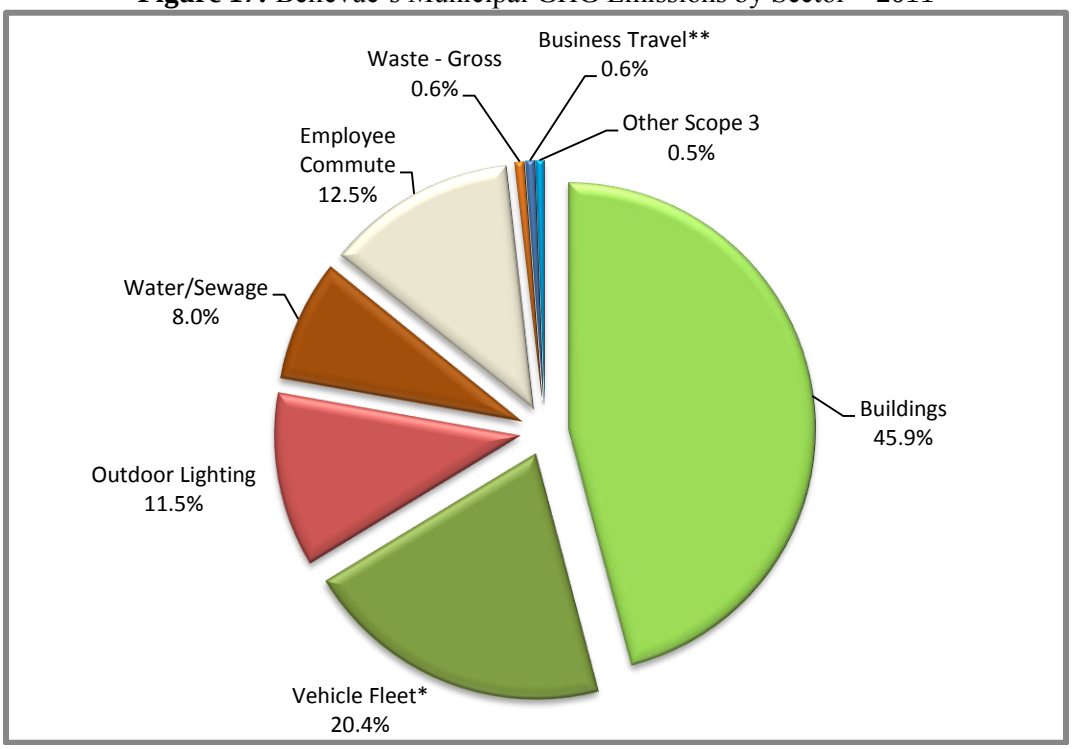
In 2011, municipal emissions in Bellevue constituted about 0.92% of the community's total emissions. As stated above, local government emissions typically fall between 2 to 5% of overall community levels. As explained, Bellevue's emissions as a percentage of the community inventory is lower than average because water and wastewater treatment activities are not included in this inventory.

Table 6: Bellevue Municipal Emissions Summary – 2011

Sources	Equiv CO_2 Emitted (Metric Tons)	% of Net Total	% of Gross Total	Energy Consumed (million Btu)	Cost ($)
Buildings	7,002	48.3%	45.9%	80,007	$1,665,000
Vehicle Fleet*	3,118	21.5%	20.5%	43,258	$1,100,500
Outdoor Lighting	1,752	12.1%	11.5%	15,996	≈$1,200,000
Water/Sewage	1,215	8.4%	8.0%	11,091	$380,400
Employee Commute	1,902	13.1%	12.5%	4,125	N/A
Waste - Net	-652	-4.5%	-4.3%	N/A	N/A
Waste - Gross	86	0.6%	0.6%	N/A	N/A
Airline and Business Travel**	92	0.6%	0.6%	N/A	N/A
Other Scope 3**	82	0.6%	0.5%		$848,000
TOTAL - NET	**14,511**	**100%**	**95%**		
TOTAL - GROSS	**15,249**	**105%**	**100%**	**154,477**	**$5,193,500**

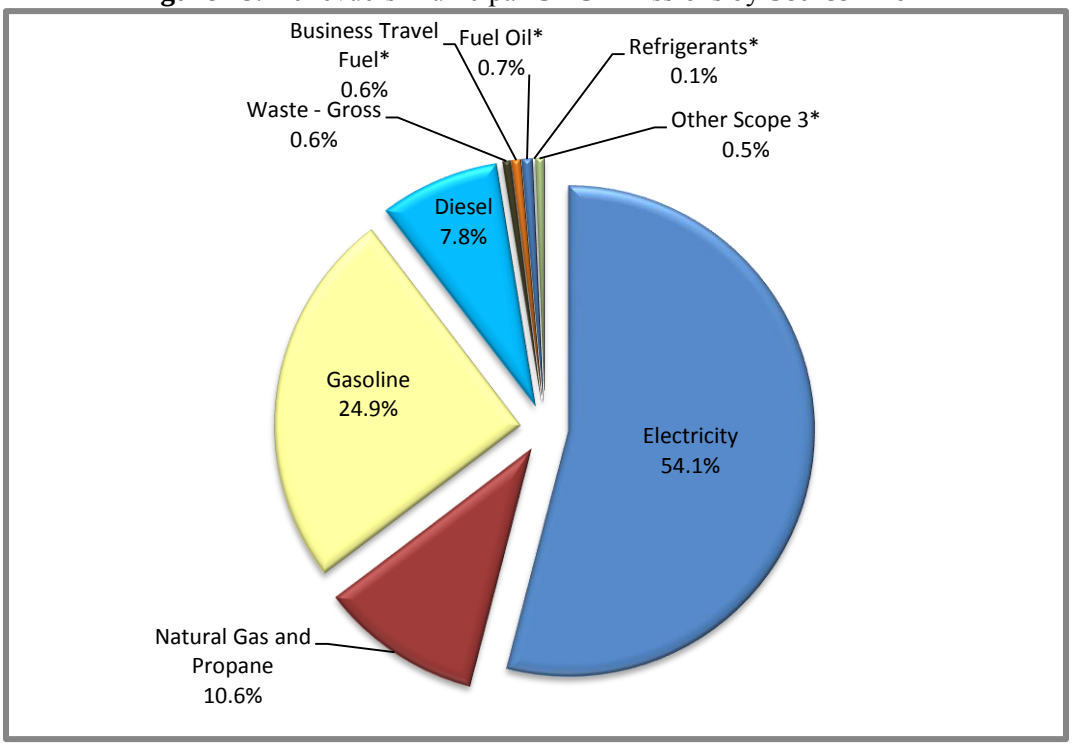
*Includes refrigerants
**New for 2011 inventory
Source: CACP Model Output

Figure 17: Bellevue's Municipal GHG Emissions by Sector – 2011



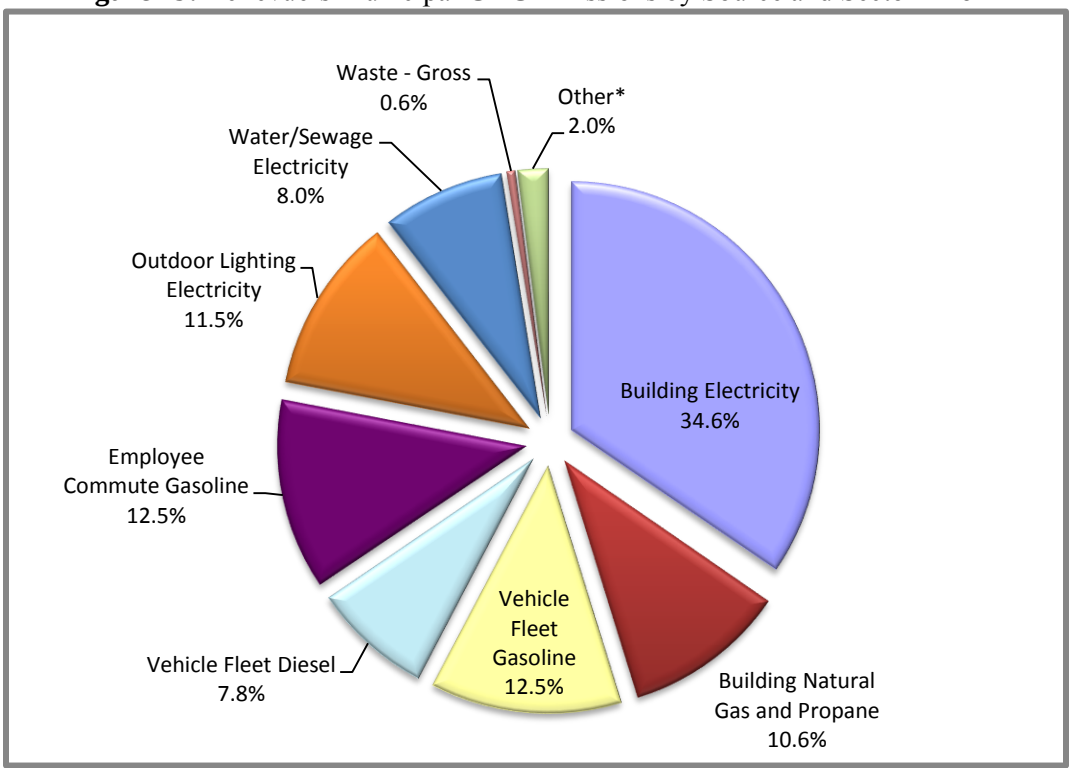
*Includes mobile refrigerants
**New for 2011 inventory
Source: CACP Model Output

Figure 18: Bellevue's Municipal GHG Emissions by Source – 2011



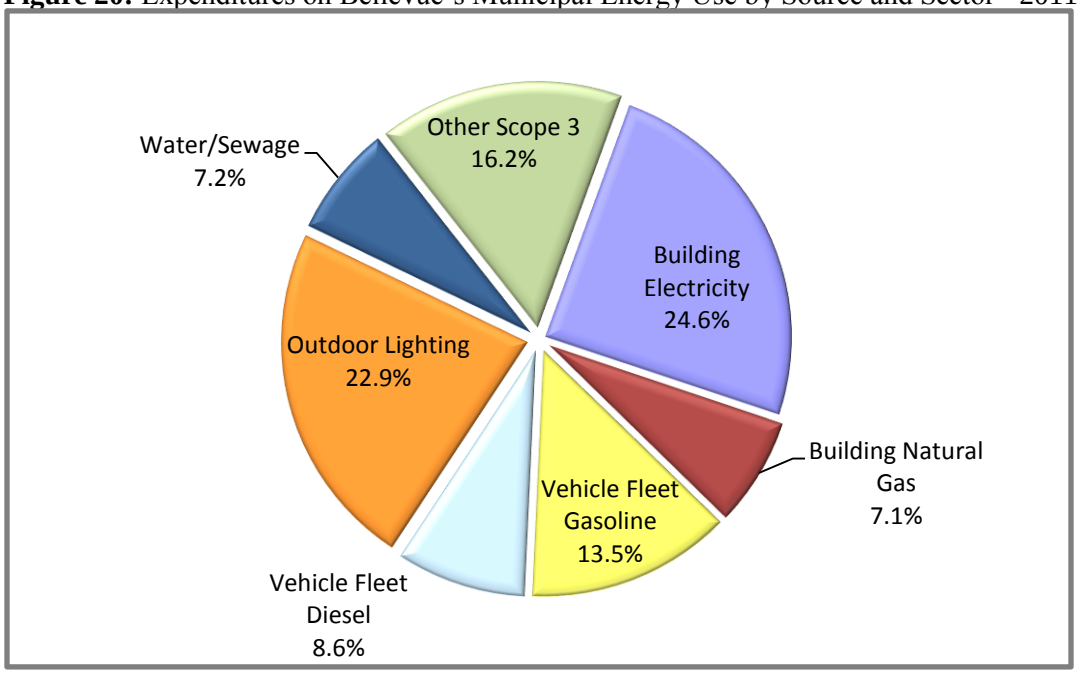
*New for 2011 inventory
Source: CACP Model Output

Figure 19: Bellevue's Municipal GHG Emissions by Source and Sector – 2011



*New for 2011 inventory
Source: CACP Model Output

Figure 20: Expenditures on Bellevue's Municipal Energy Use by Source and Sector - 2011



Source: Scope 5

Comparison Between Base and Interim Year Inventories: 2001, 2006, and 2011

Between 2001 and 2006, GHG emissions from City of Bellevue municipal operations increased 19% (Table 7).

- About 69% of the 2,587 metric ton increase in total municipal emissions was from the building sector, with 79% 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, the increase in building emissions was 4.5% (Table 8).
- 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 26% 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.

Between 2006 and 2011, net GHG emissions from City of Bellevue municipal operations decreased 12%. The largest decreases in GHG emissions were observed in employee commuting, vehicle fleet gasoline, and outdoor lighting, decreasing by 78%, 23%, and 22%, respectively.

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

Table 7: Comparison between 2001, 2006, and 2011 Municipal Emissions by Source

Sector & Source	2001 Equiv CO_2 Emitted (metric tons)	2006 Equiv CO_2 Emitted (metric tons)	% Change	2011 Equiv CO_2 Emitted (metric tons)	% Change
Buildings – Electricity	3,318	5,074	93.0%	5,275	4.0%
Buildings - Natural Gas	1,074	1,537	43.1%	1,622*	5.5%
Buildings - Fuel Oil**			N/A	105	N/A
Vehicle Fleet – Gasoline	2,280	2,463	8.0%	1,901	-22.8%
Vehicle Fleet – Diesel	873	996	14.1%	1,196	20.1%
Vehicle Fleet - Refrigerants**			N/A	21	N/A
Water/Sewage – Electricity	1,420	1,389	16.4%	1,215	-12.5%
Water/Sewage - Natural Gas	24	5	-79.2%	Included above	N/A
Outdoor Lighting – Electricity	2,462	3,362	20.1%	1,752	-47.9%
Employee Commute – Gasoline & Diesel	3,223	2,439	-24.3%	1,902	-22.0%
Waste - Landfill Disposal*	149	153	2.7%	96	-37.3%
Waste - Composting Impact*	-10	-10	0%	-10	0%
Waste - Landfill Sequestration*	-368	-379	3%	-237	-37.5%
Waste - Recycling Impact*	-487	-502	3.1%	-501	-0.2%
Business Travel**			N/A	92	N/A
Other Scope 3 Emissions**			N/A	82	N/A
All Sectors and Sources - Net	**13,958**	**16,527**	**18.4%**	**14,511**	**-12.2%**
All Sectors and Sources - Gross	**14,823**	**17,418**	**17.5%**	**15,259**	**-12.4%**

*New for 2011 inventory and retroactively populated for past years
**New for 2011 inventory
Source: CACP Model Output

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

Sector & Source	2001 Equiv CO_2 Emitted (metric tons)	2006 Equiv CO_2 Emitted (metric tons)	% Change	2011 Equiv CO_2 Emitted (metric tons)	% Change
Total Buildings – Electricity and Natural Gas	4,392	6,611	80.5%	6,897	4.3%
Total Vehicle Fleet – Gasoline and Diesel	3,153	3,460	9.7%	3,097	-10.5%
Total Water/Sewage – Electricity and Natural Gas	1,444	1,393	15.0%	1,215	-12.8%
Outdoor Lighting	2,462	3,362	20.1%	1,752	-47.9%
Employee Commute	3,223	2,439	-24.3%	1,902	-22.0%
Waste - Gross*	149	153	2.7%	96	-37.3%
Waste - Net*	-716	-738	3.1%	-652	-11.7%
Other - Refrigerants, Fuel Oil, Business Travel, Other Scope 3**			N/A	300	N/A
All Sectors - Net	**13,958**	**16,527**	**18.4%**	**14,511**	**-12.2%**
All Sectors - Gross	**14,823**	**17,418**	**17.5%**	**15,259**	**-12.4%**

*New for 2011 inventory and retroactively populated for past years
**New for 2011 inventory
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, 2006, and 2011 Municipal Emissions, Normalized

Sector	2001 Equiv CO_2 (metric tons)	2006 Equiv CO_2 (metric tons)	% Change	2011 Equiv CO_2 Emitted (metric tons)	% Change
Buildings Emissions (per 1000 ft^2) *	6.6	6.6	0%	6.9	4%
Vehicle Fleet Emissions (per FTE)	2.6	2.8	8%	2.6	-9%
Outdoor Lighting Emissions (per 1,000 residents	22.1	28.6	29%	14.2	-50%
Water/Sewage Emissions (per 1,000 residents)	12.8	11.8	-7%	9.8	-17%
Waste Emissions - Gross*(per 100 FTE)	11.3	12.3	8%	7.9	-35%
Employee Commute (per FTE)	2.6	1.95	-25%	1.6	-19%

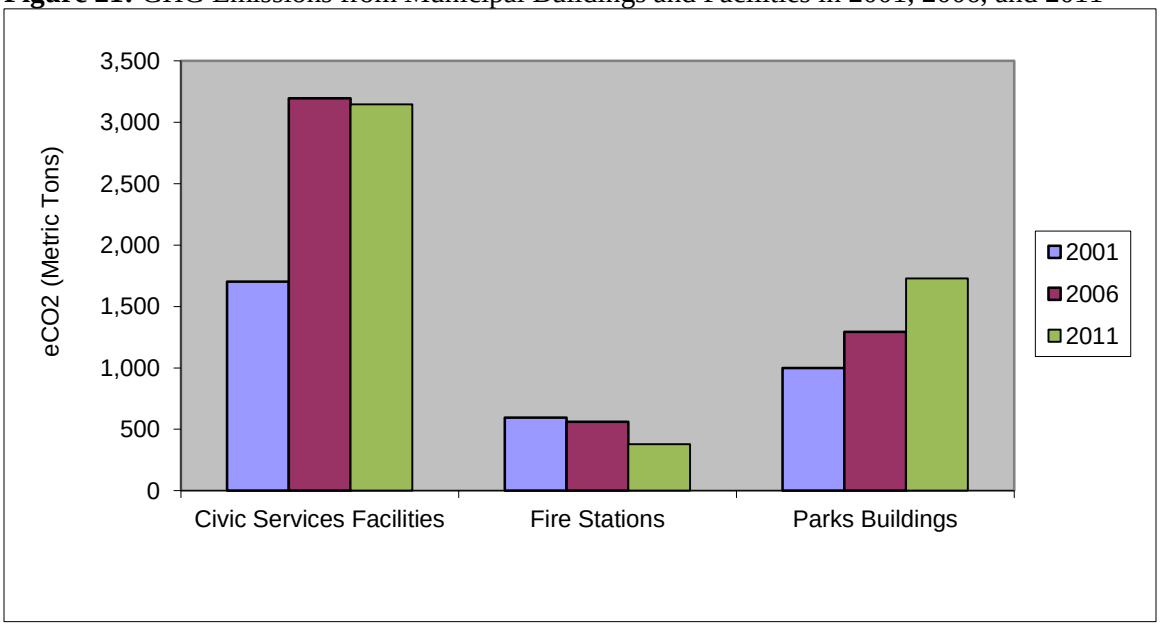
* Municipal square footage of 2001 and 2006 data records are incomplete and/or potentially inaccurate.
**New for 2011 inventory and retroactively populated for past years
***New for 2011 inventory
Source: CACP Model Output

Building Emissions

Figure 21 shows groupings of buildings sorted by departments by which they are managed. Figures 22 and 23 show electricity and natural gas usage for the same groupings. Facilities were added to the 2011 inventory include Lincoln Center and the Old Safeway Site (Civic Services). Comparison is not apples to apples, but overall emissions have increased slightly, likely due to new ball field lighting, data centers, and increased square footage.

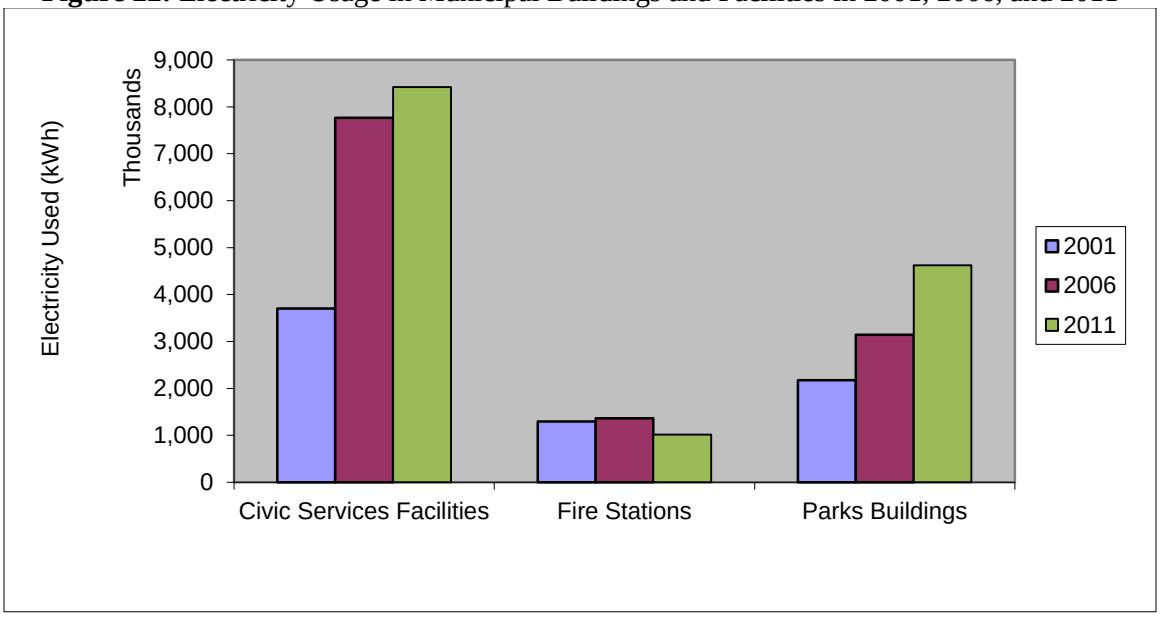
Since the regional electricity grid reduced its carbon intensity overtime, emissions per kWh have reduced and thus overall CO_2 emissions did not increase as much as kWh used.

Figure 21: GHG Emissions from Municipal Buildings and Facilities in 2001, 2006, and 2011



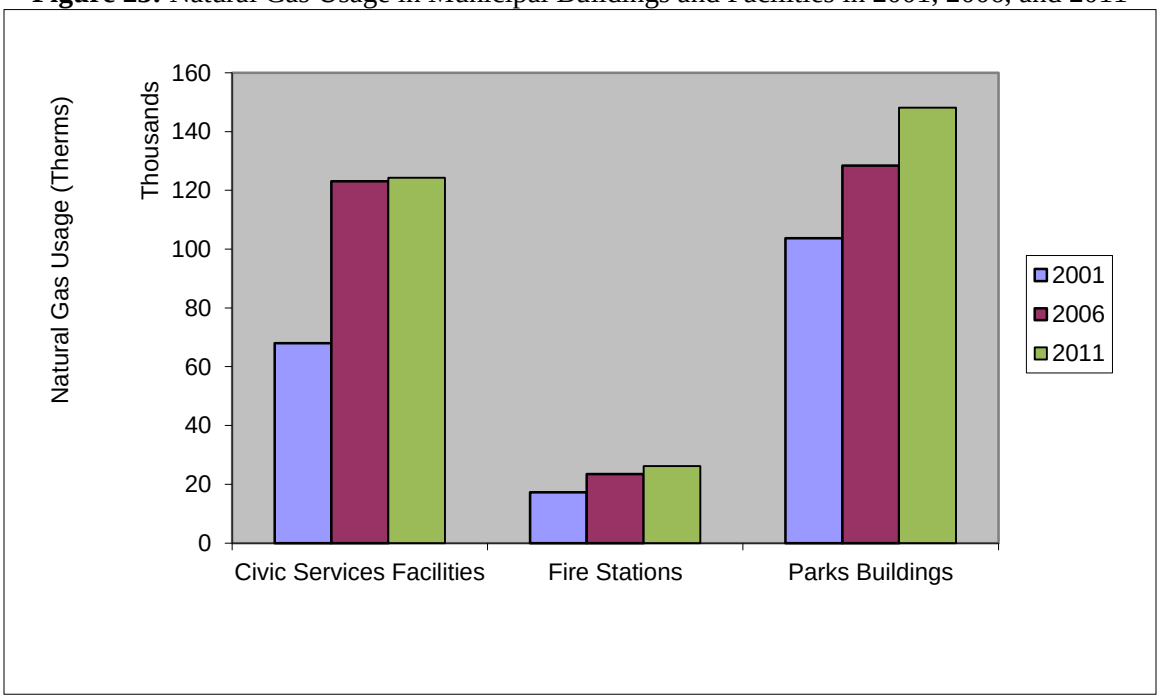
Source: EPA Egrid Emission Factors

Figure 22: Electricity Usage in Municipal Buildings and Facilities in 2001, 2006, and 2011



Source: PSE

Figure 23: Natural Gas Usage in Municipal Buildings and Facilities in 2001, 2006, and 2011



Source: PSE

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, but reduced to 3,118 metric tons in 2011 (Figure 24). Gasoline consumption increased from 234,000 gallons in 2001 to 252,000 gallons in 2006, but *reduced* to 216,607 in 2011. At the same time, diesel consumption increased from 91,000 gallons in 2001 to 104,000 gallons in 2006, and increased to 117,605 in 2011 (Figure 25).

Figure 24: Vehicle Fleet GHG Emissions in 2001, 2006, and 2011

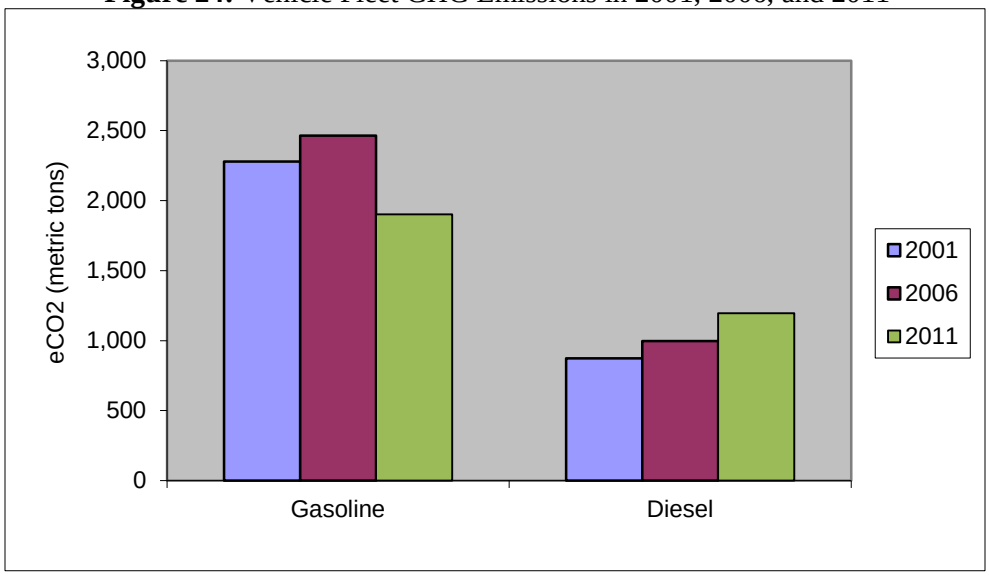
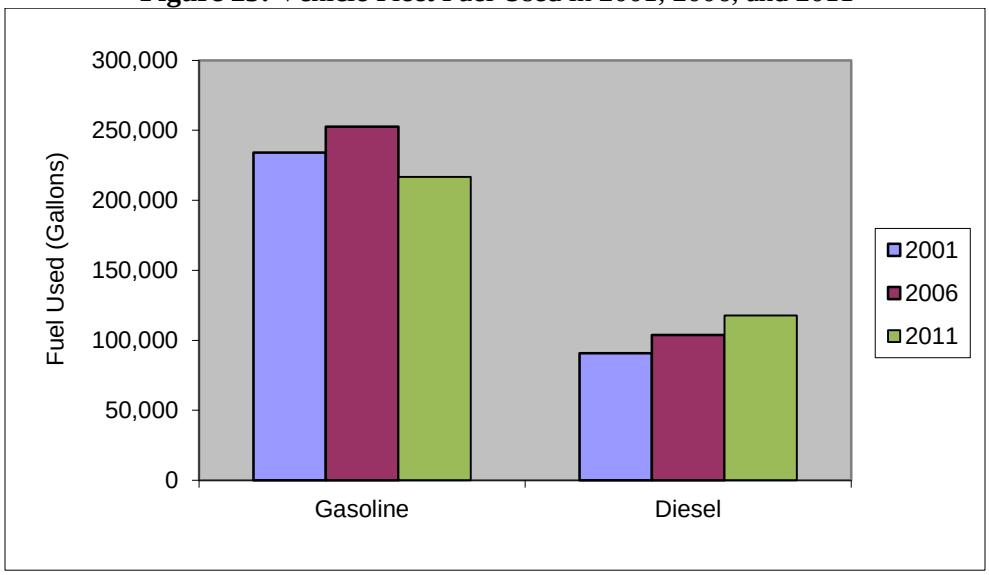


Figure 25: Vehicle Fleet Fuel Used in 2001, 2006, and 2011



Source: Scope 5 and Fleet Maximo reports

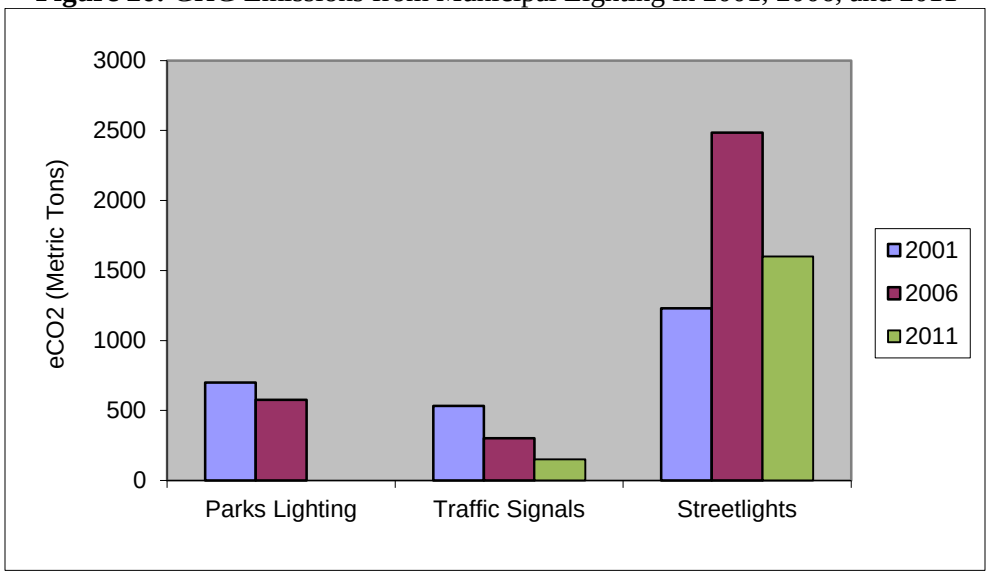
Outdoor Lighting Emissions

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. There was a significant decrease in traffic signal energy usage between 2001 and 2011 as a result of installing energy efficient LED traffic signals. 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.[12]

Year	# of Streetlights
1991	4,751
2001	6,900
2006	8,200
2011	8,553

Year	# of Signals
1990	
2000	5,491
2006	
2011	5,599

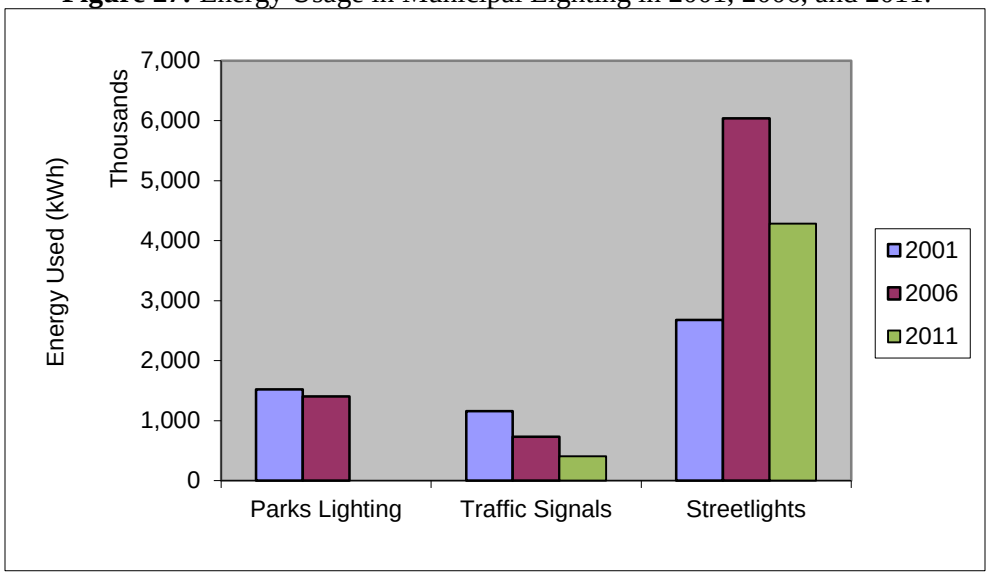
Figure 26: GHG Emissions from Municipal Lighting in 2001, 2006, and 2011



Source: EPA Egrid Emission Factors

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

Figure 27: Energy Usage in Municipal Lighting in 2001, 2006, and 2011:

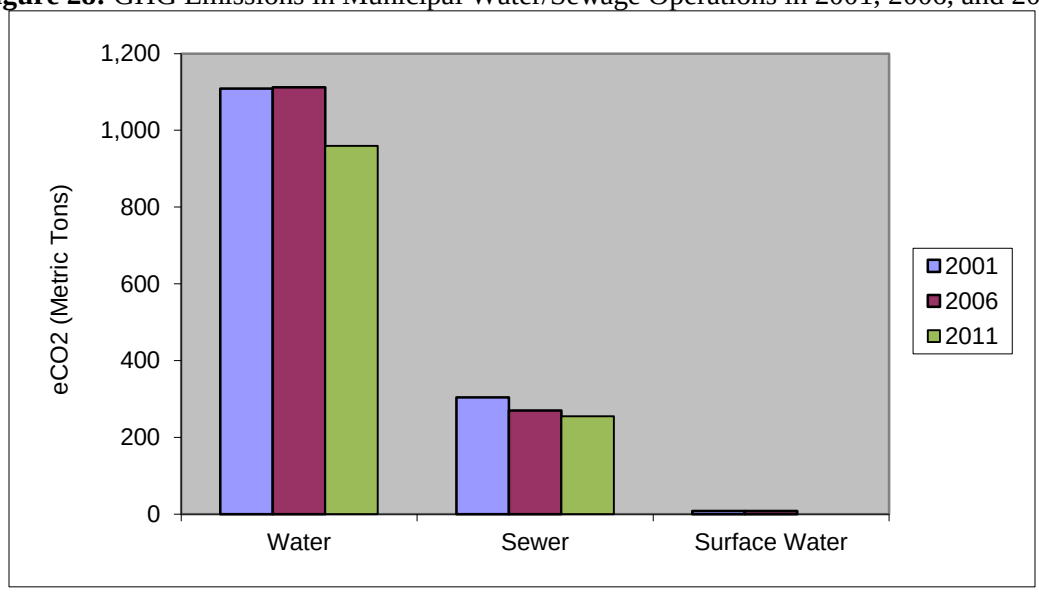


Source: CACP Model Output

Water/Sewage Pumping Emissions

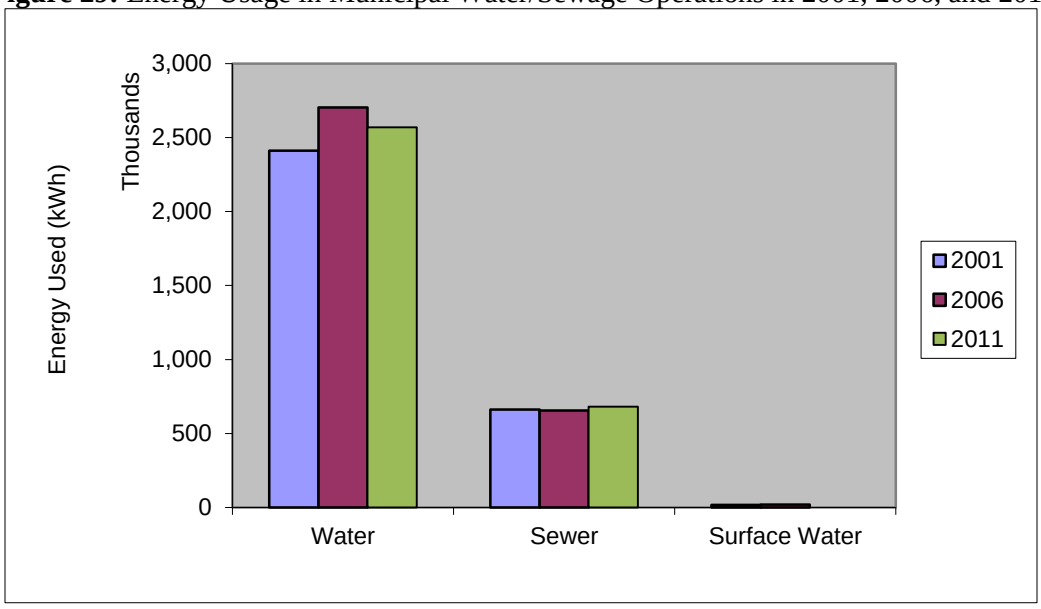
The GHG emissions produced to generate the energy to pump water and wastewater decreased from 1,420 to 1,389 metric tons between 2001 and 2006, and again decreased from 1,389 to 1,215 between 2006 and 2011 (Figure 28 and 29). Most of this energy is used to pump drinking water from reservoirs to homes. 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.

Figure 28: GHG Emissions in Municipal Water/Sewage Operations in 2001, 2006, and 2011



Source: EPA Egrid Emission Factors

Figure 29: Energy Usage in Municipal Water/Sewage Operations in 2001, 2006, and 2011



Source: PSE

Solid Waste Emissions

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 7-9.

III. Forecasts and Backcasts

The general trend of population growth coupled with decreasing per capita energy use and new technology hasresulted in a "leveling off" in annual emissions. While this is a trend in the right direction, global carbon budgets call for between 0.6 – 0.75 MTCO2e per capita worldwide[13] in order to avoid the severe climate change. Bellevue is currently at 12.8 MTCO2e— meaning a more than 90% reduction will be necessary.

Having completed the community and municipal operations emissions inventories for the base year 2001 and the interim years 2006 and 2011, the next step is 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. 2020 was selected as a forecast year.

Emissions were 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

[13] Hohne, N., and Moltmann, S. (August 2009) "Sharing the effort under a global carbon budget." Commissioned by WWF. Accessed online Dec, 24 2012 from assets.panda.org/downloads/wwf_ecofys_carbon_budget_final.pdf

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 for the 2006 inventory 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.

Forecasting for the 2011 inventory update did not consider predicated changes in population or the energy sector. Forecasts were determined using linear extrapoloations of the "business as usual" scenario for community and municipal operations. A least-squares regression line was fitted to all the inventory years to-date (1990 to 2011) and forecasts for 2012 and 2020 were based on that linear regression equation.

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	1,238,203	-21%
Backcast Year - 1990	1,331,401	-15%
Base Year -2001	1,569,631	0%
Interim Year - 2006	1,572,987	0%
Current Year - 2011	1,577,511	1%
Target Year Projection - 2020*	1,732,660	9.4%

*Projection based on the 2011 inventory update. Emissions data retroactively updated to reflect new waste emissions calculations.
Source: CACP Model Output

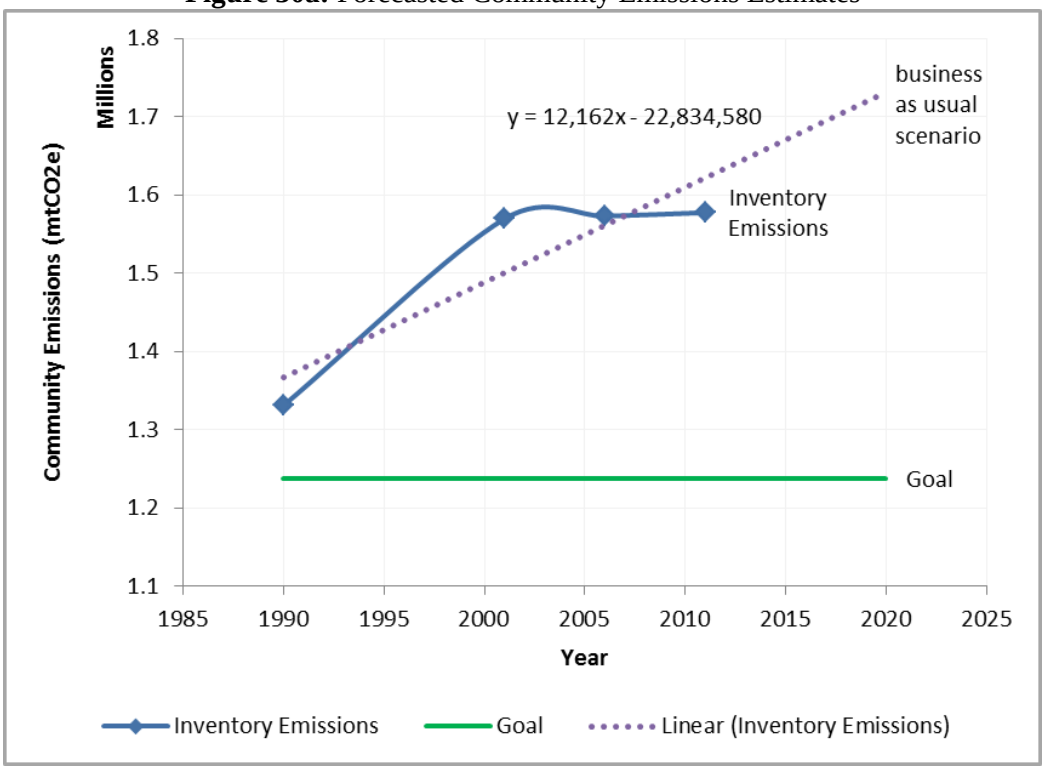
The chart below shows the volume of annual emissions that will need to be curtailed in the interim and forecast years to ensure that the community at large will meet its reduction targets. For example, in 2006 the community would have had to reduce its emissions by 334,784 tons of CO_2e in order to meet 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	334,784
Reduction of Emissions Needed to Meet Target in 2011	399,308
Reduction of Emissions Needed to Meet Target in 2020	494,457

*Projection based on the 2011 inventory update. Emissions data retroactively updated to reflect new waste emissions calculations.
Source: CACP Model Output

Figure 30a: Forecasted Community Emissions Estimates



*Projection based on the 2011 inventory update. Emissions data retroactively updated to reflect new waste emissions calculations.

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	11,247	-19%
Backcast Year -1990	12,094	-13%
Base Year -2001	13,958	N/A
Interim Year - 2006	16,528	19%
Current Year - 2011	14,511	4%
Target Year Projection - 2020	17,076	23%

*Projection based on the 2011 inventory update. Emissions data retroactively updated to reflect new waste emissions calculations.
Source: CACP Model Output

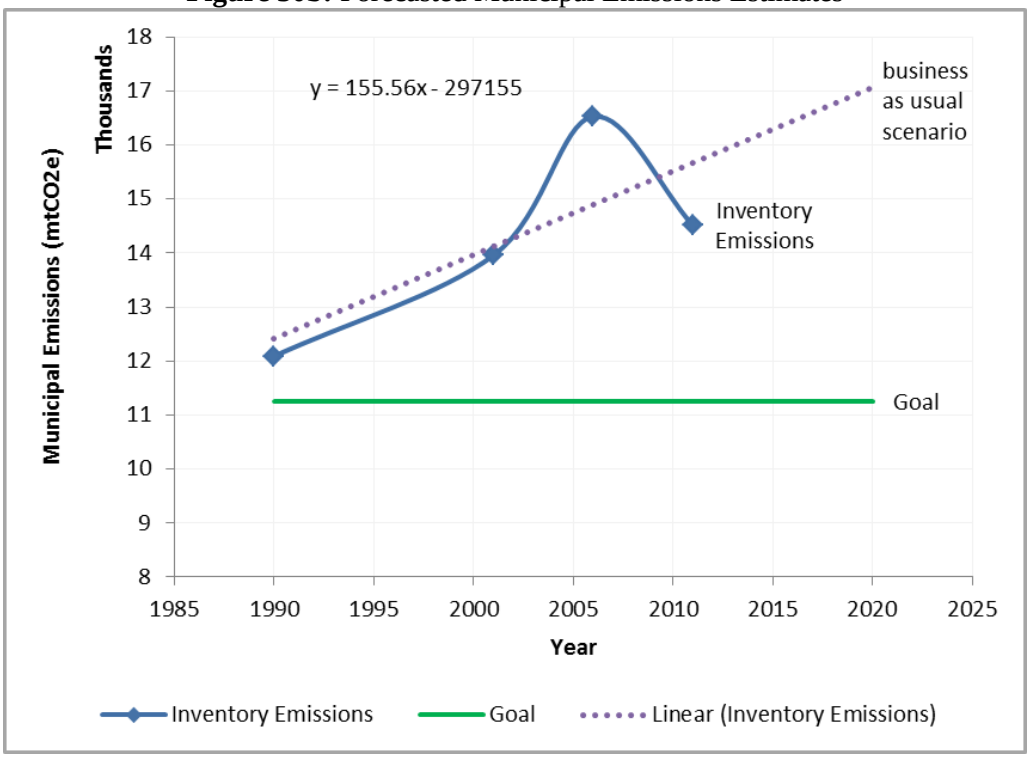
The chart below shows the volume of annual emissions that will need to be curtailed in the interim and forecast years to ensure that the city will meet its stated reduction targets. For example, in 2006 the city would have had to reduce its emissions by 5,282 metric tons of CO_2e in order to meet the 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	5,282
Reduction of Emissions Needed to Meet Target in 2011	3,265
Reduction of Emissions Needed to Meet Target in 2020	5,831

Source: CACP Model Output

Figure 30b: Forecasted Municipal Emissions Estimates



IV. Guide for Next Steps

A. Conclusions

Updating the greenhouse gas inventory every five years is an important step to monitor progress towards climate change policy goals. However, since an inventory is simply a year's snapshot of emissions, it does not tell the story of what happened in the interim years between 2006 and 2011, for instance. To address this problem, the City of Bellevue has procured a software tool (Scope 5) to provide more up-to-date analysis of emission trends. This software has a public dashboard, and can be viewed at https://city-of-bellevue.scope5.com/public_dashboard

In addition, data quality and the use of the correct conversion factors is a significant challenge in the inventory process. A rigorous, quality-checked, and consistent approach is critical in order to accurately portray emissions. At the time of completing this inventory, ICLEI's 2009 CACP methodology was currently one of the best available. As of October 2012, ICLEI released a new national methodology and standard called "U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions." In the future, Bellevue will look to align its reporting and accounting with ICLEI's national standard, King County. and its peer cities.

B. Recommendations for Future Action

Upon the completion of this inventory, Bellevue plans to communicate the results to other employees, the City's leadership team, City Council, and citizens. This inventory is a supplementary descriptive report that accompanies Bellevue's Environmental Stewardship Initiative 2013-2018 Strategic Plan document, which includes dozens of strategies to reduce emissions and accomplish other environmental and community objectives.

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, Private Lighting, and Industrial sectors.

Transportation (VMT) data:

Previous inventories used the Puget Sound Regional Council highway estimates to calculate Bellevue VMT. Bellevue's Transportation Department also models arterial and highway miles traveled. These estimates differ. Per conversation with PSRC, it was determined that Bellevue VMT is likely more accurate. However, the growth rate from 2005 to 2011 provided by Bellevue staff for arterial roads is more than 5 times greater than the regional increases on highways. Therefore, to establish a reasonable picture of the trend line over time, we applied the regional PSRC growth rate of 2.79% of daily average highway VMT between 2005 and 2011 (for King, Kitsap, Pierce and Snohomish) to the total Bellevue VMT provided by Bellevue Transportation in 2005.

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, 90%, was from the King County GHG Inventory.

The Eastgate Landfill is a covered and closed landfill within the City of Bellevue.. Given the small quantity of emissions and the limited accuracy of the estimate, this number was not included in the total community emissions inventory for 2011.

Municipal Inventory

Electricity and Natural Gas: As with the Community inventory, billing period data for electricity and natural gas were generated through a request to PSE for all city meters. Municipal account numbers were gathered through the Finance, Utilities, Civic Services, Transportation, Fire, Police, and Parks Departments within the City of Bellevue. Data was collected in either kWhs or therms for the calendar year.

Vehicle Fleet: The vehicle fleet manager was able to provide records for fueling. These were used to determine the fleet vehicle usage. Scope 5, a software program procured by the City of Bellevue, was used to calculate the GHG emissions rather than the CACP output because there seemed to be an error in the CACP output. The same emission factors of CACP were used in the Scope 5 software.

Employee Commute – In 2011, data regarding employee commute was available through Kate Johnson and Mike Ingram of the City of Bellevue. They supplied Commute Trip Reduction Surveys for both the City Hall and Bellevue Service Center, which together represent the majority of the City's employees. The CTR supplies it's own methodology for calculating GHGs, which was used rather than the CACP output. In previous years, 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 all waste. Waste numbers existed only for 2006 and 2011. 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

Forecasting for the 2011 inventory were based on "business-as-usual" linear projections of community and municipal emissions. Least-squares linear regressions of 1990 to 2011 emissions data were developed to predict emissions in 2012 and 2020.